Precision Inertial Product Catalog

Making Sense Out of Motion...

Jewell Instruments

Introduction

Force-Balanced Inclinometers

Jewell force-balanced (servo) precision inclinometers are extremely sensitive, rugged transducers designed to provide horizontal angle or vertical deviation measurements with virtually infinite resolution. Every Jewell precision inclinometer responds to changes of slope as small as 0.1 second of arc, with a high-level DC output signal proportional to the sine of the angle of tilt from as little as ±1° full range to ±90° full range.

MEMS Inclinometers

Jewell Instruments presents both analog and digital inclinometers (tilt sensors) that utilize MEMS capacitive technology. Each are capable of measuring positive and negative inclination (angle) from +/-1° to +/-90° in one or two axis configurations. You can get the exact sensor required for your application by choosing the angle range, bandwidth, analog or digital electrical output and more.

Accelerometers

Force-Balanced Accelerometers

Jewell force-balanced (servo) precision accelerometers are fully self-contained. They connect to a DC power source and a readout or control device for a complete operating system. The output is a high-level DC signal proportional to acceleration and tilt angle sine from as little as ±0.010g to ±20g full range. Jewell precision accelerometers respond to change in velocity as small as 1µg. Hysteresis is less than 0.0005% of full range output and vibration rectification is less than 50µG/G2.

MEMS Accelerometers

Jewell Instruments offers both analog and digital accelerometers utilizing MEMS capacitive technology. They can measure positive and negative acceleration in ranges up to +/-1g to +/-40g. With up to 400 Hz bandwidth, some models can be used for vibration measurement. You can get the exact sensors required for your application by choosing the g-range, bandwidth, analog or digital electrical output and more.

Quartz Flexure Accelerometers

Jewell Instruments presents mid- to high temperature range accelerometers with quartz flexure technology. Each are capable of measuring acceleration up to +/-30g in a single-axis configuration. These compact sensors are ideal for applications where space is limited and temperature is extreme such as surveying, measure while drilling, borehole mapping and more.

Inclinometer Groups & Applications

Force-Balanced

Applications: Military, Aerospace, Rail, OEM, Industrial Automation
Resolution: To 1 µrad
Angular Range: Up to ±1° to ±90°

MEMS

Applications: OEM, Industrial
Resolution: To 0.0001°
Angular Range: Up to ±10° to ±90°

Accelerometer Groups & Applications

Force-Balanced

Applications: Military, Aerospace, Rail, OEM, Industrial Automation
Resolution: To 0.001 rad/sec^2, 1 µg
Acceleration Range: Up to ±1000 rad/sec^2, ±20 g

MEMS

Applications: OEM, Industrial, Rail
Resolution: To 0.1 mg
Acceleration Range: Up to ±40 g

Quartz Flexure

Applications: Oil & gas, drilling, surveying
Resolution: 10 µg
Acceleration Range: To ±30 g
Temperature Range: -40°C to +180°C

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Force-Balanced Inclinometer Comparison Charts

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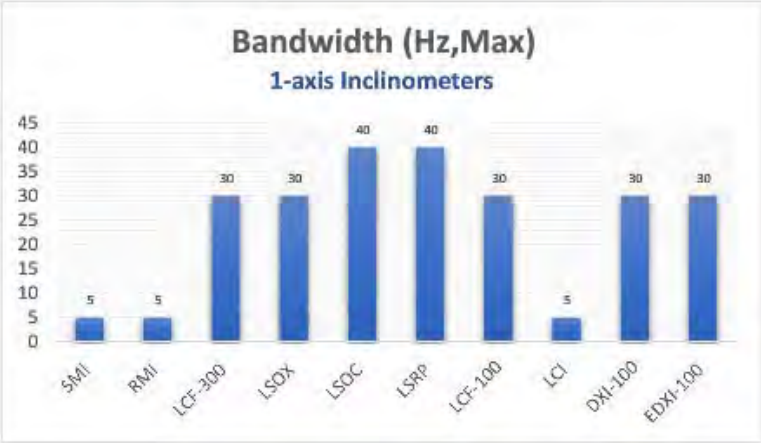

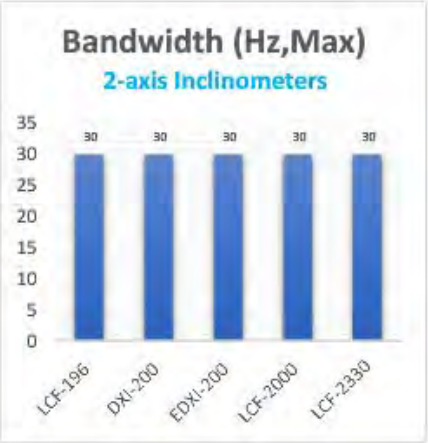

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Rev 1

Analog MEMS Inclinometer Comparison Charts

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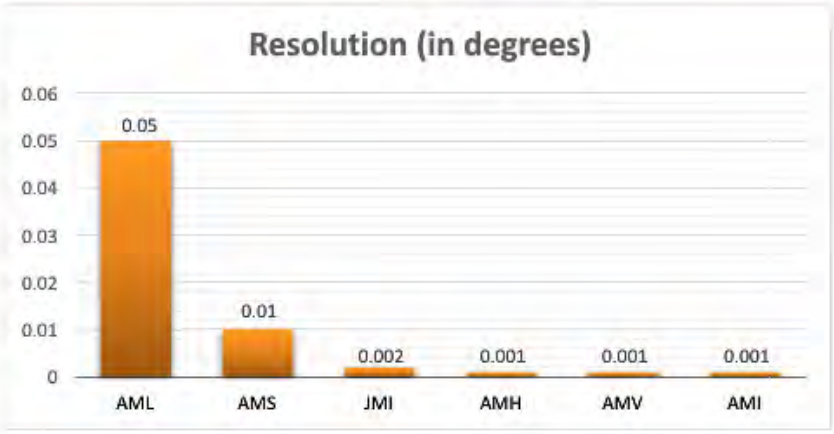

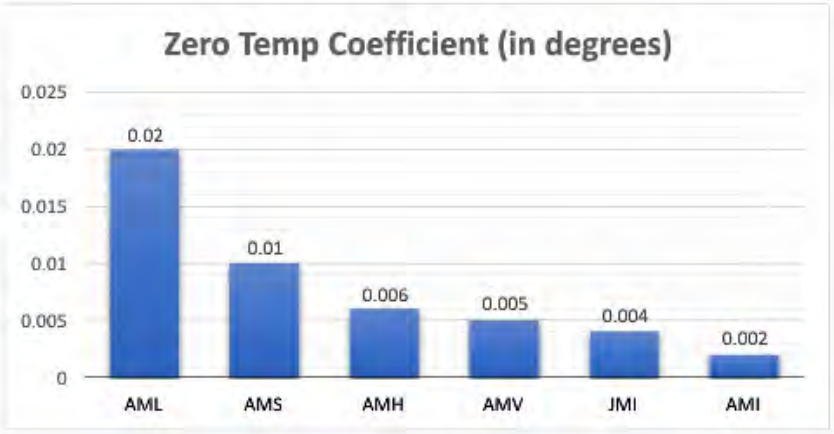

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Digital MEMS Inclinometer Comparison Charts

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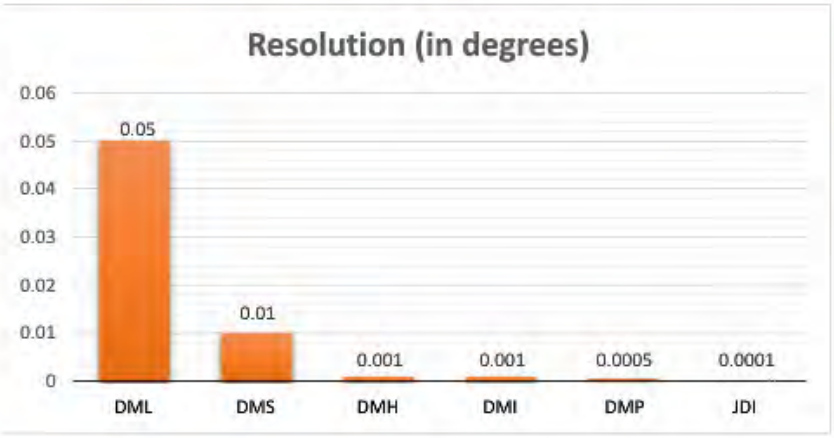

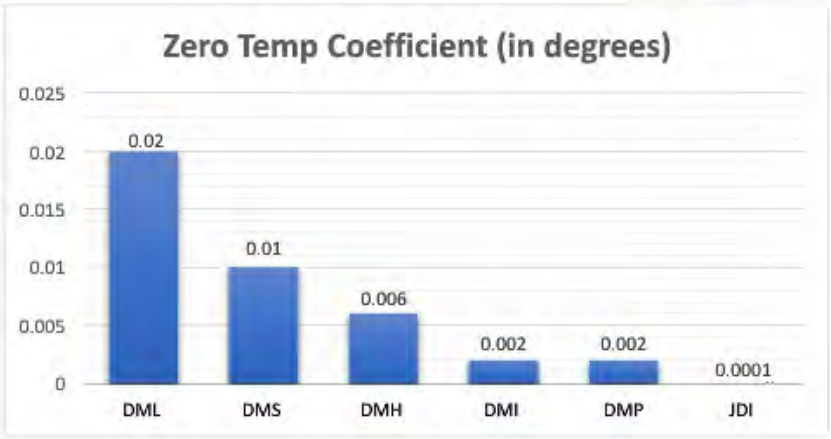

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Angular Accelerometer Comparison Charts

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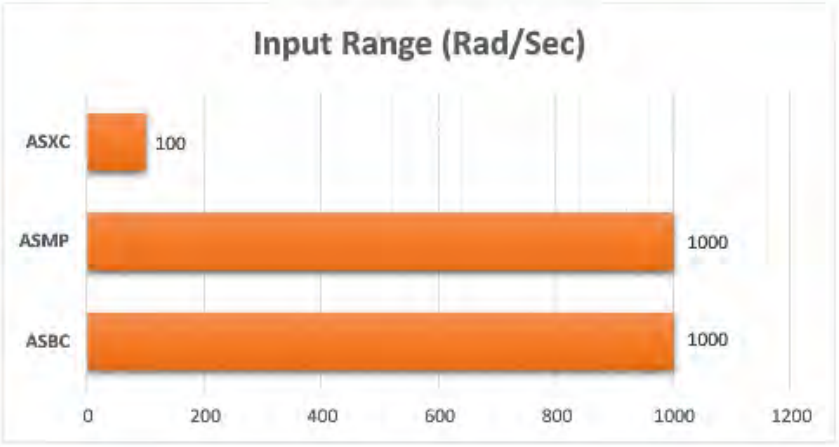

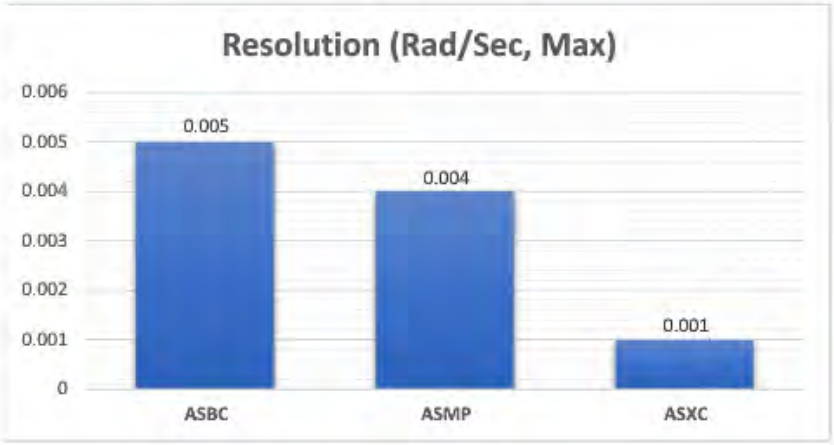

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Linear Accelerometer Comparison Charts

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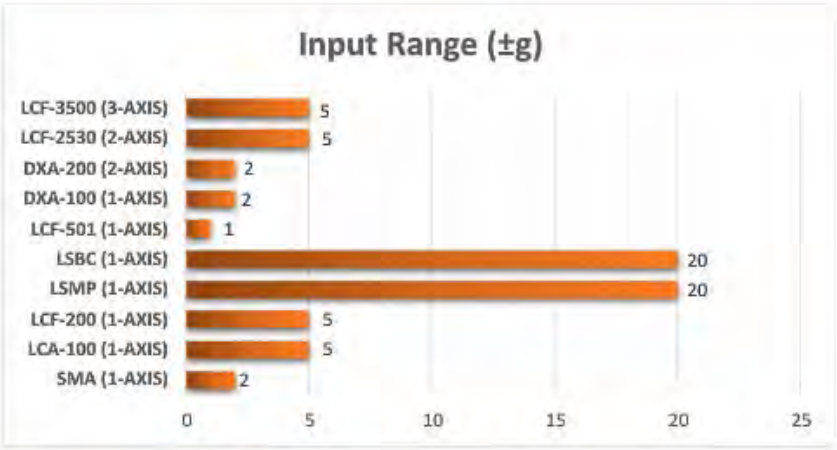

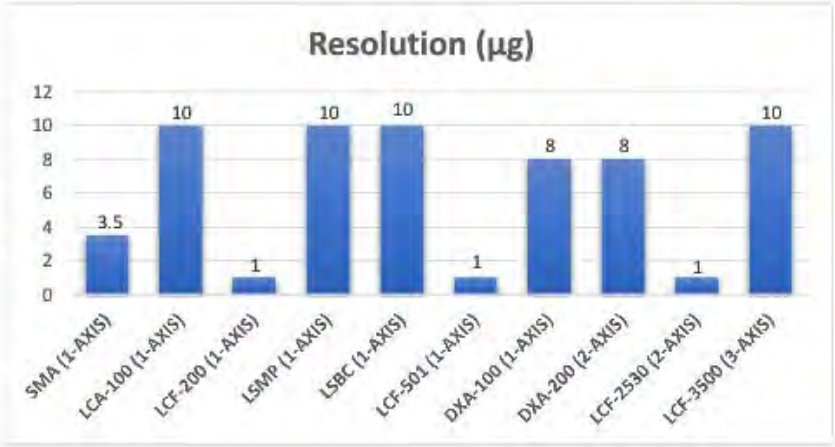

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MEMS Accelerometer Comparison Charts

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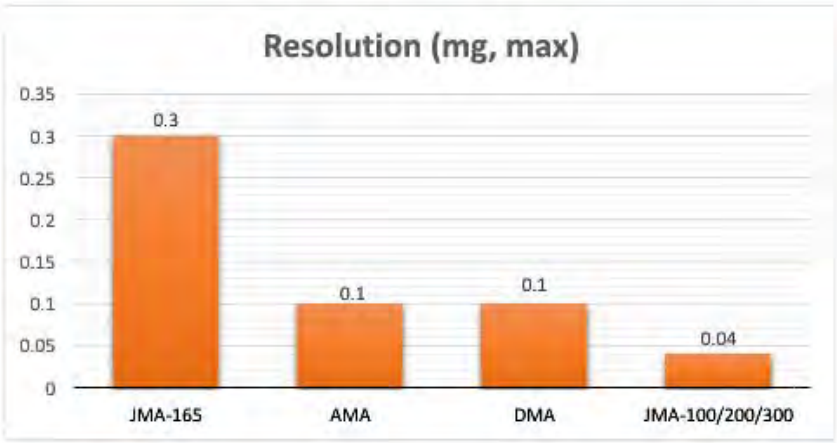

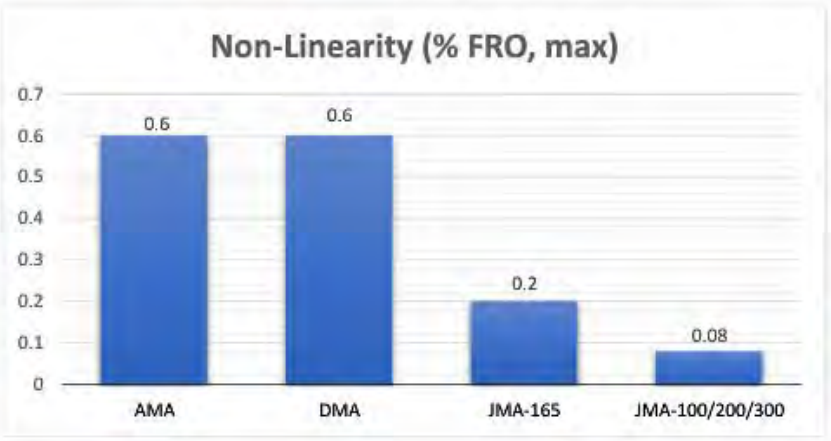

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Quartz-Flexure Accelerometer Comparison Charts

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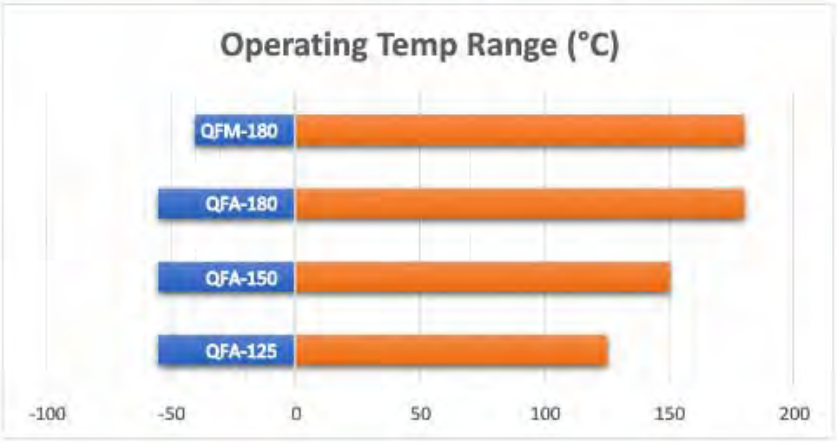

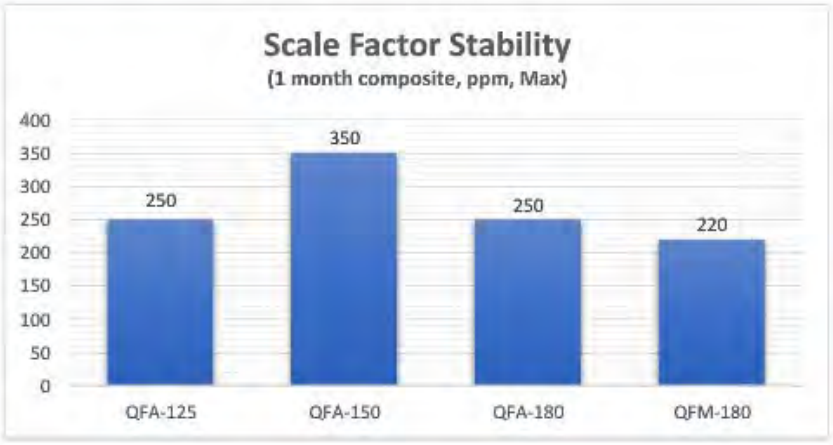

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Side-By-Side Product Comparison

Making Sense Out of Motion...

Jewell Instruments

Single Axis Inclinometers

	LSO Series	LSOX Series	LSR Series
			
Features & Benefits	• Extreme High Resolution • Vibration >35grms • Responds to changes in Slope 0.000006"/ft • High Accuracy Closed-loop (Servo) • 1,500g Shock Capability	• Temperature Compensation Available • Connector, Pin Terminals or Wired output types • 0-5, ±5 VDC or 4-20 mA Outputs • ROHS Compliant • CE Certification on 0-5 V Connector	• ± 1° to ± 90° Input Full Range • 1.43" Dia x 1.60" Tall Size • Withstands 20 grms Vibration • Stackable for 2-axis Sensing • Solder Pins Terminations
Applications	• Steel Processing & Casting • Heavy Off-road Contruction • Structural Monitoring • Train Automated Controls • Rail Leveling & Grinding	• High Precision Geotech • Oil & Gas/Riser Tilt Monitoring • Pavement Profiling Rigs • Vehicle Wheel Alignment	• Steel Mill Ladle Position • Oil & Gas Well Bore Mapping • Weapons Platform leveling • Geophysical Monitoring • Mobile Antenna Positioning

Performance Specs

Input Range (°)[1]:	±1.0	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±90.0
Full Range Output (FRO V± 1.0%)[2]:	±5.0	±5.0	±5.0	±5.0	±5.0	0-5, 0-5 (CE) ±5 or 4-20 mA					±5.0	±5.0	±5.0	±5.0	±5.0
Non Linearity (%FRO[3], Max.):	0.05	0.05	0.02	0.02	0.05	Output dependent, see datasheet					0.05	0.05	0.02	0.02	0.05
Scale Factor (V/g, Nom), %:	286.5	95.5	20.0	10.0	5.0	Output dependent, see datasheet					286.5	95.5	20.0	10.0	5.0
Scale Factor Temp Sens (PPM, %/°C, Max.):	400	300	100	60	60	350	300	100	60	60	400	300	100	60	60
Natural Frequency (Hz, Nom.[4]):	0.5	2.0	15.0	20.0	40.0	0.5	2.0	15	20	30	0.5	2.0	15.0	20.0	40.0
Bandwidth (-3db) (Hz, Nom.):	0.5	2.0	15.0	20.0	40.0	0.5	2.0	15	20	30	0.5	2.0	15.0	20.0	40.0
Transverse Axis Misalignment (° Max.):	±0.10	±0.15	±0.25	±0.50	±1.00	±0.25	±0.25	±0.5	±0.5	±0.5	±0.10	±0.15	±0.25	±0.50	±1.00
Output @ 0° Tilt (Bias) (V, Max), %/°C, m°/°C:	0.10	0.04	0.02	0.02	0.02	Output dependent, see datasheet					0.10	0.04	0.02	0.02	0.02
0° Output Temp Sensitivity (V/°C, Max.):	.005	.003	.001	.0005	.0003	Output dependent, see datasheet					.005	.003	.001	.0005	.0003
Resolution and Threshold (µrad, Max.):	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Electrical

	LSO Series	LSOX Series	LSR Series
Number of Axes	1	1	1
Input Voltage (Vdc)	±12 to ±18	Output dependent, see datasheet	±12 to ±18
Input Current (mA, Nom.)	±15	40	±15
Output Impedance (Ohms, Nom.)	100	Output dependent, see datasheet	15000
Noise (Vrms, µArms, Max.)	0.0020	0.002	0.0020

Environmental

	LSO Series	LSOX Series	LSR Series
Operating Temperature Range	-18°C to +71°C	-40°C to +80°C	-18°C to +71°C
Survival Temperature Range	-40°C to +71°C	-60°C to +90°C	-60°C to +90°C
Vibration	20 g	-	20 g
Shock	1500g, 0.5 msec, 1/2 sine	1500g, 0.5 msec, 1/2 sine	1500g, 0.5 msec, 1/2 sine
Seal	MILSTD 202, Method 112	IP66	MILSTD 202, Method 112

Mechanical

	LSO Series	LSOX Series	LSR Series
Weight	13.0 oz	13 oz	4.0 oz
Dimensions	1.60" W x 2.94" L x 1.70" H	1.60" W x 3.64" L x 1.68" H	1.43" Dia. x 1.60" H
Custom Ability	Yes	Yes	No

Notes: 1 - Other ranges available upon request 2 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle., 3 - Referenced to theoretical sine value independent of misalignment., 4 - Output phase angle = -90°

Single Axis Inclinometers

EMERALD SERIES

SMI Series

RMI Series

LCF-100 Series

LCF-300 Series

Features & Benefits

- Low cost with force-balanced technology
- Higher precision than most MEMS sensors
- Resolution of 3.5 µradians
- Connector or Pin Terminal output types (SMI)
- 0-5, ±5 VDC or 4-20 mA output options
- ROHS compliant
- Mounts horizontally or vertically (RMI)

- Direct Bogie Mount
- Filtering Available 3-30 Hz Bandwidth
- Milli-g Bias & Scale Factor
- High level ±5Vdc Output
- -40 °C to +80 °C Temp Range

- Connector or Pin Terminal output types
- 0-5, ± 5 VDC or 4-20 mA outputs
- ±1 to ±90° Input Range
- High vibration resistance

Applications

- Construction Equipment
- Antenna Positioning
- Industrial and Machining Equipment
- Vehicle Wheel Alignment

- Aircraft Flight Control
- Robot Vertical Reference
- Auto Mfging Suspension Install
- Geophysical Low Range Tilt Testing
- Platform Orientation

- Vehicle Wheel Alignment
- Robotics
- Railroad MOW Equipment
- Structural Monitoring

Performance Specs

	SMI Series						LCF-100 Series				LCF-300 Series			
Input Range (°)[1]:	±3.0	±14.5	±30.0	±45.0	±60.0	±90.0	±1.0	±14.5	±30.0	±90.0	±1.0	±14.5	±30.0	±90.0
Full Range Output (FRO V± 1.0%)[2]:	0-5, ±5 or 4-20 mA						±5.0	±5.0	±5.0	±5.0	0-5, ±5 or 4-20 mA			
Non Linearity (%FRO[3], Max.):	0.05	0.02	0.02	0.02	0.04	0.05	0.05	0.02	0.02	0.05	Output dependent			
Scale Factor (V/g, Nom), %:	Output dependent, see datasheet						286.5	20.0	10.0	5.0	Output dependent			
Scale Factor Temp Sens (PPM, %/°C, Max.):	100	100	100	100	100	100	100	100	100	100	350	100	60	60
Natural Frequency (Hz, Nom.[4]):	5.0	5.0	5.0	5.0	5.0	5.0	3.0	30.0	30.0	30.0	0.5	15	20	30
Bandwidth (-3db) (Hz, Nom.):	5.0	5.0	5.0	5.0	0.5	5.0	3.0	30.0	30.0	30.0	0.5	15	20	30
Transverse Axis Misalignment (° Max.):	±0.25	±0.50	±0.50	±0.50	±0.50	±0.50	±0.15	±0.34	±0.71	±0.71	±0.25	±0.50	±0.50	±0.50
Output @ 0° Tilt (Bias) (V, Max), %/°C, m°/°C:	Output dependent, see datasheet						0.500	0.100	0.100	0.050	Output dependent			
0° Output Temp Sensitivity (V/°C, Max.):	Output dependent, see datasheet						.015	.001	.0005	.0003	Output dependent			
Resolution and Threshold (µrad, Max.):	3.5	3.5	3.5	3.5	3.5	3.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Electrical

	SMI Series	LCF-100 Series	LCF-300 Series
Number of Axes	1	1	1
Input Voltage (Vdc)	Output dependent, see datasheet	±12 to ±18	Output dependent
Input Current (mA, Nom.)	Output dependent, see datasheet	±15	40
Output Impedance (Ohms, Nom.)	Output dependent, see datasheet	100	Output dependent
Noise (Vrms, µArms, Max.)	Output dependent, see datasheet	0.0020	0.002

Environmental

	SMI Series	LCF-100 Series	LCF-300 Series
Operating Temperature Range	-55 °C to +85 °C	-40 °C to +80 °C	-40 °C to +80 °C
Survival Temperature Range	-60 °C to +90 °C	-60 °C to +90 °C	-60 °C to +90 °C
Vibration	-	20 g	-
Shock	500g, 1 msec, 1/2 sine	1000g, 1 msec, 1/2 sine	1500g, 0.5 msec, ½ sine
Seal	IP65	MIL-STD-202, Method 112	IP65

Mechanical

	SMI Series	LCF-100 Series	LCF-300 Series
Weight	4.0 oz.	4.0 oz.	8.1 oz.
Dimensions	1.55" W x 3.10" L x 2.04" H (SMI) 2.27" W x 1.72" H (RMI)	1.50" W x 3.10" L x 1.50" H	1.38" W x 3.10" L x 2.18" H
Custom Ability	Yes		

Notes: 1 - Other ranges available upon request 2 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle., 3 - Referenced to theoretical sine value independent of misalignment., 4 - Output phase angle = -90°

Dual Axis Inclinometers

	LCF-196 Series	LCF-2330 Series	LCF-2000 Series
			
Features & Benefits	• Less > 0.02% Non-linearity • Bias Temp Sens >50µg/°C • Only 0.875" Dia Housing • IP65 Sealed Housing • 500g Shock Capability	• ±1° to ±90° Input Full Range • Micro Radian Resolution • Available Internal Temp Sensor • High level ± 5Vdc Output • Low Impedance Output • Fluid Damped	• ±1° to ±90° Input Full Range • Dual Axis • Shock Survival of 1000g • High level ± 5Vdc Output • Fluid Damped for High Shock and Vibration Applications
Applications	• Strg Motion Data Logging • Oil & Gas Well Logging • Construction Monitoring • Deviation Studies • Test Platform Orientation	• 2-Axis Machine Tool Leveling • Bridge Structural Monitoring • Submersible Control Feedback • Offshore Platform Stability • Antenna Leveling & Orientation	• Antenna Leveling • Weapons Platforms • Barge & Offshore Platform Leveling & Control • Data Buoy Measurement • Missile Launchers

Performance Specs

	LCF-196 Series			LCF-2330 Series					LCF-2000 Series				
Input Range (°)[1]:	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±90.0
Full Range Output (FRO V± 1.0%)[2]:	±5.0	±5.0	±5.0	±5.0 or 4-20 mA					±5.0	±5.0	±5.0	±5.0	±5.0
Non Linearity (%FRO[3], Max.):	0.02	0.02	0.10	0.05	0.05	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.05
Scale Factor (V/g, Nom), %:	20.0	10.0	5.0	286.5	95.5	20.0	10.0	5.0	286.5	95.5	20.0	10.0	5.0
Scale Factor Temp Sens (PPM, %/°C, Max.):	100	100	100	300	300	100	100	100	200	100	100	100	100
Natural Frequency (Hz, Nom.[4]):	30.0	30.0	30.0	2.0	3.0	30.0	30.0	30.0	3.0	3.0	30.0	30.0	30.0
Bandwidth (-3db) (Hz, Nom.):	30.0	30.0	30.0	0.5	2.0	15.0	20.0	30.0	3.0	3.0	30.0	30.0	30.0
Transverse Axis Misalignment (° Max.):	±1.00	±1.00	±1.00	±0.25	±0.50	±0.50	±1.00	±1.00	±0.25	±0.35	±0.35	±0.71	±0.71
Output @ 0° Tilt (Bias) (V, Max), %/°C, m°/°C:	0.040	0.020	0.020	0.10	0.04	0.02	0.02	0.02	0.750	0.250	0.075	0.050	0.050
0° Output Temp Sensitivity (V/°C, Max.):	.0010	.0005	.0003	.0150	.0050	.001	.0005	.0003	.0150	.005	.0010	.0005	.0003
Resolution and Threshold (µrad, Max.):	3.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Electrical

	LCF-196 Series			LCF-2330 Series	LCF-2000 Series
Number of Axes	2			2	2
Input Voltage (Vdc)	±12 to ±19			±12 to ±18	±12 to ±18
Input Current (mA, Nom.)	±15			±30	±30
Output Impedance (Ohms, Nom.)	100			100	100
Noise (Vrms, µArms, Max.)	0.002	0.001	0.001	0.002	0.0020

Environmental

	LCF-196 Series			LCF-2330 Series	LCF-2000 Series
Operating Temperature Range	-40°C to +80°C			-40°C to +80°C	-40°C to +80°C
Survival Temperature Range	-60°C to +90°C			-60°C to +90°C	-40°C to +90°C
Vibration	10 g			20 g	20 g
Shock	500g, 1 msec, 1/2 sine			1000g, 1 msec, 1/2 sine	1000g, 0.001 msec, 1/2 sine
Seal	MIL-STD-202, Method 112			IP65	MIL-STD-202, Method 112

Mechanical

	LCF-196 Series			LCF-2330 Series	LCF-2000 Series
Weight	11 oz			8.0 oz.	16 oz.
Dimensions	0.875" Dia x 9.420" Lg. Tube			1.61" W x 3.609" L x 1.83" H	2.88" W x 3.75" L x 2.75" H
Custom Ability	Yes			Yes	Yes

Notes: 1 - Other ranges available upon reque... 2 - Full range is defined as "from r ...ative full input angle to positive full input ar ...e." The inclinometer output is proportional to the sine of the tilt angle., 3 - Referenced to theoretical sine value independent of misalignment., 4 - Output phase angle = -90°

	Triple Axis Inclinometer				Digital Inclinometer				Ethernet Inclinometer			
	LCF-3000 Series				DXI-100/200 Series				eDXI-100/200 Series			
												
Features & Benefits	• ±1° to ±90° Input Full Range • Tri-axis Applications • Micro Radian Resolution • High level ± 5Vdc Output • Low Impedance Output • Fluid Damped				• Digital Output • Resolution 0.001° • Mechanical Shock 1500g 1msec ½ sine • RS485 & RS422 Outputs • High Precision and Performance • Low Noise				• Industry Standard Ethernet 10BaseT or 100 Base TX (Auto-sensing) • PoE (Power over Ethernet) • Amphenol RJF72B00 Connector • Low Noise			
Applications	• 3-Axis Machine Tool Leveling • Bridge Structural Monitoring • Antenna Leveling & Orientation • Platform Orientation • Geophysical Low Range Tilt Testing				• Radar/Antenna Control • Structural Monitoring • Automatic Train Position Control • Seismic Monitoring • Track Leveling				• Radar/Antenna Control • Structural Monitoring • Automatic Train Control (ATC, ATP)			
Performance Specs												
Input Range (°)[1]:	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±30.0	±60.0	±1.0	±3.0	±30.0	±60.0
Full Range Output (FRO V± 1.0%)[2]:	±5.0	±5.0	±5.0	±5.0	±0.25	±0.50	±1.00	±2.00	±0.25	±0.50	±1.00	±2.00
Non Linearity (%FRO[3], Max.):	0.02	0.02	0.02	0.10	0.02	0.015	0.02	0.03	0.02	0.015	0.02	0.03
Scale Factor (V/g, Nom), %:	95.54	20.0	10.0	5.0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scale Factor Temp Sens (PPM, %/°C, Max.):	100	100	100	100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Natural Frequency (Hz, Nom.[4]):	3.0	30.0	30.0	30.0	-	-	-	-	-	-	-	-
Bandwidth (-3db) (Hz, Nom.):	3.0	30.0	30.0	30.0	3.0	6.0	30.0	30.0	3.0	6.0	30.0	30.0
Transverse Axis Misalignment (° Max.):	±0.50	±0.50	±1.00	±1.00	0.15	0.15	0.5	0.5	0.15	0.15	0.5	0.5
Output @ 0° Tilt (Bias) (V, Max), %/°C, m°/°C:	0.25	0.075	0.050	0.050	0.001	0.001	0.005	0.005	0.01	0.01	0.05	0.05
0° Output Temp Sensitivity (V/°C, Max.):	.005	.001	.0005	.0003	5.0	5.0	5.0	5.0	0.001	0.001	0.005	0.005
Resolution and Threshold (µrad, Max.):	1.0	1.0	1.0	1.0	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
Electrical												
Number of Axes	3				1 or 2				1 or 2			
Input Voltage (Vdc)	±12 to ±18				±10 to ±30				36 to 57			
Input Current (mA, Nom.)	±30				See datasheet				250			
Output Impedance (Ohms, Nom.)	100				-				-			
Noise (Vrms, µArms, Max.)	0.0020				0.005				2			
Environmental												
Operating Temperature Range	-40°C to +80°C				-40°C to +85°C				-40 to +85			
Survival Temperature Range	-40°C to +90°C				-40°C to +85°C				-40 to +90			
Vibration	20 g				20 g				20 g			
Shock	1000g, 1msec, 1/2 sine				1500g, 1msec, 1/2 sine				1500g, 1msec, ½ sine			
Seal	MIL-STD-202, Mtd 112				IP67				MILD-STD-202 Method 112			
Mechanical												
Weight	16.0 oz				DXI-100 8.0 oz./DXI-200 10.0 oz.				eDXI-200: 400g			
Dimensions	2.88" W x 3.75" L x 2.75" H				1.62" W x 3.609" L x 1.83" H				3.75" W x 2.876" L x 3.63" H			
Custom Ability	Yes				Yes				Yes			

Notes: 1 - Other ranges available upon request 2 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle., 3 - Referenced to theoretical sine value independent of misalignment., 4 - Output phase angle = -90°

Analog MEMS Inclinometers

	AML Series	AMS Series	JMI Series
			
Features & Benefits	• Single and Dual Axis Available • **Resolution <0.05°** • **Zero Temp Coefficient ±0.02°/°C** • High Shock & Vibration Tolerance • Analog 0-5V, 0.5-4.5V & 4-20mA Output Options • −40° to +85°C Temp Range	• Single and Dual Axis Available • **Resolution <0.01°** • **Zero Temp Coefficient ±0.01°/°C** • High Shock & Vibration Tolerance • Analog 0-5V, 0.5-4.5V & 4-20mA Output Options • Up to ±90° Full Range Output	• Single and Dual Axis Available • **Resolution to 0.002°** • **RoHS Compliant** • Lightweight Aluminum Enclosure • Temperature Sensors Option Available
Applications	• Solar Tracking & Panel Positioning • Vehicle Wheel Alignment • Industrial Automation & Control • Radar/Antenna Mast Alignment • Platform Leveling • Navigation Pitch/Roll Measurement	• Boom Position and Control • Radar and Vehicle Platform Positioning • Industrial Measurement & Control • Drilling Equipment • Navigation Pitch/Roll Measurement	• Industrial Automation & Control • Construction & Agricultural Equipment • Platform Leveling/Positioning • Railway Track Alignment & Maintenance

Performance Specs Static/Dynamic

	AML Series				AMS Series				JMI Series		
Angular Range[1] (°):	±10	±30	±60	±90	±10	±30	±60	±90	±14.5	±30	±90
Resolution (°):	0.05				0.01				0.002	0.002	0.004
Hysteresis:	0.1	0.2	0.2	0.2	0.02	0.05	0.08	0.1	0.014	0.007	0.004
Zero Temp Coefficient, °/°C:	±0.02				±0.01				±0.004		
Scale Factor Temp Coefficient (PPM/°C):	≤350				≤200				150		
Warm Up (s):	0.5				0.5				0.5		
Time Constant (s):	0.05				0.05				0.032		

Electrical & Environmental

	AML Series	AMS Series	JMI Series
Output:	0-5V, 0.5 - 4.5V or 4-20mA	0-5V, 0.5 - 4.5V or 4-20mA	±5V, 0-5V or 4-20mA
Output Type[2]:			
Electromagnetic Compatibility:	EN61000 and GBT17626	EN61000 and GBT17626	N/A
Impact Resistance:	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)	100 g, 0.011 sec, ½ sine
Vibration Resistance:	10grms @ 10-1000Hz	10grms @ 10-1000Hz	100 g, 0.011 sec, ½ sine
Temperature Rating, Operation:	-40 to +85°C	-40 to +85°C	-40 to +85°C
Temperature Rating, Storage:	-55 to +100°C	-55 to +125°C	-40 to +95°C
Enclosure:			Anodized Aluminum
Seal:	IP67	IP67	IP65
Cables:	1m Cable (standard)	1m Cable (standard)	N/A
Weight:	90g (without cable)	120g (without cable)	165 (1 axis), 170 (2 axes)
Power Requirements:	9-36 VDC @ 60mA	9-36 VDC @ 60mA	±12 to ±18 VDC (±5V) 12 to 30 VDC (0-5V) 28mA (4-20mA)

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle.,
2 - Referenced to theoretical sine value independent of misalignment., 3 - Output phase angle = -90° 4 - Other ranges available upon request

Analog MEMS Inclinometers

Features & Benefits

AMH Series

- Single and Dual Axis Available
- **Resolution <0.001°**
- **Zero Temp Coefficient ±0.006°/°C**
- High Shock & Vibration Tolerance
- Analog 0-5V, 0.5-4.5V & 4-20mA Output Options
- −40° to +85°C Temp Range

AMI Series

- Single and Dual Axis Available
- **Resolution <0.001°**
- **Zero Temp Coefficient ±0.002°/°C**
- Excellent Performance over Temp
- Analog 0-5V, 0.5-4.5V & 4-20mA Output Options
- −40° to +85°C Temp Range

AMV Series

- Single and Dual Axis Available
- **Resolution <0.001°**
- **Zero Temp Coefficient ±0.005°/°C**
- Excellent Performance over Temp
- Analog ±5V & ±10V Output Options
- −40° to +85°C Temp Range

Applications

- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control

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Performance Specs Static/Dynamic

	AMH Series			AMI Series			AMV Series		
Angular Range[1] (°):	±10	±30	±60	±10	±30	±60	±10	±30	±60
Resolution (°):	0.001			0.001			0.001		
Hysteresis:	0.005	0.008	0.01	0.003	0.005	0.008	0.003	0.01	0.02
Zero Temp Coefficient, °/°C:	±0.006			±0.002			±0.005		
Scale Factor Temp Coefficient (PPM/°C):	≤200			≤50			≤50		
Warm Up (s):	0.5			0.5			0.5		
Time Constant (s):	0.05			0.02			0.02		

Electrical & Environmental

	AMH Series	AMI Series	AMV Series
Output:	0-5V, 0.5 - 4.5V or 4-20mA	0-5V, 0.5 - 4.5V or 4-20mA	±5V & ±10V
Output Type[2]:			
Electromagnetic Compatibility:	EN61000 and GBT17626	EN61000 and GBT17626	EN61000 and GBT17626
Impact Resistance:	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)
Vibration Resistance:	10grms @ 10-1000Hz	10grms @ 10-1000Hz	10grms @ 10-1000Hz
Temperature Rating, Operation:	-40 to +85°C	-40 to +85°C	-40 to +85°C
Temperature Rating, Storage:	-55 to +100°C	-55 to +100°C	-55 to +100°C
Enclosure:	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum
Seal:	IP67	IP67	IP67
Cables:	1m Cable (standard)	2m Cable (standard)	2m Cable (standard)
Weight:	150g (without cable)	150g (without cable)	150g (without cable)
Power Requirements:	9-36 VDC @ 60mA	9-36 VDC @ 60mA	9-36 VDC @ 60mA

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle.,
2 - Referenced to theoretical sine value independent of misalignment., 3 - Output phase angle = -90° 4 - Other ranges available upon request

Digital MEMS Inclinometers

DML Series

DMS Series

DMH Series

Features & Benefits

DML Series

- Single and Dual Axis Available
- **Resolution <0.05°**
- **Zero Temp Coefficient ±0.02°/°C**
- -40° to +85°C Operation and Storage
- Digital RS232, RS485 or UART TTL Outputs

DMS Series

- Single and Dual Axis Available
- **Resolution <0.01°**
- **Zero Temp Coefficient ±0.01°/°C**
- Digital RS232 or RS485 and UART TTL Outputs
- -40° to +85°C Operating Range

DMH Series

- Single and Dual Axis Available
- **Resolution <0.001°**
- **Zero Temp Coefficient ±0.006°/°C**
- Up to ±90° Angular Range
- -40° to +85°C Temperature Range

Applications

DML Series

- Solar Tracking & Panel Positioning
- Vehicle Wheel Alignment
- Industrial Automation & Control
- Radar/Antenna Mast Alignment
- Platform Leveling
- Navigation Pitch/Roll Measurement

DMS Series

- Boom Position and Control
- Radar and Vehicle Platform Leveling
- Drilling Equipment
- Navigation Pitch/Roll Measurement
- Industrial Measurement & Control

DMH Series

- Antenna Deflection Measurement
- Radar and Vehicle Platform Positioning
- Drill Rig Alignment
- Offshore Platform Pitch/Roll
- Industrial Measurement & Control

Performance Specs Static/Dynamic

	DML Series				DMS Series				DMH Series			
Angular Range[1] (°):	±10	±30	±60	±90	±10	±30	±60	±90	±10	±15	±30	±60
Resolution (°):	0.05	0.05	0.05	0.01	0.01				0.001			
Hysteresis:	0.1	0.1	0.2	0.2	0.02	0.05	0.08	0.1	0.005	0.007	0.008	0.01
Zero Temp Coefficient, °/°C:	±0.02				±0.01				±0.006			
Scale Factor Temp Coefficient (PPM/°C):	≤350				≤200				≤200			
Warm Up (s):	0.5				0.5				0.5			
Time Constant (s):	0.05				0.05				0.05			

Electrical & Environmental

	DML Series	DMS Series	DMH Series
Output:	5Hz, 15Hz, 35Hz, 50Hz	5Hz, 15Hz, 35Hz, 50Hz	5Hz, 15Hz, 35Hz, 50Hz
Output Type[2]:	RS232, RS485 or TTL	RS232, RS485 or TTL	RS232, RS422, RS485 or TTL
Electromagnetic Compatibility:	EN61000 and GBT17626	EN61000 and GBT17626	EN61000 and GBT17626
Impact Resistance:	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)
Vibration Resistance:	10grms @ 10-1000Hz	10grms @ 10-1000Hz	10grms @ 10-1000Hz
Temperature Rating, Operation:	-40 to +85°C	-40 to +85°C	-40 to +85°C
Temperature Rating, Storage:	-55 to +100°C	-55 to +125°C	-55 to +100°C
Enclosure:			Anodized Aluminum
Seal:	IP67	IP67	IP67
Cables:	1m Cable (standard)	1m Cable (standard)	1m Cable (standard)
Weight:	90g (without cable)	150g	150g (without cable)
Power Requirements:	9-36 VDC @ 60mA	9-36 VDC @ 60mA	9-36 VDC @ 60mA

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle.,
2 - Referenced to theoretical sine value independent of misalignment., 3 - Output phase angle = -90° 4 - Other ranges available upon request

Digital MEMS Inclinometers

	DMI Series	DMP Series	JDI Series
			
Features & Benefits	• Single and Dual Axis Available • **Resolution <0.001°** • **Zero Temp Coefficient ±0.002°/°C** • Digital RS232, RS422, RS485 or UART TTL Output Options • High Shock and Vibration Tolerance	• Single and Dual Axis Available • **Resolution <0.0005°** • **Minimal Thermal Drift (<0.002°/°C Zero)** • Digital RS232, RS422, RS485 or UART TTL Output • -40° to +85°C Operating Range • High Shock & Vibration Tolerance	• Single and Dual Axis Available • **Resolution 0.0001°** • **Full Temperature Compensation to 0.005° Accuracy** • Digital RS485 Output • -40° to +85°C Operating Range • High Shock & Vibration Tolerance • RoHS Compliant
Applications	• Radar and Vehicle Platform Leveling • Drill Rig Alignment • Offshore/Subsea Platform Pitch/Roll • Industrial Measurement & Control • Antenna Position Control	• Radar and Vehicle Platform Leveling • Drill Rig Alignment • Offshore/Subsea Platform Pitch/Roll • Industrial Measurement & Control • Antenna Position Control	• Industrial Automation & Control • Construction & Agricultural Equipment • Solar Tracking • Mobile Cranes • Platform Positioning & Leveling

Performance Specs Static/Dynamic

	DMI Series				DMP Series			JDI Series			
Angular Range[1] (°):	±10	±30	±45	±60	±10	±15	±30	±1	±14.5	±30	±60
Resolution (°):	0.001				0.0005			0.0001			
Hysteresis:	0.003	0.005	0.007	0.008	0.001	0.001	0.002				
Zero Temp Coefficient, °/°C:	±0.002	±0.003	±0.004	±0.004	±0.002			0.0001			
Scale Factor Temp Coefficient (PPM/°C):	≤50				≤50			100			
Warm Up (s):	0.5				0.5			0.5			
Time Constant (s):	0.02				0.05			N/A			

Electrical & Environmental

	DMI Series	DMP Series	JDI Series
Output:	5Hz, 15Hz, 35Hz, 50Hz	5Hz, 15Hz, 35Hz, 50Hz	3.9, 7.8, 15.6, 31.2, 62.5, 125 (Hz)
Output Type[2]:	RS232, RS422, RS485 or TTL	RS232, RS422, RS485 or TTL	RS485
Electromagnetic Compatibility:	EN61000 and GBT17626	EN61000 and GBT17626	N/A
Impact Resistance:	100g@11ms, 3 times/axis (½ sinusoid)	100g@11ms, 3 times/axis (½ sinusoid)	20grms @ 20Hz to 2KHz
Vibration Resistance:	10grms @ 10-1000Hz	10grms @ 10-1000Hz	20grms @ 20Hz to 2KHz
Temperature Rating, Operation:	-40 to +85°C	-40 to +85°C	-40 to +85°C
Temperature Rating, Storage:	-55 to +100°C	-55 to +100°C	-55 to +105°C
Enclosure:	Anodized Aluminum		Anodized Aluminum
Seal:	IP67	IP67	IP67
Cables:	2m Cable (standard)	2m Cable (standard)	DB9, USB or Wired
Weight:	150g (without cable)	150g (without cable)	160g
Power Requirements:	9-36 VDC @ 60mA	9-36 VDC @ 60mA	800 mW, max - RS485 termination enabled 600 mW, max - RS485 termination disabled

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle." The inclinometer output is proportional to the sine of the tilt angle.,
2 - Referenced to theoretical sine value independent of misalignment., 3 - Output phase angle = -90° 4 - Other ranges available upon request

Angular Accelerometers

	ASB Series	ASMP Series	ASXC Series
			
Features & Benefits	• Bandwidths to 200 Hz • IP68 Seals • Available 28V Aircraft Input • Connector or Pin Config • Aerospace Quality and Reliability	• Bandwidths to 200 Hz • 1.05" Cube Housing Size • ±15 Standard Input Voltage • Aerospace Quality & Reliability	• Standard Ranges 2 to 100 rad/sec2 • Resolution Better than 0.001 rad/sec2 • Very High Output to Size Ratio • Self-test for Greater than 95% Fail Detect • -30°C to 70°C Temperature Range
Applications	• Antenna Stabilization • Motor Torque Measurement & Control • Vehicle Ride Analysis • Autopilot System Input • Optical System Stablization	• Motor Torque Measurement & Control • Automotive Angular Acceleration Testing • Autopilot System Input • Optical System Stablization	• Aircraft Stability Augmentation • Racecar Performance Testing • Camera Angular Motion Stabilization • Autopilot System Input • Rotating System Performance Testing • Weapons Control Targeting

Performance Specs

Input Range (Ang: rads/sec², Lin: g)	±200	±500	±1000	±200	±500	±1000	±2	±10	±20	±100
Full Range Output (FRO V± 1.0%)	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±10.0	±10.0	±10.0	±10.0
Non Linearity (%FRO' Max.)	0.5	0.2	0.1	0.5	0.2	0.1	1.0	1.0	1.0	1.0
Scale Factor (Ang: V/rad/sec² Lin: V/g, Nom.)	0.025	0.010	0.005	0.025	0.010	0.005	5.000	1.000	0.500	0.100
Scale Factor Temp Sens (% reading, PPM/°C, Max.)	180	180	180	180	180	180	0.09	0.09	0.09	0.09
Bias (Ang: rad/sec², Lin: g, Dig: g, Max.)	±1.0	±4.0	±4.0	±1.0	±4.0	±4.0	±.005	±.020	±.030	±.100
Bias Temp Sens (FRO, PPM/°C, mg, Max.)	±0.05	±0.05	±0.10	±0.40	±0.40	±0.40	0.001	0.001	0.001	0.001
Bandwidth (-3db) (Hz, Nom.)	70	100	120	70	100	120	100	150	200	170
Damping Ratio (Nom)	0.6	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9
Transverse Axis Misalignment (°, Max.)	±1.0	±1.0	±1.0	±1.0	±1.0	±1.0	±0.025	±0.025	±0.025	±0.025
Resolution and Threshold (rad/sec², µg, Max.)	0.005	0.005	0.005	0.004	0.010	0.020	0.001	0.001	0.002	0.010

Electrical

Number of Axes	1			1			1			
Input Voltage (Vdc)	±12 to ±18			±12 to ±18			±15			
Input Current (mA, Nom.)	±10			±10			25			
Output Impedence (Ohms, Nom.)	10.0K	4.0K	5.0K	4.0K	4.0K	4.0K	100.0			
Noise (Vms, Max.)	5.00	5.00	5.00	0.005	0.005	0.005	0.030	0.030	0.050	0.050

Environmental

Operating Temperature Range	-55°C to +95°C	-55°C to +95°C	-30°C to +70°C
Survival Temperature Range	-65°C to +105°C	-65°C to +105°C	-40°C to +70°C
Vibration	-	-	-
Shock	100g, 11msec, 1/2 sine	100 g	100g, 11msec, 1/2 sine
Seal	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112

Mechanical

Weight	3.0 oz.	2.0 oz.	8.5 oz.
Dimensions	1.10" W x 2.60" L x 1.235" H 1.657" Over Connector	1.05" W x 1.50" L x 1.235" H 1.39" Over Terminal Pins	1.40" Dia x 2.97" L x 2.50" Flange W 3.44" Over Connector
Custom Ability	Yes	No	Yes

Linear Accelerometers

	LCA-100 Series	LCF-200 Series	LSM Series
			
Features & Benefits	• Built-in Output Filter • DO-160 Quality Versions • Available 28V Aircraft Input • Connector or Pin Config • 0.20% 10-year Scale Factor	• ±0.5g to ±5.0g Full Range • Filtering 5 to 100 Hz Bandwidth • Exceptional Bias and Scale Factor • High Level ±V dc Output • 1,500g Shock Capability	• ±0.5g to 20g Full Range • Filtering to 200 Hz Bandwidth w/0.6 Damping • Satellite Application Reliability
Applications	• Aircraft Flight Controls • Aircraft Fatigue Monitoring • Aircraft Autopilot System Input • Aircraft Wind-shear Detect • Double Integrated Railcar Pos • Train Performance Testing	• Geophysical Testing • Railcar Accel/Decel Control • Ocean Buoy Accel Sensing • Aircraft Stability Control • Aircraft Flight Testing • Vehicle Roadway Profiling	• Satellite Nutation Sensing • Radar Leveling • Fire Control • AHRS System Input • Attitude Heading and Reference System

Performance Specs

Input Range (Ang: rads/sec², Lin: g)	±0.5	±1.0	±2.0	±5.0	±0.5	±1.0	±2.0	±5.0	±0.5	±5.0	±2.0
Full Range Output (FRO V± 1.0%)	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0
Non Linearity (%FRO' Max.)	0.05	0.05	0.05	0.02	0.05	0.05	0.05	0.02	0.05	0.10	0.05
Scale Factor (Ang: V/rad/sec² Lin: V/g, Nom.)	10.0	5.0	2.5	1.0	10.0	5.0	2.5	1.0	10.0	1.0	2.5
Scale Factor Temp Sens (% reading, PPM/°C, Max.)	180	180	180	180	100	100	100	100	200	200	200
Bias (Ang: rad/sec², Lin: g, Dig: g, Max.)	±0.01	±0.01	±0.01	±0.01	±0.005	±0.005	±0.005	±0.005	±0.050	±0.010	±0.010
Bias Temp Sens (FRO, PPM/°C, mg, Max.)	100.0	100.0	100.0	100.0	50.0	50.0	50.0	50.0	50.0	100.0	50.0
Bandwidth (-3db) (Hz, Nom.)	60	60	60	60	30	30	30	30	70	100	140
Damping Ratio (Nom)	-	-	-	-	-	-	-	-		0.5 to 0.9	
Transverse Axis Misalignment (°, Max.)	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71	±0.71
Resolution and Threshold (rad/sec², µg, Max.)	10.0	10.0	10.0	10.0	1.0	1.0	1.0	1.0	10.0	10.0	10.0

Electrical

Number of Axes	1	1	1
Input Voltage (Vdc)	±12 to ±18	±12 to ±18	±12 to ±18
Input Current (mA, Nom.)	±25	±15	±10
Output Impedence (Ohms, Nom.)	100.0	100.0	10.0K 5.0K 2.5K
Noise (Vms, Max.)	0.005	0.001	5.000

Environmental

Operating Temperature Range	-55°C to +85°C	-40°C to +80°C	-55°C to +95°C
Survival Temperature Range	-60°C to +90°C	-40°C to +90°C	-65°C to +105°C
Vibration	0 g	20 g	20 g
Shock	100 g	1000g, 1 msec, 1/2 sine	100 g, 0.011 sec, ½ sine
Seal	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112

Mechanical

Weight	5.0 oz.	4.0 oz.	2.0 oz.
Dimensions	1.38" W x 3.10" L x 1.50" H	1.38" W x 3.10" L x 1.50" H	1.05" W x 1.50" L x 1.235" H 1.39" Over Terminal Pins
Custom Ability	No	No	Yes

Linear Accelerometers

	LSB Series	SMA Series	LCF-500 Series
			
Features & Benefits	• ±0.5g to 20g Full Range • Filtering to 200 Hz Bandwidth w/0.6 Damping • Satellite Application Reliability	• Low-cost, high precision solution • ±0.25g to ±2g Full Range • 3.5µg Resolution • -55°C to +85°C Operating Temperature Range	• Filtering Available • Exeptional Bias & Scale Factor • High Level ± Vdc Output • 1,000g Shock Capability
Applications	• Train Braking & Banking • Missile Orientation • Autopilot Systems • Train Performance Testing • Performance Testing	• Industrial Automation • OEM • Wind Turbine Motion Control • Robotics • Track Monitoring and Testing	• Railcar Acceleration Control • Railcar Harshness (NVH) • Train Performance Testing • Railcar Monitoring • Railcar Vibration Testing

Performance Specs

Input Range (Ang: rads/sec², Lin: g)	±5.0	±10.0	±20.0	±0.25	±0.5	±1	±2	± 0.5	± 1.0
Full Range Output (FRO V± 1.0%)	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0
Non Linearity (%FRO' Max.)	0.10	0.50	0.25	0.02	0.02	0.05	0.05	0.02	0.02
Scale Factor (Ang: V/rad/sec² Lin: V/g, Nom.)	1.0	0.5	0.25	20	10	5	2.5	5	5
Scale Factor Temp Sens (% reading, PPM/°C, Max.)	200	200	200	100	100	100	100	100	100
Bias (Ang: rad/sec², Lin: g, Dig: g, Max.)	±0.010	±0.020	±0.050	±0.0025	±0.005	±0.01	±0.02	±0.004	±0.004
Bias Temp Sens (FRO, PPM/°C, mg, Max.)	100.0	100.0	100.0	85	100	140	200	50	50
Bandwidth (-3db) (Hz, Nom.)	100	140	160	5	5	5	5	75	75
Damping Ratio (Nom)		0.5 to 0.9		-	-	-	-	30	30
Transverse Axis Misalignment (°, Max.)	±0.71	±0.71	±0.71	1	1	1	1	2	2
Resolution and Threshold (rad/sec², µg, Max.)	10.0	20.0	50.0	3.5	3.5	3.5	3.5	1	1

Electrical

Number of Axes	1			1				1	
Input Voltage (Vdc)	±12 to ±18			±12 to ±18				±12 to ±18	
Input Current (mA, Nom.)	±10			40				25	
Output Impedence (Ohms, Nom.)	10.0K	5.0K	2.5K	10				100	
Noise (Vms, Max.)	5.000			0.002				0.005	

Environmental

Operating Temperature Range	-55°C to +95°C			-55°C to +85°C				-40°C to +80°C	
Survival Temperature Range	-65°C to +105°C			-60°C to +90°C				-60°C to +90°C	
Vibration	20 g			-				20 g	
Shock	100 g, 0.011 sec, ½ sine			500g, 1 msec, ½ sine				100g, 11 msec, ½ sine	
Seal	MIL-STD-202, Method 112			IP65				MIL-STD-202, Method 112	

Mechanical

Weight	5.0 oz.			4.0 oz				8.0 oz.	
Dimensions	1.10" W x 2.60" L x 1.235" H 1.657" Over Connector			1.55" W x 3.10" L x 1.52" H 2.04" Over Connector				1.38" W x 3.46" L x 1.65" H 2.15" Over Connector	
Custom Ability	No			Yes				Yes	

	Dual Axis Accelerometer				Triple Axis Accelerometer			Digital Accelerometer			
	LCF-2530				LCF-3500			DXA-100/200 Series			
											
Features & Benefits	• ± 0.25 g to ± 5.0 g Full Range • Dual Axis Version of LCF-Series • High Accuracy and Superior Repeatability • -40°C to +80° C Operating Temp Range				• ±0.5g to ±5.0g Full Range • Filtering 5 to 100 Hz Bandwidth • Exceptional Bias & Scale Factor			• Resolution 8 µg • Mechanical Shock 1500 g 1msec ½ sine • Industry Standard RS485 & RS422 Output • High Precision and Performance			
Applications	• Satellite Nutation Sensing • Train Braking and Banking • Performance Testing • Attitude Heading and Reference Systems • Autopilot				• Geophysical Testing • Railcar Acceleration & Deceleration Control • Ocean Buoy Acel Sensing • Aircraft Stability Control • Vehicle Roadway Profiling			• Radar/Antenna Control • Structural Monitoring • Linear Acceleration/Deceleration Measuring • Automatic Train Position Control • Seismic Monitoring • Track Leveling			
Performance Specs											
Input Range (Ang: rads/sec², Lin: g)	± 0.25	± 0.50	± 1.00	± 5.00	±0.5	±2.0	±5.0	± 0.25	± 0.50	± 1.00	± 2.00
Full Range Output (FRO V± 1.0%)	± 5.0	± 5.0	± 5.0	± 5.0	±5.0	±5.0	±5.0	± 0.25	± 0.50	± 1.00	± 2.00
Non Linearity (%FRO' Max.)	0.02	0.02	0.02	0.10	0.05	0.05	0.05	0.02	0.02	0.05	0.03
Scale Factor (Ang: V/rad/sec² Lin: V/g, Nom.)	20.00	10.00	5.00	1.00	10	2.50	1.00	0.05	0.05	0.05	0.05
Scale Factor Temp Sens (% reading, PPM/°C, Max.)	100	60	60	100	100	100	100	100	100	100	100
Bias (Ang: rad/sec², Lin: g, Dig: g, Max.)	±0.001	±0.002	±0.004	±0.005	±0.005	±0.005	±0.005	1	1	1	1
Bias Temp Sens (FRO, PPM/°C, mg, Max.)	0.001	0.0005	0.0003	0.0003	100.0	100.0	100.0	90.0	90.0	90.0	90.0
Bandwidth (-3db) (Hz, Nom.)	30	30	30	30	30	30	30	30	30	30	30
Damping Ratio (Nom)	-	-	-	-	30.0	30.0	30.0	-	-	-	-
Transverse Axis Misalignment (°, Max.)	±0.50	± 1.00	± 1.00	± 1.00	±1.0	±1.0	±1.0	0.5	0.5	0.5	0.5
Resolution and Threshold (rad/sec², µg, Max.)	1.0	1.0	1.0	1.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0
Electrical											
Number of Axes	2				3			1 or 2			
Input Voltage (Vdc)	±12 to ±18				±12 to ±18			±10 to ±30			
Input Current (mA, Nom.)	±50				±15			DXA-100 ±80 mA/DXA-200 ±70 mA			
Output Impedence (Ohms, Nom.)	100.0				100.0			-			
Noise (Vms, Max.)	0.002				0.002			0.005			
Environmental											
Operating Temperature Range	-40°C to +80°C				-40°C to +80°C			-40°C to +70°C			
Survival Temperature Range	-60°C to +90°C				-60°C to +90°C			-40°C to +75°C			
Vibration	20 g				20 g			20 g			
Shock	1000g, 1msec, 1/2 sine				1000g, 1msec, 1/2 sine			1500g, 1msec, 1/2 sine			
Seal	MIL-STD-202, Mtd 112				MIL-STD-202, Mtd 112			MIL-STD-202, Mtd 112			
Mechanical											
Weight	8.0 oz.				16 oz.			DXA-100 8 oz./DXA-200 10 oz.			
Dimensions	3.609" L x 1.62" W x 1.83" H				3.25" L x 2.75" W x 2.75" H			3.609" L x 1.62" W x 1.83" H			
Custom Ability	Yes				Yes			Yes			

MEMS Accelerometers

	Industrial Sensor	Rail Sensors	
	JMA-100/200/300 Series	JMA-165 Series	JMA-165 Series (With Heater)
			
Features & Benefits	• Single, Dual and Triaxial Configuration • **Rugged & Robust Enclosure** • **Low-cost MEMS technology** • RoHs Compliant • Single or Dual Power Input • ±0.5 g, ±1.0 g and ±1.5 g ranges	• ±0.5 g & ±1.0 g full ranges • **CENELEC/AREMA certified** • **RoHs Compliant** • Filtering Available • Low-cost MEMS technology	• ±0.5 g & ±1.0 g full ranges • **CENELEC/AREMA certified** • **Internal heater for reduced thermal drift** • Filtering Available • RoHs Compliant • Low-cost MEMS technology
Applications	• Vehicle Testing • Railway Maintenance & Testing • Acceleration/Deceleration Control • Aerospace/Space Craft Testing • Lateral Train Control	• Automated Train Controls • Rail Maintenance & Testing • Acceleration/Deceleration Control • Train Performance Testing	• Automated Train Controls • Rail Maintenance & Testing • Acceleration/Deceleration Control • Train Performance Testing

Performance Specs Static/Dynamic

Measurement Range[1] (g):	±0.5	±1.0	±1.5	±0.5	±1.0	±0.5	±1.0
Resolution (mg, Max.):	0.04			0.025	0.15	0.025	0.15
Bias/Zero (g max):	±0.01	±0.01	±0.02	-0.01 to 0.01		-0.01 to 0.01	
Scale Factor Tolerance (mg):	±5	±10	±15	±7.5	±15	±7.5	±15
Scale Factor Temp Coefficient (PPM/°C):	150	150	150	300	150	125	75
Non-Linearity (% FRO max):	0.05	0.05	0.08	0.2	0.1	0.2	0.1
Bandwidth (Hz nom) (-3 dB):	100			100		100	

Electrical & Environmental

Output:	0-5 VDC, ±5 VDC or 4-20mA	±5 VDC	±5 VDC
Input Voltage Range (VDC):	12 to 30, ±12 to ±18 or 28mA	±12 to ±18	±12 to ±18
Operating Current:	7 mA or ±8 mA	±8 mA	-8mA/+150mA quiescent (+500mA peak max., 30 sec. max.)
Temperature Rating, Operation:	-40 to +85°C	-40 to +70°C	-40 to +70°C
Temperature Rating, Storage:	-40 to +95°C	-55 to +85°C	-55 to +85°C
Shock:	100 g, 0.011 sec, ½ sine	10 g, 0.011 sec, ½ sine	10 g, 0.011 sec, ½ sine
Seal:	IP65	IP65	IP65
Weight (grams):	165 (1 axis), 170 (2 axes), 180 (3 axes)	85	85
Number of Axes:	1, 2 or 3	1	1

Notes: 1 - Custom ranges available on request.

MEMS Accelerometers

Commercial Sensors

AMA Series

DMA Series

Features & Benefits

AMA Series

- 1.85" x 1.85" x 1.89" size
- **Analog Output (0-5V or 4-20mA)**
- **Single, Dual and Triaxial Configuration**
- Excellent long term stability
- Ruggedized for harsh environment operation
- High Sensitivity

DMA Series

- 1.85" x 1.85" x 1.89" size
- **Digital Output (RS232, RS485 or TTL)**
- **Single, Dual and Triaxial Configuration**
- Excellent long term stability
- Ruggedized for harsh environment operation
- High Sensitivity

Applications

- Tower Cranes
- Robotics
- Low Frequency Vibration Measurement
- Automatic Control Systems
- Vehicle Testing

Performance Specs Static/Dynamic

Measurement Range[1] (g):	±2	±10	±40	±2	±10	±40
Resolution (mg, Max.):	0.1	0.6	2.8	0.1	0.6	2.8
Bias/Zero (g max):	0.02	0.05	0.15	0.01	0.05	0.15
Scale Factor Tolerance (mg):	10	50	150	2	5	10
Scale Factor Temp Coefficient (PPM/°C):		100			100	
Non-Linearity (% FRO max):	0.3	0.5	0.6	0.2	0.5	0.6
Bandwidth (Hz nom) (-3 dB):		400			400	

Electrical & Environmental

Output:	0-5V or 4-20mA	RS232, RS485 or TTL
Input Voltage Range (VDC):	9 to 36	9 to 36
Operating Current:	<3mA at 12Vdc	<3mA at 12Vdc
Temperature Rating, Operation:	-40 to +85°C	-40 to +85°C
Temperature Rating, Storage:	-55 to +100°C	-55 to +100°C
Shock:	100g 11msec ½ sine	100g 11msec ½ sine
Seal:	IP67	IP67
Weight (grams):	100	100
Number of Axes:	1, 2 or 3	1, 2 or 3

Notes: 1 - Custom ranges available on request.

Quartz Flexure Accelerometers

	QFA - 125	QFA - 150	QFA - 180	QFM - 180
				
Features & Benefits	• Mid-Temperature Range • Excellent Repeatability • Environmentally Rugged • Choice of Square or Round Mounting Flanges • Built In Self-Test System	• Mid-Temperature Range • Excellent Repeatability • Environmentally Rugged • Choice of Square or Round Mounting Flanges • Built In Self-Test System	• High Temperature Range • Excellent Repeatability • Environmentally Rugged • Choice of Square or Round Mounting Flanges • Built In Self-Test System	• High Temperature Range • Miniature Compact Design • Environmentally Rugged • Square Mounting Flanges • Built In Self-Test System
Applications	• Rail Maintenance Track Geometry • Wind Tunnel Testing • Navigation Grade Performance • Survey Applications	• Borehole Mapping • Wind Tunnel Testing • Marine Instrumentation • 3D Modeling Equipment for Large Scale Geometries	• Well Borehole Logging • Measure While Drilling • Structural Monitoring • Survey Applications • Orientation Systems for Drilling Applications	• Borehole Mapping • Measure While Drilling • Structural Monitoring • Oil Drilling • Survey Applications • Robotics
Performance Specs				
Acceleration Range, g Max. (Note 1)	±30	±30	±30	±20
Scale Factor, mA/g (Note 2)	1.1 to 1.4	1.1 to 1.4	1.1 to 1.4	1.8 to 2.8
Bias, milli-g, Max. (@ 25° C)	40	20	40	20
Axis Alignment, mRad, Max. (@ 25° C)	1.5	±1.5	1.5	4
Threshold and Resolution, µg Max.	10	10	10	10
Bandwidth, Hz, Min.	300	300	300	300
Scale Factor Temp. Sens, PPM/°C, Max.:	+55°C to +125°C : ±200 +100°C to +125°C : ±170	+25°C to +100°C : ±80 +100°C to +125°C : ±150 +125°C to +150°C : ±200	+55°C to +180°C: ±200 +100°C to +180°C: ±170	±200
Bias Temp. Sens, µg/°C, Max.	±100	±100	±150	±150
Scale Factor Stability (1 month composite)	less than 250 ppm	less than 350 ppm	less than 250 ppm	less than 220 ppm
Bias Stability (1 month composite)	less than 250 µg	less than 500 µg	less than 250 µg	less than 220 µg
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3	3	3	4
Weight (grams)	55	55	55	25
Electrical				
Input Voltage, Vdc	±12 to ±18	±12 to ±18	±12 to ±18	±12 to ±18
Input Current (quiescent), mA (Max.)	12	12	12	20
Environmental				
Operational Temp Range, °C	-55°C to +125°C	-55°C to +150°C	-55°C to +180°C	-40°C to +180°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g	25 Hz to 500 Hz, 25g	25 Hz to 500 Hz, 25g	25 Hz to 500 Hz, 30g
Shock, g (0.5 msec, 1/2 sine)	1000	1000	1000	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Product Datasheets

Making Sense Out of Motion...

Jewell Instruments

LSOC/LSOP Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Input Ranges From ±1.0° to ±90° With High Reliability, High Resolution, and Low Non-Linearity

The Jewell **LSOC/LSOP Series** fluid damped, flexure suspension, servo inclinometer is a precision inertial-grade sensing instrument and is Jewell's most robust solution designed to meet the needs of a variety of commercial, industrial, and aerospace applications.

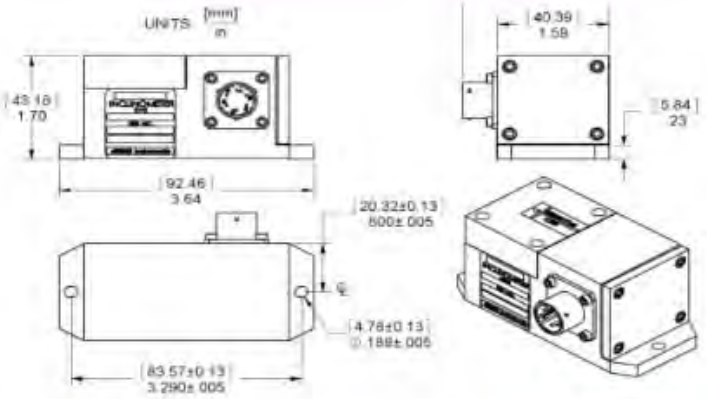
Features & Benefits

- Extremely high resolution and low hysteresis of less than 0.0005% of full range output.
- Extremely robust designed to with-stand shocks in excess of 1500g and vibration of 20 grms.
- Responds to changes of slope as small as 0.000006"/ft.
- High accuracy closed-loop force balanced sensor technology.
- Low white noise spectral density of better than 0.15µV/Sq. Root HZ

Applications

- Steel processing: continuous casting, electric arc furnace and idle control
- Heavy construction: paving, grading, mining, tunneling, and overturn detection
- Structural monitoring: walls of dams, support, columns, bridges, and others
- Railway: automated train controls, rail leveling and grinding, and rail bed analysis

Outline Diagram



Pin Out (Options: C-Connector, P-Pin)

Pin A	Supply +15Vdc
Pin B	0V Common
Pin C	Supply -15Vdc
Pin D	Output
Pin E	Not Used
Pin F	Self Test

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LSOC/LSOP Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range (°)	± 1.0	± 3.0	± 14.5	± 30.0	± 90.0
Full Range Output (FRO V± 1.0%[1])	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO[2], Max.)	0.05	0.05	0.02	0.02	0.05
Scale Factor (V/g, Nom.)	286.5	95.5	20.0	10.0	5.0
Scale Factor Temp Sens (% reading/°C, Max.)	±0.04	±0.03	±0.01	±0.06	±0.06
Bandwidth (-3db) (Hz, Nom.)	0.5	2.0	15.0	20.0	40.0
Transverse Axis Misalignment (° Max.)	±0.1	±0.15	±0.25	±0.5	±1.00
Output @ 0° Tilt (Bias) (V, Max.)	±0.1	±0.04	±0.02	±0.02	±0.02
0° Output Temp Sensitivity (V/°C, Max.)	±0.005	±0.003	±0.001	±0.0005	±0.0003
Resolution and Threshold (µrad Max.)	1.0	1.0	1.0	1.0	1.0

ELECTRICAL

Number of Axis	1
Input Voltage (Vdc)	± 12 to ± 18
Input Current (mA, Nom.)	± 15
Output Impedance (Ohms, Nom.)	100
Noise (Vms, Max.)	0.002

ENVIRONMENTAL

Operating Temp Range	-20°C to +70°C
Survival Temp Range	-40°C to +70°C
Vibration	20 grms
Shock	1500g, 05 msec, 1/2 sine

ENCLOSURE

Housing material	Anodized Aluminum
Weight	13 oz. (368.5g)
Protection Class per IEC 529	IP 68
Connector Type[4]	PT02H-10-6P
Mating Connector[3],[4]	PT06A-10-6S(SR)
Fastener Size[3]	#8-32 (M4X0.7)
Torque for Steel fasteners[4]	10 inch-lbs. (1.0Nm)
Jewell Connector Part #	62101011-000
Surface Flatness[3]	0.003 (0.0765mm)

Notes:
1 - Full range is defined as "from negative full input angle to positive full input angle." The Inclinometer output is proportional to the sine of the tilt angle.
2 - Referenced to theoretical sine value independent of misalignment.
3 - Jewell Instruments recommendations
4 - Manufacture is Amphenol or equivalent

Custom Capabilities

- 4-20mA output signal with single-ended 24 Vdc input
- Internal temperature sensor and thermal modeling for the highest levels of accuracy over a wide temperature range
- Available in LSR Series package configuration for applications requiring a more compact solution
- Factory set zero biasing for non-horizontal measurements
- Solder terminals and flying leads in place of military connector
- Custom input ranges from ±0.5° to ±90° available
- Custom output impedances available
- Custom bandwidths available on certain ranges

How to Order

LSOC-1	02550278-206
LSOC-3	02550278-207
LSOC-14.5	02550278-208
LSOC-30	02550278-209
LSOC-90	02550278-210
LSOP-1	02550278-201
LSOP-3	02550278-202
LSOP-14.5	02550278-203
LSOP-30	02550278-204
LSOP-90	02550278-205

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LSOC/LSOP "L" 4-20 mA Series Inclinometer

Making Sense out of Motion...

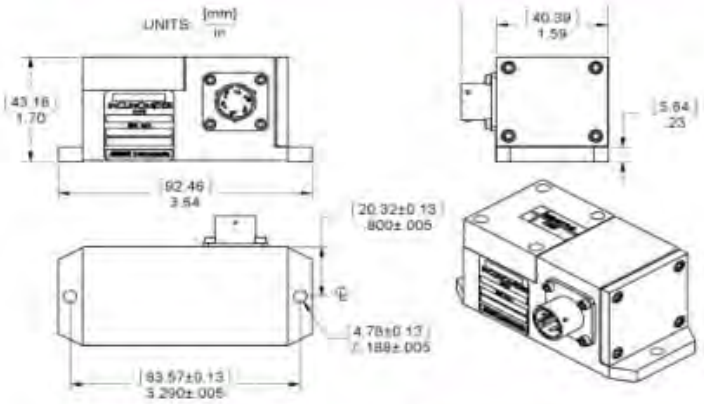
Input Ranges From ±1.0° to ±90° With High Reliability, High Resolution and Low Non-Linearity

The Jewell **LSOC/LSOP "L" Series** 4-20 mA Output Flexure Suspension Servo Fluid Damped Inclinometer is designed for applications where high levels of shock, vibration and electrical noise are present and/or long cable runs are required.

Features & Benefits

- Extremely high resolution and low hysteresis of less than 0.0005% of full range output.
- Extremely robust designed to with-stand shocks in excess of 1500g and vibration of 20 grms.
- Responds to changes of slope as small as 0.000006"/ft.
- High accuracy closed-loop force balanced sensor technology.
- Low white noise spectral density of better than 0.15µV/Sq Root HZ

Outline Diagram



Pin Out (Options C-connector, P-pin)

Pin A	+VDC Power
Pin B	Power/Signal Common
Pin C	Not Used
Pin D	4-20 mA Signal Output
Pin E	Self Test Return
Pin F	Self Test

Applications

- Steel processing: continous casting, electric arc furnance and idle control
- Heavy construction: paving, grading, mining, tunneling, and overturn detection
- Structrural monitoring: walls of dams, support, columns, bridges, and others
- Railway: automated train controls, rail leveling and grinding, and rail bed analysis
- Military Applications: Measuring of angular tilt where high levels of shock and vibration are present

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LSOC/LSOP "L" Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range (°) (Note 1)	± 1.0	± 3.0	± 14.5	± 30.0	± 90.0
Full Range Output (FRO), mADC ± 1.0%	4 to 20	4 to 20	4 to 20	4 to 20	4 to 20
Non Linearity (%FRO Max.) (Note 2)	0.05	0.05	0.10	0.10	0.05
Scale Factor, Ma/G (Nominal)	458	152.8	31.3	16.0	8.0
Scale Factor Temp Sens (PPM/°C, Max.)	400	300	100	100	100
Natural Frequency, Hz (Nominal) (Note 3)	0.3	2.0	15	20	30
Bandwidth (-3dB), Hz (Nominal)	0.3	2.0	15	20	30
Transverse Axis Misalignment, ° Max.	0.15	0.25	0.50	1.00	1.00
Output at Zero Tilt, Ma	12 ± 0.6	12 ± 0.6	12 ± 0.3	12 ± 0.3	12 ± 0.3
Zero Tilt Temp Sens, mA/°C Max.	0.015	0.01	0.0032	0.0032	0.0016
Resolution and Threshold, µ rad Max.	1	1	1	1	1

ELECTRICAL

Input Voltage, VDC	20 to 30 (24 Nominal)
Input Current (mA, Max.):	40
Noise, mA rms Max.	0.01

ENVIRONMENTAL

Operating Temp Range	-18 to +71°C
Survival Temp Range	-40 to +71°C
Vibration	20 grms
Shock	1500g, 0.5 msec, ½ sine
Seal	MIL-STD 202, Method 112

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle."
The inclinometer output is proportional to the sine of the tilt angle.
2 - Referenced to theoretical sine value independent of misalignment.
3 - Output phase angle = -90°.

Custom Capabilities

- Internal temperature sensor and thermal modeling for the highest levels of accuracy over a wide temperature range
- Available in LSR Series package configuration for applications requiring a more compact solution
- Factory set zero biasing for non-horizontal measurements
- Solder terminals and flying leads in place of military connector
- Custom input ranges from ±0.5° to ±90° available
- Custom output impedances available

How to Order

LCOC-1L	02550278-506
LSOC-3L	02550278-507
LSOC-14.5L	02550278-508
LSOC-30L	02550278-509
LSOC-90L	02550278-510

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LSOC-8-R Series Rail Measurement Inclinometer

Jewell Instruments

Making Sense out of Motion...

The Jewell LSOC-8 is the highest accuracy sensor of it's class in the world today

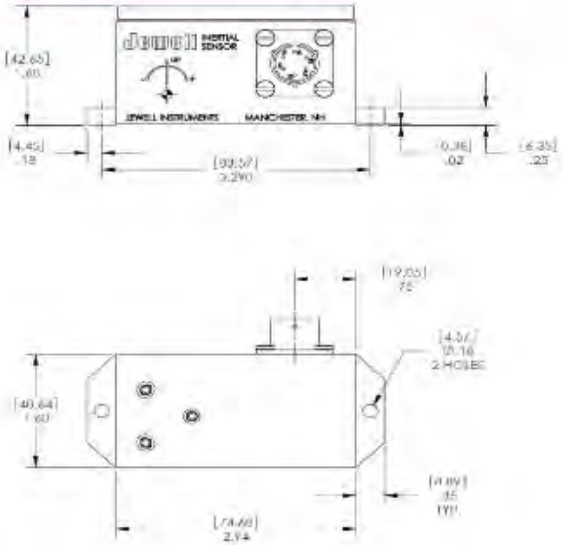
Meets CENELEC/AREMA Standards

The **LSOC-8 Series** inclinometers are configured specifically to yield a combination of high accuracy and ruggedness. The LSOC-8 has been designed to minimize thermal errors associated with outdoor applications.

Features & Benefits

- Best in class zero thermal performance (0.02 ° max error -25 to +60°C)
- Single power supply input
- Factory customized filtering
- 0° Low Output Temperature Sensitivity
- Extremely high resolution and low hysteresis of less than 0.0005% of full range output
- Extremely robust - designed to withstand shocks in excess of 1500g and vibration of 20 grms.
- Responds to changes in slope as small as 0.000006"/ft. (0.0001524mm)
- Low white noise spectral density of better than 0.15µV/√Hz
- Meets CENELEC/AREMA Standards

Outline Diagram



Applications

- Track Monitoring & Testing
- Railcar Tilt Measurement
- Train Automated Controls
- Rail Cross Slope Testing (MOW)
- Rail Lifter & Grinder

Pin Connections

CONNECTOR – PT02H-10-6P
MATES WITH PT06A-10-6S(SR)

Pin A	+12 to +18 VDC
Pin B	Power/Sig Common
Pin C	Not Connected
Pin D	Output Voltage
Pin E	Output Voltage Common (isolated)
Pin F	(Optional Temp. Sensor [+])

NOTE: Output Common can be connected to Power Common

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LSOC-8-R Series Rail Measurement Inclinometer

Jewell Instruments

Making Sense out of Motion...

Specifications

PERFORMANCE			
Input Range (°) (Note 1)	± 8.0	± 8.0	± 8.0
Full Range Output (FRO V± 1.0%)	± 5.0	0 to 5.0	0 to 3.0
Non Linearity (%FRO Max.) (Note 2)	0.02%	0.02%	0.02%
Scale Factor (V/g, Nom.)	35.93	17.96	10.78
Scale Factor Temp Sens (PPM/°C, Max.)	180	180	180
Output Temp Sensitivity, (°)	0.010	0.010	0.010
Thermal Zero Offset, (Max Degrees - Room Temp to -25 °C, Room Temp to +60°C)	0.02	0.02	0.02
Natural Frequency, Hz (Nominal) (Note 3)	(Low Pass Filter frequency range 1 Hz to 30 Hz)		
Transverse Axis Misalignment, ° Max.	0.25	0.25	0.25
Resolution and Threshold, (°) Max.	10	10	10
Hysteresis, Volts Max.	0.002	0.002	0.002
Noise, Vrms Max.	0.001	0.001	0.001

ELECTRICAL	
Input Voltage, VDC	+ 9 to + 18
Input Current (mA, Nom.)	40
Output Impedance (Ohms, Nom.)	10

ENVIRONMENTAL	
Operating Temp Range	-25 to +70°C
Survival Temp Range	-60 to +90°C
Shock	1500g, 0.5 msec, ½ sine
Seal	IP 65

Notes:
1 - Full range is defined as "from negative to Positive full tilt input".
2 - Referenced to a best-fit straight line independent of misalignment.
3 - Factory calibrated.

Meets CENELEC/AREMA Standards

CENELEC EN 55022:2010
CENELEC EN 50155:2007
CENELEC EN 61000-4-8:2010
AREMA Part 11.5.1

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LSOX-D Precision Fluid Damped Inclinometer +/-5V DC Output

Jewell Instruments

Making Sense out of Motion...

The LSOX Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector, pin-terminals or flying leads. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

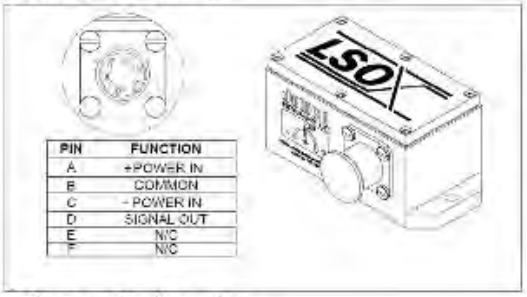
- ***Extremely Rugged***
- ***High Accuracy***
- ***Temperature Compensation Available***
- ***+/-5V Output***
- ***±12 to ±18 Volts DC Power Input***
- ***RoHS Compliant***
- ***CE Certification Pending***

Applications

- ***High-precision Geotech***
- ***Oil and Gas/Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

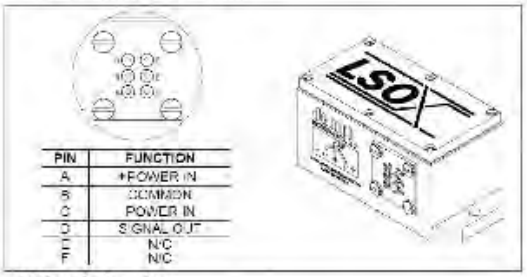
LSOX RoHS COMPLIANT

Connector Version



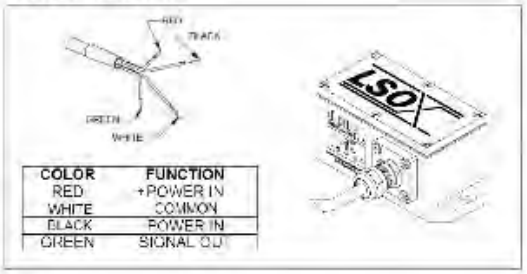
PIN	FUNCTION
A	+POWER IN
B	COMMON
C	- POWER IN
D	SIGNAL OUT
E	N/C
F	N/C

Pin Terminal Version



PIN	FUNCTION
A	+POWER IN
B	COMMON
C	POWER IN
D	SIGNAL OUT
E	N/C
F	N/C

Wired Version



COLOR	FUNCTION
RED	+POWER IN
WHITE	COMMON
BLACK	POWER IN
GREEN	SIGNAL OUT

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L00164 Rev. E

LSOX-D Precision Fluid Damped Inclinometer
+/-5V DC Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (VDC)[1]	±5	±5	±5	±5	±5	±5
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.02	0.05
Scale Factor (V/g nom.)	285.5	95.5	20.0	10.0	5.8	5.0
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (VDC)	±0.10	±0.04	±0.02	±0.02	±0.02	±0.02
0° Output Temp. Sensitivity (V/°C max)	0.015	0.005	0.001	0.0005	0.0004	0.0003
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	40
Noise, Vrms, maximum:	0.002
Output Impedance (ohms)	1
Mass (grams)	370

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP66

Order Code

Model LSOX – □ □ – □

Range
1°, 3°, 14.5°, 30°, 60°, 90°

Connection
- P : Pin Terminal
- C : Connector
- W : Wire lead (tinned ends)

Output Type
- D : +/-5V
- S : 0-5V
- L : 4-20mA

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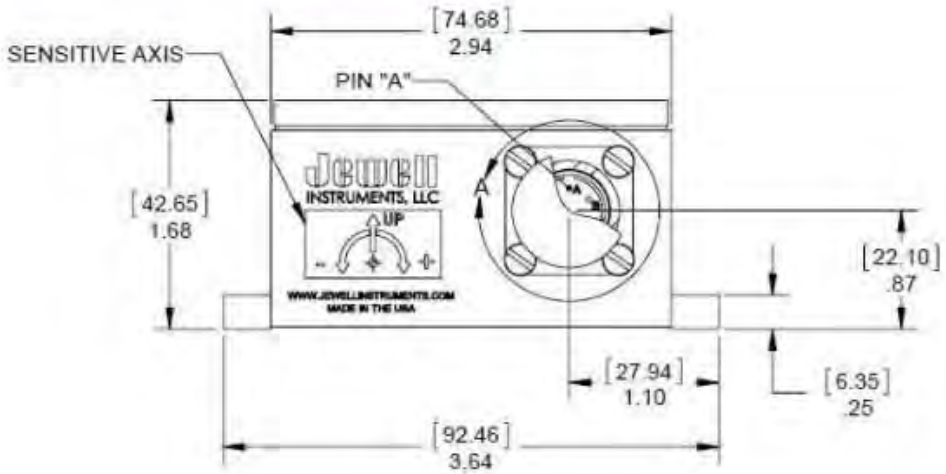
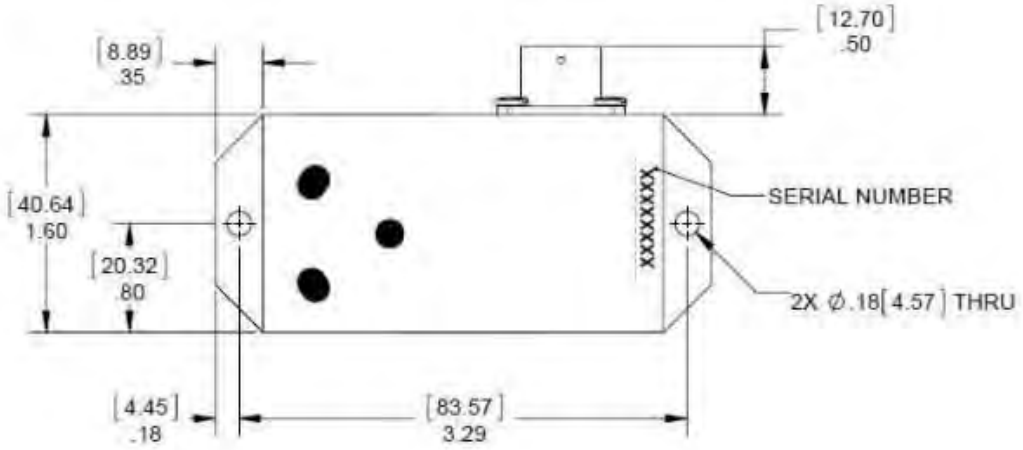
L00164 Rev. E

Outline Drawing: Connector Version





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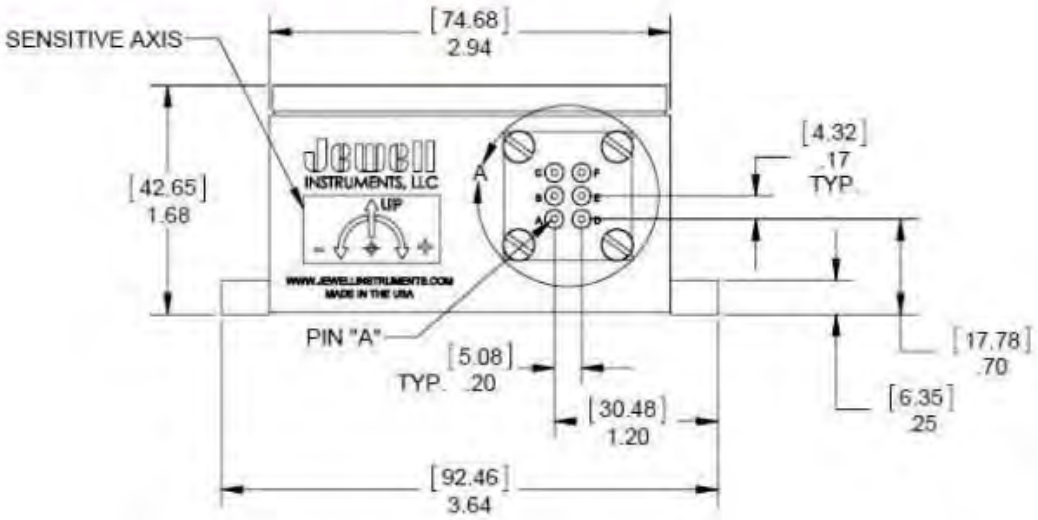
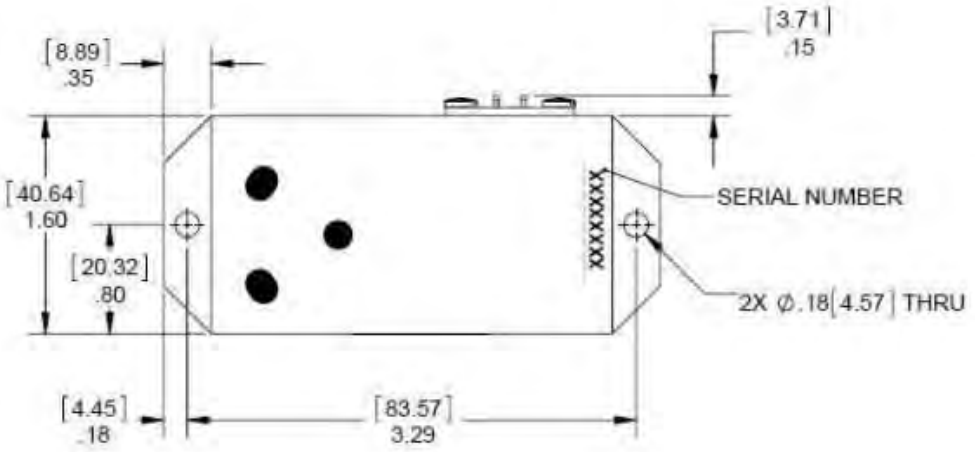
Outline Drawing: Pin Terminal Version





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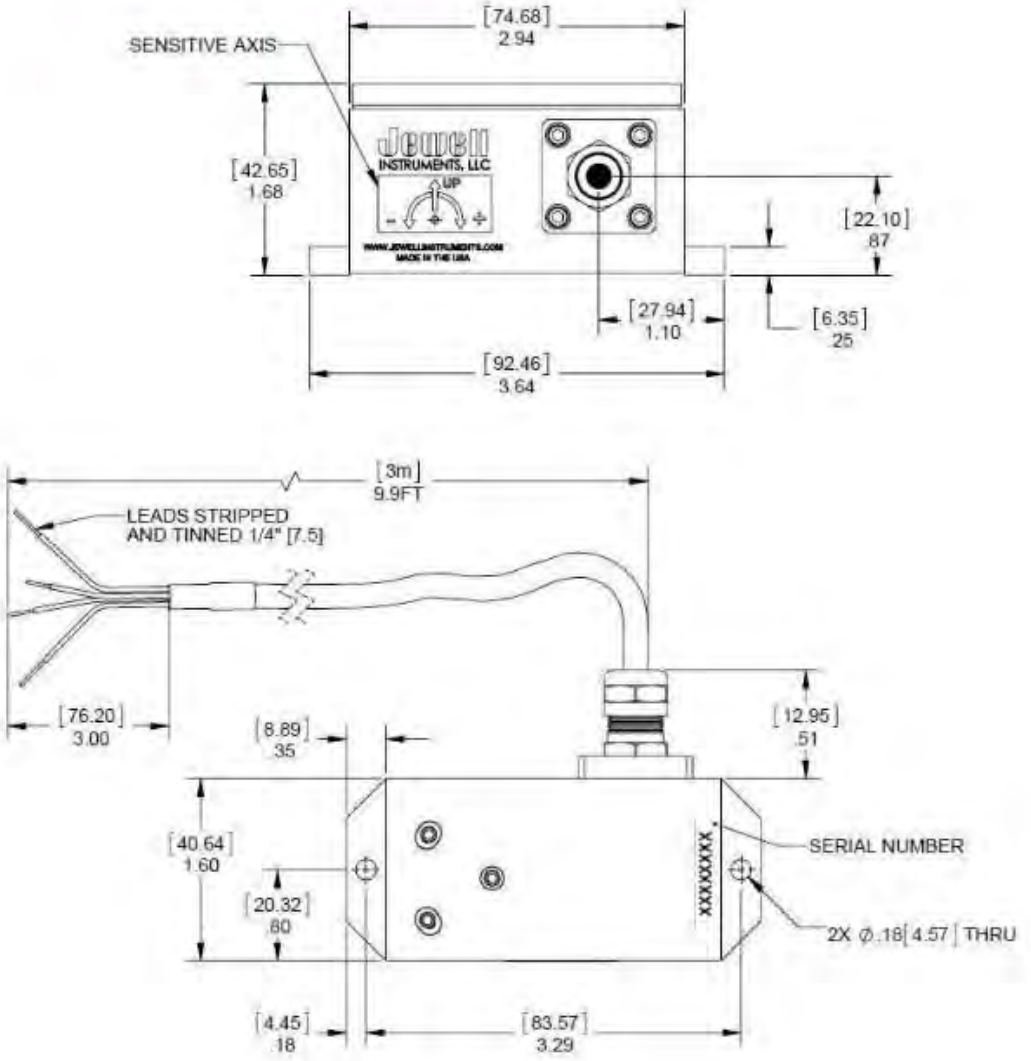
Outline Drawing: Wired Version



LSOX-L Precision Fluid Damped Inclinometer
4-20mA Output

Jewell Instruments

Making Sense out of Motion...

The LSOX Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector, pin-terminals or flying leads. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

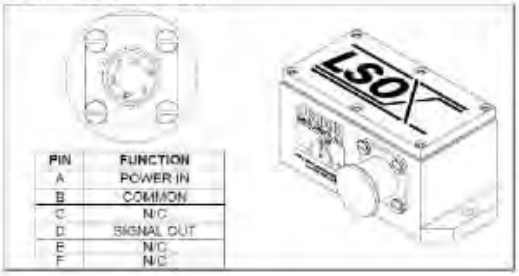
- ***Extremely Rugged***
- ***High Accuracy***
- ***Temperature Compensation Available***
- ***4-20mA Output***
- ***+20 to +30 VDC Power Input***
- ***RoHS Compliant***
- ***CE Certification Pending***

Applications

- ***High-precision Geotech***
- ***Oil and Gas/Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

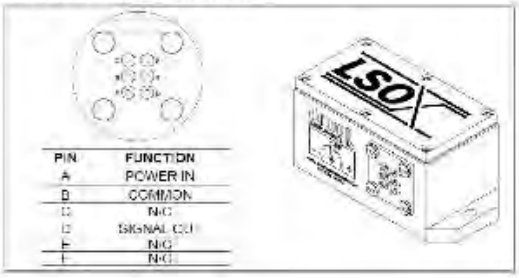
LSOX RoHS COMPLIANT

Connector Version



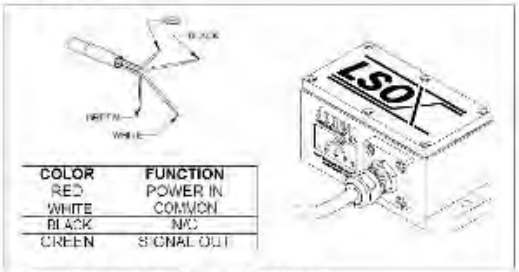
PIN	FUNCTION
A	POWER IN
B	COMMON
C	N/C
D	SIGNAL OUT
E	N/C
F	N/C

Pin Terminal Version



PIN	FUNCTION
A	POWER IN
B	COMMON
C	N/C
D	SIGNAL OUT
E	N/C
F	N/C

Wired Version



COLOR	FUNCTION
RED	POWER IN
WHITE	COMMON
BLACK	N/C
GREEN	SIGNAL OUT

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L00165 Rev. D

LSOX-L Precision Fluid Damped Inclinometer
4-20mA Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (mA)[1]	4-20	4-20	4-20	4-20	4-20	4-20
Non-linearity (% FRO)[2]	0.05	0.03	0.03	0.03	0.03	0.05
Scale Factor (mA/g nom.)	458.4	152.9	32.0	16.0	9.2	8.0
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (mA)	12 ±0.6	12 ±0.6	12 ±0.3	12 ±0.3	12 ±0.3	12 ±0.3
0° Output Temp. Sensitivity (mA/°C max)	0.024	0.01	0.002	0.001	0.001	0.0008
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+20 to +30
Input Current, mA, max:	40
Noise, µArms, maximum:	0.002
Mass (grams)	370

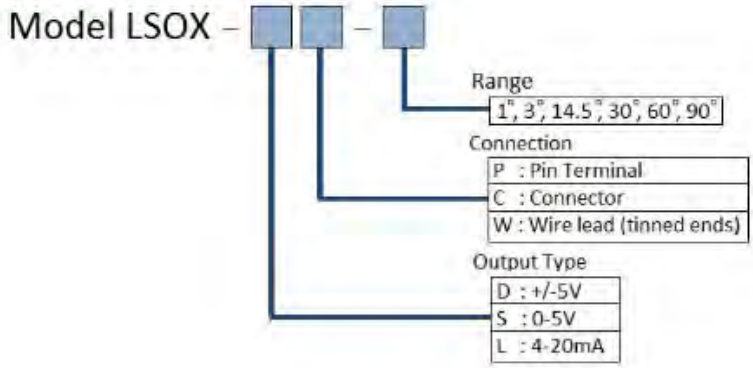
ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP66

Order Code



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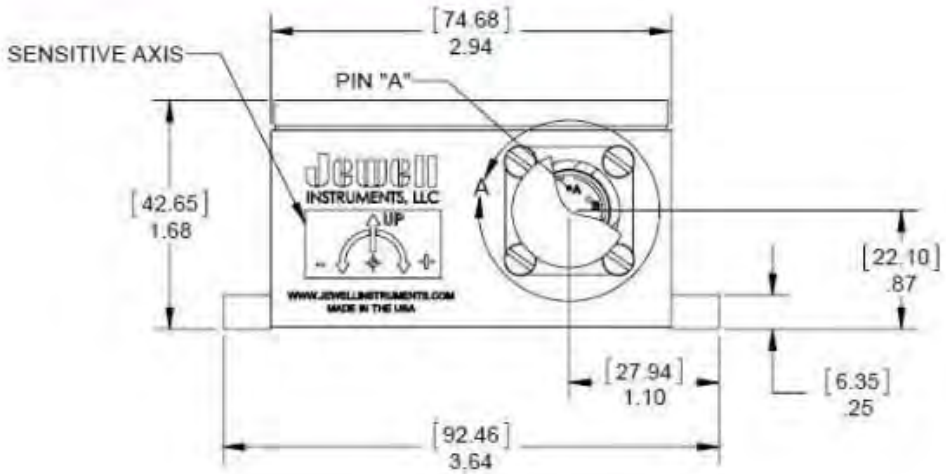
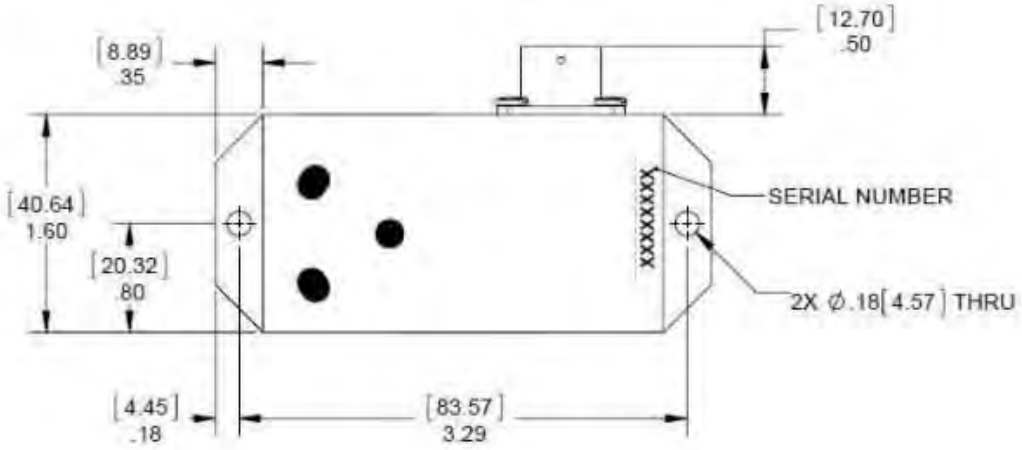
L00165 Rev. D

Outline Drawing: Connector Version





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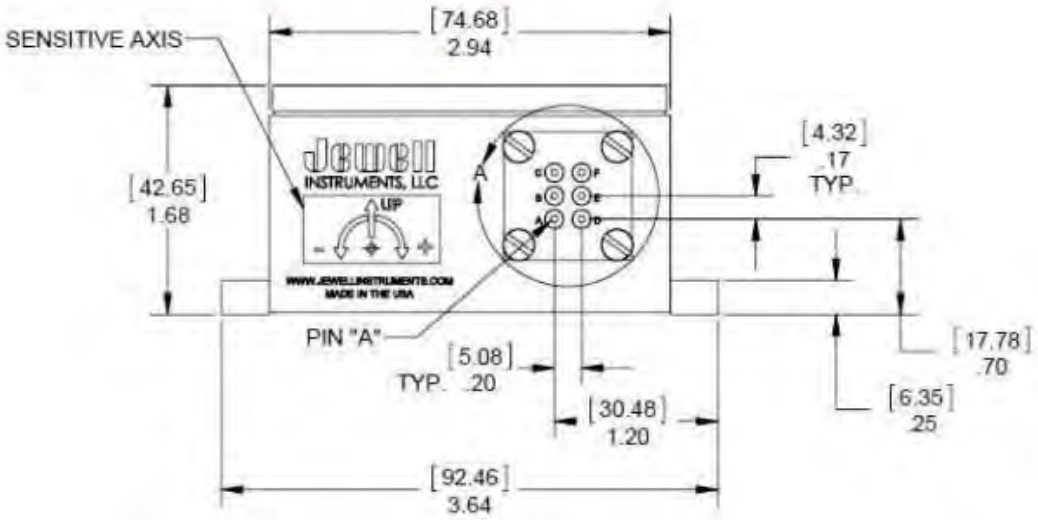
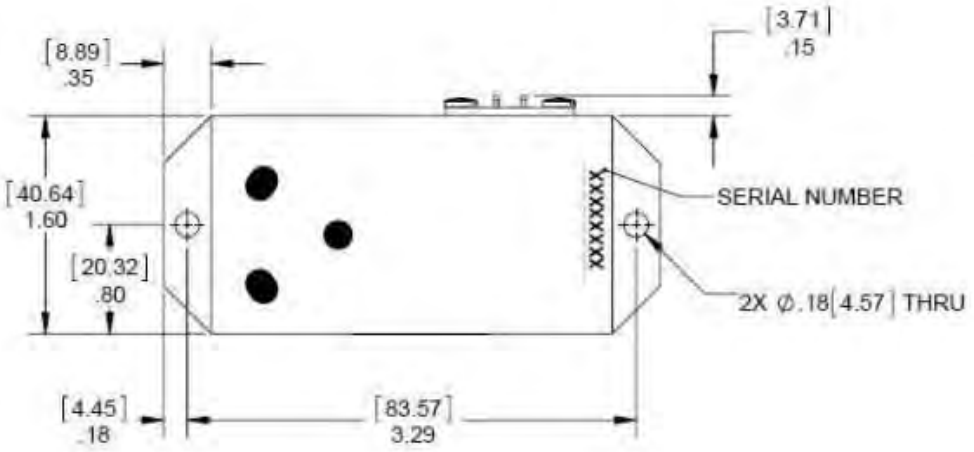
Outline Drawing: Pin Terminal Version





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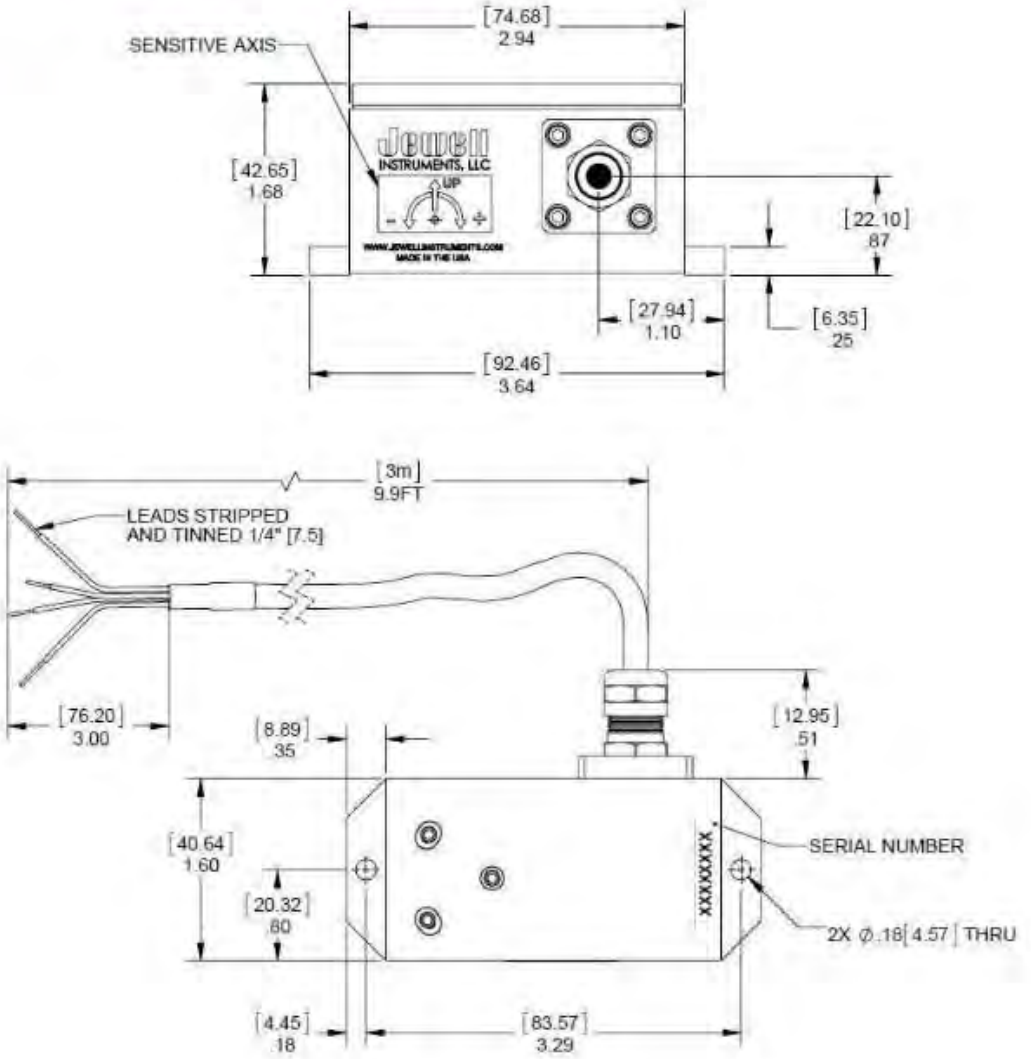
Outline Drawing: Wired Version



LSOX-S Precision Fluid Damped Inclinometer
0-5V DC Output

Jewell Instruments

Making Sense out of Motion...

The LSOX Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector, pin-terminals or flying leads. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

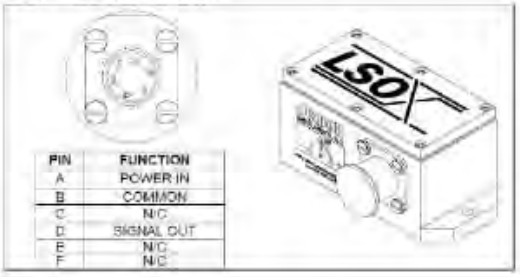
- ***Extremely Rugged***
- ***High Accuracy***
- ***Temperature Compensation Available***
- ***0-5V Output***
- ***+9 to +18 Volts DC Power Input***
- ***RoHS Compliant***
- ***CE Certification Available***

Applications

- ***High-precision Geotech***
- ***Oil and Gas, Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

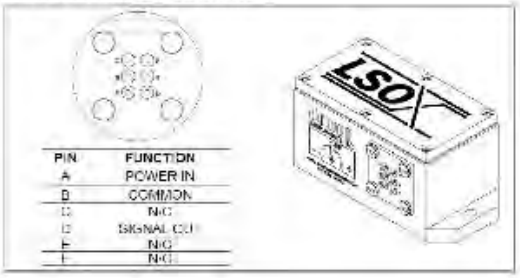
LSOX RoHS COMPLIANT

Connector Version



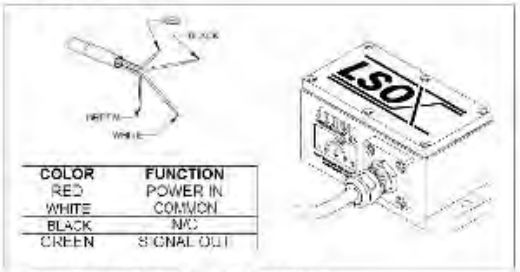
PIN	FUNCTION
A	POWER IN
B	COMMON
C	N/C
D	SIGNAL OUT
E	N/C
F	N/C

Pin Terminal Version



PIN	FUNCTION
A	POWER IN
B	COMMON
C	N/C
D	SIGNAL OUT
E	N/C
F	N/C

Wired Version



COLOR	FUNCTION
RED	POWER IN
WHITE	COMMON
BLACK	N/C
GREEN	SIGNAL OUT

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L00163 Rev. D

LSOX-S Precision Fluid Damped Inclinometer
0-5V DC Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (VDC)[1]	0-5	0-5	0-5	0-5	0-5	0-5
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.02	0.05
Scale Factor (V/g nom.)	143.2	47.8	10.0	5.0	2.9	2.5
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (mA)	±0.10	±0.04	±0.02	±0.02	±0.02	±0.02
0° Output Temp. Sensitivity (V/°C max)	0.015	0.005	0.001	0.0005	0.0004	0.0003
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+9 to +18
Input Current, mA, max:	40
Noise, µArms, maximum:	0.002
Output Impedance (ohms)	1
Mass (grams)	370

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP66

Order Code

Model LSOX – □ □ – □

Range
1°, 3°, 14.5°, 30°, 60°, 90°

Connection
- P : Pin Terminal
- C : Connector
- W : Wire lead (tinned ends)

Output Type
- D : +/-5V
- S : 0-5V
- L : 4-20mA

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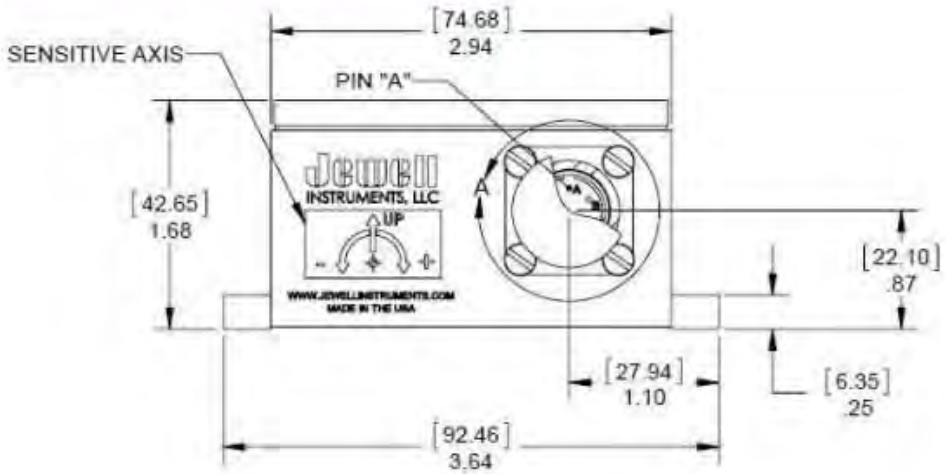
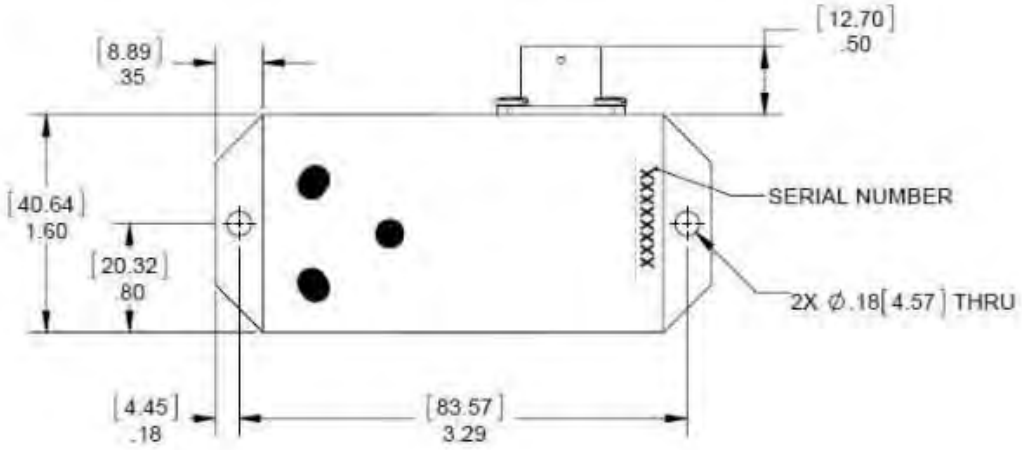
L00163 Rev. D

Outline Drawing: Connector Version





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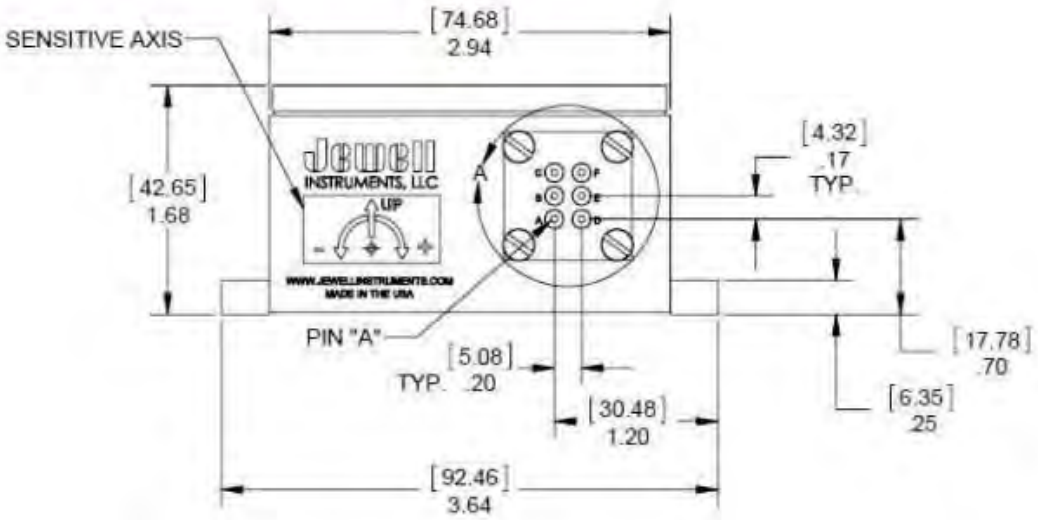
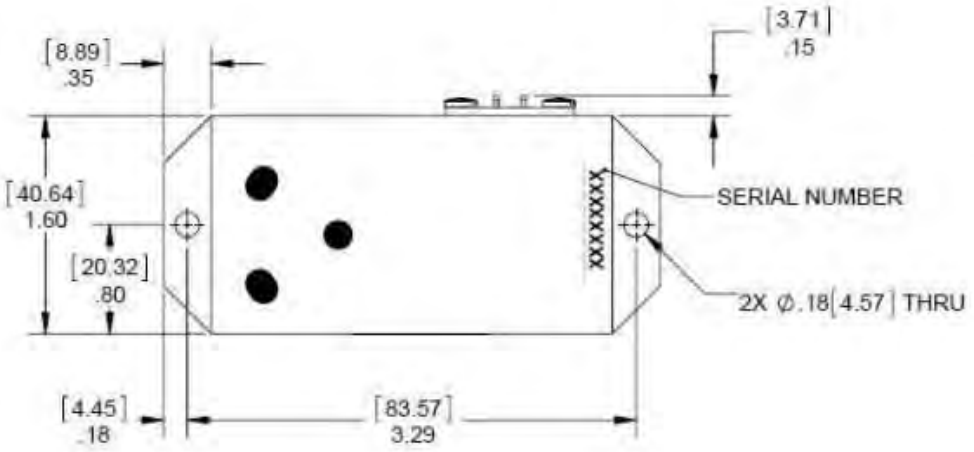
Outline Drawing: Pin Terminal Version





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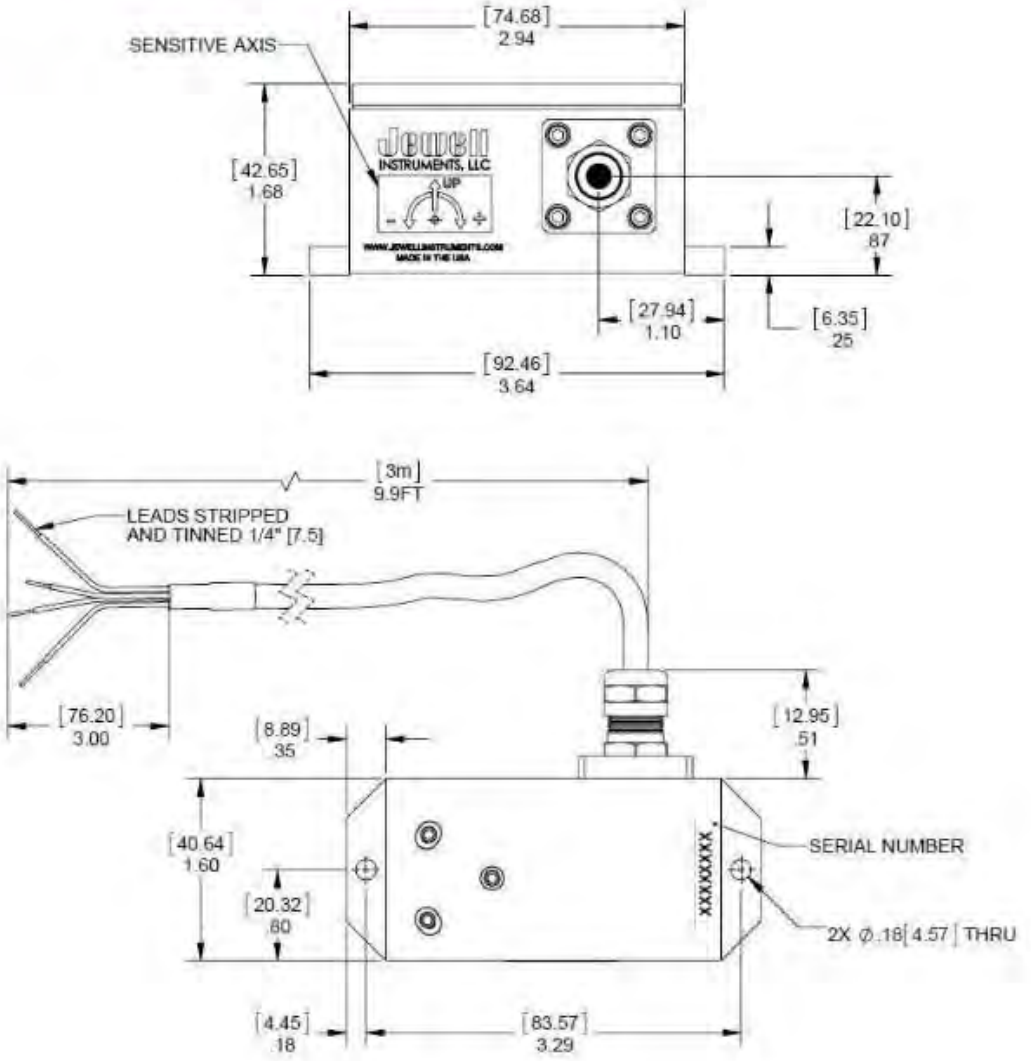
Outline Drawing: Wired Version



LSOX-SCE Precision Fluid Damped Inclinometer
0-5V DC Output – CE Marked

Jewell Instruments

Making Sense out of Motion...

The LSOX Series Inclinometer is a rugged, high performance, single-axis, **CE marked**, tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector, pin-terminals or flying leads. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

- ***Extremely Rugged***
- ***High Accuracy***
- ***Temperature Compensation Available***
- ***0-5Vdc Output***
- ***+9 to +18 Volts DC Power Input***
- ***RoHS Compliant***
- ***CE Marked***

Applications

- ***High-precision Geotechnical***
- ***Oil and Gas/Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

PIN	FUNCTION
A	POWER IN
B	COMMON
C	N/C
D	SIGNAL OUT
E	N/C
F	N/C

CE LSOX RoHS COMPLIANT

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L00163 Rev. C

LSOX-SCE Precision Fluid Damped Inclinometer
0-5V DC Output – CE Marked

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (VDC)[1]	0-5	0-5	0-5	0-5	0-5	0-5
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.02	0.05
Scale Factor (V/g nom.)	143.2	47.8	10.0	5.0	2.9	2.5
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (mA)	±0.10	±0.04	±0.02	±0.02	±0.02	±0.02
0° Output Temp. Sensitivity (V/°C max)	0.015	0.005	0.001	0.0005	0.0004	0.0003
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+9 to +18
Input Current, mA, max:	40
Noise, µArms, maximum:	0.002
Output Impedance (ohms)	1
Mass (grams)	370

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP66

Order Code

Model LSOX - S | CE - ☐

- ☐ **Range**: 1°, 3°, 14.5°, 30°, 60°, & 90°
- **Connection**: CE: Connector
- **Output Type**: S: 0-5V

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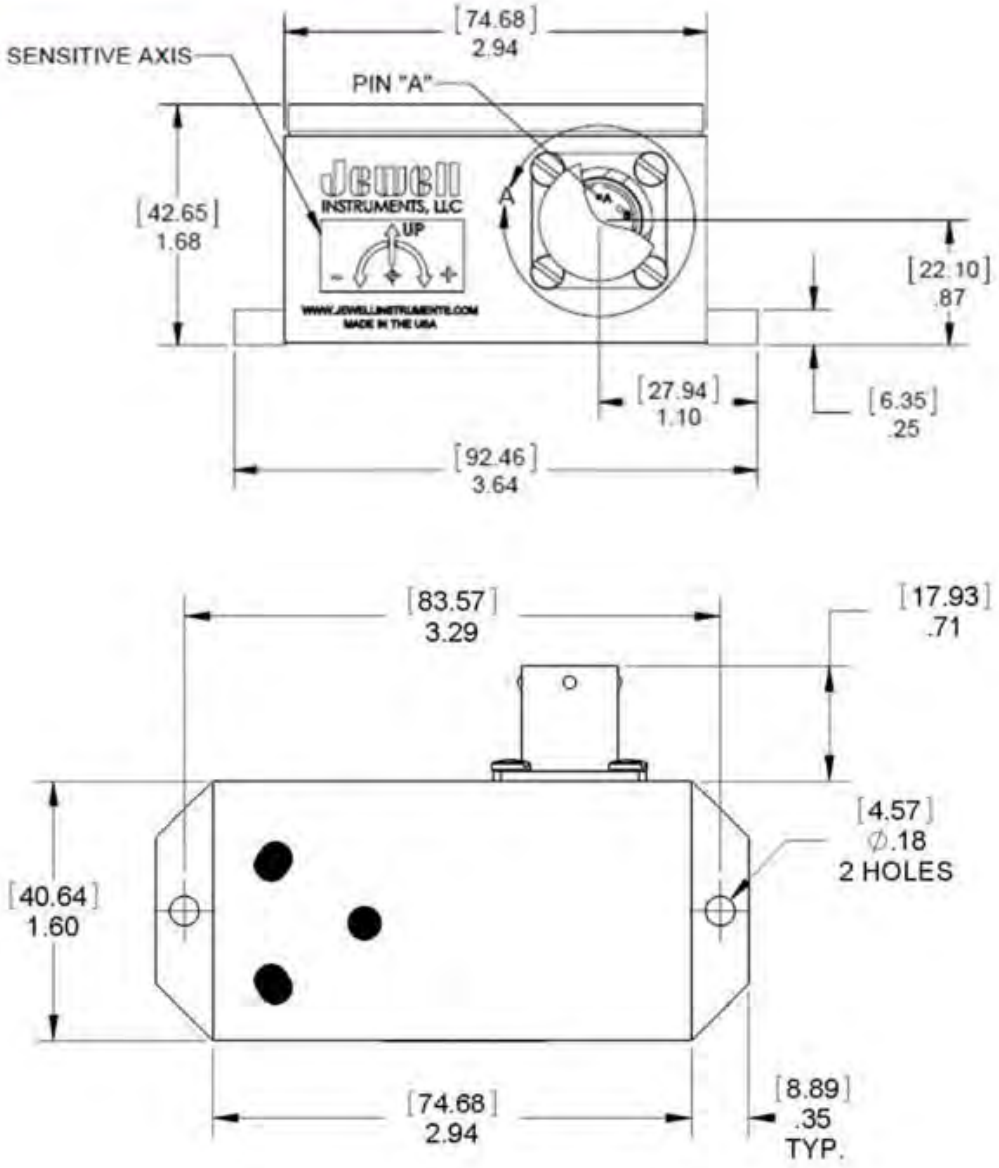
L00163 Rev. C

Outline Drawing: Connector Version



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LSRP Series Inclinometer

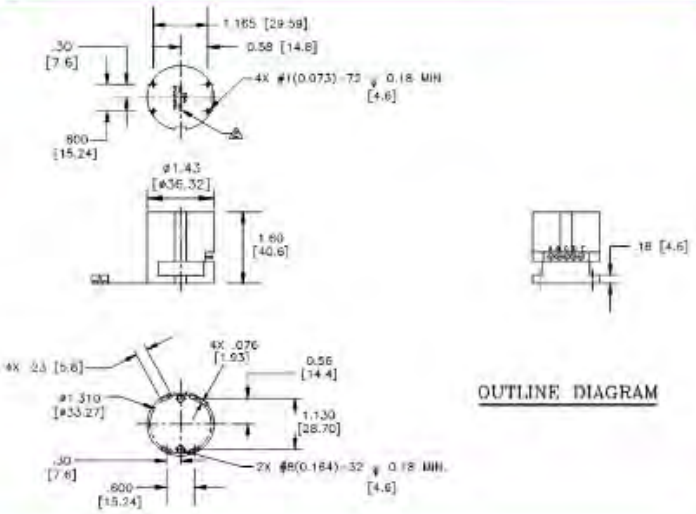
Jewell Instruments

Making Sense Out of Motion...

An extremely sensitive and rugged transducer designed to provide horizontal angle or vertical deviation measurements with virtually infinite resolution.

The Jewell **LSRP Series** meets the needs of applications with space constraints. The fluid damped compact, cylindrical shape and the "stacking" feature of the LSR facilitate the use of several inclinometers when multi-axis measurement is required. The LSRP offers precise readings with high outputs at lower range frequencies.

Dimensional Drawing: *LSRP Inclinometer Series*



OUTLINE DIAGRAM

Features & Benefits

- ±1° to ±90°C Input Full Range
- Only 1.4" diameter X 1.60" Tall in Size
- Withstands 20 grams of vibration
- Stackable for 2-Axis Sensing
- Solder Pins Terminations

Applications

- Heavy Construction Grading
- Ship and Barge Leveling
- Deviation Surveys
- Continuous Casting
- Weapons Platform Leveling
- Steel Mill Ladle Position
- Oil and Gas Well Bore Mapping
- Geophysical Monitoring
- Mobile Antenna Positioning

Pin A	+12 to +18 VDC
Pin B	Power/Sig Common
Pin C	-12 to -18 VDC
Pin D	Eo (volts/g)
Pin E	Self-Test

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LSRP Series Inclinometer

Jewell Instruments

Making Sense Out of Motion...

LSRP Inclinometer Specifications

PERFORMANCE

Input Range (°)	± 1.0	± 3.0	± 14.5	± 30.0	± 90.0
Full Range Output (FRO), ±1% (Note 1)	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO' Max.) (Note 2)	0.05	0.05	0.02	0.02	0.05
Scale Factor (V/g, Nom.)	286.5	95.5	20.0	10.0	5.0
Scale Factor Temp Sens (PPM/°C, Max.)	400	300	100	60	60
Natural Frequency, Hz, (Nom.) (Note 3)	1.0	2.0	15.0	20.0	40.0
Bandwidth (-3db), Hz, (Nom.)	1.0	2.0	15.0	20.0	40.0
Transverse Axis Misalignment, (°, Max.)	0.10	0.15	0.25	0.50	1.00
Output at 0° Tilt, Volts, (Max.)	0.10	0.04	0.02	0.02	0.02
0° Output Temp. Sens, (Volts/°C, Max.)	0.005	0.003	0.001	0.005	0.003
Resolution and Threshold	1 µradian				

ELECTRICAL

Input Voltage (Vdc) (Note 4)	±12 to ±18				
Input Current (mA, Nom.)	±15				
Output Impedance (Ohms, Nom.)	15k	5k	16k	8k	4k
Noise (Vrms, Max.)	0.002				

ENVIRONMENTAL

Operating Temp Range	-18°C to +71°C
Survival Temp Range	-60°C to +90°C
Vibration	20 grms
Shock	1500g, 0.5 msec, 1/2 sine
Seal	MIL-STD 202, Method 112
Weight	4.0 oz.

Notes:
1 - Full range is defined as "from negative full input angle to positive full input angle."
2 - Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
3 - Output phase angle = 90°
4 - Unit Power connections can easily be adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC.

How to Order

LSRP Series

LSRP-1	02550276-001
LSRP-3	02550276-002
LSRP-14.5	02550276-003
LSRP-30	02550276-004
LSRP-90	02550276-005

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SMIC/SMIP-D Series

Jewell Instruments

Making Sense out of Motion...

Input Ranges From ±3° to ±90° Rugged, High Precision, Low Cost, Dual-Ended Power Input Inclinometer

The Jewell **Emerald Series** inclinometer is a low cost, high precision inclinometer designed with higher accuracy sensor than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining. All Emerald Series inclinometers are RoHS compliant.

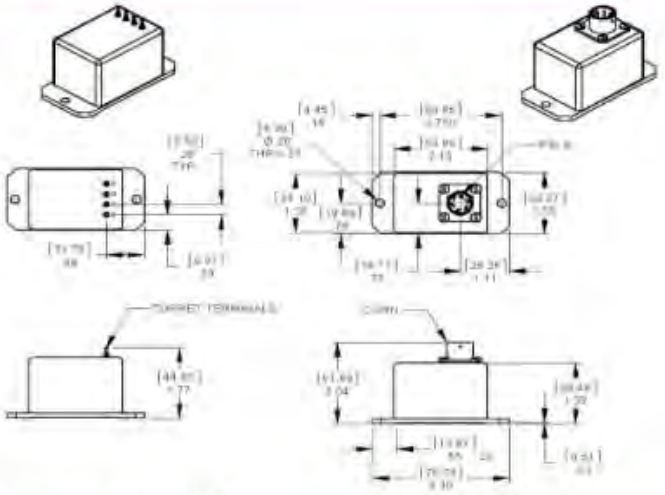
Features

- Extremely Rugged
- Lower Cost than Traditional Forced-Balance Inclinometers
- High Accuracy
- Greater Precision than MEMS Technologies
- ±5V DC Output
- Dual Power Input
- RoHS Compliant

Applications

- Aerospace
- Military
- Robotics
- Academic Research
- Geotechnical Monitoring
- Track Monitoring and Testing
- Vehicle Wheel Alignment

Outline Diagram



Dimensions in inches [mm]

Pin Out (Options: C-connector, P-Pin)

Pin Option

A	Positive Input Power
B	Power/Signal Common
C	Negative Input Power
D	Signal

Connector Option

A	Positive Input Power
B	Power/Signal Common
C	Negative Input Power
D	Signal
E	N/C
F	N/C

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Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±45	±60	±90
Full Range Output (FRO -Note 1) VDC ±0.5%:	±5	±5	±5	±5	±5	±5
Nonlinearity (Note 2) % FRO maximum:	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor, Volts/g, nominal:	95.5	20.0	10.0	7.1	5.8	5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	5.0	5.0	5.0	5.0	5.0	5.0
Output Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
Pendulous Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
0° Output, Volts range:	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
0° Output Temp. Sensitivity, Volts /°C maximum:	0.0070	0.0017	0.0010	0.0008	0.0007	0.0007
Resolution and Threshold (Note 3), µradians maximum:	3.5	3.5	3.5	3.5	3.5	3.5

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	40
Output Impedance, Ohms, nom:	10
Noise, Vrms, maximum:	0.002

ENCLOSURE

Seal:	IP65

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

Notes:
Note 1: Full Range is defined "from negative full input angle to positive full input angle."
Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
Note 3: Full Resolution is achieved with noise reduction techniques.

Custom Capabilities

- 15 to 30V single-ended input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

How to Order

Connector Version		Pin Version	
Model #	Part #	Model #	Part #
SMIC-D-3	02550308-001	SMIP-D-3	02550307-001
SMIC-D-14.5	02550308-002	SMIP-D-14.5	02550307-002
SMIC-D-30	02550308-003	SMIP-D-30	02550307-003
SMIC-D-45	02550308-004	SMIP-D-45	02550307-004
SMIC-D-60	02550308-005	SMIP-D-60	02550307-005
SMIC-D-90	02550308-006	SMIP-D-90	02550307-006

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SMIC/SMIP "-L" Series

Jewell Instruments

Making Sense out of Motion...

Model SMI-L
Rugged, High Precision
Single-axis Force Balance
4-20mA Inclinometer

The SMI "-L" offers the same low cost and precision of our **Emerald Series** in a convenient 4-20mA package. Units operate as a 3-wire current loop for use with any 4-20mA PLC or data logger. The SMI-L is also ideal for geotechnical applications requiring long cable runs. Use the SMI-L in robotics, geotechnical, and industrial measurement and control applications where low cost and peak performance are key.

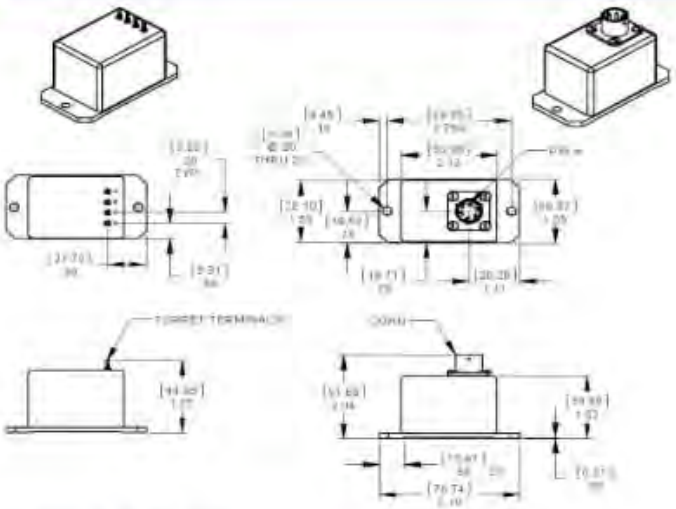
Features

- Extremely Rugged
- Lower cost than traditional Force-Balanced Inclinometers
- High Accuracy
- Greater precision than MEMS technologies
- 4-20mA Output
- Single-Ended Power Input
- RoHS Compliant

Applications

- Geotechnical Monitoring
- Robotics
- Academic Research
- Geotechnical Monitoring
- Track Monitoring and Testing
- Vehicle Wheel Alignment

Outline Diagram



Dimensions in inches [mm]

Pin Out (Options: C-connector, P-Pin)

Pin Option		Connector Option	
A	Input Power	A	Input Power
B	Power/Signal Common	B	Power/Signal Common
C	N/C	C	N/C
D	Signal	D	Signal
		E	N/C
		F	N/C

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SMIC/SMIP-L Series

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range (deg.)	±3	±14.5	±30	±45	±60	±90
Full Range Output (mA, +/-1%)[1]	4-20	4-20	4-20	4-20	4-20	4-20
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor (mA/g nom.)	152.9	32	16	11.3	9.2	8
Scale Factor Temp. Sensitivity (PPM/°C max)	100	100	100	100	100	100
Bandwidth, Hz (-3 dB)	5	5	5	5	5	5
Output Axis Misalignment (deg. max)	0.25	0.5	0.5	0.5	0.5	0.5
Pendulous Axis Misalignment (deg. max)	0.25	0.5	0.5	0.5	0.5	0.5
0° Output nominal (mA)	11.7 to 12.3					
0° Output Temp. Sensitivity (mA/°C max)	0.01	0.003	0.002	0.0015	0.0015	0.0015
Resolution & Threshold (μradians)[3]	3.5	3.5	3.5	3.5	3.5	3.5

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+12 to +28
Input Current, mA, max:	55
Noise, Vrms, maximum:	0.006

ENCLOSURE

Seal:	IP65

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

Notes:
Note 1: Full Range is defined "from negative full input angle to positive full input angle."
Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
Note 3: Full Resolution is achieved with noise reduction techniques.

Custom Capabilities

- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

How to Order

Connector Version		Pin Version	
Model #	Part #	Model #	Part #
SMIC-L-3	02550331-001	SMIP-L-3	02550330-001
SMIC-L-14.5	02550331-002	SMIP-L-14.5	02550330-002
SMIC-L-30	02550331-003	SMIP-L-30	02550330-003
SMIC-L-45	02550331-004	SMIP-L-45	02550330-004
SMIC-L-60	02550331-005	SMIP-L-60	02550330-005
SMIC-L-90	02550331-006	SMIP-L-90	02550330-006

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SMIC/SMIP-S Series

Jewell Instruments

Making Sense out of Motion...

Input Ranges From ±3° to ±90° Rugged, High Precision, Low Cost, Single-Ended Power Input Inclinometer

The Jewell **Emerald Series** inclinometer is a low cost, high precision inclinometer designed with higher accuracy than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining. All Emerald Series inclinometers are RoHS compliant.

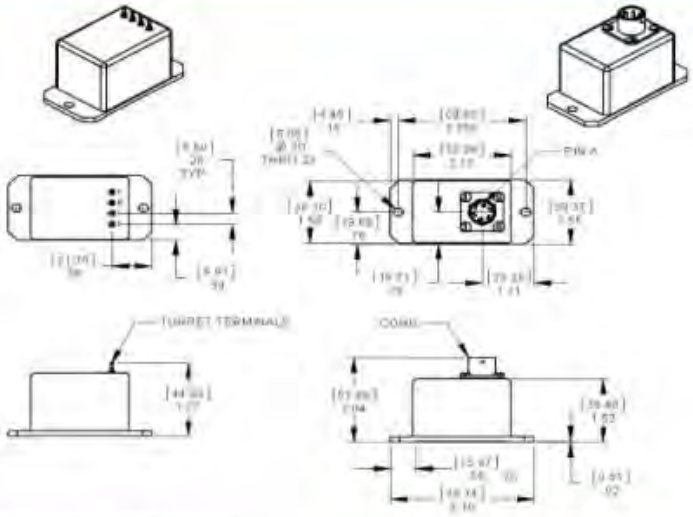
Features

- Extremely Rugged
- Lower Cost than traditional Force-Balanced Inclinometers
- High Accuracy
- Greater Precision than MEMS Technologies
- 0-5V DC Output
- Single-Ended Power Input
- RoHS Compliant

Applications

- Aerospace
- Military
- Robotics
- Academic Research
- Geotechnical Monitoring
- Track Monitoring and Testing
- Vehicle Wheel Alignment

Outline Diagram



Dimensions in inches [mm]

Pin Out (Options: C-connector, P-Pin)

Pin Option

A	Input Power
B	Power/Signal Common
C	N/C
D	Signal

Connector Option

A	Input Power
B	Power/Signal Common
C	N/C
D	Signal
E	N/C
F	N/C

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Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±45	±60	±90
Full Range Output (FRO -Note 1) VDC ±0.5%:	0-5	0-5	0-5	0-5	0-5	0-5
Nonlinearity (Note 2) % FRO maximum:	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor, Volts/g, nominal:	47.8	10.0	5.0	3.5	2.9	2.5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	5.0	5.0	5.0	5.0	5.0	5.0
Output Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
Pendulous Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
0° Output, Volts range:	+2.45 to +2.55					
0° Output Temp. Sensitivity, Volts /°C maximum:	0.0036	0.0010	0.0007	0.0005	0.0005	0.0005
Resolution and Threshold, µradians maximum:	3.5	3.5	3.5	3.5	3.5	3.5

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+15 to +30
Input Current, mA, max:	40
Output Impedance, Ohms, nom:	10
Noise, Vrms, maximum:	0.002

ENCLOSURE

Seal:	IP65

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

Notes:

Note 1: Full Range is defined "from negative full input angle to positive full input angle."

Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

Note 3: Full Resolution is achieved with noise reduction techniques

Custom Capabilities

- ±15V bipolar input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

How to Order

Connector Version		Pin Version	
Model #	Part #	Model #	Part #
SMIC-S-3	02550304-001	SMIP-S-3	02550303-001
SMIC-S-14.5	02550304-002	SMIP-S-14.5	02550303-002
SMIC-S-30	02550304-003	SMIP-S-30	02550303-003
SMIC-S-45	02550304-004	SMIP-S-45	02550303-004
SMIC-S-60	02550304-005	SMIP-S-60	02550303-005
SMIC-S-90	02550304-006	SMIP-S-90	02550303-006

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RMIW-D Series
±5VDC Output

Making Sense out of Motion...

Input Ranges From ±3° to ±90° Rugged, High Precision, Low Cost, Dual-Ended Power Input Inclinometer

The Jewell **Emerald Series** inclinometer is a low cost, high precision inclinometer designed with higher accuracy than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining.

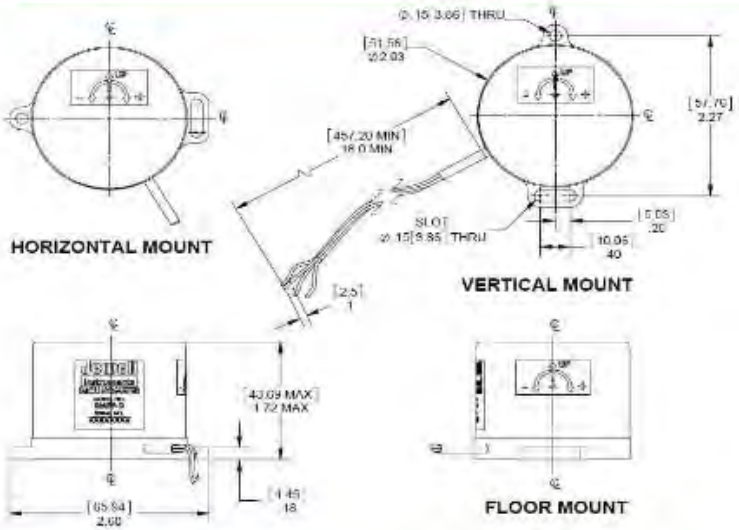
Features

- Mounts horizontally or vertically to match the AccuStar footprint
- Extremely Rugged
- Lower Cost than traditional Force Balanced Inclinometers
- High Accuracy
- Greater Precision than MEMS Technologies
- Withstands up to 500g shock
- ±5 V DC Output
- Dual Input Power

Applications

- Wheel Alignment
- Construction Equipment
- Antenna Positioning
- Robotics
- Cross Rail Management
- Tilt Safety Systems
- Industrial and Machining Equipment
- Stadium Loudspeaker Positioning

Outline Diagram



Dimensions in inches [mm]

Wire Description

Wiring Code

Red	Positive Input Power
Brown	Power/Signal Common
Black	Negative Input Power
Green	Signal

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Rev. B

RMIW-D Series
±5VDC Output

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±45	±60	±90
Full Range Output (FRO -Note 1) VDC ±0.5%:	±5	±5	±5	±5	±5	±5
Nonlinearity (Note 2) % FRO maximum:	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor, Volts/g, nominal:	95.5	20.0	10.0	7.1	5.8	5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	5.0	5.0	5.0	5.0	5.0	5.0
Output Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
Pendulous Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
0° Output, Volts range:	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
0° Output Temp. Sensitivity, Volts /°C maximum:	0.007	0.0017	0.001	0.0008	0.0007	0.0007
Resolution and Threshold (Note 3), µradians maximum:	3.5	3.5	3.5	3.5	3.5	3.5
Weight (oz.):	4.2	4.2	4.2	4.2	4.2	4.2

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	40
Output Impedance, Ohms, nom:	10
Noise, Vrms, maximum:	0.002

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

ENCLOSURE

Seal:	IP65

Custom Capabilities

- +15 to +30 V single-ended input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

Notes:
Note 1: Full Range is defined "from negative full input angle to positive full input angle."
Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
Note 3: Full Resolution is achieved with noise reduction techniques

How to Order

02550305 - 2 0 2

RMIW-D Series
Dual-ended Power with ±5Vdc Output

Range Options
1 - ±3°
2 - ±14.5°
3 - ±30°
4 - ±45°
5 - ±60°
6 - ±90°

Mount Options
0 - Floor Mount
1 - Wall, Vertical Mount
2 - Wall, Horizontal Mount

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RMIW-L Series
4-20mA Output

Making Sense out of Motion...

Input Ranges From ±3° to ±90° Rugged, High Precision, Low Cost, Dual-Ended Power Input Inclinometer

The Jewell **Emerald Series** inclinometer is a low cost, high precision inclinometer designed with higher accuracy than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining.

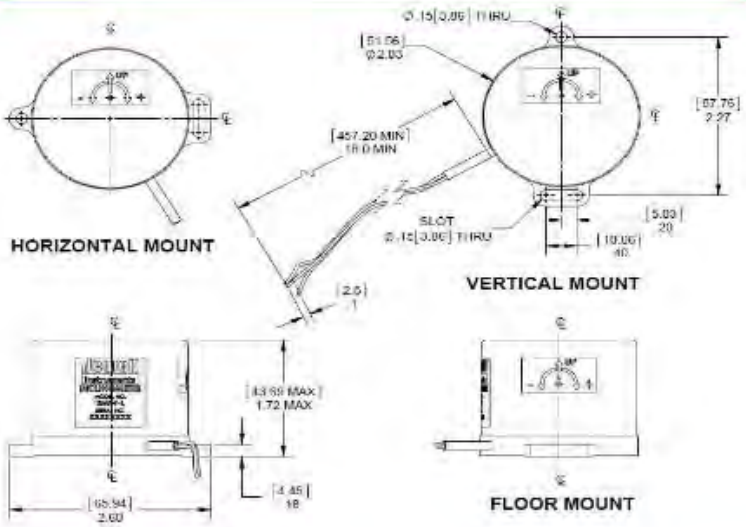
Features

- Mounts horizontally or vertically to match the AccuStar footprint
- Extremely Rugged
- Lower Cost than traditional Force Balanced Inclinometers
- High Accuracy
- Greater Precision than MEMS Technologies
- Withstands up to 500g shock
- ±5 V DC Output
- Single-Ended Power Input

Applications

- Wheel Alignment
- Construction Equipment
- Antenna Positioning
- Robotics
- Cross Rail Management
- Tilt Safety Systems
- Industrial and Machining Equipment
- Stadium Loudspeaker Positioning

Outline Diagram



Dimensions in inches [mm]

Wire Description

Wiring Code

Red	Positive Input Power
Brown	Power/Signal Common
Black	Negative Input Power
Green	Signal

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Rev. C

RMIW-L Series
4-20mA Output

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±45	±60	±90
Full Range Output (mA):	4 to 20	4 to 20	4 to 20	4 to 20	4 to 20	4 to 20
Nonlinearity (Note 2) % FRO maximum:	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor, Volts/g, nominal:	152.9	32.0	16.0	11.3	9.2	8
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	5.0	5.0	5.0	5.0	5.0	5.0
Output Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
Pendulous Axis Misalignment, ° maximum:	0.50	0.75	0.75	0.75	0.75	0.75
0° Output, Volts range (mA):	11.7-12.3	11.7-12.3	11.7-12.3	11.7-12.3	11.7-12.3	11.7-12.3
0° Output Temp. Sensitivity, Volts /°C maximum:	0.01	0.0030	0.002	0.0015	0.0015	0.0015
Resolution and Threshold (Note 3), µradians maximum:	3.5	3.5	3.5	3.5	3.5	3.5
Weight (oz.):	4.2	4.2	4.2	4.2	4.2	4.2

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±28
Input Current, mA, max:	55
Output Impedance, Ohms, nom:	10
Noise, Vrms, maximum:	0.006

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

ENCLOSURE

Seal:	IP65

Custom Capabilities

- +15 to +30 V single-ended input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

Notes:
Note 1: Full Range is defined "from negative full input angle to positive full input angle."
Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
Note 3: Full Resolution is achieved with noise reduction techniques

How to Order

02550332 - 0 0 3

RMIW-L Series
Single-ended Power with 4-20mA Output

Range Options
1 - ±3°
2 - ±14.5°
3 - ±30°
4 - ±45°
5 - ±60°
6 - ±90°

Mount Options
0 - Floor Mount
1 - Wall, Vertical Mount
2 - Wall, Horizontal Mount

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RMIW-S Series
0-5Vdc Output

Making Sense out of Motion...

Input Ranges From ±3° to ±90° Rugged, High Precision, Low Cost, Single-Ended Power Input Inclinometer

The Jewell **Emerald Series** inclinometer is a low cost, high precision inclinometer designed with higher accuracy than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining.

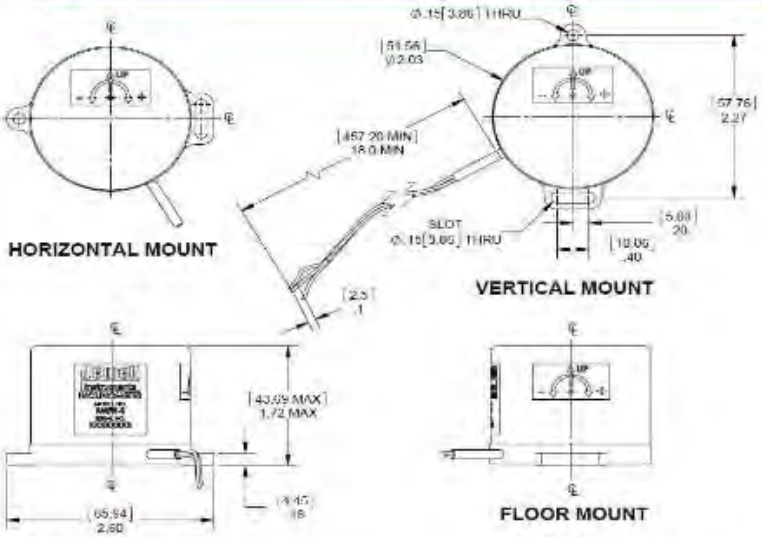
Features

- Mounts horizontally or vertically to match the AccuStar footprint
- Extremely Rugged
- Lower Cost than traditional Force Balanced Inclinometers
- High Accuracy
- Greater Precision than MEMS Technologies
- Withstands up to 500g shock
- 0-5 VDC Output
- Single-Ended Power Input

Applications

- Wheel Alignment
- Construction Equipment
- Antenna Positioning
- Robotics
- Cross Rail Management
- Tilt Safety Systems
- Industrial and Machining Equipment
- Stadium Loudspeaker Positioning

Outline Diagram



Dimensions in inches [mm]

Wire Description

Wiring Code

Red	Input Power
Brown	Power/Signal Common
Black	N/C
Green	Signal

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Rev. B

RMIW-S Series
0-5Vdc Output

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±45	±60	±90
Full Range Output (FRO -Note 1) VDC ±0.5%:	0-5	0-5	0-5	0-5	0-5	0-5
Nonlinearity (Note 2) % FRO maximum:	0.05	0.02	0.02	0.02	0.04	0.05
Scale Factor, Volts/g, nominal:	47.8	10.0	5.0	3.5	2.9	2.5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	5.0	5.0	5.0	5.0	5.0	5.0
Output Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
Pendulous Axis Misalignment, ° maximum:	0.25	0.50	0.50	0.50	0.50	0.50
0° Output, Volts range:	2.45 to 2.55					
0° Output Temp. Sensitivity, Volts /°C maximum:	0.0035	0.001	0.0070	0.0005	0.0005	0.0005
Resolution and Threshold (Note 3), µradians maximum:	3.5	3.5	3.5	3.5	3.5	3.5
Weight:	4.2	4.2	4.2	4.2	4.2	4.2

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+15 to +30
Input Current, mA, max:	40
Output Impedance, Ohms, nom:	10
Noise, Vrms, maximum:	0.002

ENVIRONMENTAL

Operating Temp Range:	-55°C to +85°C
Storage Temp Range:	-60°C to +90°C
Shock:	500g, 1 msec, ½ sine

ENCLOSURE

Seal:	IP65

Custom Capabilities

- ±15V bipolar input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

Notes:
Note 1: Full Range is defined "from negative full input angle to positive full input angle."
Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.
Note 3: Full Resolution is achieved with noise reduction techniques

How to Order

02550290 - 1 0 4

RMIW-S Series
Single-ended Power with 0-5Vdc Output

Mount Options
- 0 - Floor Mount
- 1 - Wall, Vertical Mount
- 2 - Wall, Horizontal Mount

Range Options
- 1 - ±3°
- 2 - ±14.5°
- 3 - ±30°
- 4 - ±45°
- 5 - ±60°
- 6 - ±90°

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LCF-100/LCF-101 Series Inclinometer

Making Sense Out of Motion...

The LCF-100/LCF-101 Series Inclinometer provides excellent turn on repeatability and very low hysteresis

The Jewell **LCF-100 Series** Flexure Suspension Servo Fluid Damped Inclinometer is a ±1° to ±90° device designed for applications where high levels of shock and vibration are present.

Features & Benefits

- Direct Bogie Mount
- 3-30 Hz Bandwidth
- Milligram Bias and Scale Factor
- High Level ± 5Vdc Output
- -40°C to +80°C Temperature Rating

Applications

- Heavy Construction, Grading
- Ship and Barge Leveling
- Deviation Surveys
- Continuous Casting for Steel Industry
- Weapons Platform Leveling
- Aircraft Flight Control
- Robot Vertical Referencing
- Auto Manufacturing Suspension Install
- Geophysical Low Range Tilt Sensing
- Platform Orientation
- Dam Sluice Gate Control

Dimensional Drawing: *LCF Inclinometer Series (inch/mm)*

LCF-100

LCF-101

Pin Out: *LCF Inclinometer Series*

LCF-100 Pin Termination

Pin A	+12 to +18 VDC
Pin B	-12 to -18 VDC
Pin C	Power/Signal Common
Pin D	Eo (Volts/g)

LCF-101 Pin Out

Pin A	+12 to +18 VDC
Pin B	PWR/SIG COM
Pin C	-12 to -18 VDC
Pin D	Eo (volts/g)
Pin E	N/C
Pin F	N/C

Rev B

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LCF-100/LCF-101 Series Inclinometer

Jewell Instruments

Making Sense Out of Motion...

LCF-100 Inclinometer Specifications

PERFORMANCE

Input Range (°) (Note 1)	± 1.0	± 14.5	± 30.0	± 90.0
Full Range Output (FRO), Vdc ±0.5%	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO Max.) (Note 2)	0.05	0.02	0.02	0.05
Scale Factor (V/g, Nom.)	286.5	20.0	10.0	5.0
Scale Factor Temp Sens (PPM/°C, Max.)	100	100	100	100
Natural Frequency. Hz, Nom. (Note 3)	3	30	30	30
Bandwidth (-3dB), Hz, Nom.	3	30	30	30
Transverse Axis Misalignment (° Max.)	0.15	0.05	1.00	1.00
Bias, Volts Max.	0.500	0.100	0.100	0.050
Zero Tilt Temp. Sens., (Volts/°C, Max.)	0.015	0.001	0.0005	0.0003
Resolution and Threshold, μ rad (Max.)	1	1	1	1

ELECTRICAL

Input Voltage (Vdc)	±12 to ±18
Input Current (mA, Nom.)	± 15
Output Impedance (Ohms, Nom.)	100
Noise (Vrms, Max.)	0.002

ENVIRONMENTAL

Operating Temp Range	-40°C to +80°C
Survival Temp Range	-60°C to +90°C
Vibration	20 grms
Shock	1000g, 1 msec, 1/2 sine
Seal	Epoxy

Notes:
1 - Full range is defined as "from negative full input angle to positive full input angle."
The Inclinometer output is proportional to the sine of the tilt angle.
2 - Referenced to theoretical sine value independent of misalignment.
3 - Output phase angle = 90°

How to Order

LCF-100 (Pin Terminals)

Model #	Part #
LCF-100-1	458100-001
LCF-100-14.5	458100-002
LCF-100-30	458100-003
LCF-100-90	458100-004

LCF-101 (Circular Connector)

Model #	Part #
LCF-101-1	458101-002
LCF-101-14.5	458101-001
LCF-101-30	458101-003
LCF-101-90	458101-004

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LCF-300-L Precision Fluid Damped Inclinometer
4-20 mA Output

Jewell Instruments

Making Sense out of Motion...

The LCF-300 Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector or pin-terminals. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

- ***Resolution of 1 µrad***
- ***Temperature Compensation Available***
- ***4-20 mA Output***
- ***+20 to +30 Volts DC Power Input***
- ***RoHS Compliant***

Applications

- ***High-precision Geotech***
- ***Oil and Gas, Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

Connector Version

PIN	FUNCTION
	4-20 mA OUTPUT
A	+ VDC
B	PWR / SIG COM
C	N/C
D	SIG OUT
E	N/C
F	N/C

Pin Terminal Version

PIN	FUNCTION
	4-20 mA OUTPUT
A	+ VDC
B	N/C
C	PWR / SIG COM
D	SIG OUT

RoHS COMPLIANT

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L00173 Rev. B

LCF-300-L Precision Fluid Damped Inclinometer
4-20 mA Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (mA)[1]	4-20	4-20	4-20	4-20	4-20	4-20
Non-linearity (% FRO)[2]	0.05	0.03	0.03	0.03	0.03	0.05
Scale Factor (mA/g nom.)	458.4	152.9	32.0	16.0	9.2	8.0
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (mA)	12 ±0.6	12 ±0.6	12 ±0.3	12 ±0.3	12 ±0.3	12 ±0.3
0° Output Temp. Sensitivity (mA/°C max)	0.024	0.01	0.002	0.001	0.001	0.0008
Resolution & Threshold (μradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+20 to +30
Input Current, mA, max:	40
Noise, μArms, maximum:	0.002
Mass (grams)	230

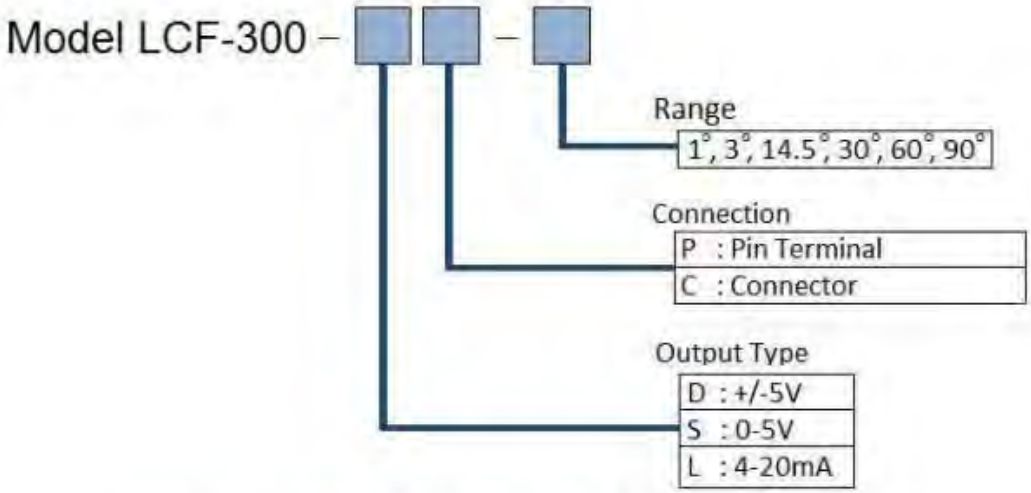
ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP65

Order Code



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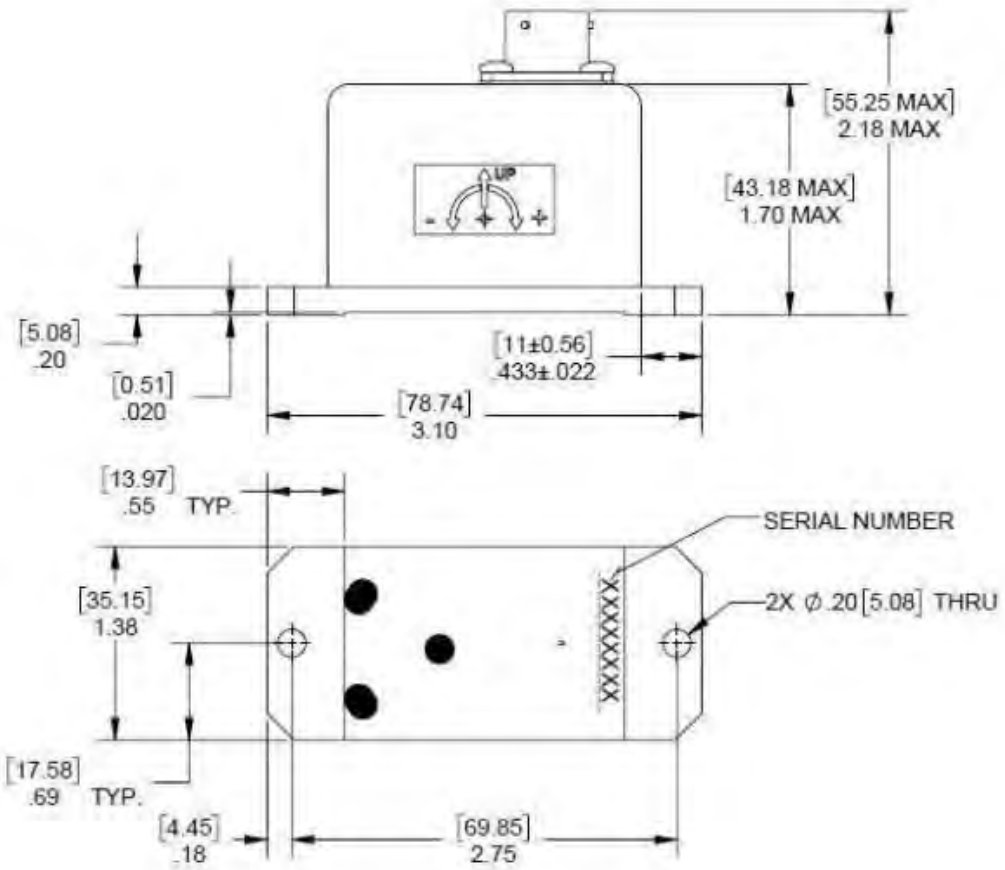
L00173 Rev. B

Outline Drawing: Connector Version



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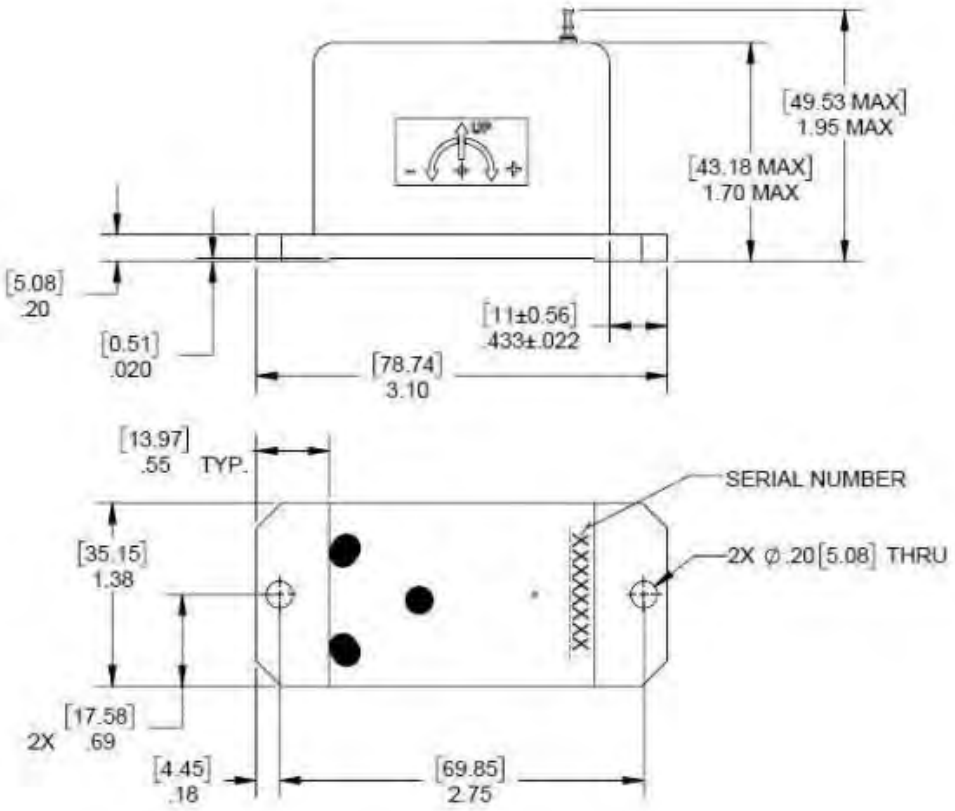
Outline Drawing: Pin Terminal Version



LCF-300-D Precision Fluid Damped Inclinometer
±5V DC Output

Jewell Instruments

Making Sense out of Motion...

The LCF-300 Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector or pin-terminals. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

- ***Resolution of 1 µrad***
- ***Temperature Compensation Available***
- ***±5V Output***
- ***±12 to ±18 Volts DC Power Input***
- ***RoHS Compliant***

Applications

- ***High-precision Geotech***
- ***Oil and Gas, Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

RoHS COMPLIANT

Connector Version

PIN	FUNCTION DUAL SUPPLY
A	+ VDC
B	PWR / SIG COM
C	- VDC
D	SIG OUT
E	N/C
F	N/C

Pin Terminal Version

PIN	FUNCTION DUAL SUPPLY
A	+ VDC
B	- VDC
C	PWR / SIG COM
D	SIG OUT

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L00174 Rev. A

LCF-300-D Precision Fluid Damped Inclinometer
±5V DC Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (VDC)[1]	±5	±5	±5	±5	±5	±5
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.02	0.05
Scale Factor (V/g nom.)	285.5	95.5	20.0	10.0	5.8	5.0
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (VDC)	±0.10	±0.04	±0.02	±0.02	±0.02	±0.02
0° Output Temp. Sensitivity (V/°C max)	0.015	0.005	0.001	0.0005	0.0004	0.0003
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	±15
Noise, Vrms, maximum:	0.002
Output Impedance (ohms)	1
Mass (grams)	230

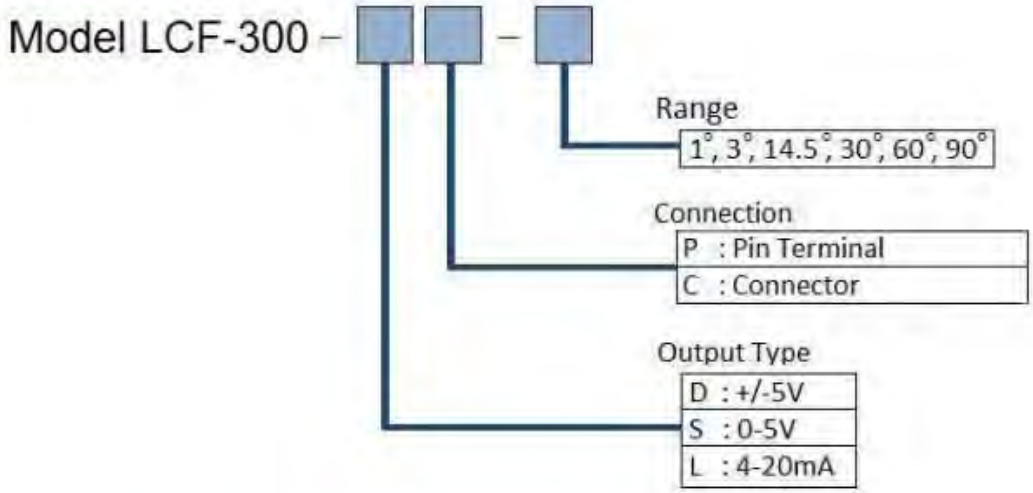
ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP65

Order Code



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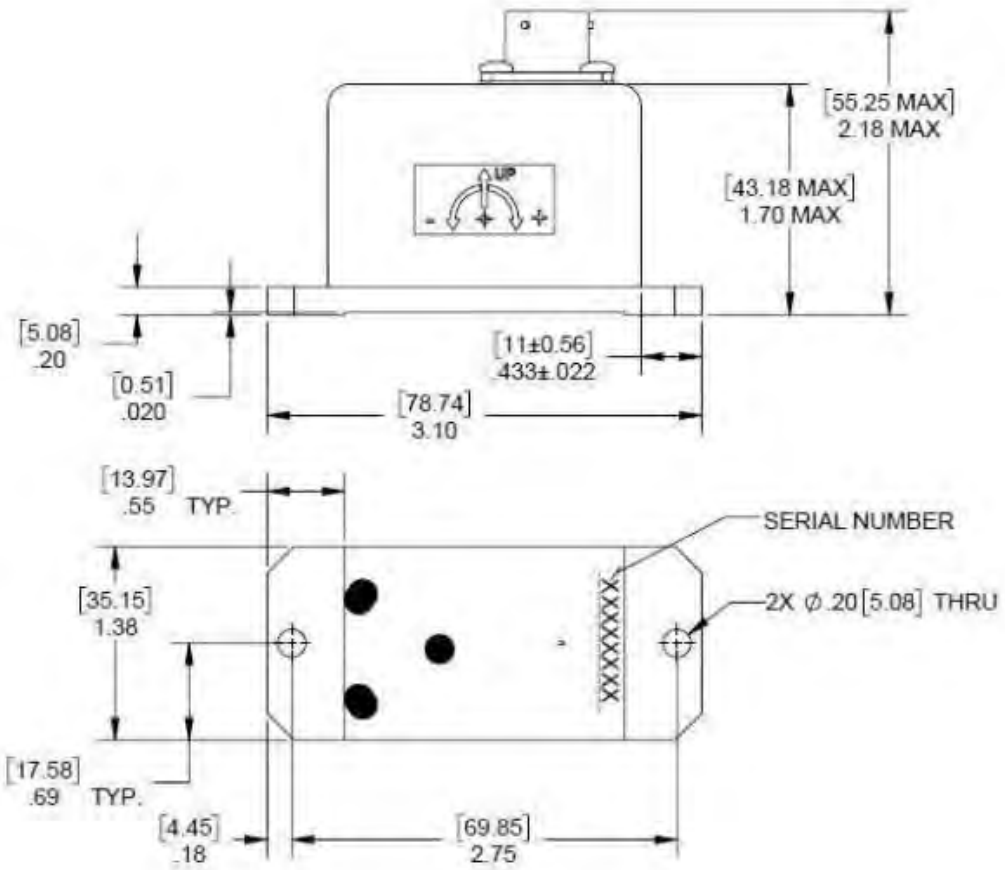
L00174 Rev. A

Outline Drawing: Connector Version



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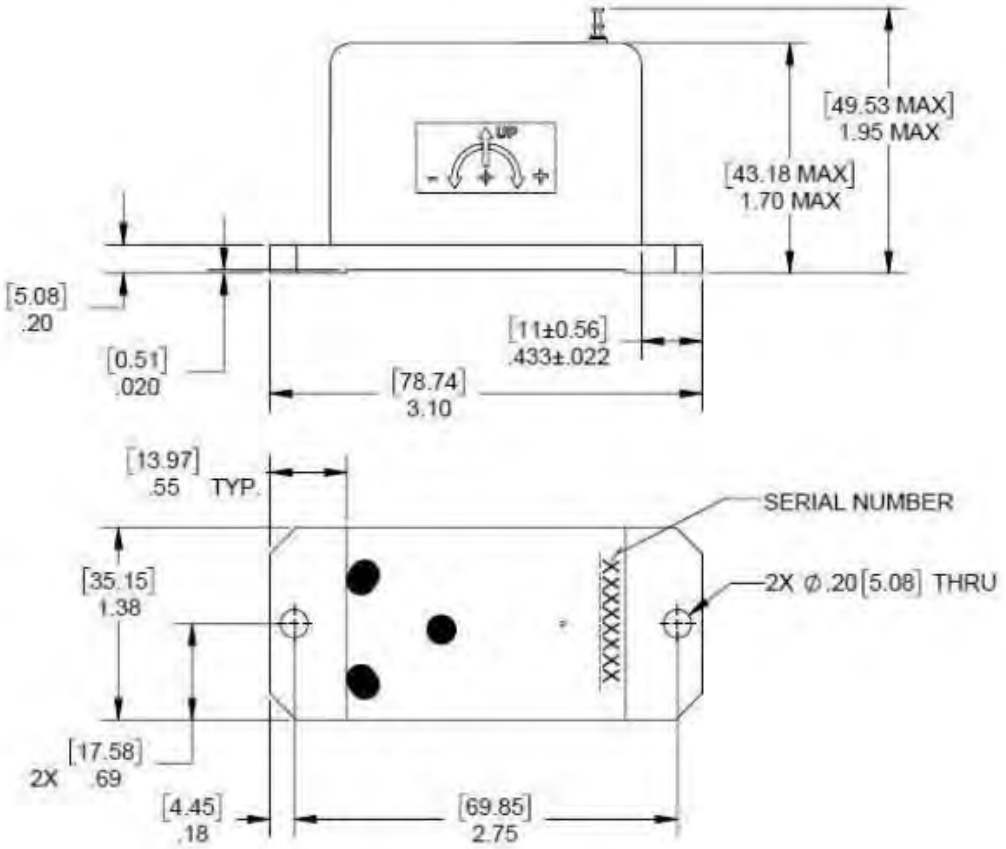
Outline Drawing: Pin Terminal Version



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LCF-300-S Precision Fluid Damped Inclinometer
0-5V DC Output

Jewell Instruments

Making Sense out of Motion...

The LCF-300 Series Inclinometer is a rugged, high performance, single-axis tilt sensor designed for peak performance in extreme conditions. The fluid damped mechanism delivers superior noise rejection in high shock and vibration environments as well as excellent output stability. Units are available with a 6-pin connector or pin-terminals. Available outputs include +/-5V, 0-5V and 4-20mA. Custom input ranges, filters and temperature compensation are also available on request.

Features

- ***Resolution of 1 µrad***
- ***Temperature Compensation Available***
- ***0-5V Output***
- ***+9 to +18 Volts DC Power Input***
- ***RoHS Compliant***

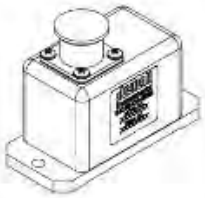
Applications

- ***High-precision Geotech***
- ***Oil and Gas, Riser Tilt Monitoring***
- ***Railroad MOW Equipment***
- ***Pavement Profiling Rigs***
- ***Vehicle Wheel Alignment***
- ***Robotics***

RoHS COMPLIANT

Connector Version

PIN	FUNCTION SINGLE SUPPLY
A	+ VDC
B	PWR / SIG COM
C	N/C
D	SIG OUT
E	N/C
F	N/C



Pin Terminal Version

PIN	FUNCTION SINGLE SUPPLY
A	+ VDC
B	N/C
C	PWR / SIG COM
D	SIG OUT

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L00175 Rev. A

LCF-300-S Precision Fluid Damped Inclinometer
0-5V DC Output

Jewell Instruments

Making Sense out of Motion...

STATIC/DYNAMIC

Input Range (deg.)	±1	±3	±14.5	±30	±60	±90
Full Range Output (VDC)[1]	0-5	0-5	0-5	0-5	0-5	0-5
Non-linearity (% FRO)[2]	0.05	0.02	0.02	0.02	0.02	0.05
Scale Factor (V/g nom.)	143.2	47.8	10.0	5.0	2.9	2.5
Scale Factor Sensitivity (PPM/°C max)	350	300	100	60	60	60
Bandwidth, Hz (-3 dB)	0.5	2	15	20	30	30
Transverse Axis Misalignment (° max)	±0.25	±0.25	±0.5	±0.5	±0.5	±0.5
0° Output nominal (mA)	±0.10	±0.04	±0.02	±0.02	±0.02	±0.02
0° Output Temp. Sensitivity (V/°C max)	0.015	0.005	0.001	0.0005	0.0004	0.0003
Resolution & Threshold (µradians)[3]	1	1	1	1	1	1

[1]Full Range is defined "from negative full input angle to positive full input angle." [2]Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment. [3]Full Resolution is achieved with noise reduction techniques.

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	+9 to +18
Input Current, mA, max:	40
Noise, µArms, maximum:	0.002
Output Impedance (ohms)	1
Mass (grams)	230

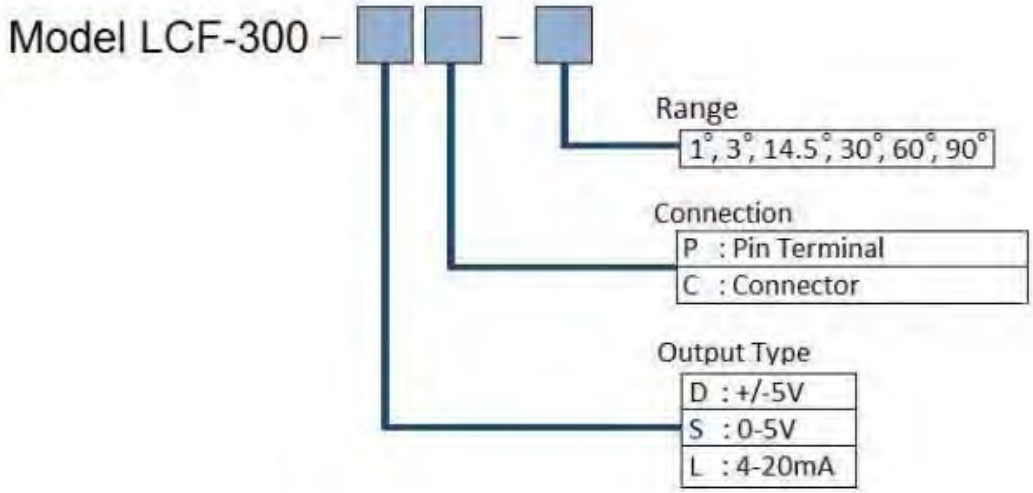
ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Shock:	1500g, 0.5 msec, ½ sine

ENCLOSURE

Seal:	IP65

Order Code



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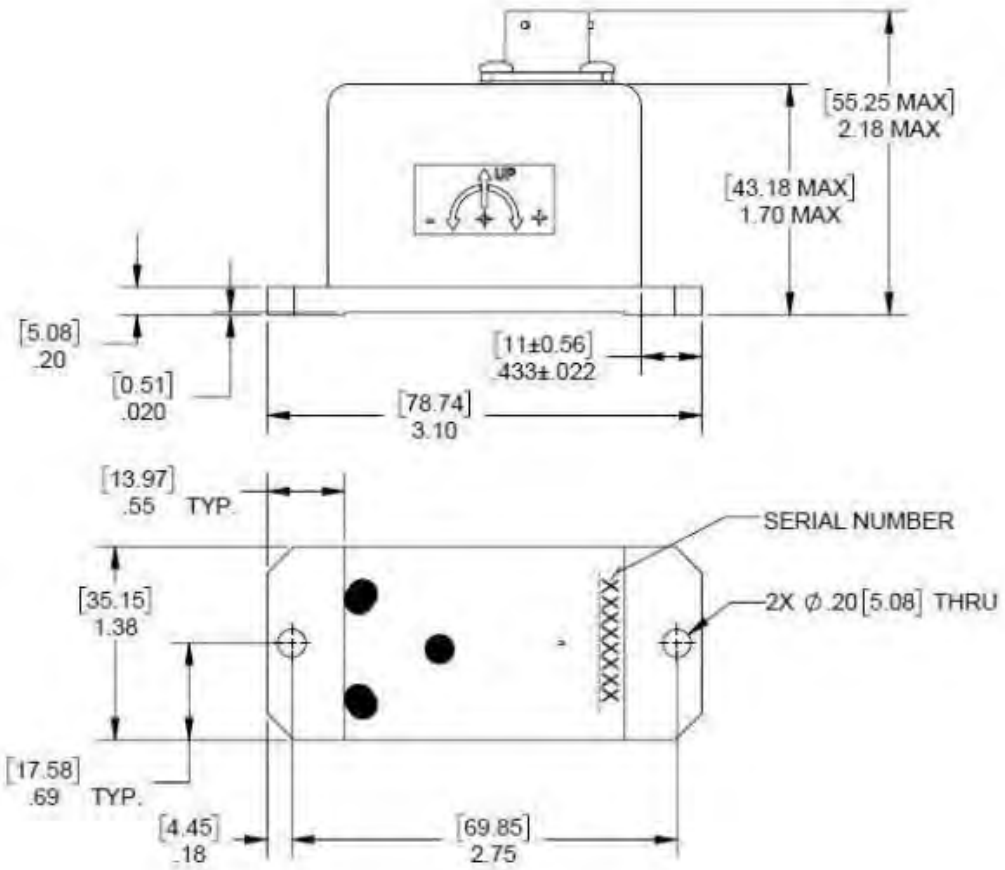
L00175 Rev. A

Outline Drawing: Connector Version



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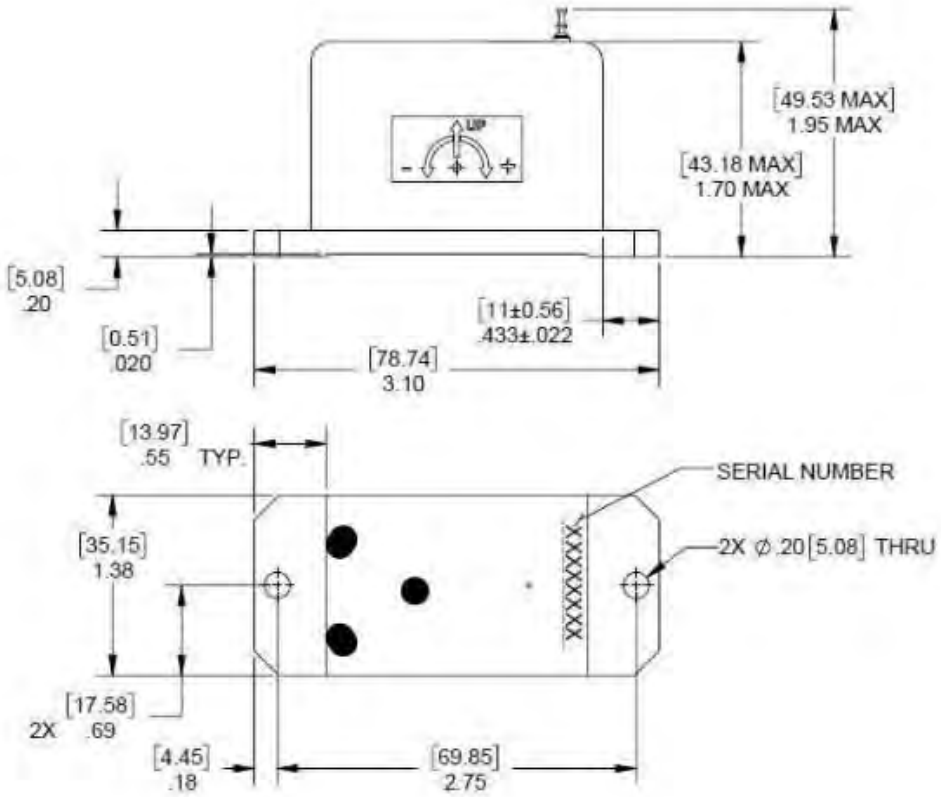
Outline Drawing: Pin Terminal Version



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LCF-196 Biaxial Series Inclinometer

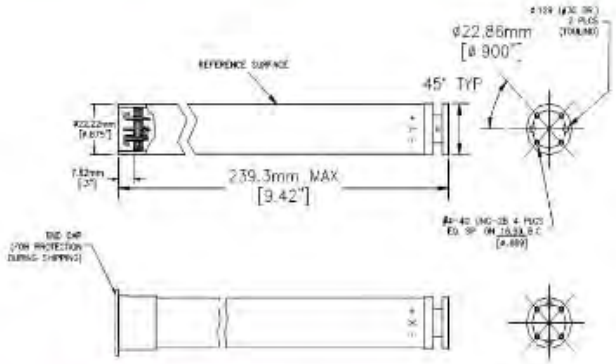
Jewell Instruments

Making Sense out of Motion...

Biaxial Inclinometer is a ±14.5 to ±90 device, with lower ranges available with customization.

The Jewell **LCF 196 Series** is a high accuracy sensor designed for applications where high levels of shock and vibration are present. The LCF 196 is a two-axis tilt sensor in a 22 mm diameter stainless steel package.

Outline Diagram



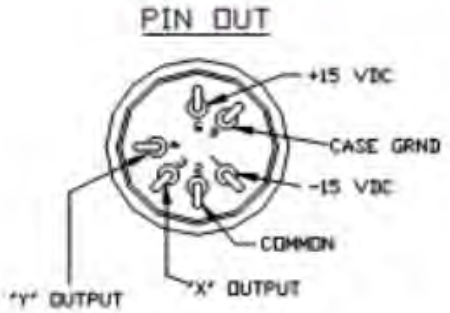
Features & Benefits

- Very low hysteresis
- Excellent turn on repeatability
- High Accuracy Sensor
- 500g Shock Capability
- IP65 Sealed Housing
- Less > 0.02% Non-linearity
- Bias Temp Sens >50µg/°C
- Small diameter

Applications

- Geophysical Measurement
- Earth Movement Monitoring
- Oil & Gas Well Logging
- Dam Monitoring
- Heavy Construction, Grading
- Ship & Barge Leveling
- Deviation Surveys
- Continuous Casting
- Weapons Platform Leveling
- Data Logging

Pin Out (Options: C-connector, P-Pin)



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LCF-196 Biaxial Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °	±14.5	±30.0	±90.0
Full Range Output (FRO) VDC ±1%[1]	±5.0	±5.0	±5.0
Non Linearity (%FRO Max.)[2]	0.02	0.02	0.10
Scale Factor, Volts/g, Nominal	20.0	10.0	5.0
Scale Factor Temp. Sensitivity (SFTS), PPM /°C Maximum	100	100	100
Natural Frequency, Hz Nominal[3]	30.0	30.0	30.0
Bandwidth (-3dB), Hz Nominal	30.00	30.00	30.00
Input Axis Misalignment, ° Maximum	1.00	1.00	1.00
Bias, Volts, Maximum	0.040	0.020	0.020
0° Output Temp Sensitivity, Volts/°C, Maximum	0.001	0.0005	0.0003
Resolution and Threshold		3 µradians	

ELECTRICAL

Input Voltage Range, (VDC)[4]		±12 to ±19	
Input Current, mA, Nominal		15	
Output Impedance, Ohms, Nominal		100	
Noise, Vrms, Maximum	0.002	0.001	0.001

ENVIRONMENTAL

Operating Temp Range	-40°C to +80°C
Survival Temp Range	-60°C to +90°C
Vibration grms	10
Shock	500g, 0.001 sec
Seal	MIL-STD 202, Method 112
Weight	11.0 oz.

Notes:

1- Full Range is defined as "from negative full input angle to positive full input angle."

2 - Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

3 - Output phase angle = -90°

4 - Unit Power connections can easily be adapted for operations from single-ended, floating power supplies of 24 to 34 Volts DC.

Custom Capabilities

Available in lower ranges with customization.
Single Axis lower cost until available.

How to Order

LCF-196-14.5	475196-001
LCF-196-30	475196-002
LCF-196-90	475196-003

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LCF-2330 Series Dual Axis Inclinometer

Making Sense Out of Motion...

The Jewell LCF-2330 Series Inclinometer is a dual axis version of the rugged and high accuracy LCF Series.

The design of the **LCF-2330 Series** was optimized to provide the high accuracy and superior repeatability of Jewell's rugged, fluid damped, flexure suspension, servo technology in a small and convenient package for applications requiring a compact dual axis solution.

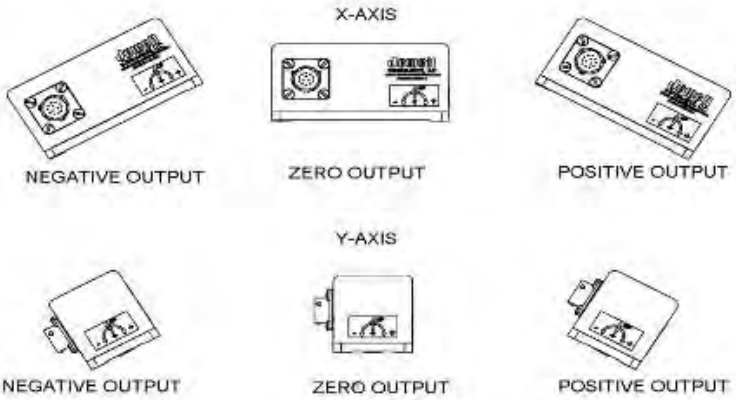
Features & Benefits

- ±1° to ±90° Input Full Range
- Micro Radian Resolution
- Available Internal Temp Sensor
- High Level ± 5 Vdc Output
- Superior 0° Output Stability over Temperature
- Low Impedance Output

Applications

- Radar & Antenna Leveling
- Weapons Platform Leveling
- Barge and Offshore Platform Control
- Deviation Surveys
- 2-Axis Machine Tool Leveling
- Bridge Structural Monitoring
- Submersible Control Feedback
- Offshore Platform Stability
- Production/Manufacturing Process Equipment for Aerospace Industry

Tilt Orientation



Pin-Out: *LCF-2330 Inclinometer Series*

CONNECTOR		CABLE ASSEMBLY
PIN	FUNCTION	COLOR CODING
1	+12 TO +18 VDC	RED
2	-12 TO -18 VDC	BLACK
3	POWER COMMON	WHITE
4	X-AXIS OUTPUT SIGNAL	ORANGE
5	X-AXIS OUTPUT RETURN	GREEN
6	Y-AXIS OUTPUT SIGNAL	RED/BLACK
7	Y-AXIS OUTPUT RETURN	BLUE

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LCF-2330 Inclinometer Specifications

PERFORMANCE

Input Range (°)	± 1.0	± 3.0	± 14.5	± 30.0	± 90.0
Full Range Output (FRO), Volts, ±1% (Note 1)	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO Max.) (Note 2)	0.05	0.05	0.02	0.02	0.02
Scale Factor (V/g, Nom.)	286.5	95.5	20.0	10.0	5.0
Scale Factor Temp Sens (PPM/°C, Max.)	300	300	100	100	100
Bandwidth (-3dB), Hz, Nom.	0.5	2.0	15.0	20.0	30.0
Transverse Axis Misalignment, (°, Max.)	±0.25	±0.50	±0.50	±1.00	±1.00
Output at 0° Tilt, Volts, Max.	0.10	0.04	0.02	0.02	0.02
0° Output Temp Sens, Volts/°C, Max.	0.015	0.005	0.001	0.0005	0.0003
Resolution and Threshold			1µradian		

ELECTRICAL

Input Voltage (Vdc)	±12 to ±18
Input Current (mA, Nom.)	30
Output Impedance (Ohms, Nom.)	100
Noise (Vrms, Max.)	0.002

ENVIRONMENTAL

Operating Temp Range	-40°C to +80°C
Survival Temp Range	-60°C to +90°C
Vibration	20 grms
Shock	1000g, 1 msec, 1/2 sine
Seal	IP65
Weight	280 grams

Optional Temperature Sensor

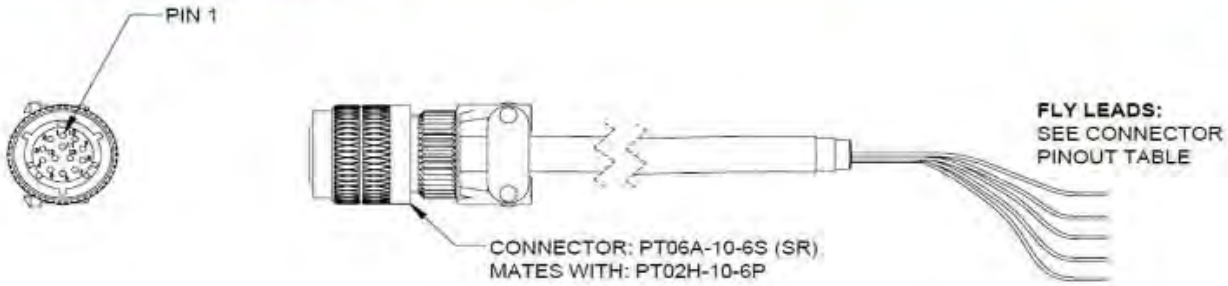
Sensor Type	AD590
Scale Factor	1 µA/K
Sensor Spec @ Room Ambient Temperature	298.2 ±10.5 µA

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle."

2 - Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

*Specifications subject to change without notice on account of continued product development

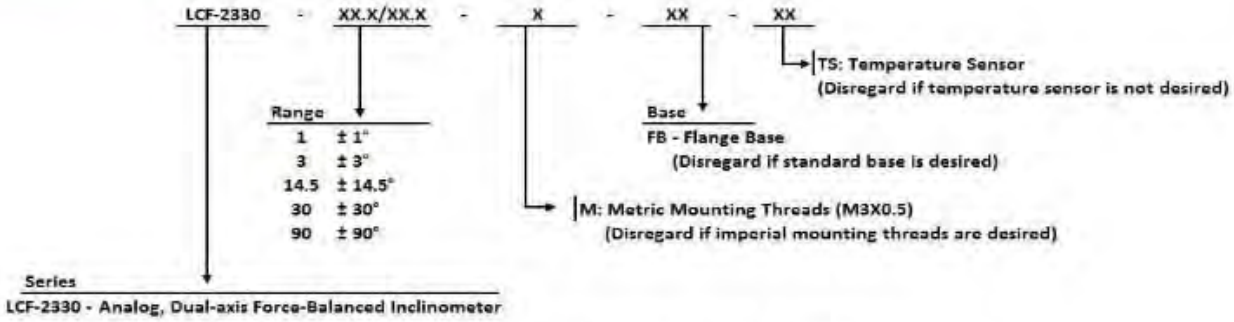
CABLE ACCESSORY



CABLE CONFIGURATIONS & PART NUMBERS

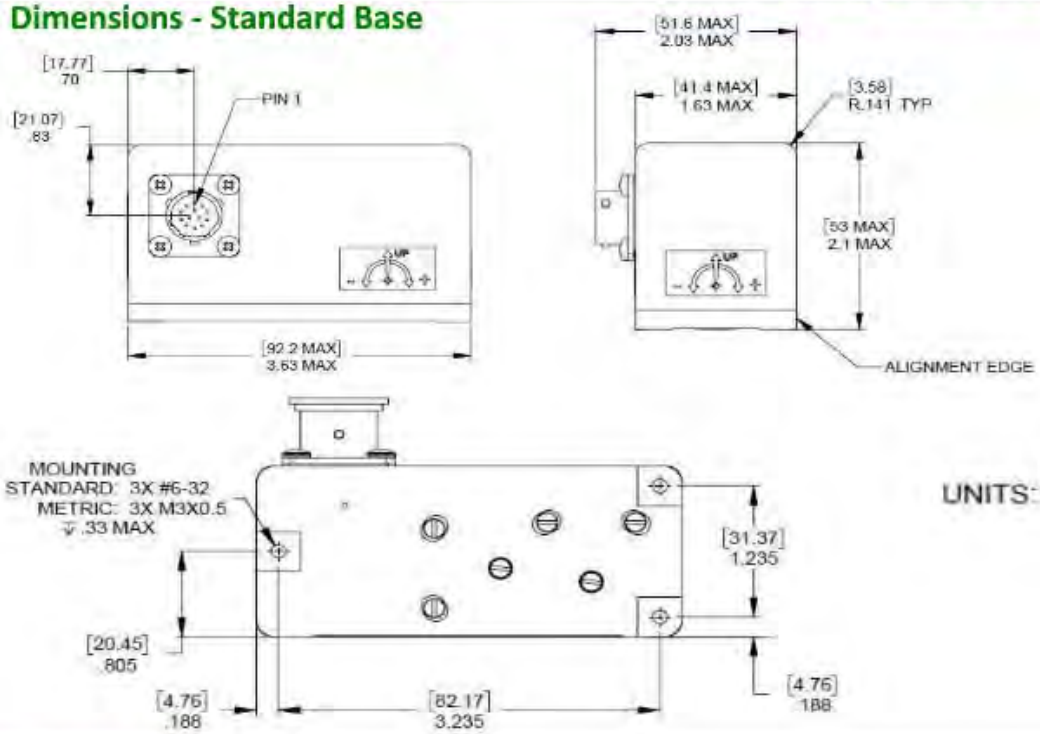
Part Number	Description
847774-002	Circular Connector(13 Pin)
879605-003	DSI-CBL-006-2 (6 Ft)
879605-004	DSI-CBL-010-2 (10 Ft)
879605-009	DSI-CBL-02M-2 (2M)
879605-010	DSI-CBL-03M-2 (3M)

How to Order

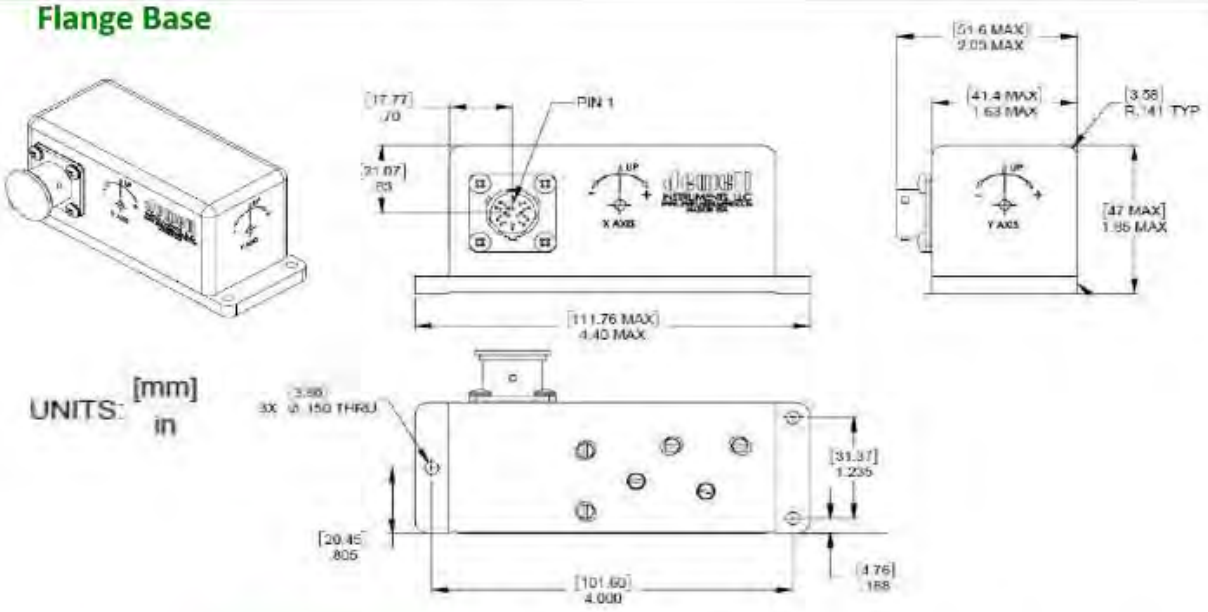


Example: LCF-2330-90/90 = LCF-2330, ±90° range, imperial mounting threads, standard base

Dimensions - Standard Base



Flange Base



LCF-2330-L Series Dual Axis Inclinometer
4-20mA Output

Making Sense Out of Motion...

The Jewell LCF-2330-L Series Inclinometer is a dual axis version of the rugged and high accuracy LCF Series.

The **LCF-2330-L** offers the same performance and reliablility as the standard LCF-2330 series, but with a convenient 4-20mA output signal. This solution is ideal for applications that require long cable runs such as platform/radar leveling and geotechnical monitoring.

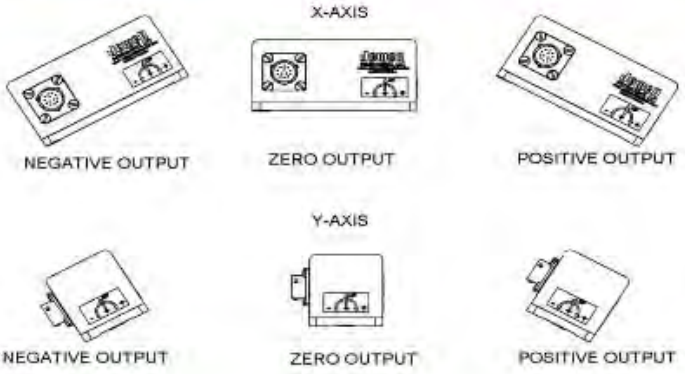
Features & Benefits

- ±1° to ±90° Input Full Range
- Micro Radian Resolution
- Available Internal Temp Sensor
- 4-20mA Output Signal
- Superior 0° Output Stability over Temperature
- Low Impedance Output

Applications

- Radar & Antenna Leveling
- Weapons Platform Leveling
- Barge and Offshore Platform Control
- Deviation Surveys
- 2-Axis Machine Tool Leveling
- Bridge Structural Monitoring
- Submersible Control Feedback
- Offshore Platform Stability
- Production/Manufacturing Process Equipment for Aerospace Industry

Tilt Orientation



Pin-Out: *LCF-2330-L Inclinometer Series*

CONNECTOR		CABLE ASSEMBLY
PIN	FUNCTION	COLOR CODING
1	+20 to +30 VDC	RED
2	N/C	-
3	Power Return	WHITE
4	X-Axis Output Signal	ORANGE
5	Signal Return	GREEN
6	Y-Axis Output Signal	RED/BLACK
7	Signal Return	BLUE
8 - 13	N/C	-

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LCF-2330-L Inclinometer Specifications

PERFORMANCE

Input Range, deg.	±1.0	±3	±14.5	±30	±90
Full Range Output (FRO), mA, ±1 %	4-20	4-20	4-20	4-20	4-20
Nonlinearity, % FRO, maximum	0.05	0.05	0.02	0.03	0.04
Scale Factor, mA/g, nominal	458.39	152.86	31.95	16.00	8.00
Scale Factor Temp Sensitivity, PPM/°C, maximum	300	300	100	100	100
Bandwidth, (-3 dB), Hz, nominal	0.5	2.0	15.0	20.0	30.0
Transverse Axis Misalignment, deg, maximum	±0.5	±0.5	±0.5	±0.5	±0.5
Output at 0° Tilt, mA, maximum	12 ±0.6	12 ±0.6	12 ±0.3	12 ±0.3	12 ±0.3
0° Output Temp Sensitivity, mA/°C, maximum	0.024	0.009	0.002	0.001	0.001
Resolution and Threshold, µradians, maximum	1	1	1	1	1

ELECTRICAL

Input Voltage, VDC	+20 to +30
Input Current, mA, maximum	90
Output Noise, mArms, maximum	0.01

ENVIRONMENTAL

Operating Temperature Range	-40°C to +80°C
Storage Temperature Range	-60°C to +90°C
Vibration	20 grms
Shock	1000g, 1 msec, 1/2 sine
Seal	IP65
Weight	280 grams

Optional Temperature Sensor

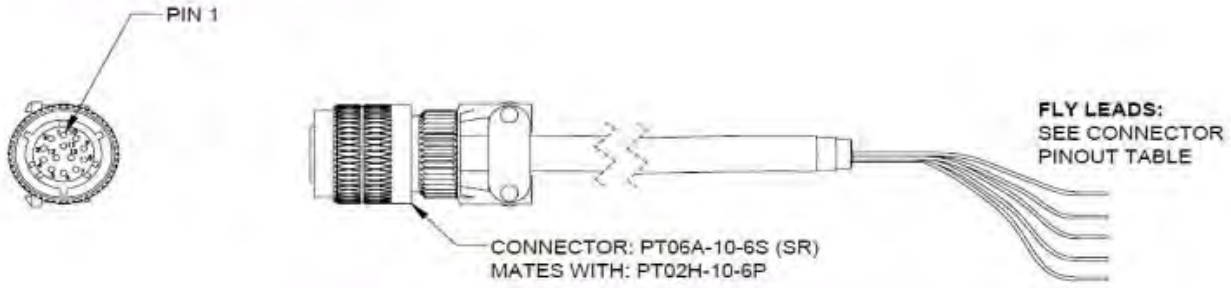
Sensor Type	AD590
Scale Factor	1 µA/K
Sensor Spec @ Room Ambient Temperature	298.2 ±10.5 µA

Notes: 1 - Full range is defined as "from negative full input angle to positive full input angle."

2 - Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

*Specifications subject to change without notice on account of continued product development

CABLE ACCESSORY



CABLE CONFIGURATIONS & PART NUMBERS

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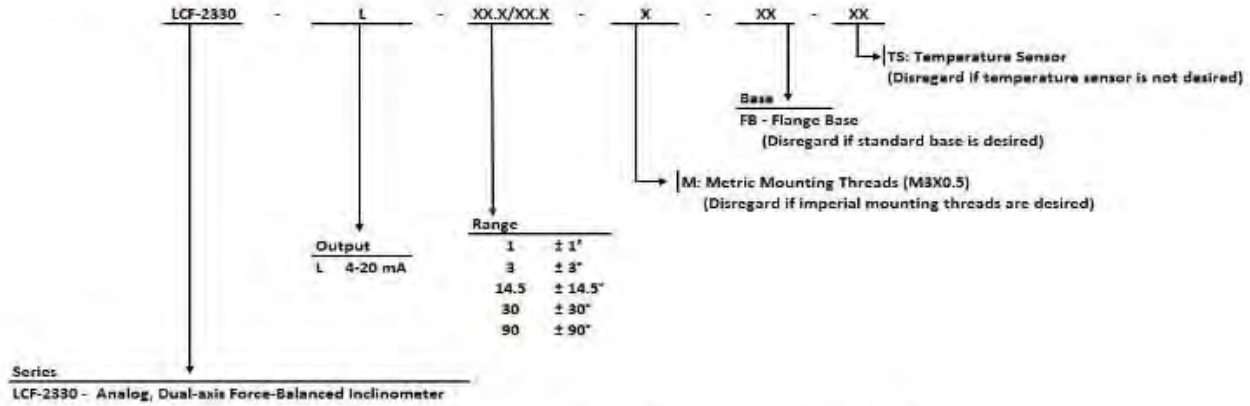
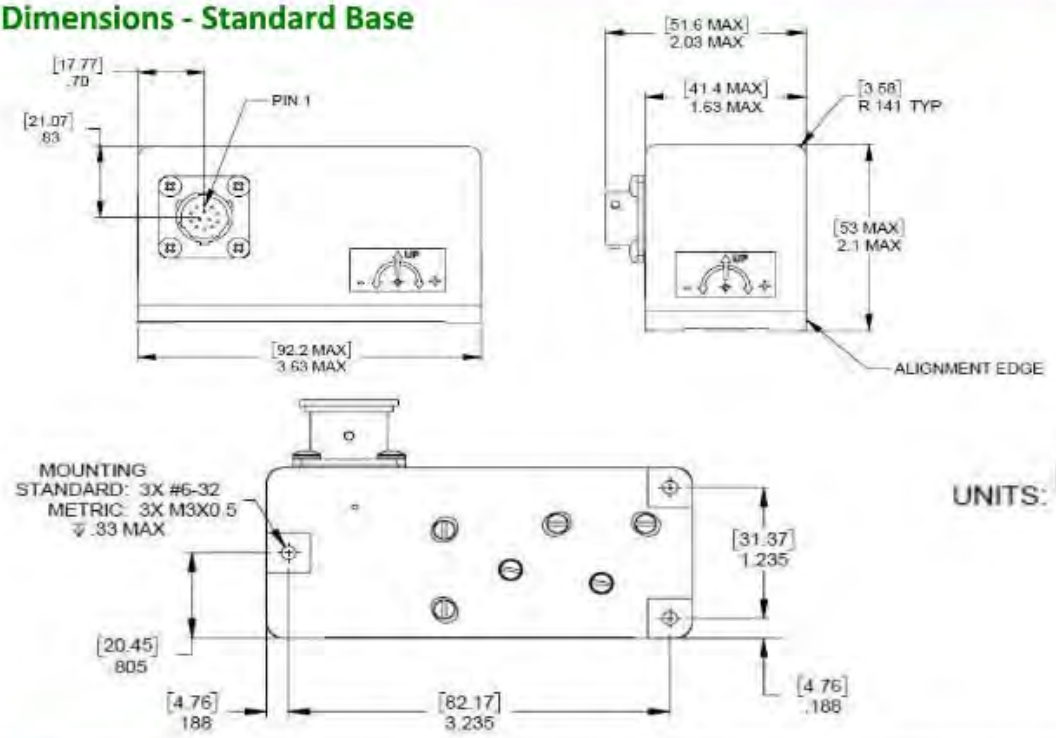
879605-004	DSI-CBL-010-2 (10 Ft)
879605-009	DSI-CBL-02M-2 (2M)
879605-010	DSI-CBL-03M-2 (3M)

How to Order

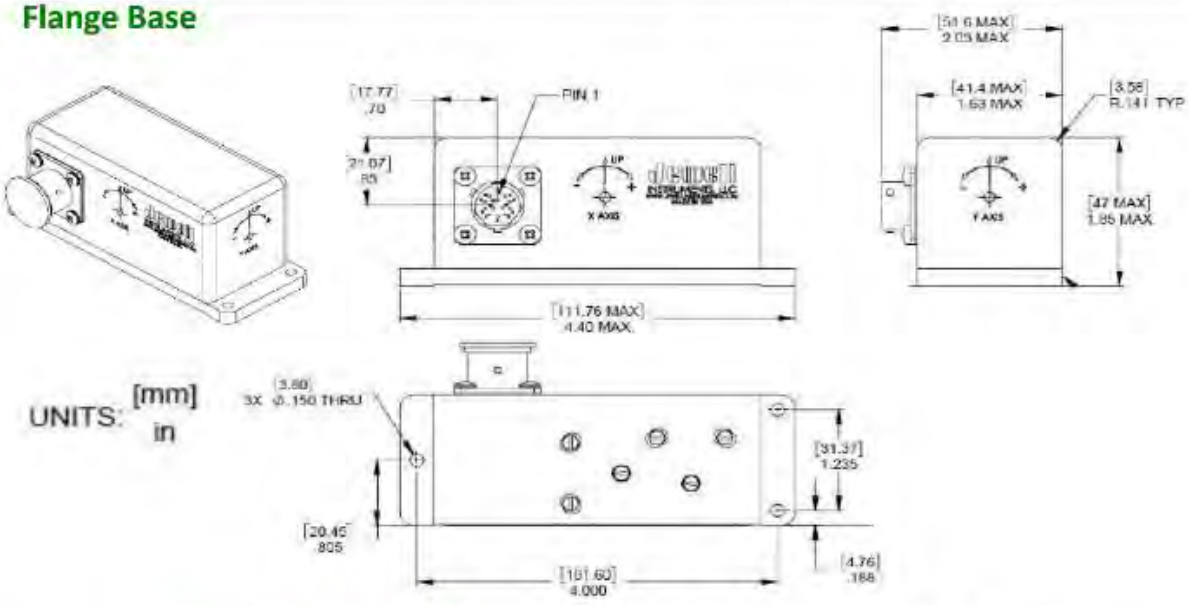


Example: LCF-2330-L-90/90 = LCF-2330, 4-20 mA output, ±90° range, imperial mounting threads, standard base

Dimensions - Standard Base



Flange Base



LCF 2000 Inclinometer

Jewell Instruments

Making Sense out of Motion...

Input Ranges From ±1.0° to ±90° With High Reliability, High Resolution, and Dual Axis

The Jewell **LCF 2000 Series** dual axis inclinometer is a rugged, high accuracy version of the LCF Series. It is available with a wide range of custom options including single ended input power, internal temperature sensor and 4-20mA.

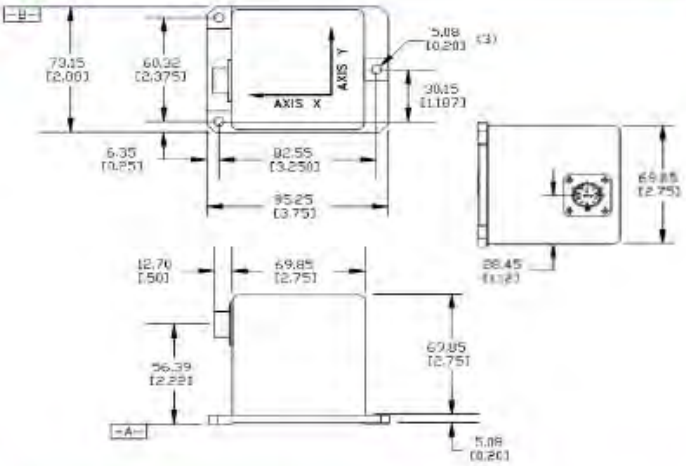
Features

- Ranges Available from ±1° to ±90°
- Operating Temp Range of -40°C to +80°C
- Shock Survival of 1000g
- High Level of ±5 Vdc Output
- Fluid Damped for High Shock and Vibration Applications
- Dual Axis

Applications

- Antenna Leveling
- Weapons Platforms
- Barge & Offshore Platform Leveling & Control
- Data Buoy Pitch and Roll Measurement
- Missile Launchers
- Crane Overturning-Moment Alarms
- Electronic Level Applications
- Aircraft Manufacturing Equipment
- Wind Turbine Tilt Control Nacelle

Outline Diagram



Pin Out (Options: C-connector, P-Pin)

CONNECTOR
MS27476Y10D35P

Pin 1	+15 VDC
Pin 2	-15 VDC
Pin 3	Power/Output Common
Pin 4	Output Signal, X Axis
Pin 5	Output Signal, Y Axis
Pin 6-13	N/C

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Rev C

LCF-2000 Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±1	±3	±14.5	±30	±90
Full Range Output (FRO -Note 1) VDC ±1%:	±5.00	±5.00	±5.00	±5.00	±5.00
Scale Factor, Volts/g, nominal:	286.5	95.54	20	10	5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	200	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	3.00	3.00	30.00	30.00	30.00
Output Axis Misalignment, ° maximum:	0.2	0.4	0.4	0.7	0.7
Pendulous Axis Misalignment, ° maximum:	0.18	0.35	0.35	0.71	0.71
0° Output, Volts range:	±0.75	±0.25	±0.075	±0.05	±0.05
0° Output Temp. Sensitivity, Volts /°C maximum:	0.015	0.005	0.001	0.0005	0.0003
Resolution and Threshold, µradians maximum:	1.0	1.0	1.0	1.0	1.0
Nonlinearity (Note 2) % FRO maximum	0.05	0.05	0.02	0.02	0.05

ELECTRICAL

Number of Axes:	2
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	30
Output Impedance, Ohms, nom:	100
Noise, Vrms, maximum:	0.002

ENCLOSURE

Weight oz.:	16
Seal:	Mil-Std 202, Mtd 112

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-40°C to +90°C
Vibration grms:	20
Shock:	1000g, 0.001 sec., ½ sine

Notes: Note 1: Full Range is defined "from negative full input angle to positive full input angle."

Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

***Specifications subject to change without notice on account of continued product development**

Custom Capabilities

- Unit Power Connections can be easily adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC
- Internal Temperature Sensor
- 4-20 mA output

How to Order

LCF-2000 ± 1	468200-005
LCF-2000 ± 3	468200-006
LCF-2000 ± 14.5	468200-002
LCF-2000 ± 30	468200-003
LCF-2000 ± 90	468200-004

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Rev C

LCF-3000 Tri-Axis Inclinometer

Jewell Instruments

Making Sense out of Motion...

Input Ranges From ±3.0° to ±90° With High Reliability, High Resolution, and Three Axis

The Jewell **LCF 3000 Series** tri axis inclinometer is a rugged, high accuracy version of the LCF Series. It is available with a wide range of options including single ended input power, internal temperature sensor and 4-20mA.

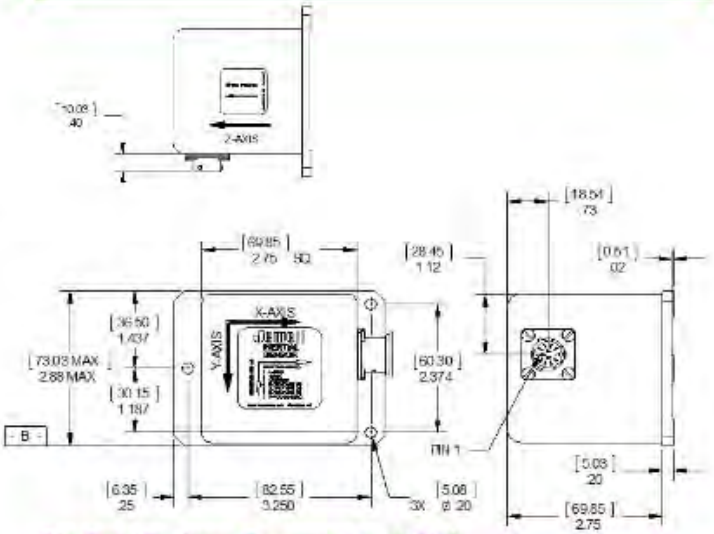
Features & Benefits

- Ranges Available from ±3° to ±90°
- Operating Temp Range of -40°C to +80°C
- Shock Survival of 1000g
- High Level of ±5 Vdc Output
- Fluid Damped
- Tri-Axis

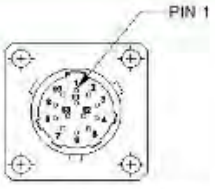
Applications

- Antenna Leveling
- Weapons Platforms
- Barge & Offshore Platform Leveling & Control
- Missile Launchers
- Crane Overturning-Moment Alarms
- Electronic Level Applications
- Marine Data Bouy Applications

Outline Diagram



Pin Out (Options: C-connector, P-Pin)



CONNECTOR: MS27476Y10D35P
MATE: MS27473T10B35S

CONNECTOR INTERFACE	
PIN	FUNCTION
1	+15 VDC
2	-15 VDC
3	COMMON
4	X OUTPUT
5	Y OUTPUT
6	Z OUTPUT
7-13	N/C

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LCF-3000 Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range, °:	±3	±14.5	±30	±90
Full Range Output (FRO -Note 1) VDC ±1%:	±5.00	±5.00	±5.00	±5.00
Scale Factor, Volts/g, nominal:	95.54	20	10	5
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100
Bandwidth (-3 dB), Hz nominal:	3.00	30.00	30.00	30.00
Output Axis Misalignment, ° maximum:	0.4	0.4	0.7	0.7
Pendulous Axis Misalignment, ° maximum:	0.35	0.35	0.71	0.71
0° Output, Volts range:	±0.25	±0.075	±0.05	±0.05
0° Output Temp. Sensitivity, Volts /°C maximum:	0.005	0.001	0.0005	0.0003
Resolution and Threshold, µradians maximum:	1.0	1.0	1.0	1.0

ELECTRICAL

Number of Axes:	3
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	30
Output Impedance, Ohms, nom:	100
Noise, Vrms, maximum:	0.002

ENCLOSURE

Weight oz:	16
Seal:	Mil-Std 202, Mtd 112

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-40°C to +90°C
Vibration grms:	20
Shock:	1000g, 0.001 sec., ½ sine

Notes: Note 1: Full Range is defined "from negative full input angle to positive full input angle."

Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

Custom Capabilities

- Unit Power Connections can be easily adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC
- Internal Temperature Sensor
- 4-20 mA output

How to Order

LCF-3000-3/3/3	471300-001
LCF-3000-14.5/14.5/14.5	471300-002
LCF-3000-30/30/30	471300-003
LCF-3000-90/90/90	471300-004

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DXI-100/200 Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

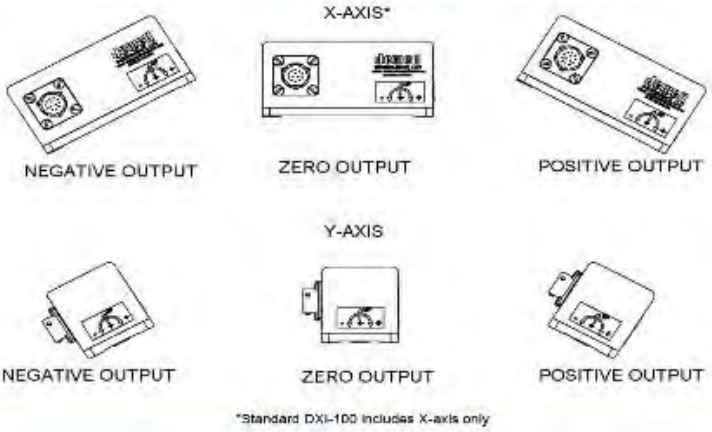
Digital Output - Single or Dual Axis for a wide variety of applications.

The Jewell **DXI-100/200 Series** single or dual digital inclinometer takes Jewell's highly accurate analog closed loop sensor technology to the next level.

Features & Benefits

- Digital output
- Resolution 0.001°
- Mechanical Shock 1500g 1msec 1/2 sine
- Industry Standard EIA RS485 and EIA RS422 output
- For use in high shock and vibration environments
- High Precision and Performance
- Low Noise

Tilt Configuration



*Standard DXI-100 includes X-axis only

Pin Out

Pin	Color	Pin Out
1	-	N/C
2	-	N/C
3	Green	Case Ground
4	Blue	+Serial Port
5	Yellow	-Serial Port
6	-	N/C
7	-	N/C
8	-	N/C
9	-	N/C
10	-	N/C
11	Black	Power Return
12	Red	+Power
13	-	N/C

Applications

- Radar/Antenna Control
- Structural Monitoring
- Linear Acceleration/Deceleration Measuring
- Automatic Train Position Control
- Seismic Monitoring
- Platform Leveling

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DXI-100/200 Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance

Input Range[1], °	±1.0	±3.0	±14.5	±30.0	±60.0
Number of Axis	1,2	1,2	1,2	1,2	1,2
Non Linearity[2], %FRO, Max	0.02	0.015	0.02	0.02	0.03
Scale Factor Tolerance, % Max	0.05	0.05	0.05	0.05	0.05
Scale Factor Temperature Sensitivity, % reading/°C, Max	0.01	0.01	0.01	0.01	0.01
Output at 0° Tilt, °Max	0.01	0.01	0.05	0.05	0.05
0° Output Temperature Sensitivity, °/°C, Max	0.001	0.001	0.005	0.005	0.005
Bandwidth (-3dB), Hz, Nom[3]	3	6	30	30	30
Transverse Axis Misalignment, °, Max	0.15	0.15	0.5	0.5	0.5
Hysteresis, °, Max	0.001	0.001	0.001	0.001	0.001
Resolution and Threshold, °, Max	0.001	0.001	0.001	0.001	0.001
Power On Repeatability, °Max	0.001	0.001	0.001	0.001	0.001
Repeatability, °Max	0.001	0.001	0.002	0.002	0.003

Digital Output

Interface	EIA-RS485 (default)/EIA-RS422
Protocol	Proprietary (Custom)
Output Representation	Degrees
Baud Rate[4]	19200, 38400, 57600, 115200, 230400

Electrical

Supply Voltage, Volts DC		10 to 30
Input Current, mA, Max	Transmitting	DXI-100 32 mA & DXI-200 50 mA
	Not transmitting	DXI-100 22 mA & DXI-200 40 mA

Environmental

Operational Temp Range, °C	-40 to +85
Storage and Temp Range, °C	-40 to +85
Protection Class per IEC 529	IP67
NEMA Enclosure Rating	6
Seal	MILD-STD-202 Method 112
Shock Survival	1500g, 1msec, ½ sine
Vibration Survival, grms (20Hz to 2 KHz)	20

Enclosure

Housing Material	Anodized and Alodine Aluminum
Weight	DXI-100 8oz [226.80 g]/ DXI-200 10oz [283.50 g]
Connector Type	MS27476Y10D35P
Recommended Mating Connector	MS27473T10B35S

NOTES:

1 - Full range is defined as "from negative full input angle to positive full input angle"

2 - Non-linearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.

3 - In default condition without averaging enabled.

4 - Default Baud Rate is 38400

*Specifications subject to change without notice on account of continued product development

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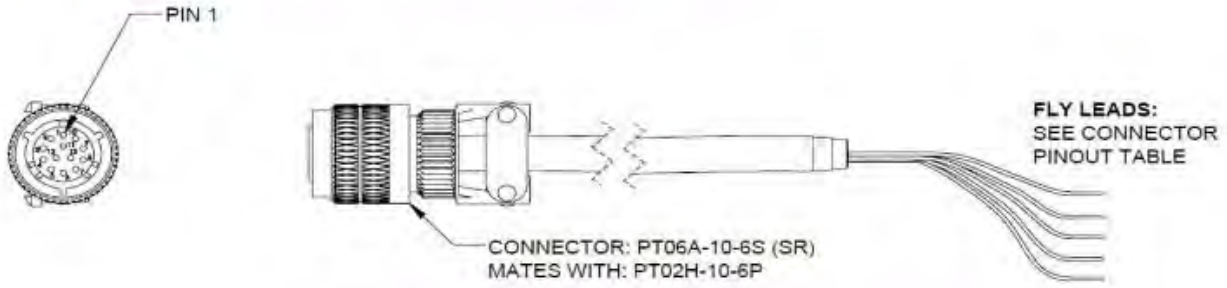
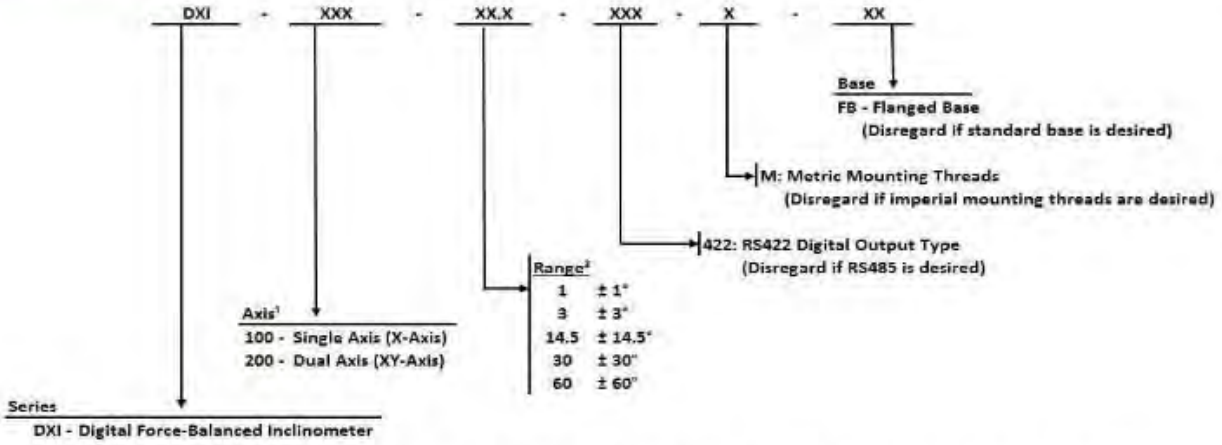
CABLE ACCESSORY (Part Number: 879839-XX)



CABLE CONFIGURATIONS & PART NUMBERS

Part Number	Length
879839-01	5 m
879839-02	3 m
879839-03	1.8 m

How to Order



Example: DXI-100-14.5 = DXI series, single axis, ±14.5° range, RS485 output, imperial mounting threads, standard base

¹Call factory for customized axis configurations
²For dual axis, include the range for both axes. Ex: 1/1

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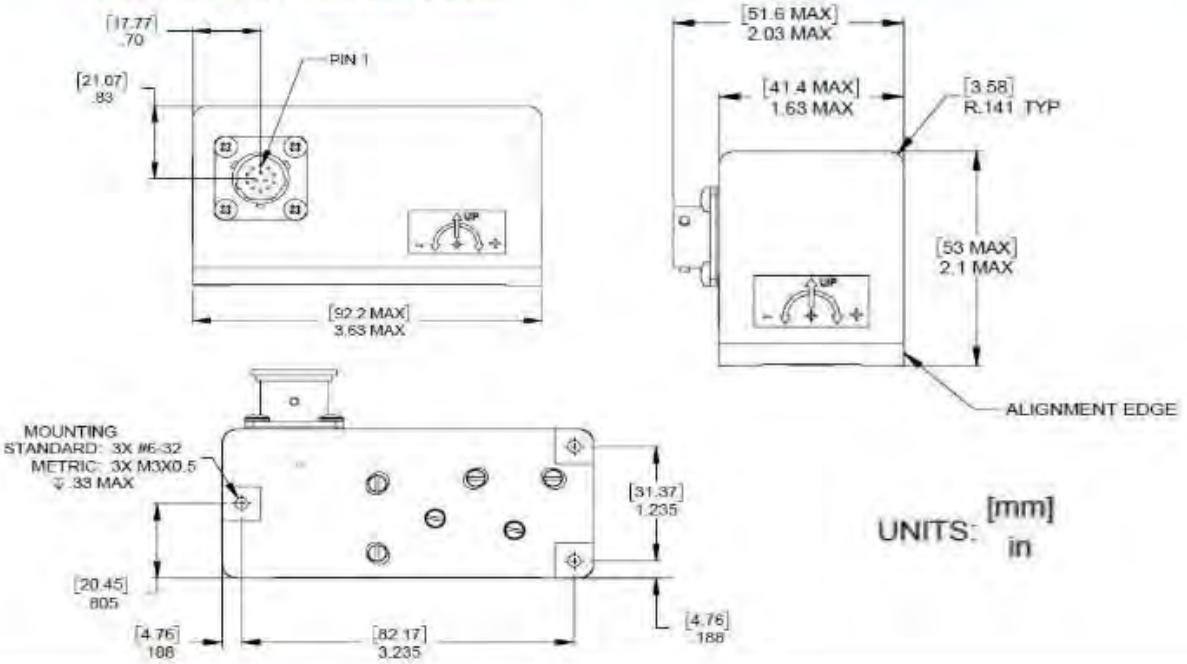
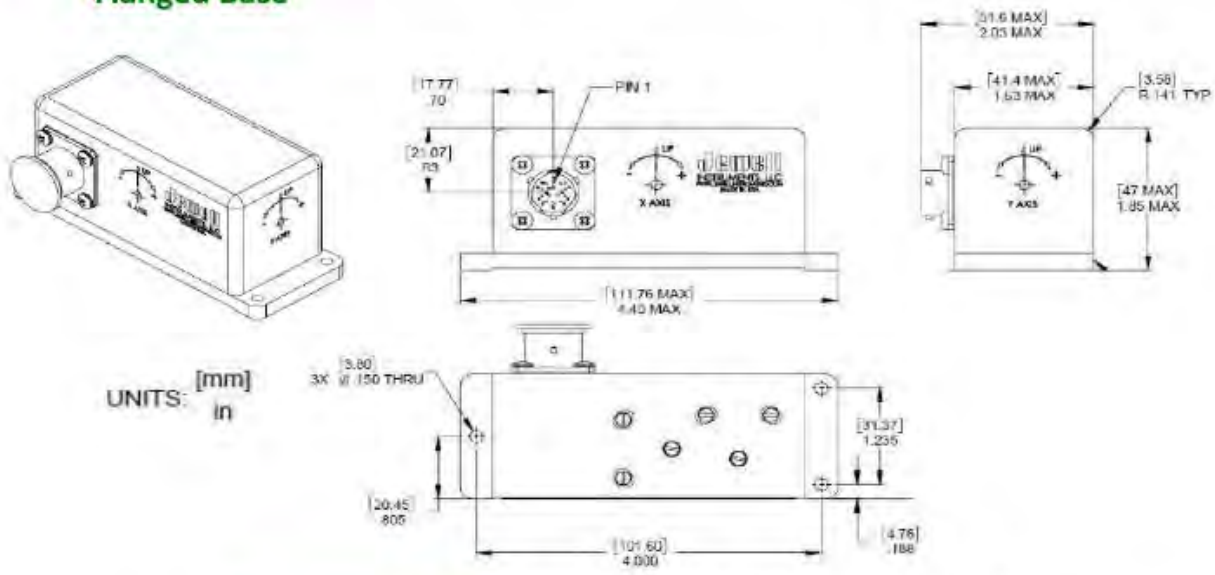
Dimensions - Standard Base



Flanged Base



DXI-100/200-R Series Inclinometer

Jewell Instruments

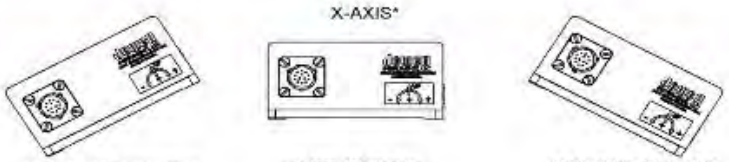
Making Sense out of Motion...

Digital Output - Single or Dual Axis for a wide variety of applications.

Meets CENELEC/AREMA Standards

The Jewell **DXI-100/200 Series** single or dual digital inclinometer takes Jewell's highly accurate analog closed loop sensor technology to the next level.

Tilt Configuration



*Standard DXI-100 includes X-axis only

Features & Benefits

- Digital output
- Resolution 0.001°
- Mechanical Shock 1500g 1msec 1/2 sine
- Industry Standard EIA RS485 and EIA RS422 output
- For use in high shock and vibration environments
- High Precision and Performance
- Low Noise
- Meets CENELEC/AREMA Standards

See Spec Table Page 2

Applications

- Radar/Antenna Control
- Structural Monitoring
- Linear Acceleration/Deceleration Measuring
- Automatic Train Position Control
- Seismic Monitoring
- Platform Leveling

Pin Out

Pin	Color	Pin Out
1	-	N/C
2	-	N/C
3	Green	Case Ground
4	Blue	+Serial Port
5	Yellow	-Serial Port
6	-	N/C
7	-	N/C
8	-	N/C
9	-	N/C
10	-	N/C
11	Black	Power Return
12	Red	+Power
13	-	N/C

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DXI-100/200-R Series Inclinometer

Making Sense out of Motion...

Performance

Input Range[1], °	±1.0	±3.0	±14.5	±30.0	±60.0
Number of Axis	1,2	1,2	1,2	1,2	1,2
Non Linearity[2], %FRO, Max	0.02	0.015	0.02	0.02	0.03
Scale Factor Tolerance, % Max	0.05	0.05	0.05	0.05	0.05
Scale Factor Temperature Sensitivity, % reading/°C, Max	0.01	0.01	0.01	0.01	0.01
Output at 0° Tilt, °Max	0.01	0.01	0.05	0.05	0.05
0° Output Temperature Sensitivity, °/°C, Max	0.001	0.001	0.005	0.005	0.005
Bandwidth (-3dB), Hz, Nom[3]	3	6	30	30	30
Transverse Axis Misalignment, °, Max	0.15	0.15	0.5	0.5	0.5
Hysteresis, °, Max	0.001	0.001	0.001	0.001	0.001
Resolution and Threshold, °, Max	0.001	0.001	0.001	0.001	0.001
Power On Repeatability, °Max	0.001	0.001	0.001	0.001	0.001
Repeatability, °Max	0.001	0.001	0.002	0.002	0.003

Digital Output

Interface	EIA-RS485 (default)/EIA-RS422
Protocol	Proprietary (Custom)
Output Representation	Degrees
Baud Rate[4]	19200, 38400, 57600, 115200, 230400

Electrical

Supply Voltage, Volts DC		10 to 30
Input Current, mA, Max	Transmitting	DXI-100 32 mA & DXI-200 50 mA
	Not transmitting	DXI-100 22 mA & DXI-200 40 mA

Environmental

Operational Temp Range, °C	-40 to +85
Storage and Temp Range, °C	-40 to +85
Protection Class per IEC 529	IP67
NEMA Enclosure Rating	6
Seal	MILD-STD-202 Method 112
Shock Survival	1500g, 1msec, ½ sine
Vibration Survival, grms (20Hz to 2 KHz)	20

Enclosure

Housing Material	Anodized and Alodine Aluminum
Weight	DXI-100 8oz [226.80 g]/ DXI-200 10oz [283.50 g]
Connector Type	MS27476Y10D35P
Recommended Mating Connector	MS27473T10B35S

NOTES:

1- Full range is defined as "from negative full input angle to positive full input angle"

2 - Non-linearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.

3 - In default Condition without averaging enabled.

4- Default Baud Rate is 38400

*Specifications subject to change without notice on account of continued product development

CENELEC EN 55022:2010
CENELEC EN 50155:2007
CENELEC EN 61000-4-8:2010
AREMA Part 11.5.1

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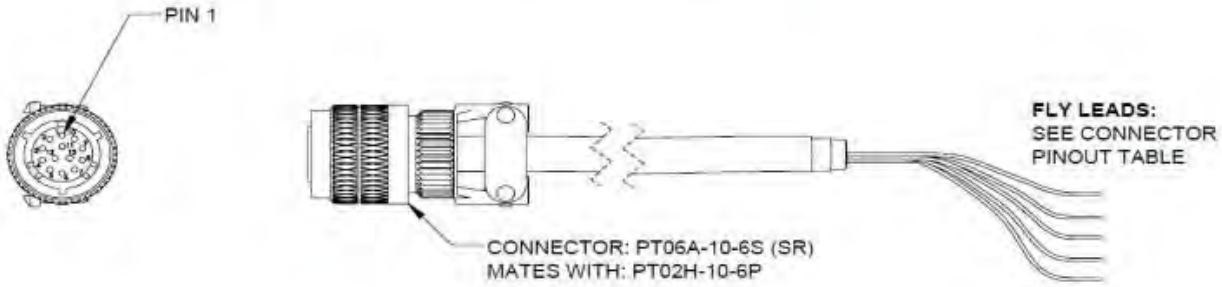
CABLE ACCESSORY (Part Number: 879839-XX)



CABLE CONFIGURATIONS & PART NUMBERS

Part Number	Length
879839-01	5 m
879839-02	3 m
879839-03	1.8 m

How to Order

DXI - XXX - XX.X - XXX - X - X - XX

Series
DXI - Digital Force-Balanced Inclinometer

Axis[1]
100 - Single Axis (X-Axis)
200 - Dual Axis (XY-Axis)

Range[2]
1 ± 1°
3 ± 3°
14.5 ± 14.5°
30 ± 30°
60 ± 60°

422: RS422 Digital Output Type
(Disregard if RS485 is desired)

R: CENELEC/AREMA Certified

M: Metric Mounting Threads
(Disregard if imperial mounting threads are desired)

Base
FB - Flanged Base
(Disregard if standard base is desired)

Example: DXI-100-14.5-R = DXI series, single axis, ±14.5° range, RS485 output, CENELEC/AREMA certified, imperial mounting threads, standard base

[1]Call factory for customized axis configurations
[2]For dual axis, include the range for both axes. Ex: 1/1

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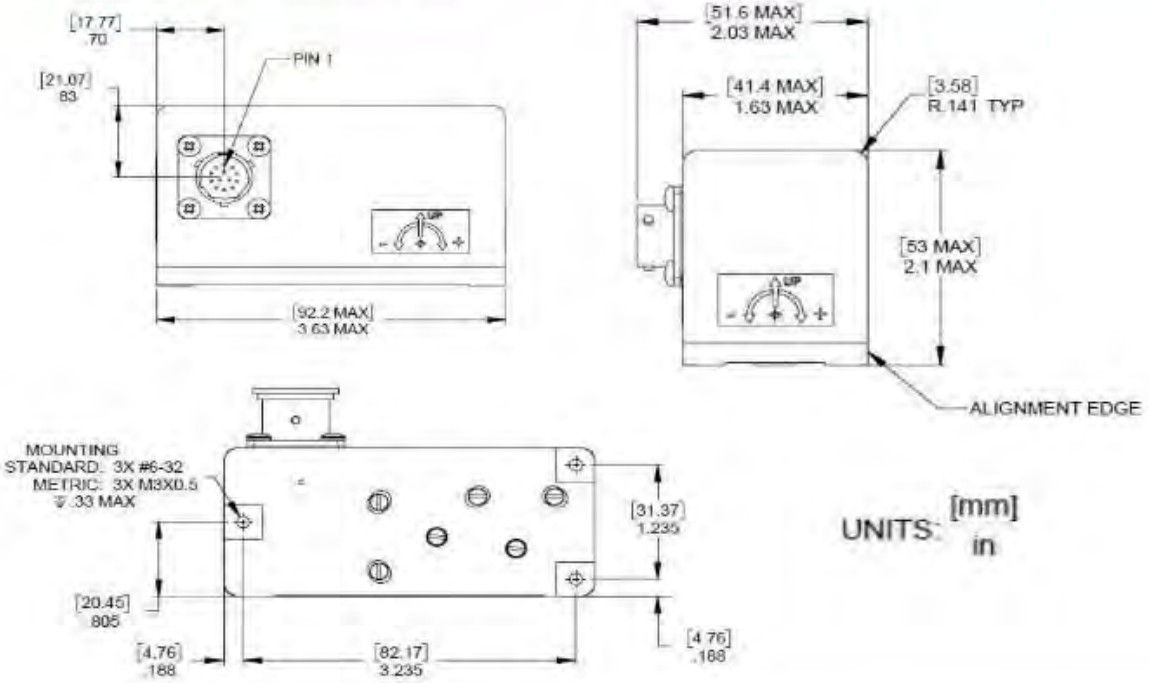
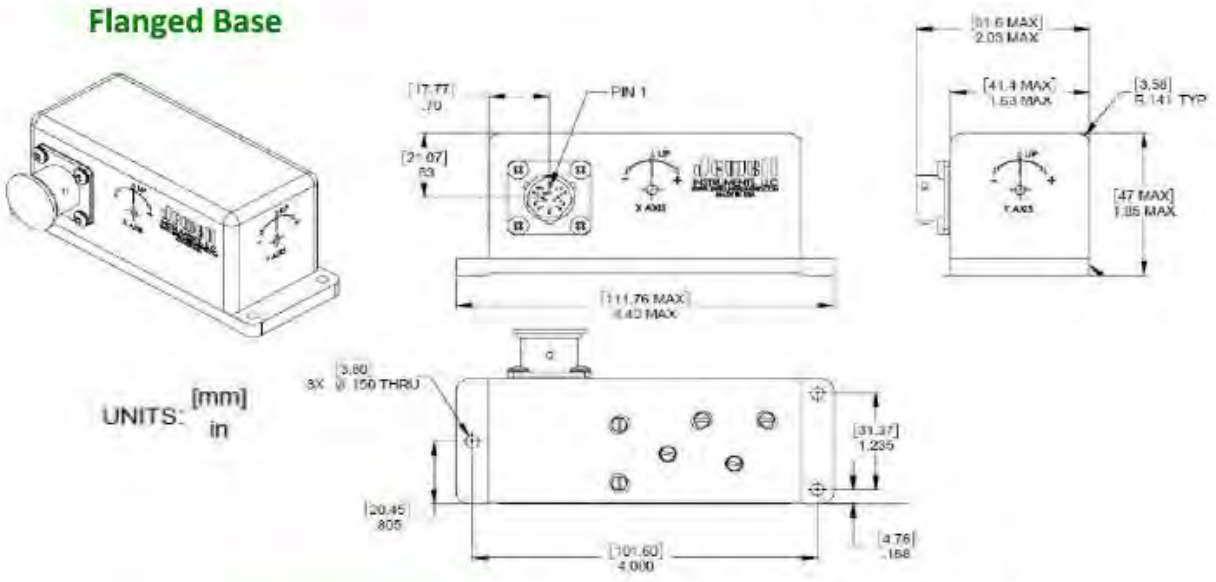
Dimensions - Standard Base



Flanged Base



eDXI-100/200 Series Inclinometer

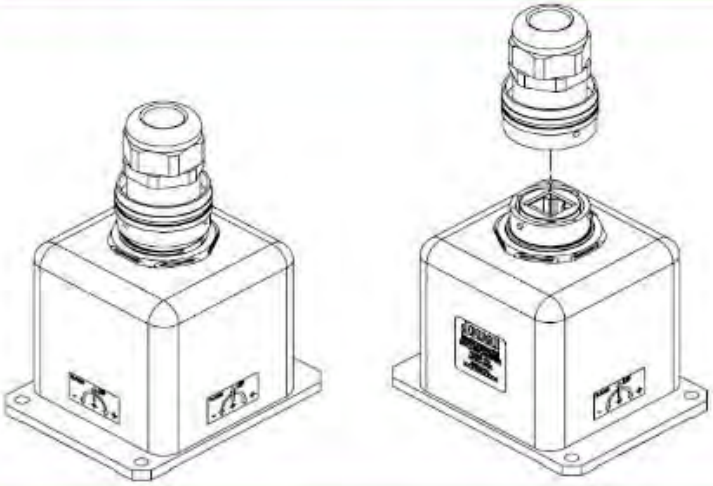
Jewell Instruments

Making Sense out of Motion...

Digital Ethernet Output - Single and Dual Axis for a wide variety of applications.

The Jewell eDXI-100/200 Series is a single or dual digital inclinometer with the convenience of Ethernet output. With its power over ethernet capability, no power source is needed. Simply plug it in to your computer.

Outline Diagram: *eDXI-100/200 Series Digital Inclinometer*



Features & Benefits

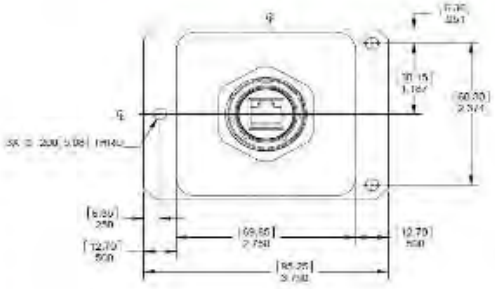
- Digital output
- Resolution 0.001°
- Mechanical Shock 1500g 1msec 1/2 sine
- Industry Standard Ethernet 10BaseT or 100 Base TX (Auto-sensing)
- For use in high shock and vibration environments
- PoE (power over Ethernet)
- Low Noise

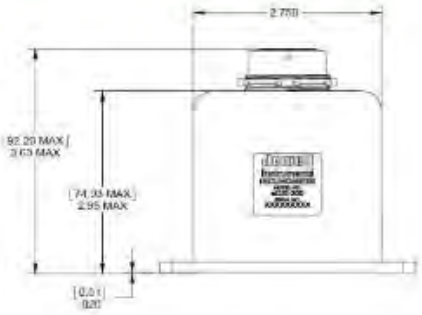
Applications

- Radar/Antenna Control
- Structural Monitoring
- Linear Acceleration/Deceleration Measuring
- Automatic Train Control (ATC, ATP)

Pin Out

Pin	Function
1	TX+
2	TX-
3	RX+
4	PoE45+
5	PoE45-
6	RX-
7	PoE78+
8	PoE78-





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eDXI-100/200 Series Inclinometer

Jewell Instruments

Making Sense out of Motion...

Performance[4]

Input Range[1], °	±1.0	±3.0	±14.5	±30.0	±60.0
Number of Axes	1,2	1,2	1,2	1,2	1,2
Non Linearity[2], %FRO, Max	0.02	0.015	0.02	0.02	0.03
Scale Factor Tolerance, % Max	0.05	0.05	0.05	0.05	0.05
Scale Factor Temperature Sensitivity, % reading/°C, Max	0.01	0.01	0.01	0.01	0.01
Output at 0° Tilt, °Max	0.01	0.01	0.05	0.05	0.05
0° Output Temperature Sensitivity, °/°C, Max	0.001	0.001	0.005	0.005	0.005
Bandwidth (-3dB), Hz, Nom[3]	3	6	30	30	30
Transverse Axis Misalignment, °, Max	0.15	0.15	0.5	0.5	0.5
Hysteresis, °, Max	0.001	0.001	0.001	0.001	0.001
Resolution and Threshold, °, Max	0.001	0.001	0.001	0.001	0.001
Power On Repeatability, °Max	0.001	0.001	0.001	0.001	0.001
Repeatability, °Max	0.001	0.001	0.002	0.002	0.003

Digital Output[4]

Interface	Ethernet 10Base-T or 100Base-TX (Auto-sensing)
Protocol	TCP/IP, UDP/IP, ARP, Telnet, ICMP, SNMP, DHCP, BOOTP, TFTP, AutoIP, and HTTP
Output Representation	Degrees

Electrical[4]

Supply Voltage, Volts DC	36 to 57
Start-up Voltage, Vdc Min	42
Input Current, mA, Max	250
Input to Output Isolation, Vpeak Impluse	1500
Noise, milli-degrees rms max	2

Environmental[4]

Operational Temp Range, °C	-40 to +85
Storage and Temp Range, °C	-40 to +90
Protection Class per IEC 529	IP67
NEMA Enclosure Rating	6
Seal	MILD-STD-202 Method 112
Shock Survival	1500g, 1msec, ½ sine
Vibration Survival, grms (20Hz to 2 KHz)	20

Enclosure[4]

Housing Material	Anodized and Alodine Aluminum
Weight	eDXI-200: 400g
Connector Type	Amphenol RJF72B00
Recommended Mating Connector	Amphenol RJF6B

NOTES:
1- Full range is defined as "from negative full input angle to positive full input angle"
2 - Non-linearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.
3 - In default condition without averaging enabled.
4 - Specifications are subject to change

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How to Order

Model Numbers	Part Number	Description
eDXI-100-1	02550380-101	Single axis, ±1° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-100-3	02550380-102	Single axis, ±3° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-100-14.5	02550380-103	Single axis, ±14.5° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-100-30	02550380-104	Single axis, ±30° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-100-60	02550380-105	Single axis, ±60° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-200-1/1	02550380-201	Dual axis, ±1° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-200-3/3	02550380-202	Dual axis, ±3° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-200-14.5/14.5	02550380-203	Dual axis, ±14.5° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-200-30/30	02550380-204	Dual axis, ±30° range, fluid damped, Ethernet interface, RJ45 connector
eDXI-200-60/60	02550380-205	Dual axis, ±60° range, fluid damped, Ethernet interface, RJ45 connector

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Precise Platform Positioning & Leveling

When the position of a radar or platform is crucial, a force-balanced inclinometer can get you the needed precision. For an analog solutions, use the LCF-2330, for digital, the DXI-100/200. The eDXI ethernet inclinometer uses power-over-internet, with no power source necessary. Simply plug into a computer and watch your measurements.

Jewell Instruments

AML Series - Low Cost Analog MEMS Inclinometer

Making Sense out of Motion...

The Jewell Instruments model AML is a low cost analog MEMS inclinometer for industrial applications. Standard units are available with 0-5V, 0.5-4.5V and 4-20mA output options. All AML series inclinometers are rated IP67 waterproof up to 1m. Custom ranges and output types are also available on request.

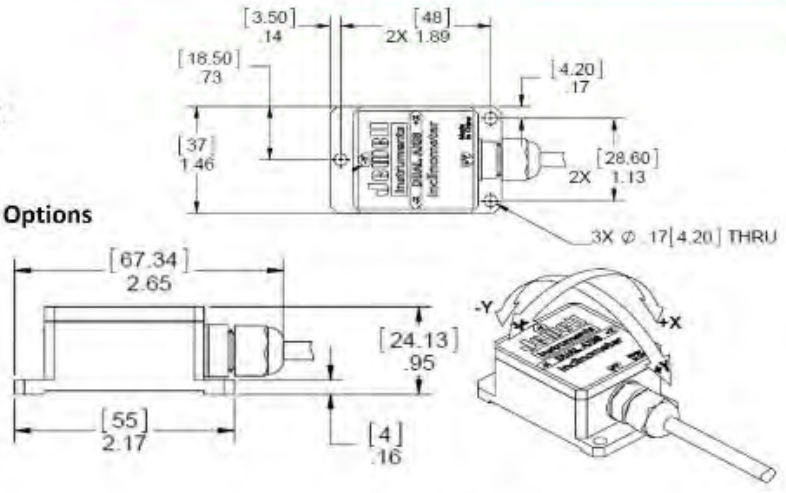
Features & Benefits:

- Single and Dual-Axis Available
- Resolution: 0.05°
- Zero Temperature Coefficient: ±0.02°/°C
- High Shock & Vibration Tolerance
- -40° to +85°C Temperature Range
- Analog 0-5V, 0.5-4.5V & 4-20mA Output Options
- 1m cable whip included

Applications:

- Solar Tracking & Panel Positioning
- Vehicle Wheel Alignment
- Industrial Automation & Control
- Radar/Antenna Mast Alignment
- Platform Leveling
- Navigation Pitch/Roll Measurement

Outline Diagram



**Dimensions in Inches [mm]*

Wiring Code

Wire	Function
Red	+VDC 9V~36V
Yellow	X-Axis Out
Green	Y-Axis Out
Black	Ground

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Performance Specifications

	STATIC/DYNAMIC				
*	Angular Range, °	±10°	±30°	±60°	±90°
	Resolution, °	0.05	0.05	0.05	0.05
	Hysteresis, °	0.1	0.2	0.2	0.2
	Zero Offset Tolerance (°)	0.56	0.56	0.56	0.56
	Zero Temperature Coefficient, °/°C	±0.02	±0.02	±0.02	±0.02
	Scale Factor Tolerance (%)	0.7	1.4	2.8	3
	Scale Factor Temperature Coefficient, ppm/°C	≤350	≤350	≤350	≤350
	Warm Up, s	0.5	0.5	0.5	0.5
	Time Constant, s	0.05	0.05	0.05	0.05
	ELECTRICAL AND ENVIRONMENTAL				
	Output	0-5V, 0.5 - 4.5V or 4-20mA			
	Electromagnetic Compatability	EN61000 and GBT17626			
	Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)			
	Vibration Resistance	10grms @ 10-1000Hz			
	Temperature Rating , Operation	-40 to +85°C			
	Temperature Rating, Storage	-55 to +100°C			
	Seal	IP67			
	Cables	1m Cable (standard)			
	Weight	90g (without cable)			
	Power Requirements	9-36 VDC @ 60mA			

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development

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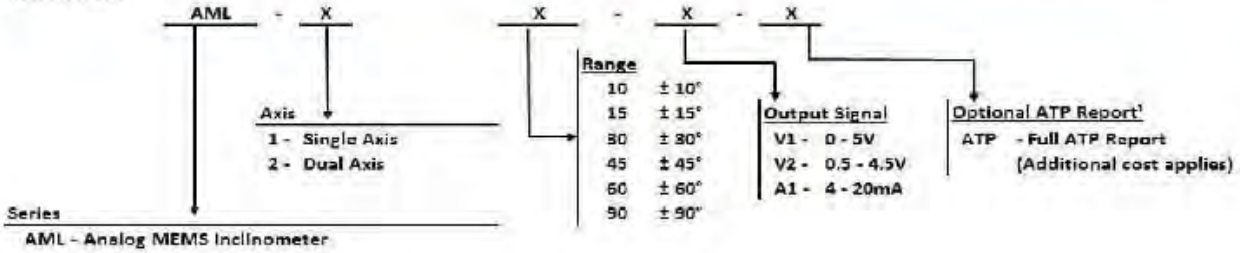
How To Order:



Example:
AML - 1 - 60 - V1 - ATP
AML, Single Axis, +/- 60 degree range, 0-5V output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
Voltage output (0-5Vdc)	AML-1-10-V1	02550322-0111	AML-2-10-V1	02550322-0211
	AML-1-15-V1	02550322-0121	AML-2-15-V1	02550322-0221
	AML-1-30-V1	02550322-0131	AML-2-30-V1	02550322-0231
	AML-1-45-V1	02550322-0141	AML-2-45-V1	02550322-0241
	AML-1-60-V1	02550322-0151	AML-2-60-V1	02550322-0251
	AML-1-90-V1	02550322-0161	AML-2-90-V1	02550322-0261
Voltage output (0.5-4.5Vdc)	AML-1-10-V2	02550322-0112	AML-2-10-V2	02550322-0212
	AML-1-15-V2	02550322-0122	AML-2-15-V2	02550322-0222
	AML-1-30-V2	02550322-0132	AML-2-30-V2	02550322-0232
	AML-1-45-V2	02550322-0142	AML-2-45-V2	02550322-0242
	AML-1-60-V2	02550322-0152	AML-2-60-V2	02550322-0252
	AML-1-90-V2	02550322-0162	AML-2-90-V2	02550322-0262
Current output (4-20mA)	AML-1-10-A1	02550322-0116	AML-2-10-A1	02550322-0216
	AML-1-15-A1	02550322-0126	AML-2-15-A1	02550322-0226
	AML-1-30-A1	02550322-0136	AML-2-30-A1	02550322-0236
	AML-1-45-A1	02550322-0146	AML-2-45-A1	02550322-0246
	AML-1-60-A1	02550322-0156	AML-2-60-A1	02550322-0256
	AML-1-90-A1	02550322-0166	AML-2-90-A1	02550322-0266

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

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AMS Series - Analog MEMS Inclinometer

Making Sense out of Motion...

The Jewell Instruments model AMS is a mid-level performance analog MEMS inclinometer for industrial applications. Standard units are available with 0-5V, 0.5-4.5V and 4-20mA output options. All AMS series inclinometers are rated IP67 waterproof up to 1m. Custom ranges and output types are also available on request.

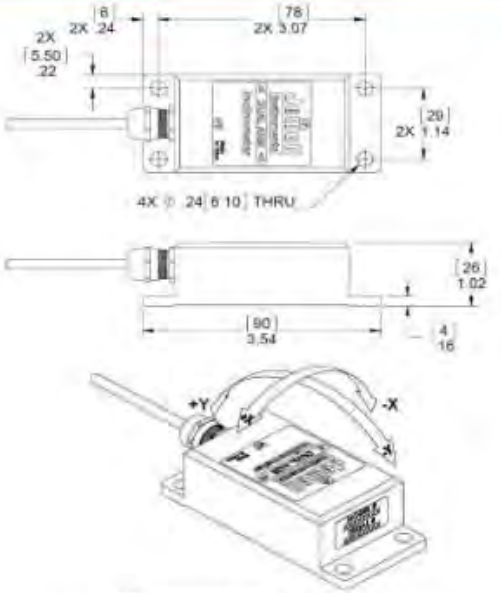
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.01°
- Zero Temperature Coefficient: ±0.01°/°C
- High Shock & Vibration Tolerance
- -40° to +85°C Temperature Range
- Analog 0-5V, 0.5-4.5V & 4-20mA Output Options
- 1m cable whip included

Applications:

- Boom Position and Control
- Radar and Vehicle Platform Positioning
- Industrial Measurement and Control
- Drilling Equipment
- Navigation Pitch/Roll Measurement
- Railway Track Alignment & Maintentance

Outline Diagram



**Dimensions in Inches [mm]*

Wiring Code

Wire	Function
Red	+VDC 9V~36V
White or Yellow	X-Axis Out
Green	Y-Axis Out
Black	Ground

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Performance Specifications

STATIC/DYNAMIC

* Angular Range, °	±10°	±30°	±60°	±90°
Resolution, °	0.01	0.01	0.01	0.01
Hysteresis, °	0.02	0.05	0.08	0.1
Zero Offset Tolerance (°)	0.56	0.56	0.56	0.56
Zero Temperature Coefficient, °/°C	±0.01	±0.01	±0.01	±0.01
Scale Factor Tolerance (%)	0.7	1.4	2.8	3
Scale Factor Temperature Coefficient, ppm/°C	≤200	≤200	≤200	≤200
Warm Up, s	0.5	0.5	0.5	0.5
Time Constant, s	0.05	0.05	0.05	0.05

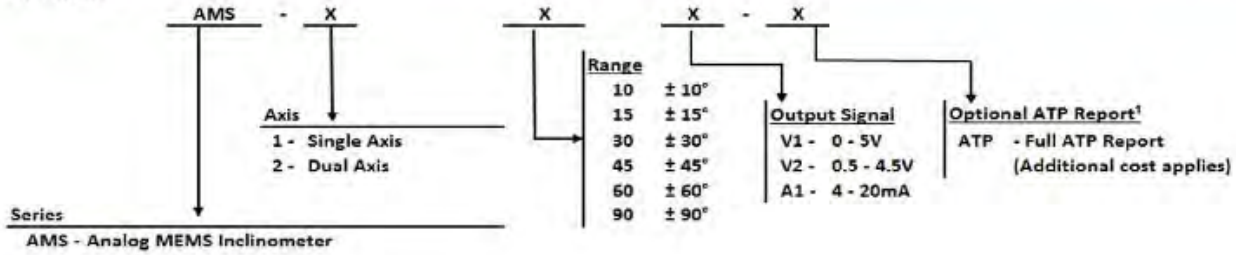
ELECTRICAL AND ENVIRONMENTAL

Output	0-5V, 0.5 - 4.5V or 4-20mA
Electromagnetic Compatability	EN61000 and GBT17626
Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)
Vibration Resistance	10grms @ 10-1000Hz
Temperature Rating , Operation	-40 to +85°C
Temperature Rating, Storage	-55 to +125°C
Seal	IP67
Cables	1m Cable (standard)
Weight	120g (without cable)
Power Requirements	9-36 VDC @ 60mA

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice due to continued product development

How To Order:



Example:
AMS - 1 - 30 - V1 - ATP
AMS Single Axis, +/- 30 degree, 0-5V output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
Voltage output (0-5Vdc)	AMS-1-10-V1	02550320-0111	AMS-2-10-V1	02550320-0211
	AMS-1-15-V1	02550320-0121	AMS-2-15-V1	02550320-0221
	AMS-1-30-V1	02550320-0131	AMS-2-30-V1	02550320-0231
	AMS-1-45-V1	02550320-0141	AMS-2-45-V1	02550320-0241
	AMS-1-60-V1	02550320-0151	AMS-2-60-V1	02550320-0251
	AMS-1-90-V1	02550320-0161	AMS-2-90-V1	02550320-0261
Voltage output (0.5-4.5Vdc)	AMS-1-10-V2	02550320-0112	AMS-2-10-V2	02550320-0212
	AMS-1-15-V2	02550320-0122	AMS-2-15-V2	02550320-0222
	AMS-1-30-V2	02550320-0132	AMS-2-30-V2	02550320-0232
	AMS-1-45-V2	02550320-0142	AMS-2-45-V2	02550320-0242
	AMS-1-60-V2	02550320-0152	AMS-2-60-V2	02550320-0252
	AMS-1-90-V2	02550320-0162	AMS-2-90-V2	02550320-0262
Current output (4-20mA)	AMS-1-10-A1	02550320-0116	AMS-2-10-A1	02550320-0216
	AMS-1-15-A1	02550320-0126	AMS-2-15-A1	02550320-0226
	AMS-1-30-A1	02550320-0136	AMS-2-30-A1	02550320-0236
	AMS-1-45-A1	02550320-0146	AMS-2-45-A1	02550320-0246
	AMS-1-60-A1	02550320-0156	AMS-2-60-A1	02550320-0256
	AMS-1-90-A1	02550320-0166	AMS-2-90-A1	02550320-0266

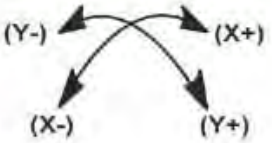
NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

JMI-100/200-D MEMS Inclinometer Series
±5VDC Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced inclinometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMI-100/200 series is available in single (JMI-100) and dual (JMI-200) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.



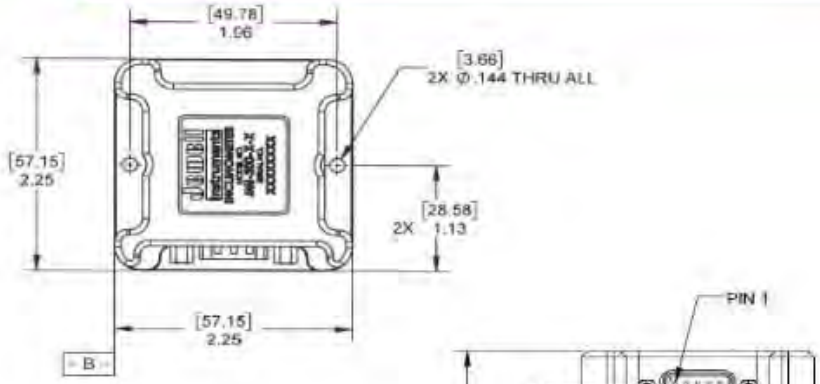
Features

- Robust and Rugged Enclosure
- Single and Dual Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Dual Power Input
- ±5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Industrial Automation & Control
- Solar Tracking
- Construction & Agricultural Equipment
- Mobile Cranes
- Platform Leveling/Positioning
- Mobile Radar Equipment
- Railway Track Alignment & Maintenance

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN TWO VERSIONS: SINGLE AXIS (X AXIS) DUAL AXIS (X & Y AXIS). DUAL AXIS SHOWN HERE
3. DATUM [- A -] AND [- B -] ARE DEFINED AS REFERENCE SURFACES

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	-Vin
4	X Out
5	Y Out
6	N/C
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

Measurement Range[1] (°)	±14.5	±30	±90
Output Voltage Range (VDC)	±5.00	±5.00	±5.00
Scale Factor Tolerance (%)	±1	±1	±1
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150
0° Output (Volts max)	±0.03	±0.03	±0.03
0° Output Temp. Sensitivity (V/°C max)	±0.004	±0.004	±0.004
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5
Resolution (° max)	0.002	0.002	0.004
Threshold (° max)	0.002	0.002	0.002
Non-linearity (% FRO max)	0.05	0.05	0.05
Nonrepeatability, Hysteresis (° max)	0.004	0.004	0.004
Bandwidth (Hz nom) (-3 dB)	5	5	5
Warm Up Time (Seconds max)	0.5	0.5	0.5
Voltage to Radian conversion[2]	ASIN(<voltage>/20)	ASIN(<voltage>/10)	ASIN(<voltage>/5)

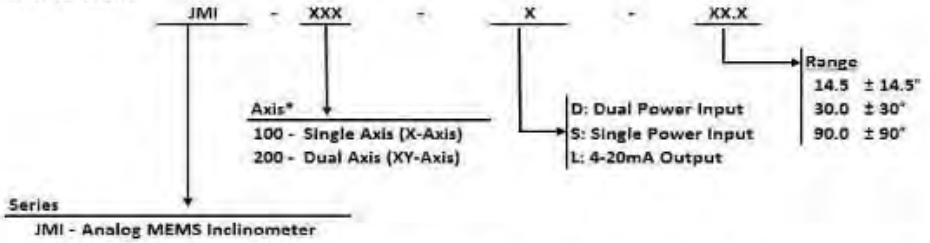
ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1 or 2
Input Voltage Range (VDC)	±12 to ±18
Input Current (mA max)	6 (1-axis), 12 (2-axis)
Output Noise (vrms max)	0.005
Output Impedance (Ohms nom)	1
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request.
2 - Does not take into account any sources of error.

*Specifications subject to change without notice on account of continued product development.

How To Order:



Example: JMI-100-L-14.5 = JMI series, single axis, 4-20mA Output, ±14.5° range

*Call factory for customized axis configurations

Single Axis Part Numbers		Dual Axis Part Numbers	
JMI-100-D-14.5	02550375-125	JMI-200-D-14.5	02550375-225
JMI-100-D-30	02550375-126	JMI-200-D-30	02550375-226
JMI-100-D-90	02550375-129	JMI-200-D-90	02550375-229

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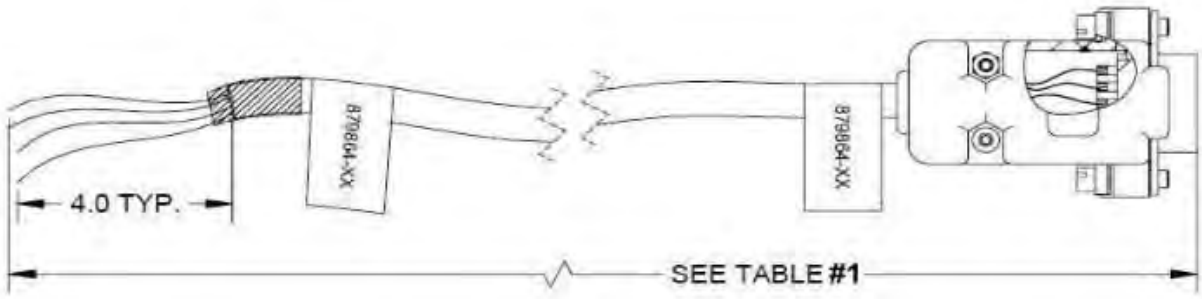
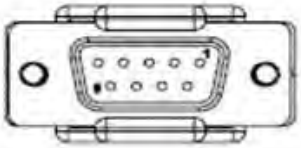
CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1	
Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other lengths available (specify on order)

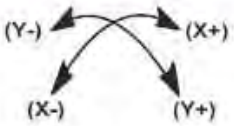
JMI-100/200-L MEMS Inclinometer Series
4-20mA Output

Jewell Instruments

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced inclinometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMI-100/200 series is available in single (JMI-100) and dual (JMI-200) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.



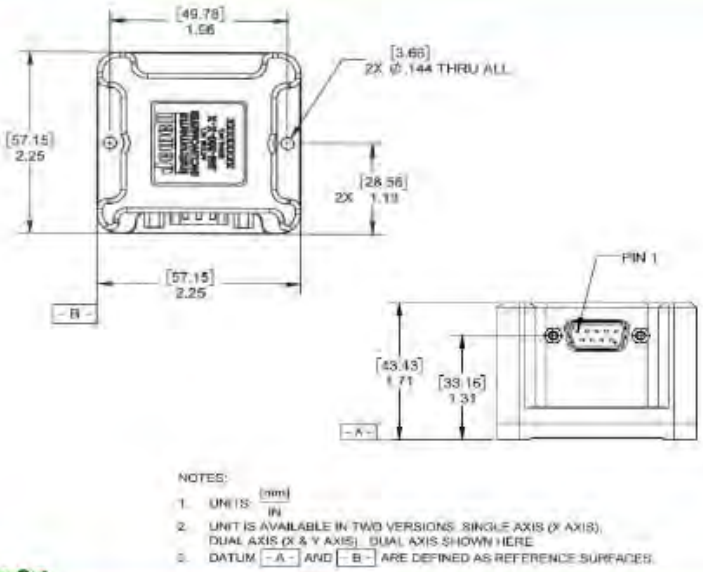
Features

- **±14.5°, ±30° and ±90° ranges**
- **Robust and Rugged Enclosure**
- **Single and Dual Axis Models Available**
- **Low-Cost MEMS Technology**
- **RoHS Compliant**
- **Filtering Available**
- **Single Power Input**
- **4-20 mA Output**
- **Temperature Sensor Option Available**
- **IP65 Seal**

Applications

- **Industrial Automation & Control**
- **Construction & Agricultural Equipment**
- **Solar Tracking**
- **Mobile Cranes**
- **Platform Leveling/Positioning**
- **Mobile Radar Equipment**
- **Railway Track Alignment & Maintenance**

Outline Diagram



NOTES:
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3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	N/C
7	Sig Rtn
8	Temp Out
9	N/C

Performance Specifications

STATIC/DYNAMIC

Measurement Range[1] (°)	±14.5	±30	±90
Output Current Range (mA)	4-20	4-20	4-20
Scale Factor Tolerance (%)	±1	±1	±1
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150
0° Output (mA)	12 ±0.3	12 ±0.3	12 ±0.3
0° Output Temp. Sensitivity (mA/°C max)	±0.004	±0.004	±0.004
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5
Resolution (° max)	0.002	0.002	0.004
Threshold (° max)	0.002	0.002	0.002
Non-linearity (% FRO max)	0.05	0.05	0.05
Nonrepeatability, Hysteresis (° max)	0.004	0.004	0.004
Bandwidth (Hz nom) (-3 dB)	5	5	5
Warm Up Time (Seconds max)	0.5	0.5	0.5
Current to Radian conversion[2]	arcsin((<output> - 12mA) / 32mA)	arcsin((<output> - 12mA) / 16mA)	arcsin((<output> - 12mA) / 8mA)

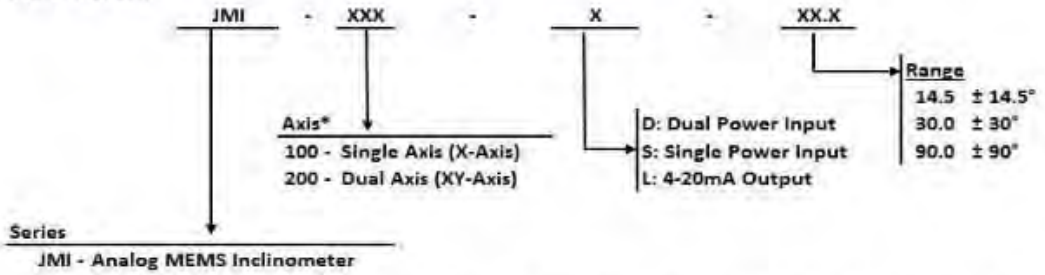
ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1 or 2
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	28 (1-axis), 56 (2-axis)
Output Noise (vrms max)	0.01
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request.
2 - Does not take into account any sources of error.

*Specifications subject to change without notice on account of continued product development.

How To Order:



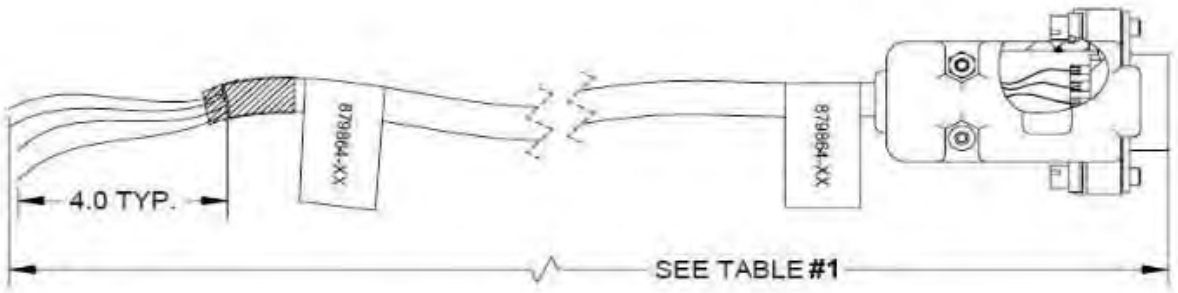
Example: JMI-100-L-14.5 = JMI series, single axis, 4-20mA Output, ±14.5° range

*Call factory for customized axis configurations

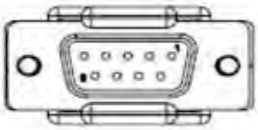
Single Axis Part Numbers		Dual Axis Part Numbers	
JMI-100-L-14.5	02550375-135	JMI-200-L-14.5	02550375-235
JMI-100-L-30	02550375-136	JMI-200-L-30	02550375-236
JMI-100-L-90	02550375-139	JMI-200-L-90	02550375-239

CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1	
Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other lengths available (specify on order)

JMI-100/200-S MEMS Inclinometer Series
0-5Vdc Output

Making Sense out of Motion...

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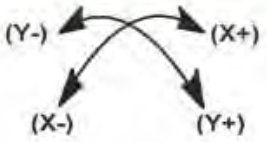


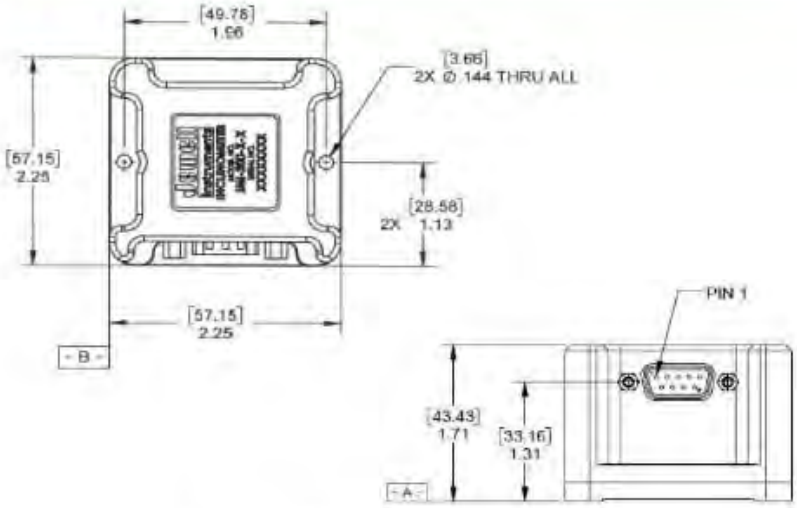
Features

- ±14.5°, ±30° and ±90° ranges
- Robust and Rugged Enclosure
- Single and Dual Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single Power Input
- 0-5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Industrial Automation & Control
- Construction & Agricultural Equipment
- Solar Tracking
- Mobile Cranes
- Platform Leveling/Positioning
- Mobile Radar Equipment
- Railway Track Alignment & Maintenance

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
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3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	N/C
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

Measurement Range[1] (°)	±14.5	±30	±90
Output Voltage Range (VDC)	0-5	0-5	0-5
Scale Factor Tolerance (%)	±1	±1	±1
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150
0° Output Error (Volts max)	±0.03	±0.03	±0.03
0° Output Temp. Sensitivity (V/°C max)	±0.004	±0.004	±0.004
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5
Resolution (° max)	0.002	0.002	0.004
Threshold (° max)	0.002	0.002	0.002
Non-linearity (% FRO max)	0.05	0.05	0.05
Nonrepeatability, Hysteresis (° max)	0.004	0.004	0.004
Bandwidth (Hz nom) (-3 dB)	5	5	5
Warm Up Time (Seconds max)	0.5	0.5	0.5
Voltage to Radian conversion[2]	ASIN((<voltage> - 2.5)/10)	ASIN((<voltage> - 2.5)/5)	ASIN((<voltage> - 2.5)/2.5)

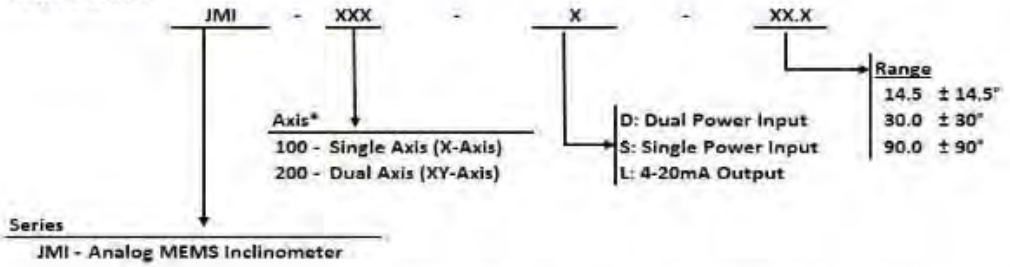
ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1 or 2
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	7 (1-axis), 14 (2-axis)
Output Noise (vrms max)	0.005
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request.
2 - Does not take into account any sources of error.

*Specifications subject to change without notice on account of continued product development.

How To Order:



Example: JMI-100-L-14.5 = JMI series, single axis, 4-20mA Output, ±14.5° range

*Call factory for customized axis configurations

Single Axis Part Numbers		Dual Axis Part Numbers	
JMI-100-S-14.5	02550375-115	JMI-200-S-14.5	02550375-215
JMI-100-S-30	02550375-116	JMI-200-S-30	02550375-216
JMI-100-S-90	02550375-119	JMI-200-S-90	02550375-219

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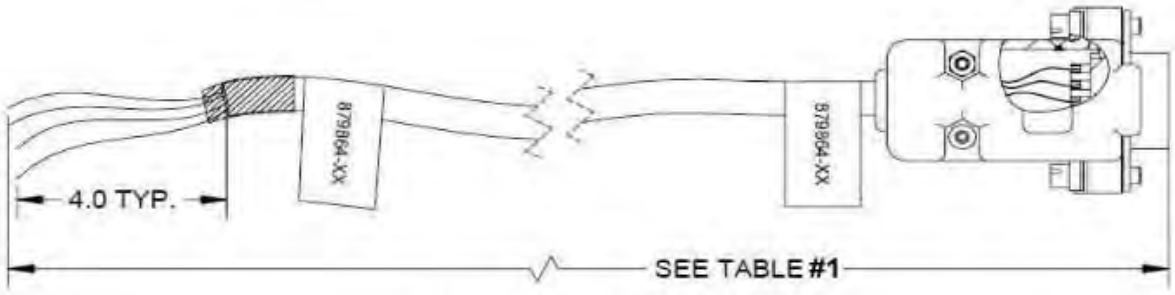
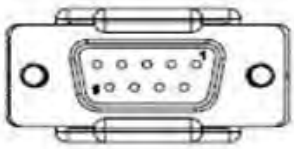
CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1	
Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other lengths available (specify on order)

Performance Specifications

STATIC/DYNAMIC

* Angular Range, °	±10°	±30°	±60°
Resolution, °	0.001	0.001	0.001
Hysteresis, °	0.005	0.008	0.01
Zero Tolerance (°)	0.01	0.01	0.01
Zero Temperature Coefficient, °/°C	±0.006	±0.006	±0.006
Scale Factor Tolerance (%)	0.7	1.4	2.8
Scale Factor Temperature Coefficient, ppm/°C	≤200	≤200	≤200
Warm Up, s	0.5	0.5	0.5
Time Constant, s	0.05	0.05	0.05

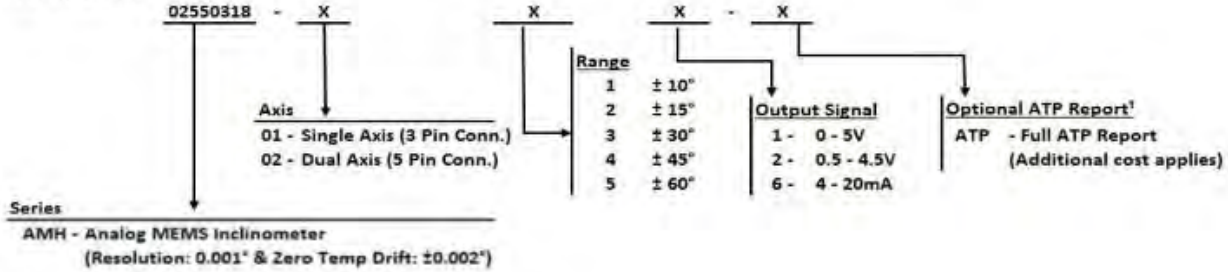
ELECTRICAL AND ENVIRONMENTAL

Output	0-5V, 0.5 - 4.5V or 4-20mA
Electromagnetic Compatibility	EN61000 and GBT17626
Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)
Vibration Resistance	10grms @ 10-1000Hz
Temperature Rating , Operation	-40 to +85°C
Temperature Rating, Storage	-55 to +100°C
Enclosure	Anodized Aluminum
Seal	IP67
Cables	1m Cable (standard)
Weight	150g (without cable)
Power Requirements	9-36 VDC @ 60mA

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development

How to Order:



Example:
02550318-0121-ATP
AMH Single Axis, +/- 15 degrees, 0-5V Output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

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AMH Series - Analog MEMS Inclinometer

Making Sense out of Motion...

The Jewell Instruments model AMH is a high precision MEMS inclinometer. Standard units are available with 0-5V, 0.5-4.5V, or 4-20mA output options. All AMH series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

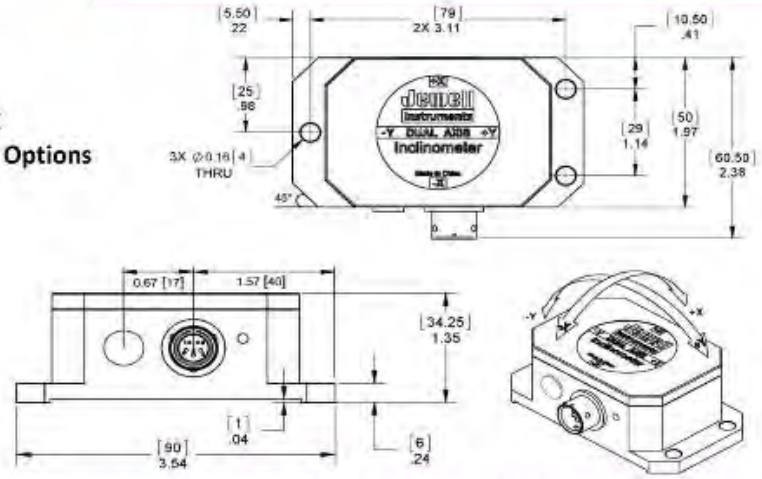
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.001°
- Zero Temperature Coefficient: ±0.006°/°C
- Analog 0-5V, 0.5 - 4.5V & 4-20mA Output Options
- -40° to +85°C Operating Range
- 1m cable whip included

Applications:

- Geotechnical Monitoring
- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance

Outline Diagram



**Dimensions in Inches [mm]*

Pin Out

3-pin Connector (Single Axis)

5-pin Connector (Dual Axis)

3-pin	5-pin	Function
1	1	+VDC 9V~36V
2	2	X-Axis Out
--	3	Y-Axis Out
3	4	Ground
--	5	Factory Use Only

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Performance Specifications

	STATIC/DYNAMIC			
*	Angular Range, °	±10°	±30°	±60°
	Resolution, °	0.001	0.001	0.001
	Hysteresis, °	0.005	0.008	0.01
	Zero Tolerance (°)	0.01	0.01	0.01
	Zero Temperature Coefficient, °/°C	±0.006	±0.006	±0.006
	Scale Factor Tolerance (%)	0.7	1.4	2.8
	Scale Factor Temperature Coefficient, ppm/°C	≤200	≤200	≤200
	Warm Up, s	0.5	0.5	0.5
	Time Constant, s	0.05	0.05	0.05
	ELECTRICAL AND ENVIRONMENTAL			
	Output	0-5V, 0.5 - 4.5V or 4-20mA		
	Electromagnetic Compatibility	EN61000 and GBT17626		
	Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)		
	Vibration Resistance	10grms @ 10-1000Hz		
	Temperature Rating , Operation	-40 to +85°C		
	Temperature Rating, Storage	-55 to +100°C		
	Enclosure	Anodized Aluminum		
	Seal	IP67		
	Cables	1m Cable (standard)		
	Weight	150g (without cable)		
	Power Requirements	9-36 VDC @ 60mA		

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development

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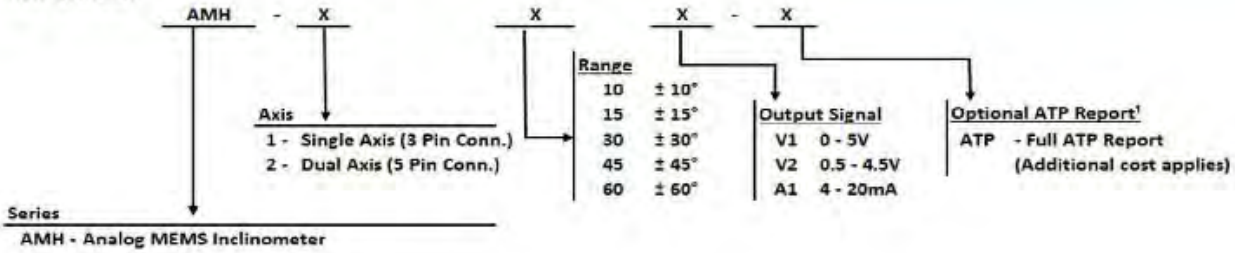
How to Order:



Example:
AMH - 1 - 15 - V1 - ATP
AMH Single Axis, +/- 15 degrees, 0-5V Output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
Voltage output (0-5Vdc)	AMH-1-10-V1	02550318-0111	AMH-2-10-V1	02550318-0211
	AMH-1-15-V1	02550318-0121	AMH-2-15-V1	02550318-0221
	AMH-1-30-V1	02550318-0131	AMH-2-30-V1	02550318-0231
	AMH-1-45-V1	02550318-0141	AMH-2-45-V1	02550318-0241
	AMH-1-60-V1	02550318-0151	AMH-2-60-V1	02550318-0251
Voltage output (0.5-4.5Vdc)	AMH-1-10-V2	02550318-0112	AMH-2-10-V2	02550318-0212
	AMH-1-15-V2	02550318-0122	AMH-2-15-V2	02550318-0222
	AMH-1-30-V2	02550318-0132	AMH-2-30-V2	02550318-0232
	AMH-1-45-V2	02550318-0142	AMH-2-45-V2	02550318-0242
	AMH-1-60-V2	02550318-0152	AMH-2-60-V2	02550318-0252
Current output (4-20mA)	AMH-1-10-A1	02550318-0116	AMH-2-10-A1	02550318-0216
	AMH-1-15-A1	02550318-0126	AMH-2-15-A1	02550318-0226
	AMH-1-30-A1	02550318-0136	AMH-2-30-A1	02550318-0236
	AMH-1-45-A1	02550318-0146	AMH-2-45-A1	02550318-0246
	AMH-1-60-A1	02550318-0156	AMH-2-60-A1	02550318-0256

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

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AMI Series - Analog MEMS Inclinometer, Temp. Corrected

Making Sense out of Motion...

The model AMI is a high precision MEMS inclinometer with built-in thermal compensation. Standard units come with 0-5V, 0.5-4.5V or 4-20mA output options. All AMI series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

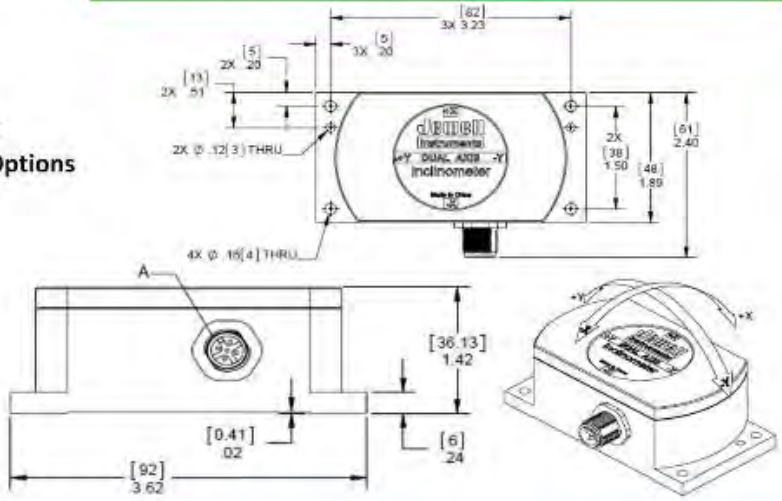
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.001°
- Zero Temperature Coefficient: ±0.002°/°C
- Analog 0-5V, 0.5-4.5V & 4-20mA Output Options
- -40° to +85°C Operating Range
- High Shock & Vibration Tolerance
- 2m cable whip included

Applications:

- Geotechnical Monitoring
- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance
- Antenna Position Control

Outline Diagram



**Dimensions in Inches [mm]*

Pin Out

Pin	Function
1	+VDC 9V~36V
2	X-Axis Out
3	Y-Axis Out
4	Ground
5	Factory Use Only

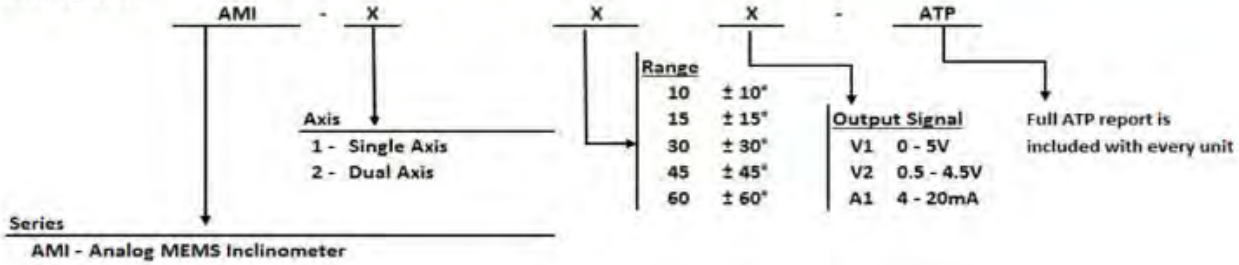
Performance Specifications

STATIC/DYNAMIC			
* Angular Range, °	±10°	±30°	±60°
Resolution, °	0.001	0.001	0.001
Hysteresis, °	0.003	0.005	0.008
Zero Tolerance (°)	0.1	0.1	0.1
Zero Temperature Coefficient, °/°C	±0.002	±0.002	±0.002
Scale Factor Tolerance (%)	0.7	1.4	2.8
Scale Factor Temperature Coefficient, ppm/°C	≤50	≤50	≤50
Warm Up, s	0.5	0.5	0.5
Time Constant, s	0.02	0.02	0.02
ELECTRICAL AND ENVIRONMENTAL			
Output	0-5V, 0.5 - 4.5V or 4-20mA		
Electromagnetic Compatability	EN61000 and GBT17626		
Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)		
Vibration Resistance	10grms @ 10-1000Hz		
Temperature Rating , Operation	-40 to +85°C		
Temperature Rating, Storage	-55 to +100°C		
Enclosure	Anodized Aluminum		
Seal	IP67		
Cables	2m Cable (standard)		
Weight	150g (without cable)		
Power Requirements	9-36 VDC @ 60mA		

Notes: * - Custom ranges available, please see model number structure below.

Specifications are subject to change without notice on account of continued product development.

How To Order:



Example:
AMI - 1 - 10 - A1 - ATP
AMI Single Axis, +/- 10 degrees, 4-20 mA output, ATP report

Note: ATP report is included with every unit
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current, Thermo Data Points.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
Voltage output (0-5Vdc)	AMI-1-10-V1-ATP	02550316-0111-ATP	AMI-2-10-V1-ATP	02550316-0211-ATP
	AMI-1-15-V1-ATP	02550316-0121-ATP	AMI-2-15-V1-ATP	02550316-0221-ATP
	AMI-1-30-V1-ATP	02550316-0131-ATP	AMI-2-30-V1-ATP	02550316-0231-ATP
	AMI-1-45-V1-ATP	02550316-0141-ATP	AMI-2-45-V1-ATP	02550316-0241-ATP
	AMI-1-60-V1-ATP	02550316-0151-ATP	AMI-2-60-V1-ATP	02550316-0251-ATP
Voltage output (0.5-4.5Vdc)	AMI-1-10-V2-ATP	02550316-0112-ATP	AMI-2-10-V2-ATP	02550316-0212-ATP
	AMI-1-15-V2-ATP	02550316-0122-ATP	AMI-2-15-V2-ATP	02550316-0222-ATP
	AMI-1-30-V2-ATP	02550316-0132-ATP	AMI-2-30-V2-ATP	02550316-0232-ATP
	AMI-1-45-V2-ATP	02550316-0142-ATP	AMI-2-45-V2-ATP	02550316-0242-ATP
	AMI-1-60-V2-ATP	02550316-0152-ATP	AMI-2-60-V2-ATP	02550316-0252-ATP
Current output (4-20mA)	AMI-1-10-A1-ATP	02550316-0116-ATP	AMI-2-10-A1-ATP	02550316-0216-ATP
	AMI-1-15-A1-ATP	02550316-0126-ATP	AMI-2-15-A1-ATP	02550316-0226-ATP
	AMI-1-30-A1-ATP	02550316-0136-ATP	AMI-2-30-A1-ATP	02550316-0236-ATP
	AMI-1-45-A1-ATP	02550316-0146-ATP	AMI-2-45-A1-ATP	02550316-0246-ATP
	AMI-1-60-A1-ATP	02550316-0156-ATP	AMI-2-60-A1-ATP	02550316-0256-ATP

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply.

AMV Series - Analog MEMS Inclinometer, Temp. Corrected

Making Sense out of Motion...

The model AMV is a high precision MEMS inclinometer with built-in thermal compensation. Standard units come with ±5V, or ± 10V output options. All AMV series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

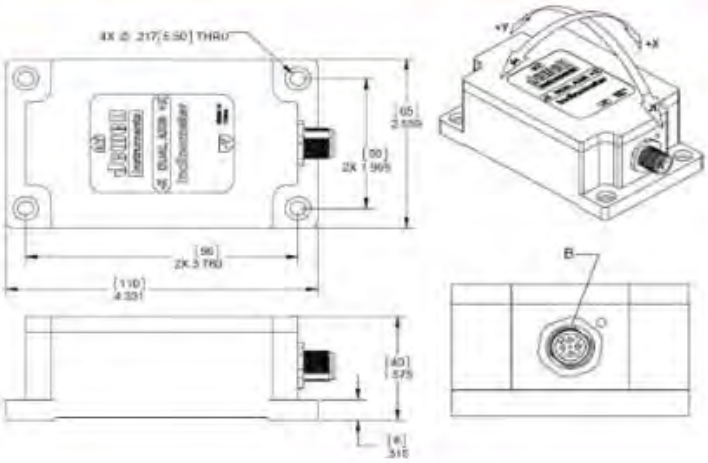
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.001°
- Zero Temperature Coefficient: ±0.005°/°C
- ±5V & ±10V
- -40° to +85°C Operating Range
- High Shock & Vibration Tolerance
- 2m cable whip included

Applications:

- Geotechnical Monitoring
- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance
- Antenna Position Control

Outline Diagram



*Dimensions in Inches [mm]

Pin Out

Pin	Function
1	9V - 36V
2	X-Axis Out
3	Y-Axis Out
4	Power Return
5	Sig Return for X & Y

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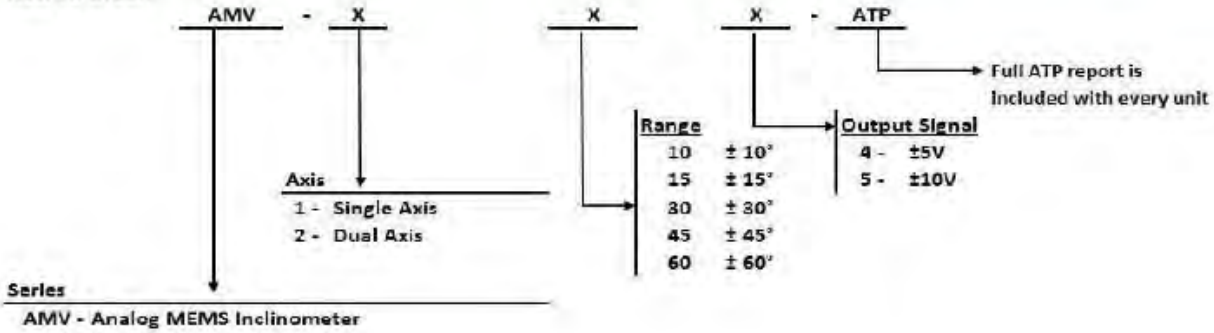
Performance Specifications

STATIC/DYNAMIC			
* Angular Range, °	±10°	±30°	±60°
Resolution, °	0.001	0.001	0.001
Hysteresis, °	0.003	0.01	0.02
Zero Offset Tolerance (°)	0.1	0.1	0.1
Zero Temperature Coefficient, °/°C	±0.005	±0.005	±0.005
Scale Factor Tolerance (%)	0.7	1.4	2.8
Scale Factor Temperature Coefficient, ppm/°C	≤50	≤50	≤50
Warm Up, s	0.5	0.5	0.5
Time Constant, s	0.02	0.02	0.02
ELECTRICAL AND ENVIRONMENTAL			
Output	±5V or ±10V		
Electromagnetic Compatability	EN61000 and GBT17626		
Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)		
Vibration Resistance	10grms @ 10-1000Hz		
Temperature Rating , Operation	-40 to +85°C		
Temperature Rating, Storage	-55 to +100°C		
Enclosure	Anodized Aluminum		
Seal	IP67		
Cables	2m Cable (standard)		
Weight	150g (without cable)		
Power Requirements	9-36 VDC @ 60mA		

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change on account of continued product development

How To Order:



Example:
AMV - 1 - 10 - V5 - ATP
AMV Single Axis, +/- 10 degrees, ± 10V output, ATP report

Note: ATP report is included with every unit.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current, Thermo Data Points.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
Voltage output (±5Vdc)	AMV-1-10-V4-ATP	02550343-0114-ATP	AMV-2-10-V4-ATP	02550343-0214-ATP
	AMV-1-15-V4-ATP	02550343-0124-ATP	AMV-2-15-V4-ATP	02550343-0224-ATP
	AMV-1-30-V4-ATP	02550343-0134-ATP	AMV-2-30-V4-ATP	02550343-0234-ATP
	AMV-1-45-V4-ATP	02550343-0144-ATP	AMV-2-45-V4-ATP	02550343-0244-ATP
	AMV-1-60-V4-ATP	02550343-0154-ATP	AMV-2-60-V4-ATP	02550343-0254-ATP
Voltage output (±10Vdc)	AMV-1-10-V5-ATP	02550343-0115-ATP	AMV-2-10-V5-ATP	02550343-0215-ATP
	AMV-1-15-V5-ATP	02550343-0125-ATP	AMV-2-15-V5-ATP	02550343-0225-ATP
	AMV-1-30-V5-ATP	02550343-0135-ATP	AMV-2-30-V5-ATP	02550343-0235-ATP
	AMV-1-45-V5-ATP	02550343-0145-ATP	AMV-2-45-V5-ATP	02550343-0245-ATP
	AMV-1-60-V5-ATP	02550343-0155-ATP	AMV-2-60-V5-ATP	02550343-0255-ATP

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply.

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DML Series - Low Cost Digital MEMS Inclinometer

Making Sense out of Motion...

The Jewell Instruments model DML is a low cost digital MEMS inclinometer for industrial applications. Units are available with RS232, RS485 and UART TTL output options. All DML series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

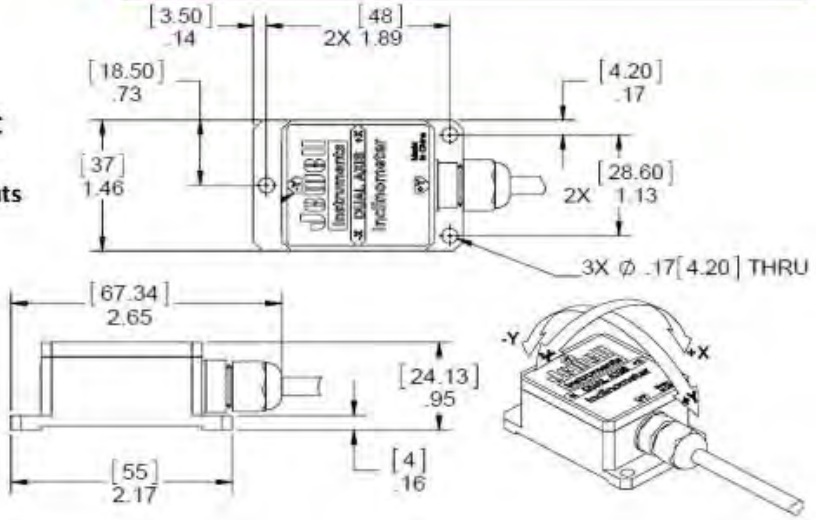
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.05°
- Zero Temperature Coefficient: ±0.02°/°C
- -40° to +85°C Operation and Storage
- Digital RS232, RS485 or UART TTL Outputs
- 1m cable whip included

Applications:

- Solar Tracking & Panel Positioning
- Vehicle Wheel Alignment
- Industrial Automation & Control
- Radar/Antenna Mast Alignment
- Platform Leveling
- Navigation Pitch/Roll Measurement

Outline Diagram



**Dimensions in Inches [mm]*

Wiring Code

Wire	Function
Red	+VDC 9V~36V
Yellow	RS232 (Rx), RS485 (D+)
Green	RS232 (Tx), RS485 (D-)
Black	Ground

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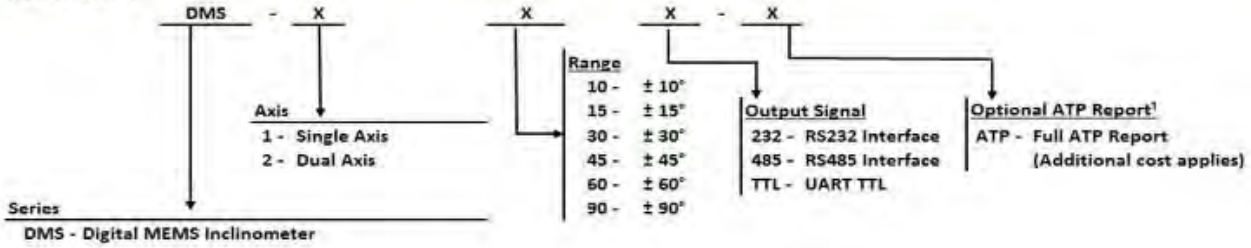
Performance Specifications

STATIC/DYNAMIC					
*	Angular Range, °	±10°	±30°	±60°	±90°
	Resolution, °	0.05	0.05	0.05	0.1
	Hysteresis, °	0.1	0.1	0.2	0.2
	Zero Tolerance (°)	0.56	0.56	0.56	0.56
	Zero Temperature Coefficient, (°/°C)	±0.02	±0.02	±0.02	±0.02
	Scale Factor Tolerance (%)	0.7	1.4	2.8	3
	Scale Factor Temperature Coefficient, (ppm/°C)	≤350	≤350	≤350	≤350
	Warm up, s	0.5	0.5	0.5	0.5
	Time Constant, s	0.05	0.05	0.05	0.05
ELECTRICAL AND ENVIRONMENTAL					
	Output Rate	5Hz, 15Hz, 35Hz, 50Hz			
	Output Type	RS232/RS485/TTL			
	Electromagnetic Compatability	EN61000 and GBT17626			
	Impact Resistance	100g@11ms, 3 Times/Axis (1/2 sinusoid)			
	Vibration Resistance	10grms, 10~1000 Hz			
	Temperature Rating , Operation	-40 to +85°C			
	Temperature Rating, Storage	-55 to +100°C			
	Seal	IP67			
	Cables	1m Cable (standard)			
	Weight	90g (without cable)			
	Power Requirements	9-36 VDC @ 60mA			

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development.

How To Order:



Example:
DMS - 1 - 30 - 232 - ATP
DMS Single Axis, +/- 30 degrees, RS232 Interface, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
RS232 Interface	DMS-1-10-232	02550321-0111	DMS-2-10-232	02550321-0211
	DMS-1-15-232	02550321-0121	DMS-2-15-232	02550321-0221
	DMS-1-30-232	02550321-0131	DMS-2-30-232	02550321-0231
	DMS-1-45-232	02550321-0141	DMS-2-45-232	02550321-0241
	DMS-1-60-232	02550321-0151	DMS-2-60-232	02550321-0251
	DMS-1-90-232	02550321-0161	DMS-2-90-232	02550321-0261
RS485 Interface	DMS-1-10-485	02550321-0113	DMS-2-10-485	02550321-0213
	DMS-1-15-485	02550321-0123	DMS-2-15-485	02550321-0223
	DMS-1-30-485	02550321-0133	DMS-2-30-485	02550321-0233
	DMS-1-45-485	02550321-0143	DMS-2-45-485	02550321-0243
	DMS-1-60-485	02550321-0153	DMS-2-60-485	02550321-0253
	DMS-1-90-485	02550321-0163	DMS-2-90-485	02550321-0263
UART TTL Interface	DMS-1-10-TTL	02550321-0114	DMS-2-10-TTL	02550321-0214
	DMS-1-15-TTL	02550321-0124	DMS-2-15-TTL	02550321-0224
	DMS-1-30-TTL	02550321-0134	DMS-2-30-TTL	02550321-0234
	DMS-1-45-TTL	02550321-0144	DMS-2-45-TTL	02550321-0244
	DMS-1-60-TTL	02550321-0154	DMS-2-60-TTL	02550321-0254
	DMS-1-90-TTL	02550321-0164	DMS-2-90-TTL	02550321-0264

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

DMS Series - Digital MEMS Inclinometer

Making Sense out of Motion...

The model DMS is a mid-level performance digital MEMS inclinometer for industrial applications. Standard units are available in RS232, RS485 and UART TTL interface options. All DMS series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

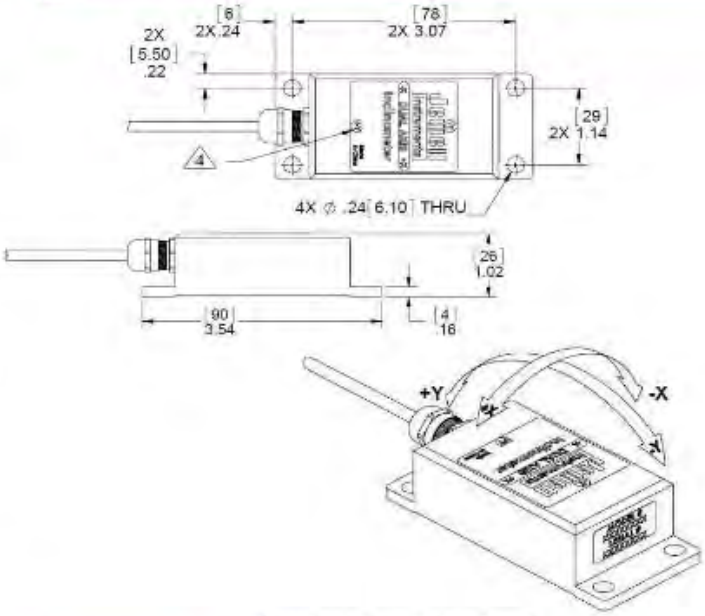
Features & Benefits:

- Single-Axis and Dual-axis Available
- Resolution: 0.01°
- Zero Temperature Coefficient: ±0.01°/°C
- -40° to +85°C Operation and Storage
- RS232, RS485 & UART TTL Outputs
- 1m cable whip included

Applications:

- Boom Position and Control
- Radar and Vehicle Platform Positioning
- Industrial Measurement and Control
- Drilling Equipment
- Navigation Pitch/Roll Measurement
- Railway Track Alignment & Maintentance

Outline Diagram



**Dimensions in Inches [mm]*

Wiring Code

Wire	Function
Red	+VDC 9V~36V
White or Yellow	RS232 (Rx), RS485 (D+)
Green	RS232 (Tx), RS485 (D-)
Black	Ground

Performance Specifications

STATIC/DYNAMIC

* Angular Range, °	±10°	±30°	±60°	±90°
Resolution, °	0.01	0.01	0.01	0.01
Hysteresis, °	0.02	0.05	0.08	0.1
Zero Offset Tolerance (°)	0.56	0.56	0.56	0.56
Zero Temperature Coefficient, (°/°C)	±0.01	±0.01	±0.01	±0.01
Scale Factor Tolerance (%)	0.7	1.4	2.8	3
Scale Factor Temperature Coefficient, (ppm/°C)	≤200	≤200	≤200	≤200
Warm up, s	0.5	0.5	0.5	0.5
Time Constant, s	0.05	0.05	0.05	0.05

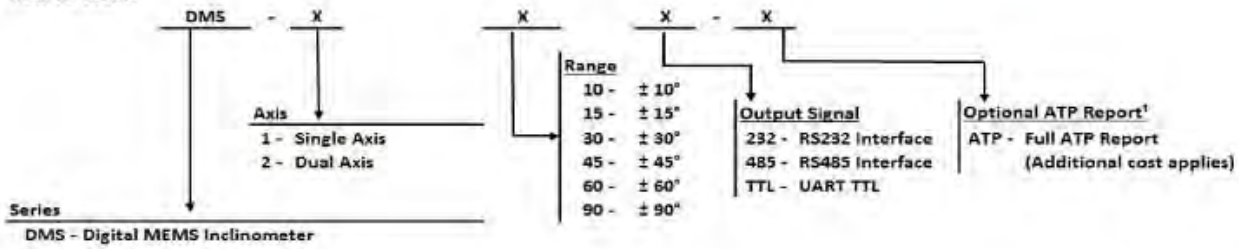
ELECTRICAL AND ENVIRONMENTAL

Output Rate	5Hz, 15Hz, 35Hz, 50Hz
Output Type	RS232/RS485/TTL
Electromagnetic Compatability	EN61000 and GBT17626
Impact Resistance	100g@11ms, 3 Times/Axis (1/2 sinusoid)
Vibration Resistance	10grms, 10~1000 Hz
Temperature Rating , Operation	-40 to +85°C
Temperature Rating, Storage	-55 to +125°C
Seal	IP67
Cables	1m Cable (standard)
Weight	150g
Power Requirements	9-36 VDC @ 60mA

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development.

How To Order:



Example:
DMS - 1 - 30 - 232 - ATP
DMS Single Axis, +/- 30 degrees, RS232 Interface, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
RS232 Interface	DMS-1-10-232	02550321-0111	DMS-2-10-232	02550321-0211
	DMS-1-15-232	02550321-0121	DMS-2-15-232	02550321-0221
	DMS-1-30-232	02550321-0131	DMS-2-30-232	02550321-0231
	DMS-1-45-232	02550321-0141	DMS-2-45-232	02550321-0241
	DMS-1-60-232	02550321-0151	DMS-2-60-232	02550321-0251
	DMS-1-90-232	02550321-0161	DMS-2-90-232	02550321-0261
RS485 Interface	DMS-1-10-485	02550321-0113	DMS-2-10-485	02550321-0213
	DMS-1-15-485	02550321-0123	DMS-2-15-485	02550321-0223
	DMS-1-30-485	02550321-0133	DMS-2-30-485	02550321-0233
	DMS-1-45-485	02550321-0143	DMS-2-45-485	02550321-0243
	DMS-1-60-485	02550321-0153	DMS-2-60-485	02550321-0253
	DMS-1-90-485	02550321-0163	DMS-2-90-485	02550321-0263
UART TTL Interface	DMS-1-10-TTL	02550321-0114	DMS-2-10-TTL	02550321-0214
	DMS-1-15-TTL	02550321-0124	DMS-2-15-TTL	02550321-0224
	DMS-1-30-TTL	02550321-0134	DMS-2-30-TTL	02550321-0234
	DMS-1-45-TTL	02550321-0144	DMS-2-45-TTL	02550321-0244
	DMS-1-60-TTL	02550321-0154	DMS-2-60-TTL	02550321-0254
	DMS-1-90-TTL	02550321-0164	DMS-2-90-TTL	02550321-0264

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

DMH Series - Digital MEMS Inclinometer

Making Sense out of Motion...

The Jewell Instruments model DMH is a high precision MEMS inclinometer. Units are available with RS232, RS422, RS485 and UART TTL options. All DMH series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

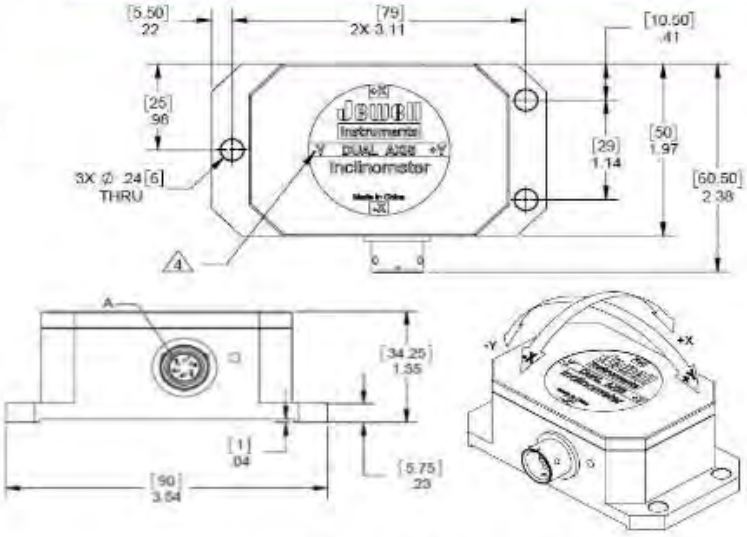
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution <0.001°
- Zero Temperature Coefficient: ±0.006°/°C
- Up to ±90° Angular Range
- -40° to +85°C Temperature Range
- 1m cable whip included

Applications:

- Antenna Deflection Measurement
- Radar & Vehicle Platform Positioning
- Drill Rig Alignment
- Offshore Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance

Outline Diagram



**Dimensions in Inches [mm]*

Pin Out

DETAIL A
FACE VIEW
SCALE 1.5 : 1

Pin	Function
1	+VDC 9V~36V
2	RS232 (Rx), RS485 (D+)
3	RS232 (Tx), RS485 (D-)
4	Ground
5	Factory Use Only

Consult Factory for RS422

Performance Specifications

STATIC/DYNAMIC					
*	Angular Range, °	±10°	±15°	±30°	±60°
	Resolution, °	0.001	0.001	0.001	0.001
	Hysteresis, °	0.005	0.007	0.008	0.01
	Zero Tolerance (°)	0.01	0.01	0.01	0.01
	Zero Temperature Coefficient, (°/°C)	±0.006	±0.006	±0.006	±0.006
	Scale Factor Tolerance (%)	0.7	1.1	1.4	2.8
	Scale Factor Temperature Coefficient, (ppm/°C)	≤200	≤200	≤200	≤200
	Warm up, s	0.5	0.5	0.5	0.5
	Time Constant, s	0.05	0.05	0.05	0.05
ELECTRICAL AND ENVIRONMENTAL					
	Output Rate	5Hz, 15Hz, 35Hz, 50Hz			
	Output Type	RS232, RS422, RS485, UART TTL			
	Electromagnetic Compatability	EN61000 and GBT17626			
	Impact Resistance	100g@11ms, 3 Times/Axis (1/2 sinusoid)			
	Vibration Resistance	10grms, 10~1000 Hz			
	Temperature Rating , Operation	-40 to +85°C			
	Temperature Rating, Storage	-55 to +100°C			
	Seal	IP67			
	Enclosure	Anodized Aluminum			
	Cables	1m Cable (standard)			
	Weight	150g (without cable)			
	Power Requirements	9-36 VDC @ 60mA			

Notes: * - Custom ranges available, please see model number structure below.

Specifications subject to change without notice on account of continued product development

How To Order:

DMH - X X X - X

Series
DMH - Digital MEMS Inclinometer

Axis
1 - Single Axis (3 Pin Conn.)
2 - Dual Axis (5 Pin Conn.)

Range

10	± 10°
15	± 15°
30	± 30°
45	± 45°
60	± 60°

Output Signal
232 - RS232 Interface
422 - RS422 Interface
485 - RS485 Interface
TTL - UART TTL

Optional ATP Report[1]
ATP - Full ATP Report
(Additional cost applies)

Example:
DMH - 2 - 15 - 232 - ATP
DMH Dual Axis, +/-15 degree, RS232 Interface, Full ATP Report

Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
RS232 Interface	DMH-1-10-232	02550319-0111	DMH-2-10-232	02550319-0211
	DMH-1-15-232	02550319-0121	DMH-2-15-232	02550319-0221
	DMH-1-30-232	02550319-0131	DMH-2-30-232	02550319-0231
	DMH-1-45-232	02550319-0141	DMH-2-45-232	02550319-0241
	DMH-1-60-232	02550319-0151	DMH-2-60-232	02550319-0251
RS422 Interface	DMH-1-10-422	02550319-0112	DMH-2-10-422	02550319-0212
	DMH-1-15-422	02550319-0122	DMH-2-15-422	02550319-0222
	DMH-1-30-422	02550319-0132	DMH-2-30-422	02550319-0232
	DMH-1-45-422	02550319-0142	DMH-2-45-422	02550319-0242
	DMH-1-60-422	02550319-0152	DMH-2-60-422	02550319-0252
RS485 Interface	DMH-1-10-485	02550319-0113	DMH-2-10-485	02550319-0213
	DMH-1-15-485	02550319-0123	DMH-2-15-485	02550319-0223
	DMH-1-30-485	02550319-0133	DMH-2-30-485	02550319-0233
	DMH-1-45-485	02550319-0143	DMH-2-45-485	02550319-0243
	DMH-1-60-485	02550319-0153	DMH-2-60-485	02550319-0253
UART TTL Interface	DMH-1-10-TTL	02550319-0114	DMH-2-10-TTL	02550319-0214
	DMH-1-15-TTL	02550319-0124	DMH-2-15-TTL	02550319-0224
	DMH-1-30-TTL	02550319-0134	DMH-2-30-TTL	02550319-0234
	DMH-1-45-TTL	02550319-0144	DMH-2-45-TTL	02550319-0244
	DMH-1-60-TTL	02550319-0154	DMH-2-60-TTL	02550319-0254

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

DMI Series - Digital MEMS Inclinometer, Temperature Corrected

Making Sense out of Motion...

The model DMI is a high precision, digital MEMS inclinometer with built-in thermal compensation. Standard units come with RS232, RS422, RS485 or TTL output options. All DMI series inclinometers are rated IP67 for waterproofing up to 1m. Custom ranges and output types are also available on request.

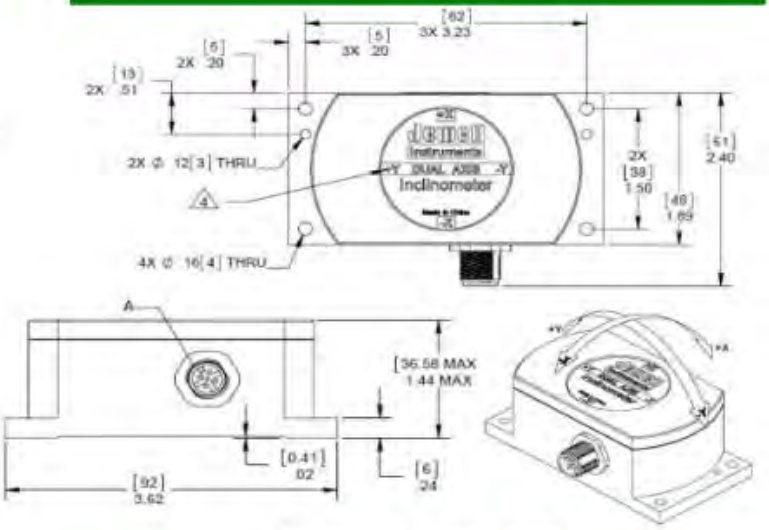
Features & Benefits:

- Single-Axis and Dual-Axis Available
- Resolution: 0.001°
- Zero Temperature Coefficient to ±0.002°/°C
- RS232, RS422, RS485 & TTL Outputs
- -40° to +85°C Operating Range
- High Shock & Vibration Tolerance
- 2m cable whip included

Applications:

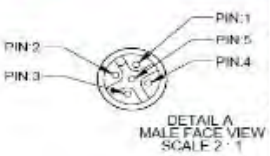
- Geotechnical Monitoring
- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance
- Antenna Position Control

Outline Diagram



**Dimensions in Inches [mm]*

Pin Out



Pin	Function
1	+VDC 9V~36V
2	RS232 (Rx), RS485 (D+)
3	RS232 (Tx), RS485 (D-)
4	Ground
5	Factory Use Only

Consult Factory for RS422

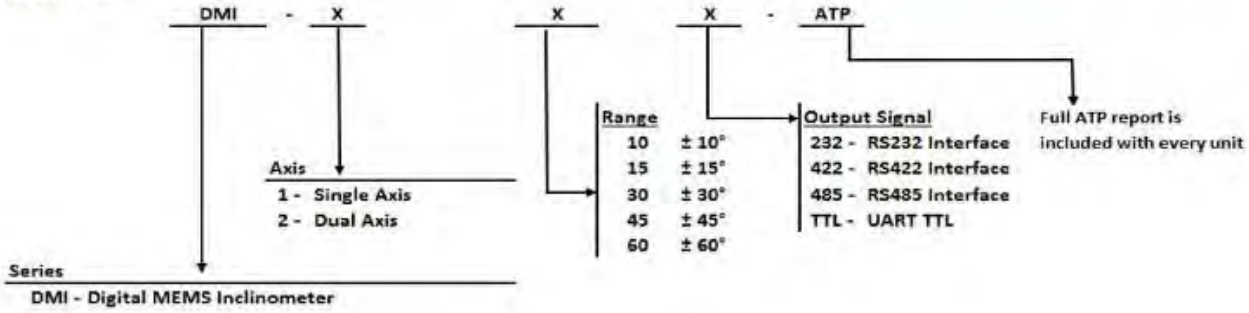
Performance Specifications

STATIC/DYNAMIC					
*	Angular Range, °	±10°	±30°	±45°	±60°
	Resolution, °	0.001	0.001	0.001	0.001
	Hysteresis, °	0.003	0.005	0.007	0.008
	Zero Tolerance (°)	0.1	0.1	0.1	0.1
	Zero Temperature Coefficient, °/°C	±0.002	±0.003	±0.004	±0.004
	Scale Factor Tolerance (%)	0.7	1.4	0.7	2.8
	Scale Factor Temperature Coefficient, ppm/°C	≤50	≤50	≤50	≤50
	Warm Up, s	0.5	0.5	0.5	0.5
	Time Constant, s	0.02	0.02	0.02	0.02
ELECTRICAL AND ENVIRONMENTAL					
	Output Rate	5Hz, 15Hz, 35Hz, 50Hz			
	Output Type	RS232, RS422, RS485, UART TTL			
	Electromagnetic Compatability	EN61000 and GBT17626			
	Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)			
	Vibration Resistance	10grms @ 10-1000Hz			
	Temperature Rating , Operation	-40 to +85°C			
	Temperature Rating, Storage	-55 to +100°C			
	Enclosure	Anodized Aluminum			
	Seal	IP67			
	Cables	2m Cable (standard)			
	Weight	150g (without cable)			
	Power Requirements	9-36 VDC @ 60mA			

Notes: * - Custom ranges available, please see model number structure below.

Specifications are subject to change without notice on account of continued product development

How To Order:



Example:
DMI - 2 - 15 - 232 - ATP
DMI Dual Axis, +/-15 degree, RS232 Interface, ATP Report

Note: ATP report is included with every unit
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current, Thermo Data Points.

Part Numbers

	Single-axis		Dual-axis	
	Model #	**Part #**	**Model #**	**Part #**
RS232 Interface	DMI-1-10-232-ATP	02550317-0111-ATP	DMI-2-10-232-ATP	02550317-0211-ATP
	DMI-1-15-232-ATP	02550317-0121-ATP	DMI-2-15-232-ATP	02550317-0221-ATP
	DMI-1-30-232-ATP	02550317-0131-ATP	DMI-2-30-232-ATP	02550317-0231-ATP
	DMI-1-45-232-ATP	02550317-0141-ATP	DMI-2-45-232-ATP	02550317-0241-ATP
	DMI-1-60-232-ATP	02550317-0151-ATP	DMI-2-60-232-ATP	02550317-0251-ATP
RS422 Interface	DMI-1-10-422-ATP	02550317-0112-ATP	DMI-2-10-422-ATP	02550317-0212-ATP
	DMI-1-15-422-ATP	02550317-0122-ATP	DMI-2-15-422-ATP	02550317-0222-ATP
	DMI-1-30-422-ATP	02550317-0132-ATP	DMI-2-30-422-ATP	02550317-0232-ATP
	DMI-1-45-422-ATP	02550317-0142-ATP	DMI-2-45-422-ATP	02550317-0242-ATP
	DMI-1-60-422-ATP	02550317-0152-ATP	DMI-2-60-422-ATP	02550317-0252-ATP
RS485 Interface	DMI-1-10-485-ATP	02550317-0113-ATP	DMI-2-10-485-ATP	02550317-0213-ATP
	DMI-1-15-485-ATP	02550317-0123-ATP	DMI-2-15-485-ATP	02550317-0223-ATP
	DMI-1-30-485-ATP	02550317-0133-ATP	DMI-2-30-485-ATP	02550317-0233-ATP
	DMI-1-45-485-ATP	02550317-0143-ATP	DMI-2-45-485-ATP	02550317-0243-ATP
	DMI-1-60-485-ATP	02550317-0153-ATP	DMI-2-60-485-ATP	02550317-0253-ATP
UART TTL Interface	DMI-1-10-TTL-ATP	02550317-0114-ATP	DMI-2-10-TTL-ATP	02550317-0214-ATP
	DMI-1-15-TTL-ATP	02550317-0124-ATP	DMI-2-15-TTL-ATP	02550317-0224-ATP
	DMI-1-30-TTL-ATP	02550317-0134-ATP	DMI-2-30-TTL-ATP	02550317-0234-ATP
	DMI-1-45-TTL-ATP	02550317-0144-ATP	DMI-2-45-TTL-ATP	02550317-0244-ATP
	DMI-1-60-TTL-ATP	02550317-0154-ATP	DMI-2-60-TTL-ATP	02550317-0254-ATP

DMP Series - Advanced Precision Digital MEMS Inclinometer

Making Sense out of Motion...

The model DMP digital MEMS inclinometer provides advanced thermal compensation in a high precision, robust package. Resolution is to <0.0005°. Standard units come with RS232, RS422, RS485 or TTL output options. Custom ranges and output types are also available on request.

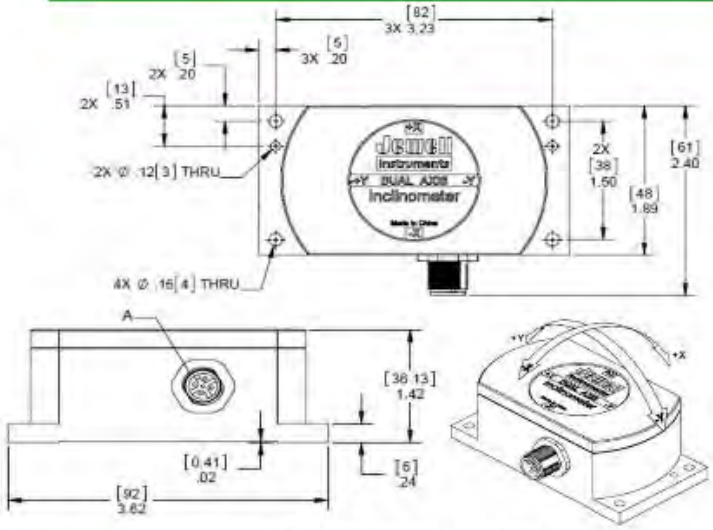
Features & Benefits:

- Single and Dual-Axis Available
- Resolution to <0.0005°
- Minimal Thermal Drift (<0.002°/°C Zero)
- Digital RS232, RS422, RS485 or TTL Output
- -40° to +85°C Operating Range
- High Shock & Vibration Tolerance
- 2m cable whip included

Applications:

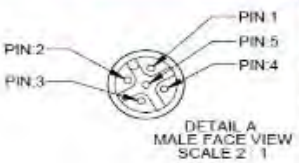
- Geotechnical Monitoring
- Radar & Vehicle Platform Leveling
- Drill Rig Alignment
- Offshore/Subsea Platform Pitch & Roll
- Industrial Measurement & Control
- Railway Track Alignment & Maintenance
- Antenna Position Control

Outline Diagram



**Dimensions in Inches [mm]*

Pin Out



Pin	Function
1	+VDC 9V~36V
2	RS232 (Rx), RS485 (D+)
3	RS232 (Tx), RS485 (D-)
4	Ground
5	Factory Use Only

Consult Factory for RS422

Performance Specifications

STATIC/DYNAMIC

*	Angular Range, °	±10°	±15°	±30°
	Resolution, °	0.0005	0.0005	0.0005
	Hysteresis, °	0.001	0.001	0.002
	Zero Tolerance (°)	0.1	0.1	0.1
	Zero Temperature Coefficient, °/°C	±0.002	±0.002	±0.002
	Scale Factor Tolerance (%)	0.7	1.1	1.4
	Scale Factor Temperature Coefficient, ppm/°C	≤50	≤50	≤50
	Warm Up, s	0.5	0.5	0.5
	Time Constant, s	0.05	0.05	0.05

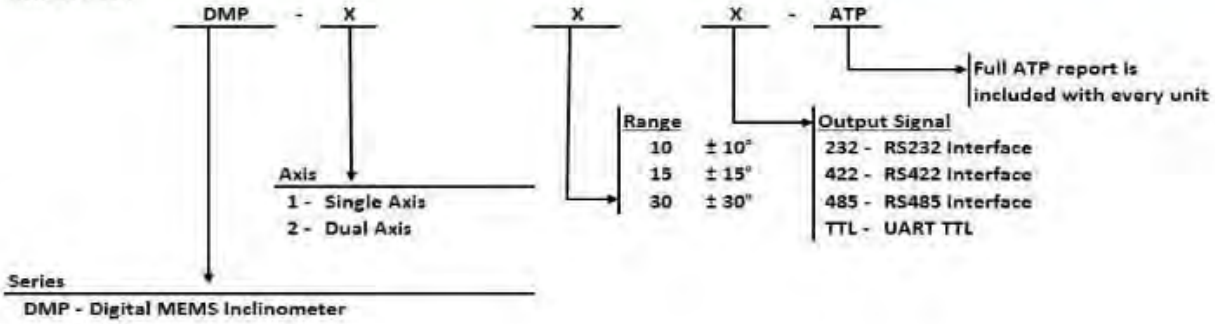
ELECTRICAL AND ENVIRONMENTAL

Output Rate	5Hz, 15Hz, 35Hz, 50Hz
Output Type	RS232, RS422, RS485, UART TTL
Electromagnetic Compatability	EN61000 and GBT17626
Impact Resistance	100g@11ms, 3 times/axis (1/2 sinusoid)
Vibration Resistance	10grms @ 10-1000Hz
Temperature Rating , Operation	-40 to +85°C
Temperature Rating, Storage	-55 to +100°C
Seal	IP67
Cables	2m Cable (standard)
Weight	150g (without cable)
Power Requirements	9-36 VDC @ 60mA

Notes: * - Custom ranges available, please see model number structure below.

Specifications are subject to change on account of continued product development.

How To Order:



Example:
DMP - 1 - 15 - 485 - ATP
DMP Single Axis, +/- 15 degrees, RS485 Interface, ATP Report

Note: ATP report is included with every unit
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current, Thermo Data Points.

Part Numbers

	Single-axis		Dual-axis	
	Model #	Part #	Model #	Part #
RS232 Interface	DMP-1-10-232-ATP	02550315-0111-ATP	DMP-2-10-232-ATP	02550315-0211-ATP
	DMP-1-15-232-ATP	02550315-0121-ATP	DMP-2-15-232-ATP	02550315-0221-ATP
	DMP-1-30-232-ATP	02550315-0131-ATP	DMP-2-30-232-ATP	02550315-0231-ATP
RS422 Interface	DMP-1-10-422-ATP	02550315-0112-ATP	DMP-2-10-422-ATP	02550315-0212-ATP
	DMP-1-15-422-ATP	02550315-0122-ATP	DMP-2-15-422-ATP	02550315-0222-ATP
	DMP-1-30-422-ATP	02550315-0132-ATP	DMP-2-30-422-ATP	02550315-0232-ATP
RS485 Interface	DMP-1-10-485-ATP	02550315-0113-ATP	DMP-2-10-485-ATP	02550315-0213-ATP
	DMP-1-15-485-ATP	02550315-0123-ATP	DMP-2-15-485-ATP	02550315-0223-ATP
	DMP-1-30-485-ATP	02550315-0133-ATP	DMP-2-30-485-ATP	02550315-0233-ATP
UART TTL Interface	DMP-1-10-TTL-ATP	02550315-0114-ATP	DMP-2-10-TTL-ATP	02550315-0214-ATP
	DMP-1-15-TTL-ATP	02550315-0124-ATP	DMP-2-15-TTL-ATP	02550315-0224-ATP
	DMP-1-30-TTL-ATP	02550315-0134-ATP	DMP-2-30-TTL-ATP	02550315-0234-ATP

JDI-100/200 MEMS Inclinometer Series
RS485, Digital Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced inclinometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JDI-100/200 series is a digitally temperature compensated inclinometer available in single (JDI-100) and dual (JDI-200) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

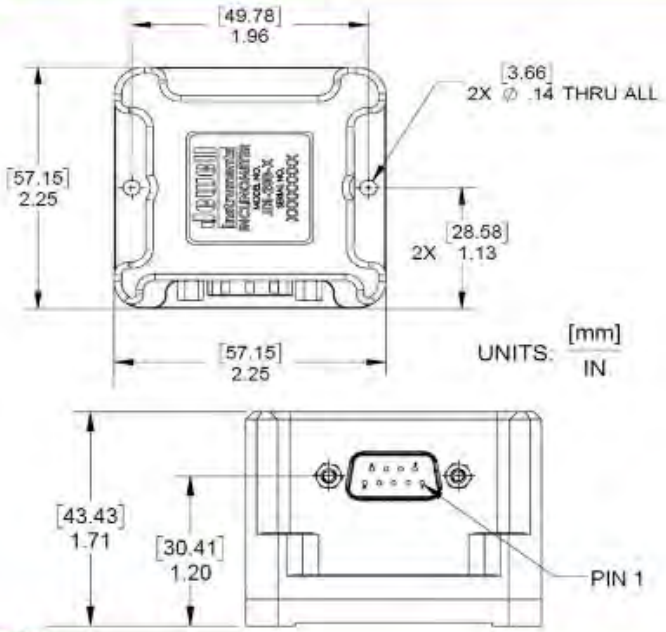
Features

- ±1°, ±3°, ±14.5°, ±30° and ±60° ranges
- Robust and Rugged Enclosure
- Single and Dual Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single DC Power Input, Galvanically Isolated
- RS-485 Half Duplex, Galvanically Isolated
- Integrated Temperature Sensor
- IP67 Seal (when mated to IP67 connector)

Applications

- Industrial Automation & Control
- Construction & Agricultural Equipment
- Solar Tracking
- Mobile Cranes
- Platform Leveling/Positioning
- Mobile Radar Equipment
- Bridge Monitoring

Outline Diagram



Pin Out

9-PIN CONNECTOR	
PIN	ASSIGNMENT
1	DATA-, [RS485]
2	DATA+, [RS485]
3	N/C
4	N/C
5	GND, [RS485]
6	N/C
7	N/C
8	PWR-
9	PWR+

Jewell Instruments LLC, 850 Perimeter Road, Manchester, NH 03103
sales@jewellinstruments.com • www.jewellinstruments.com • Tel (800) 227-5955

Performance Specifications

PERFORMANCE STATIC/DYNAMIC

Measurement Range[1] (°)	±1	±3	±14.5	±30	±60
Absolute Accuracy[2] (°, typ)	0.015	0.015	0.015	0.015	0.015
Relative Accuracy[2] (°, typ)	0.004	0.004	0.004	0.004	0.004
Digital Resolution (°, max)	0.0001	0.0001	0.0001	0.0001	0.0001
Repeatability (°)	0.01	0.01	0.01	0.01	0.01
Bias Over Temperature (ppm / °C)	80	80	80	80	80
Transverse Axis Misalignment (°, max)	0.25	0.25	0.25	0.25	0.25
Bandwidth (Hz nom) (-3 dB)	(Sample Rate) / 4				
Non-Linearity (% FS)	0.60	0.20	0.05	0.03	0.02
Accuracy - Temperature Sensor (°C, max)	±1	±1	±1	±1	±1
Warm Up Time (seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL / PROTOCOL

Number of Axes	1 or 2
Input Voltage Range (VDC)	5 min, 9 to 36 typ, 38 max, reverse wiring protected
Power - RS485 termination enabled (mW, max)	800.0
Power - RS485 termination disabled (mW, max)	600.0
Galvanic Isolation - Power Inputs (VAC)	2000
Galvanic Isolation - RS485 (VAC)	5000
Protocol	Half Duplex, Proprietary ASCII, CRC is optional
Baud[3] (bps)	300 (min), 9600, **19200**, 38400, 57600, 115200, 250000, 500000 (max)
Communication Settings[3]	8 bits, 1 stop bit, **even** | odd
Data Sample Rate[3] (Hz)	**3.9**, 7.8, 15.6, 31.2, 62.5, 125
Node ID[3]	Enter "0" followed by the last two digits of specific sensor's serial number
Filtering	User selectable
Bus Termination - internal[3] (120Ω)	**On** / Off

ENVIRONMENTAL / MECHANICAL

Operating Temp. Range	-40° to +85°C
Storage Temp. Range	-55° to +105°C
Shock	100 g, 0.011 sec, ½ sine
Vibration	20grms 20Hz to 2KHz
Weight (oz , [grams])	5.6 [160]
Seal	IP67

Notes: 1 - Custom ranges available on request. 2 - Observed using noise reduction methods. 3 - User Selectable, default is underlined.

ORDERING INFORMATION

JDI - XXX - YY.Y

SERIES
JDI Series Inclinometer

AXIS

-100	Single
-200	Dual

RANGE

-1	±1°
-3	±3°
-14.5	±14.5°
-30	±30°
-60	±60°

Part & model numbers are on page 3

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PART NUMBERS

Part Number	Model	Description
02550385-101	JDI-100-1	Single Axis, ±1°, DB9, Inclinometer, Shippable Assembly
02550385-103	JDI-100-3	Single Axis, ±3°, DB9, Inclinometer, Shippable Assembly
02550385-114	JDI-100-14.5	Single Axis, ±14.5°, DB9, Inclinometer, Shippable Assembly
02550385-130	JDI-100-30	Single Axis, ±30°, DB9, Inclinometer, Shippable Assembly
02550385-160	JDI-100-60	Single Axis, ±60°, DB9, Inclinometer, Shippable Assembly
02550385-201	JDI-200-1/1	Dual Axis, ±1°, DB9, Inclinometer, Shippable Assembly
02550385-203	JDI-200-3/3	Dual Axis, ±3°, DB9, Inclinometer, Shippable Assembly
02550385-214	JDI-200-14.5/14.5	Dual Axis, ±14.5°, DB9, Inclinometer, Shippable Assembly
02550385-230	JDI-200-30/30	Dual Axis, ±30°, DB9, Inclinometer, Shippable Assembly
02550385-260	JDI-200-60/60	Dual Axis, ±60°, DB9, Inclinometer, Shippable Assembly

JDI ACCESSORIES

Model	Part Number	Description
65050	65050	Mating Female D-sub Connector, 9 Pin
65052	65052-01	Connector Hood for a 9 Pin D-sub
84241	849241	IP67 Sealed Connector Backshell for a 9 Pin D-sub
95055	95055-03	JDI Accessory Cable, RS485, Leads, 3m long*
	95055-05	JDI Accessory Cable, RS485, Leads, 5m long*
95051	95051-03	JDI Accessory Cable, RS485, DB9 & DC Pwr, 3m long*
	95051-05	JDI Accessory Cable, RS485, DB9 & DC Pwr, 5m long*
95053	95053-01	JDI Accessory Cable, RS485 to USB, 1.8m long*
	95053-05	JDI Accessory Cable, RS485 to USB, 5m long*

*See page 4 for more information

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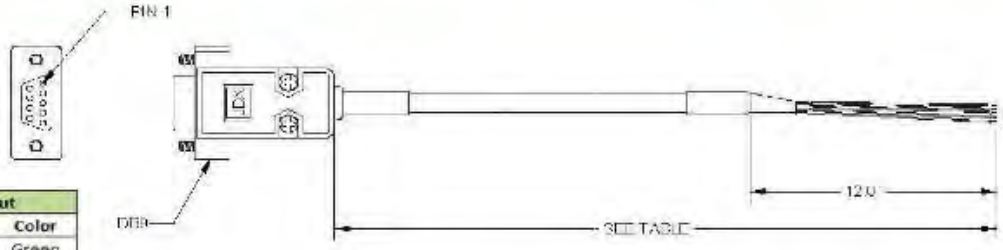
CABLE OPTION - LEADS (Part Number: 95055-XX)

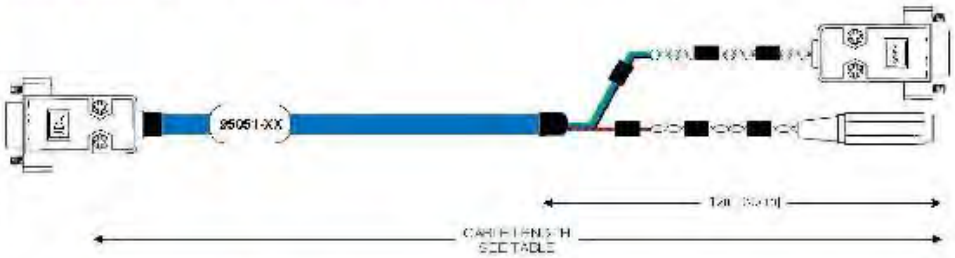


DB9 Female Pin Out		
Pin	Function	Color
1	DATA -	Green
2	DATA +	Blue
3	NO CONNECT	
4	NO CONNECT	
5	GND ISO	White
6	NO CONNECT	
7	NO CONNECT	
8	PWR -	Black
9	PWR +	Red

Model	Part Number	Description
95055	95055-03	JDI Accessory Cable, RS485, Leads, 3m long
	95055-05	JDI Accessory Cable, RS485, Leads, 5m long

CABLE OPTION - DB9 & DC Power (Part Number: 95051-XX)

DB9 Female Pin Out	
Pin	Function
1	DATA -
2	DATA +
3	NO CONNECT
4	NO CONNECT
5	GND ISO
6	NO CONNECT
7	NO CONNECT
8	PWR -
9	PWR +



Model	Part Number	Description
95051	95051-03	JDI Accessory Cable, RS485, DB9 & DC Pwr, 3m long
	95051-05	JDI Accessory Cable, RS485, DB9 & DC Pwr, 5m long

CABLE OPTION - USB (Part Number: 95053-XX)

DB9 Female Pin Out	
Pin	Function
1	DATA -
2	DATA +
3	NO CONNECT
4	NO CONNECT
5	NO CONNECT
6	NO CONNECT
7	NO CONNECT
8	PWR -
9	PWR +

Model	Part Number	Description
95053	95053-01	JDI Accessory Cable, RS485 to USB, 1.8m long
	95053-05	JDI Accessory Cable, RS485 to USB, 5m long

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LSM Series Accelerometer

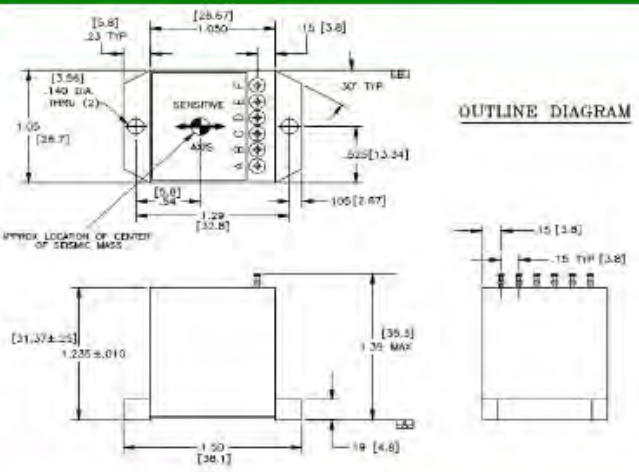
Jewell Instruments

Making Sense Out of Motion...

LSM Series Accelerometers have 100,000 hour MTBF reliability and up to 20g full scale sensing range

If space is a concern, the Jewell **LSM Series** accelerometer is the solution for you. The LSM offers equivalent features to the LSA in a smaller package - approximately 1" cube. Its wide input range and bandwidth features meet the demanding needs of a variety of aerospace applications.

Outline Drawing: ***Dimensional Drawing for the LSM Accelerometer (Inch/mm)***



Features & Benefits

- ±0.5g to ±20.0g Full Range
- Filtering up to 200 Hz Bandwidth with 0.6 Damping
- Satellite Application Reliability
- Better than 20 µg Res at 10g Full Scale
- -55°C to +95°C Operating Temp Range

Applications

- Satellite Nutation Sensing
- Radar Leveling
- Train Braking and Banking
- Autopilot Systems
- Train Performance Testing
- Performance Testing
- Wind Shear Detection Systems
- Mars Rover
- Thermal Vacuum Chamber (product) Testing

Block Diagram: ***LSM Accelerometer***

Pin F	Self-Test
Pin E	Current Output
Pin D	E_o (Volts/g)
Pin C	-VDC Power
Pin B	Power Common
Pin A	+VDC Power

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LSM Series Accelerometer

Jewell Instruments

Making Sense Out of Motion...

LSM Accelerometer Specifications

PERFORMANCE

Input Range, g (Note 1)	± 0.5	± 1.0	± 2.0	± 5.0	± 10.0	± 20.0
Full Range Output (FRO V± 1.0%)	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO' Max.) (Note 2)	0.05	0.05	0.05	0.10	0.10	0.25
Scale Factor (V/g, Nom.)	10.0	5.0	2.5	1.0	0.5	0.25
Scale Factor Temp Sens (PPM/°C, Max.)	200	200	200	200	200	200
Bias, g, (Max.)	0.050	0.010	0.010	0.010	0.020	0.050
Bias Temp. Sens., (µg/°C)	50	50	50	100	100	200
Natural Frequency, Hz, (Nom.) (Note 3)	70	100	140	100	140	160
Bandwidth (-3db), Hz, (Nom.)	70	100	140	100	140	160
Input-Axis Misalignment, °(Max.)	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0
Resolution and Threshold, µg	10	10	10	10	20	50

ELECTRICAL

Input Voltage (Vdc Nom.) (Note 4)	±12 to ±18					
Input Current (mA, Nom.)	10.0					
Output Impedance (Ohms, Nom.)	10k	5k	2.5k	5k	2.5k	2.5k
Noise, mV rms (Max.)	5.0					

ENVIRONMENTAL

Operating Temp Range:	-55°C to +95°C
Survival Temp Range	-65°C to +105°C
Shock	100g - 11 msec, ½ sine
Seal	MIL-STD 202, Method 112
Weight	2.0 oz.

Notes:
1 - Full range is defined as "from negative full input acceleration to positive full input acceleration."
2 - Nonlinearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.
3 - Output phase angle = -90°
4-Unit Power connections can be easily adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC.

How to Order

Model #	Part #
LSMP-0.5g	02550277-001
LSMP-1g	02550277-002
LSMP-2g	02550277-003
LSMP-5g	02550277-004
LSMP-10g	02550277-005
LSMP-20g	02550120-000

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LSBC/LSBP Series Accelerometer

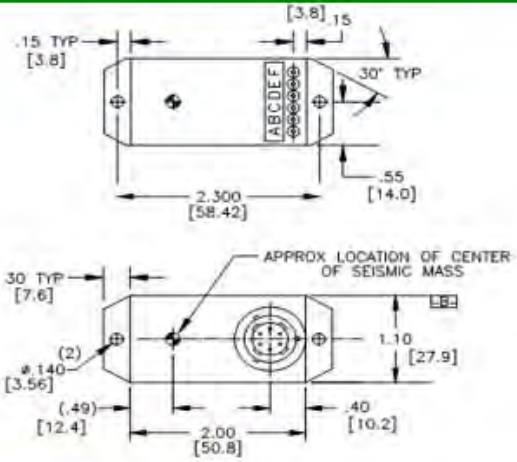
Jewell Instruments

Making Sense Out of Motion...

Input Ranges from ±0.5g to ±20g and options for either connector or pin configurations

The Jewell **LSB Series** Accelerometer is a general purpose ±0.5G to ±20G device designed for rail, commercial, and aerospace sensing requirements.

Outline Drawing: ***Dimensional Drawing for the LSB Accelerometer***



Block Diagram: ***LSB Accelerometer***

Features & Benefits

- ±0.5g to ±20.0g Full Range
- Bandwidth up to 200 Hz
- Satellite Application Reliability
- Better than 20 µg Res at 10g Full Scale
- Available with 1g Bias Options
- -55°C to +95°C Operating Temp Range
- Standard for Train Control for more than 30 years

Applications

- Train Braking & Banking
- Train Performance Testing
- Acceleration Control
- Automotive Performance Testing
- Active Damping
- Rail Car Monitoring
- Lateral Acceleration Sensing
- Tilt Train Controls
- Super-elevation Measurement
- Rail Car Vibration Testing
- Wind shear Detection
- Autopilot
- AHARS
- Wind Turbine Control

Pin A	+12 to +18 VDC
Pin B	Power/Sig Common
Pin C	-12 to -18 VDC
Pin D	Eo [Volts/g]
Pin E	Current Output
Pin F	Self-Test

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LSBC/LSBP Series Accelerometer

Jewell Instruments

Making Sense Out of Motion...

LSB Accelerometer Specifications

PERFORMANCE

Input Range, g	± 0.5	± 1.0	± 2.0	± 5.0	± 10.0	± 20.0
Full Range Output (FRO V± 1.0%)	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO' Max.)	0.05	0.05	0.05	0.10	0.10	0.25
Scale Factor (V/g, Nom.)	10.0	5.0	2.5	1.0	0.5	0.25
Scale Factor Temp Sens (PPM/°C, Max.)	200	200	200	200	200	200
Bias, g, (Max.)	0.050	0.010	0.010	0.010	0.020	0.050
Bias Temp. Sens., (µg/°C)	50	50	50	100	100	200
Natural Frequency, Hz, (Nom.)	70	100	140	100	140	160
Bandwidth (-3db), Hz, (Nom.)	70	100	140	100	140	160
Input-Axis Misalignment, °(Max.)	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0
Resolution and Threshold, µg	10	10	10	10	20	50

ELECTRICAL

Input Voltage (Vdc Nom.)	±12 to ±18					
Input Current (mA, Nom.)	10.0					
Output Impedance (Ohms, Nom.)	10.0K	5.0K	2.5K	5.0K	2.5K	2.5K
Noise, mV rms (Max.)	0.005					

ENVIRONMENTAL

Operating Temp Range	-55°C to +95°C
Survival Temp Range	-65°C to +105°C
Shock	100g - 0.011 second, ½ sine
Seal	MIL-STD 202, Method 112

How to Order

LSBC Series (with Connector)		LSBP Series (with Pin)	
LSBC-0.5g	02550275-006	LSBP-0.5g	02550275-001
LSBC-1g	02550275-007	LSBP-1g	02550275-002
LSBC-2g	02550275-008	LSBP-2g	02550275-003
LSBC-5g	02550275-009	LSBP-5g	02550275-004
LSBC-10g	02550275-010	LSBP-10g	02550275-005
LSBC-20g	02550275-000	LSBP-20g	02550275-000

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LSBC-R Series Accelerometer

Jewell Instruments

Making Sense Out of Motion...

Input Ranges from ±0.5g to ±20g and options for either connector or pin configurations

Meets CENELEC/AREMA Standards

The Jewell **LSBC-R Series** Accelerometer is a general purpose ±0.5G to ±20G device designed for rail, commercial, and aerospace sensing requirements.

Features & Benefits

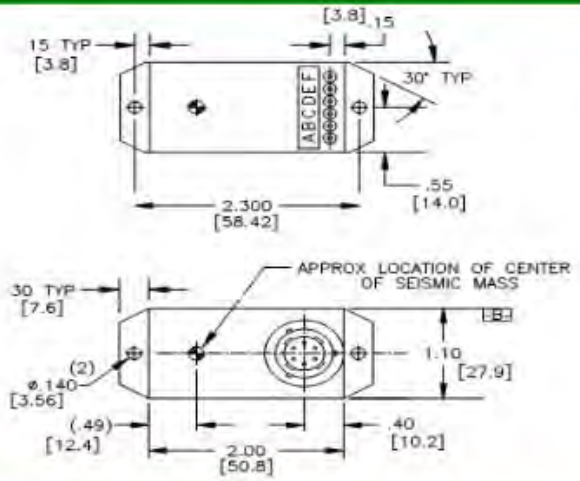
- ±0.5g to ±20.0g Full Range
- Bandwidth up to 200 Hz
- Satellite Application Reliability
- Better than 20 µg Res at 10g Full Scale
- Available with 1g Bias Options
- -55°C to +95°C Operating Temp Range
- Standard for Train Control for more than 30 years
- Meets CENELEC/AREMA Standards

See Spec Table page 2

Applications

- Train Braking & Banking
- Train Performance Testing
- Acceleration Control
- Automotive Performance Testing
- Active Damping
- Rail Car Monitoring
- Lateral Acceleration Sensing
- Tilt Train Controls
- Super-elevation Measurement
- Rail Car Vibration Testing
- Wind shear Detection
- Autopilot
- AHARS
- Wind Turbine Control

Outline Drawing: ***Dimensional Drawing for the LSB Accelerometer***



Block Diagram: ***LSB Accelerometer***

Pin A	+12 to +18 VDC
Pin B	Power/Sig Common
Pin C	-12 to -18 VDC
Pin D	Eo [Volts/g]
Pin E	Current Output
Pin F	Self-Test

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ASXC Series Angular Accelerometer

Jewell Instruments

Making Sense Out of Motion...

ASXC Series Angular Accelerometer Specifications

PERFORMANCE

STATIC/DYNAMIC

Input Range, rad/sec²	± 2	± 10	± 20	± 50	± 100
Full Range Output (FRO, V ±5%)	± 10.0	± 10.0	± 10.0	± 10.0	± 10.0
Non Linearity (%FRO' Max.)	1.0	1.0	1.0	1.0	1.0
Scale Factor (V/rad/sec², 5%)	5.000	1.000	0.500	0.200	0.100
Scale Factor Temp Sens (% reading/°C, Max.)	0.09	0.09	0.09	0.09	0.09
Bias (rad/sec²)	±0.005	±0.020	±0.030	±0.080	±0.100
Bias Temp. Sens. (FRO/°C, Max.)	0.001	0.001	0.001	0.001	0.001
Natural Frequency (Hz, Min.)	100	150	200	170	170
Damping Ratio (Nominal)	0.9	0.9	0.9	0.9	0.9
Input Axis Misalignment (rad/sec²/rad/sec², max.)	±0.025	±0.025	±0.025	±0.025	±0.025
Resolution and Threshold (rad/sec², Max.)	0.001	0.001	0.002	0.005	0.010

ELECTRICAL

# of Axes	1
Input Voltage (Vdc, 10%)	±15
Input Current (mA, Max.)	25
Output Impedance (Ohms, Nom.)	100
Noise (Vrms, Max.)	0.03	0.03	0.05	0.05	0.05

ENVIRONMENTAL

Operating Temp Range	-30°C to +70°C
Survival Temp Range	-40°C to +70°C
Seal	MIL-STD 202, Method 112
Weight	8.5 oz.

How to Order

ASXC-2	02550271-000
ASXC-10	02550267-000
ASXC-50	02550257-000
ASXC-100	02550262-000

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

FM03-04

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SMAC/SMAP-D Emerald Accelerometer Series

Input Ranges From ±0.25G to ±2G° Rugged, High Precision, Low Cost, Dual-Ended Power Input Accelerometer

The Jewell **Emerald Series** accelerometer is a low cost, high precision sensor designed with higher accuracy than comparable MEMS devices. Applications include robotics, construction equipment, industrial measurement and control, and precision machining. All Emerald Series accelerometers are RoHS compliant.

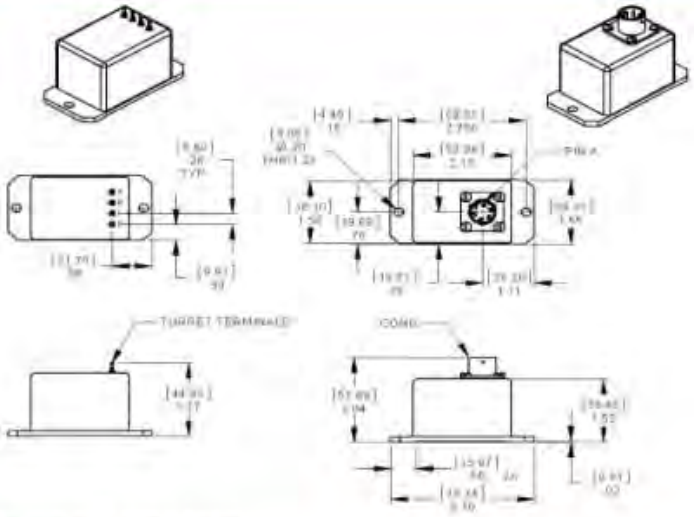
Features

- Extremely Rugged
- Lower Cost than traditional Force-Balanced Accelerometers
- High Accuracy
- Greater Precision than MEMS Technologies
- ±5 V DC Output
- Dual-Ended Power Input
- RoHS Compliant

Applications

- Aerospace
- Military
- Robotics
- Academic Research
- Wind Turbine Controls
- Track Monitoring and Testing
- Vehicle Wheel Alignment

Outline Diagram



Dimensions in inches [mm]

Pin Out

Pin Option		Connector Option	
A	Input Power	A	Input Power
B	Power/Signal Common	B	Power/Signal Common
C	N/C	C	Return
D	Signal	D	Signal
		E	N/C
		F	N/C

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Rev A

SMAC/SMAP-D Emerald Accelerometer Series

Performance Specifications

STATIC/DYNAMIC

Input Range, G:	**±0.25**	**±0.5**	**±1**	**±2**
Full Range Output (FRO -Note 1) VDC ±0.5%:	**±5**	**±5**	**±5**	**±5**
Nonlinearity (Note 2) % FRO maximum:	**0.02**	**0.02**	**0.05**	**0.05**
Scale Factor, Volts/g, nominal:	**20.0**	**10.0**	**5.0**	**2.5**
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	**100**	**100**	**100**	**100**
Bandwidth (-3 dB), Hz nominal:	**5.0**	**5.0**	**5.0**	**5.0**
Output Axis Misalignment, ° maximum:	**0.50**	**0.50**	**0.50**	**0.50**
Pendulous Axis Misalignment, ° maximum:	**0.50**	**0.50**	**0.50**	**0.50**
Resolution and Threshold, µg maximum:	**3.5**	**3.5**	**3.5**	**3.5**

ELECTRICAL

Number of Axes:	**1**
Input Voltage Range, (VDC):	**±12 to ±18**
Input Current, mA, max:	**40**
Output Impedance, Ohms, nom:	**10**
Noise, Vrms, maximum:	**0.002**

ENCLOSURE

Seal:	**IP65**

ENVIRONMENTAL

Operating Temp Range:	**-55°C to +85°C**
Storage Temp Range:	**-60°C to +90°C**
Shock:	**500g, 1 msec, ½ sine**

Notes:

Note 1: Full Range is defined "from negative full input acceleration to positive full input acceleration."

Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

Note 3: Full Resolution is achieved with noise reduction techniques.

Custom Capabilities

- ±15V bipolar input option available
- Pigtail and Connector alternative options available
- Custom ranges and bandwidths available

How to Order

Connector Version		Pin Version	
Model #	**Part #**	**Model #**	**Part #**
SMAC-D-0.25	02550354-001	SMAP-D-0.25	02550353-001
SMAC-D-0.5	02550354-002	SMAP-D-0.5	02550353-002
SMAC-D-1	02550354-003	SMAP-D-1	02550353-003
SMAC-D-2	02550354-004	SMAP-D-2	02550353-004

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LCF-500-DC Series Accelerometer

Making Sense out of Motion...

Proven history of producing high precision accelerometers with the durability to serve many demanding conditions and requirements.

The Jewell **LCF-500-DC Series** accelerometers are configured specifically to yield a combination of high accuracy and ruggedness in numerous applications. The inertial sensor moving system is supported by a taut-band torsional suspension, which is floated in a silicon damping fluid.

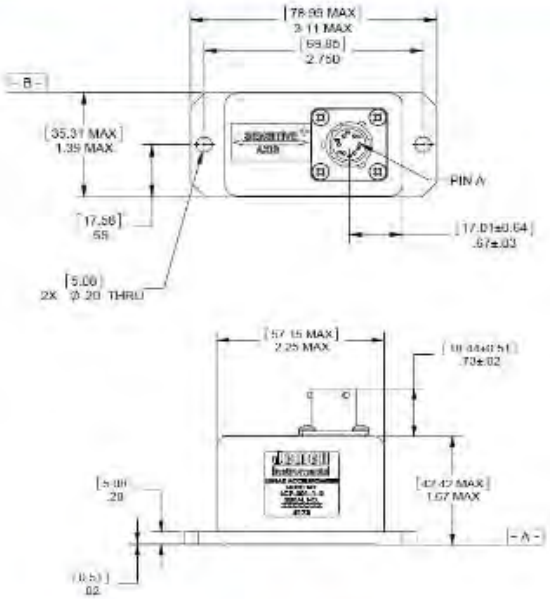
Features

- Ranges available in ±0.5g to ±5g
- Extremely rugged in long term low level vibration applications
- Can withstand high shock environments up 1500g
- Exceptional bias and scale factor

Applications

- Train performance testing
- Industrial automation
- Simulator inertial monitoring
- Platform orientation
- Geophysical & geotechnical structure monitoring
- Aircraft flight testing

Outline Diagram



Pin Out (Options: C-connector, P-Pin)

CONNECTOR PIN	FUNCTION
A	+ Power
B	PWR/SIG COM
C	-Power
D	Signal Out
E	N/C
F	Self-Test (Optional)

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LCF-200 Series Flexure Suspension

Jewell Instruments

Making Sense out of Motion...

LCF-200 Series Accelerometer Specifications

STATIC/DYNAMIC

Input Range, g:	±0.5	±1	±2	±5
Full Range Output (FRO -Note 1) VDC ±0.5%:	±5.00	±5.00	±5.00	±5.00
Scale Factor, Volts/g, nominal:	10	5	2.5	1
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	100	100	100
Natural Frequency, Hz nominal (Note 3):	30.00	30.00	30.00	30.00
Bandwidth (-3 dB), Hz nominal:	30.0	30.0	30.0	30.0
Output Axis Misalignment, ° maximum:	0.71	0.71	0.71	0.71
Pendulous Axis Misalignment, ° maximum:	0.71	0.71	0.71	0.71
Bias, g range:	±0.005	±0.005	±0.005	±0.005
Bias Temperature Sensitivity, µg /°C maximum:	50	50	50	50
Resolution and Threshold, µg maximum:	1	1	1	1

ELECTRICAL

Number of Axes:	1
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	15
Output Impedance, Ohms, nom:	100
Noise, grms, maximum:	0.001

ENCLOSURE

Weight oz:	4
Seal:	MIL-STD-202, Mtd. 112

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-40°C to +90°C
Vibration grms:	20
Shock:	1000 g, 1 msec, ½ sine

Notes:
1 - Full range is defined as "from negative full input acceleration."
2 - Referenced to best-fit straight line independent of misalignment.
3 - Output phase angle = -90°.

How to Order

LCF-200-.5g	458200-001
LCF-200-1.0g	458200-004
LCF-200-2.0g	458200-002
LCF-200-5.0g	458200-003

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LCF-2530 Series Dual Axis Accelerometer

Jewell Instruments

Making Sense out of Motion...

Part of our RailStar Series of products, the LCF-2530 is ideal for Rail Maintenance of Way applications

The Jewell **LCF-2530** Series is a dual axis version of the rugged, high accuracy LCF Series. The design of the LCF-2530 was optimized to provide the high suspension, servo technology in a small and convenient package for applications requiring a a compact dual axis solution.

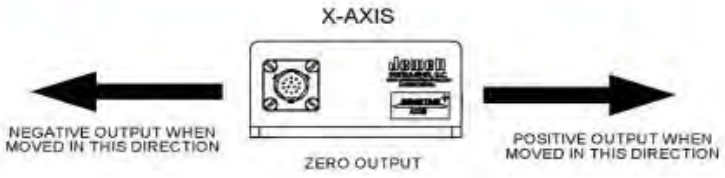
Features & Benefits

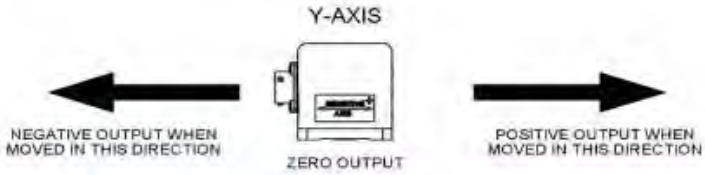
- ± 0.5g to ± 5.0g Full Range
- Filtering 5-100 Hz Bandwidth Available
- Exeptional Bias & Scale Factor Repeatability
- High Level ± 5 Vdc Output
- 1,000g Shock Capability
- Built In Temperature Sensor Available
- Fluid Damped
- High Accuracy Dual Axis in Small Package
- Superior Bias Stability
- Low EMI

Applications

- Railcar Accel/Decel Control
- Train Performance Testing
- Active Damping
- Rail Car Harshness (NVH)
- Manual Rail Measurement

Axis Orientation





Pin Out (Options: C-connector, P-Pin)

	PIN-OUT
1	+12 to +18 VDC
2	-12 to -18 VDC
3	COMMON
4	OUTPUT SIGNAL, X AXIS
5	OUTPUT SIGNAL RTN, X AXIS
6	OUTPUT SIGNAL, Y AXIS
7	OUTPUT SIGNAL RTN, Y AXIS
8-13	N/C

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Performance Specifications

STATIC/DYNAMIC

Input Range, g:	±0.25	±0.5	±1.0	±2.0	±5.0
Full Range Output (FRO -Note 1) VDC ±1%:	±5.00	±5.00	±5.00	±5.00	±5.00
Nonlinearity (Note 2) % FRO maximum:	0.02	0.02	0.02	0.05	0.10
Scale Factor, Volts/g, nominal:	20.0	10.0	5.0	2.5	1.0
Scale Factor Temp. Sensitivity (SFTS), PPM /°C maximum:	100	60	60	100	100
Bandwidth (-3 dB), Hz nominal:	30.0	30.0	30.0	30.0	30.0
Output Axis Misalignment, ° maximum:	0.50	1.00	1.00	1.00	1.00
Pendulous Axis Misalignment, ° maximum:	0.50	1.00	1.00	1.00	1.00
Bias, g range:	±0.001	±0.002	±0.004	±0.005	±0.005
Bias Temperature Sensitivity, Volts /°C maximum:	0.001	0.0005	0.0003	0.0003	0.0003
Resolution and Threshold, µg maximum:	1	1	1	1	1

ELECTRICAL

Number of Axes:	2
Input Voltage Range, (VDC):	±12 to ±18
Input Current, mA, max:	50
Output Impedance, Ohms, nom:	100
Noise, Vrms, maximum:	0.002

ENVIRONMENTAL

Operating Temp Range:	-40°C to +80°C
Storage Temp Range:	-60°C to +90°C
Vibration grms:	20
Shock:	1000 g, 1 msec, ½ sine

ENCLOSURE

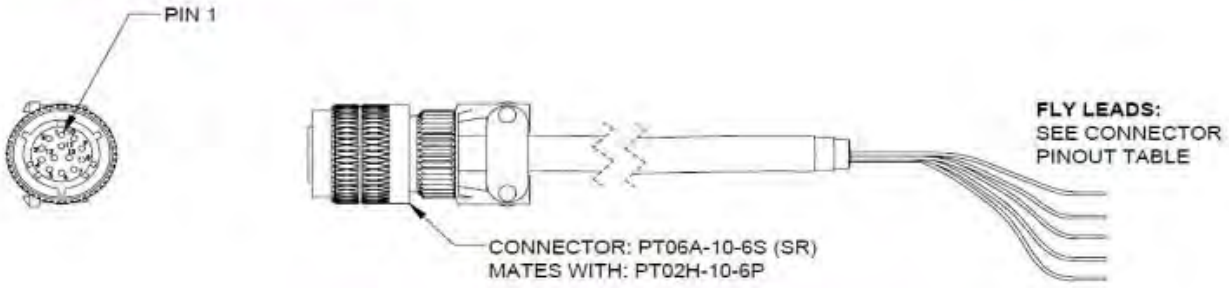
Weight oz:	8
Seal:	MIL-STD-202, Method 112, IP65

Note 1: Full Range is defined "from negative full input acceleration to positive full input acceleration."

Note 2: Nonlinearity is specified as deviation of output referenced to theoretical sine function value, independent of misalignment.

*Specifications subject to change without notice on account of continued product development

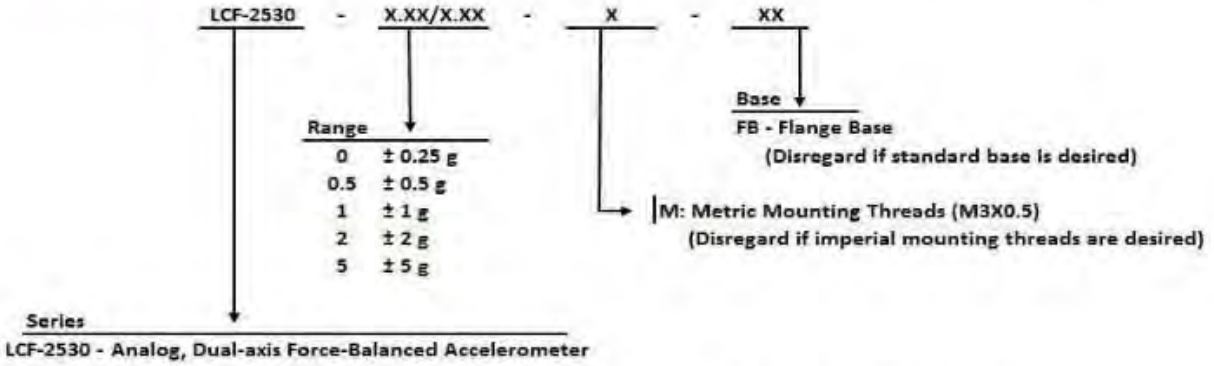
CABLE ACCESSORY



CABLE CONFIGURATIONS & PART NUMBERS

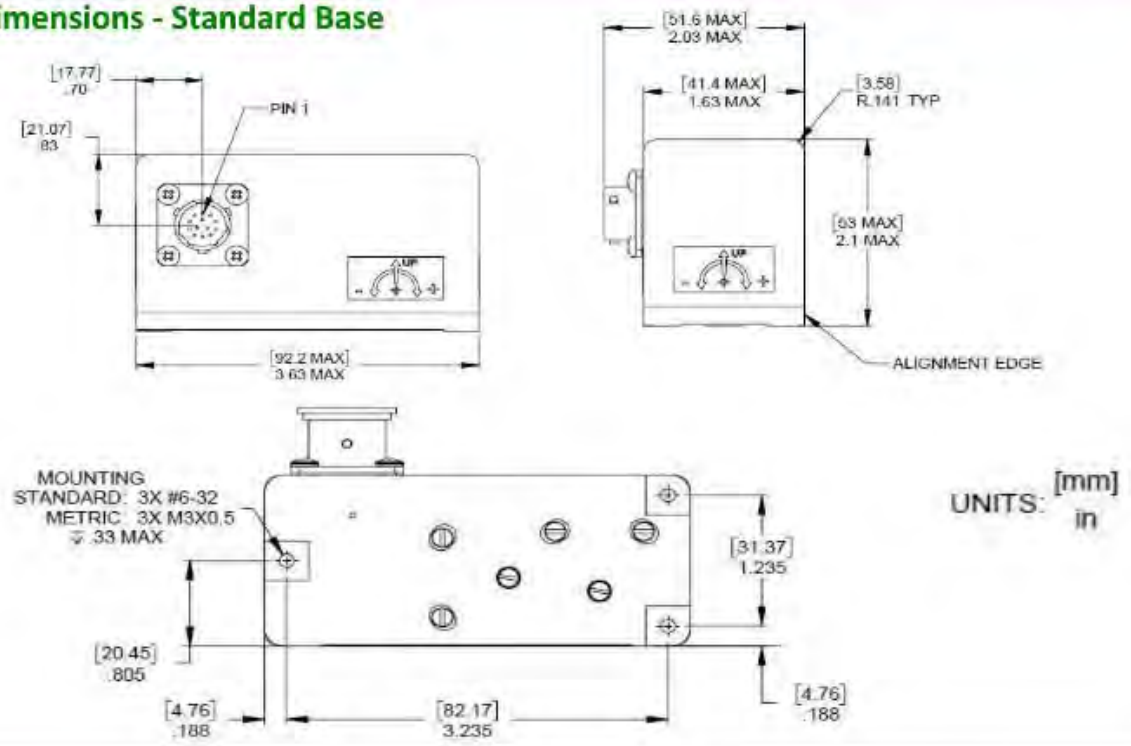
Part Number	Description
847774-002	Circular Connector(13 Pin)
879605-003	DSI-CBL-006-2 (6 Ft)
879605-004	DSI-CBL-010-2 (10 Ft)
879605-009	DSI-CBL-02M-2 (2M)
879605-010	DSI-CBL-03M-2 (3M)

How to Order

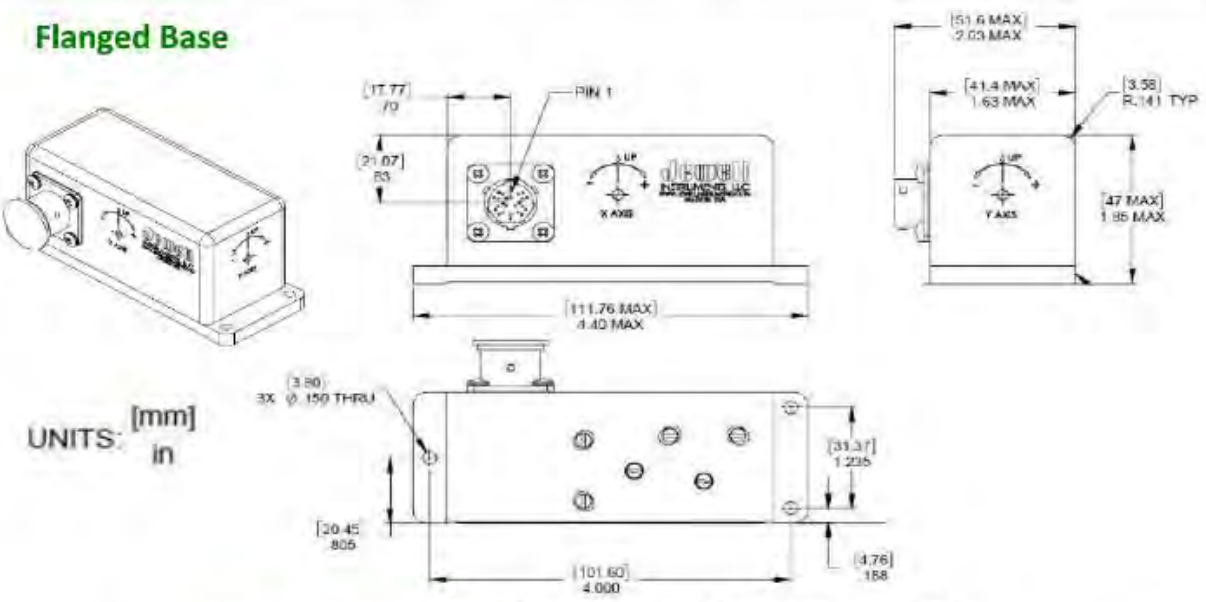


Example: LCF-2530-5/5 = LCF-2530, ±5 g range, imperial mounting threads, standard base

Dimensions - Standard Base



Flanged Base



LSBC-R Series Accelerometer

Jewell Instruments

Making Sense Out of Motion...

Input Ranges from ±0.5g to ±20g and options for either connector or pin configurations

Meets CENELEC/AREMA Standards

The Jewell **LSBC-R Series** Accelerometer is a general purpose ±0.5G to ±20G device designed for rail, commercial, and aerospace sensing requirements.

Features & Benefits

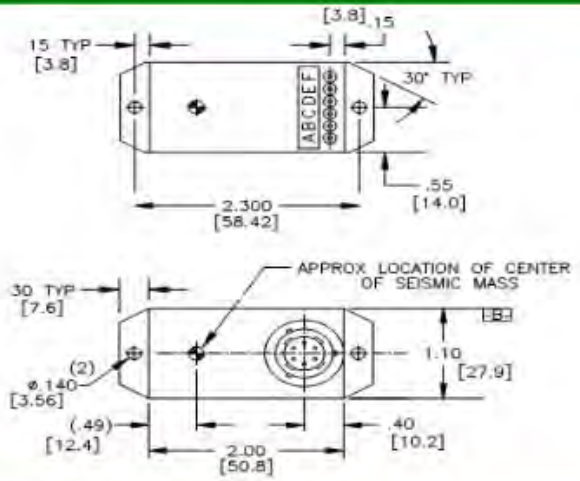
- ±0.5g to ±20.0g Full Range
- Bandwidth up to 200 Hz
- Satellite Application Reliability
- Better than 20 µg Res at 10g Full Scale
- Available with 1g Bias Options
- -55°C to +95°C Operating Temp Range
- Standard for Train Control for more than 30 years
- Meets CENELEC/AREMA Standards

See Spec Table page 2

Applications

- Train Braking & Banking
- Train Performance Testing
- Acceleration Control
- Automotive Performance Testing
- Active Damping
- Rail Car Monitoring
- Lateral Acceleration Sensing
- Tilt Train Controls
- Super-elevation Measurement
- Rail Car Vibration Testing
- Wind shear Detection
- Autopilot
- AHARS
- Wind Turbine Control

Outline Drawing: ***Dimensional Drawing for the LSB Accelerometer***



Block Diagram: ***LSB Accelerometer***

Pin A	+12 to +18 VDC
Pin B	Power/Sig Common
Pin C	-12 to -18 VDC
Pin D	Eo [Volts/g]
Pin E	Current Output
Pin F	Self-Test

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LCF-3500 Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range (g) (Note 1)	± 0.50	± 2.0	± 5.0
Full Range Output (FRO), volts ± 0.5%	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO' Max.) (Note 2)	0.05	0.05	0.05
Scale Factor, volts/g (Nominal)	10.0	2.50	1.00
Scale Factor Temp. Sens., (PPM/°C, Max.)	100	100	100
Bias, g (Max.)	0.005	0.005	0.005
Bias Temp. Sens., micro g/° (Max.)	100	100	100
Natural Frequency, Hz min (Note 3)	30	30	30
Bandwidth (-3dB), Hz min	30	30	30
Input Axis Misalignment, ° (Max.)	1.0	1.0	1.0
Resolution and Threshold, micro g (Max.)	10	10	10

ELECTRICAL

Input Voltage, VDC	±12 to ±18
Input Current (mA, Nominal):	±45
Output Impedance, ohms (Nominal)	100
Noise, Vrms (Max.)	0.002

ENVIRONMENTAL

Operating Temp Range	-40 to +80°C
Survival Temp Range	-60 to +90°C
Vibration	20 grms
Shock	1000g, 1 msec, ½ sine
Seal	Epoxy

Notes: 1 - Full range is defined as "from negative to positive full input acceleration."
2 - Referenced to best-fit straight line independent of misalignment.
3 - Output phase angle = -90°.

Custom Capabilities

- Unit Power Connections can be easily adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC
- Internal Temperature Sensor
- 4-20 mA output

How to Order

LCF-3500-.5g/.5g/.5g	Call for part number
LCF-3500-2.0g/2.0g/2.0g	Call for part number
LCF-3500-5.0g/5.0g/5.0g	Call for part number

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DXA-100/200 Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

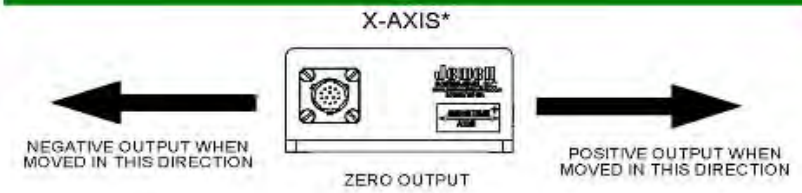
Digital Output - Single or Dual Axis for a wide variety of applications.

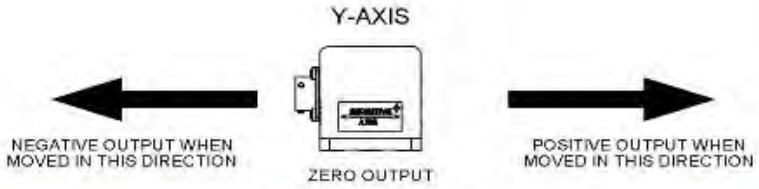
The Jewell **DXA-100/200 Series** single or dual digital accelerometer takes Jewell's highly accurate analog closed loop sensor technology to the next level.

Features & Benefits

- Digital output
- Resolution 8 µg
- Mechanical Shock 1500g 1msec half sine
- Industry Standard EIA-RS485 and EIA-RS422 output
- For use in high shock and vibration environments
- High Precision and Performance
- Low Noise

Axis Orientation





*Standard DXA-100 includes X-axis only

Applications

- Radar/Antenna Control
- Structural Monitoring
- Linear Acceleration/Deceleration Measuring
- Automatic Train Position Control
- Seismic Monitoring
- Platform Leveling

Pin Out

Pin	Color	Pin Out
1	-	N/C
2	-	N/C
3	Green	Case Ground
4	Blue	+Serial Port
5	Yellow	-Serial Port
6	-	N/C
7	-	N/C
8	-	N/C
9	-	N/C
10	-	N/C
11	Black	Power Return
12	Red	+Power
13	-	N/C

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DXA-100/200 Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance

Input Range[1], g	±0.25	±0.50	±0.87	±1.00	±2.00
Number of Axis	1,2	1,2	1,2	1,2	1,2
Non Linearity[2], %FRO, Max	0.02	0.02	0.03	0.05	0.03
Scale Factor Tolerance, % Max	0.05	0.05	0.05	0.05	0.05
Bias, mg	1.00	1.00	1.00	1.00	1.00
Bias Thermal Sensitivity, mg	90	90	90	90	90
Bandwidth (-3dB), Hz, Nom[3]	30	30	30	30	30
Transverse Axis Misalignment, °, Max	0.5	0.5	0.5	0.5	0.5

Digital Output

Interface	EIA-RS485 (default)/EIA-RS422				
Protocol	Proprietary (Custom)				
Output Representation	g's				
Baud Rate[4]	19200	38400	57600	115200	230400

Electrical

Supply Voltage, Volts DC		10 to 30
Input Current, mA, Max	Transmitting	DXA-100 32 mA/DXA-200 50 mA
	Not transmitting	DXA-100 22 mA/DXA-200 40 mA

Environmental

Operational Temp Range, °C	-40 to +85
Storage and Temp Range, °C	-40 to +85
Protection Class per IEC 529	IP67
NEMA Enclosure Rating	6
Shock Survival	1500g, 1msec, ½ sine
Vibration Survival, grms (20Hz to 2 KHz)	20

Enclosure

Housing Material	Anodized Aluminum
Weight	DXA-100 8 oz [226.80 g]/ DXA-200 10 oz [283.50 g]
Connector Type	MS27476Y10D35P
Recommended Mating Connector	MS27473T10B35S

NOTES:
1- Full range is defined as "from negative full input angle to positive full input angle"
2 - Non-linearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.
3 - In default condition without averaging.
4- Default Baud Rate is 38400
*Specifications subject to change without notice on account of continued product development

LCF-500-DC Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Proven history of producing high precision accelerometers with the durability to serve many demanding conditions and requirements.

The Jewell **LCF-500-DC Series** accelerometers are configured specifically to yield a combination of high accuracy and ruggedness in numerous applications. The inertial sensor moving system is supported by a taut-band torsional suspension, which is floated in a silicon damping fluid.

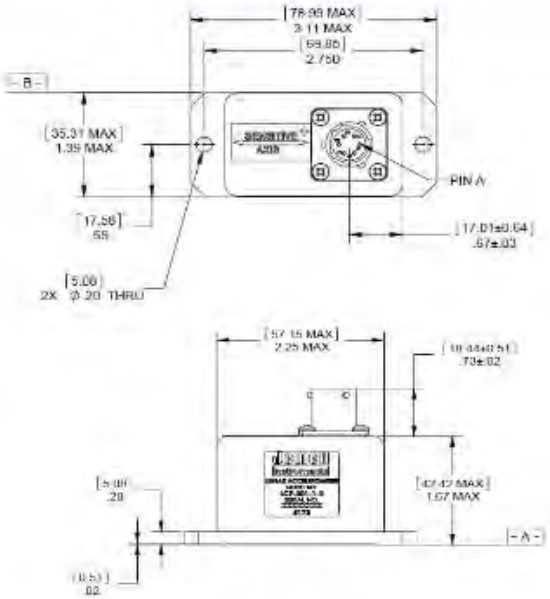
Features

- Ranges available in ±0.5g to ±5g
- Extremely rugged in long term low level vibration applications
- Can withstand high shock environments up 1500g
- Exceptional bias and scale factor

Applications

- Train performance testing
- Industrial automation
- Simulator inertial monitoring
- Platform orientation
- Geophysical & geotechnical structure monitoring
- Aircraft flight testing

Outline Diagram



Pin Out (Options: C-connector, P-Pin)

CONNECTOR PIN	FUNCTION
A	+ Power
B	PWR/SIG COM
C	-Power
D	Signal Out
E	N/C
F	Self-Test (Optional)

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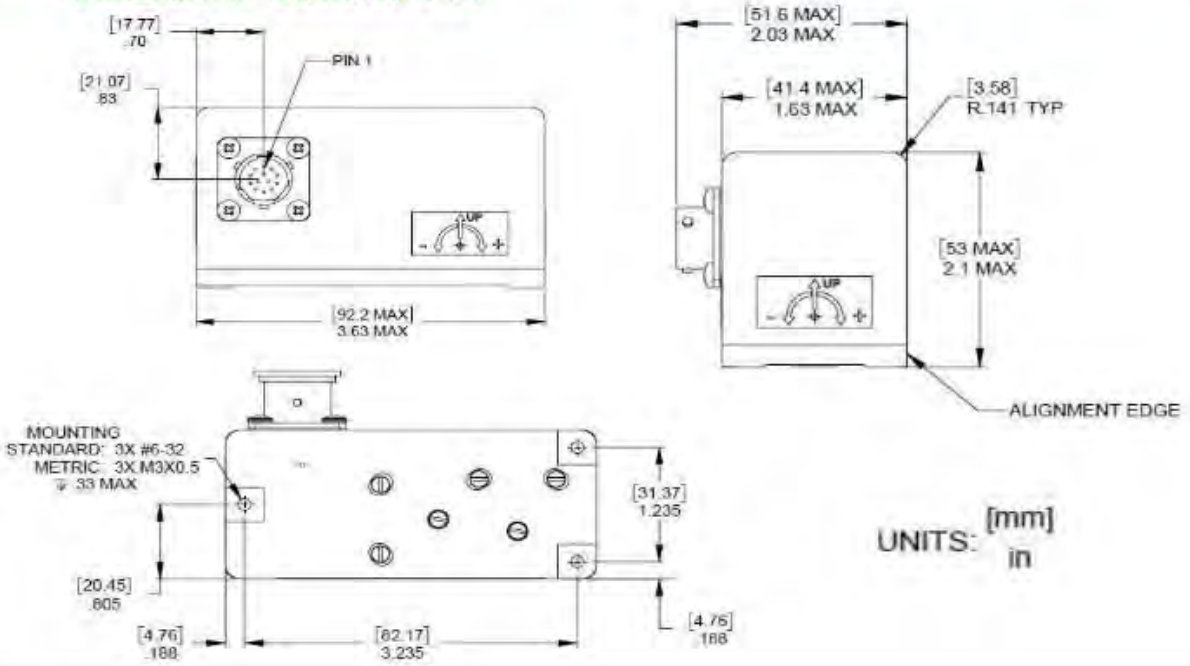
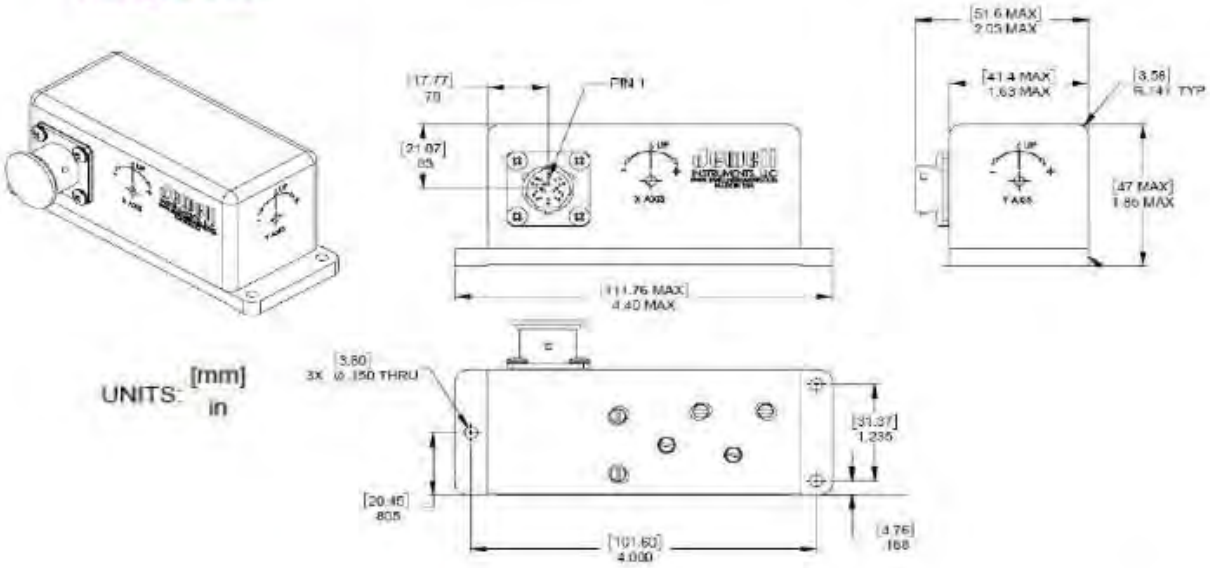
Dimensions - Standard Base



Flanged Base



DXA-100/200-R Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Digital Output - Single or Dual Axis for railway applications.

Meets CENELEC/AREMA Standards

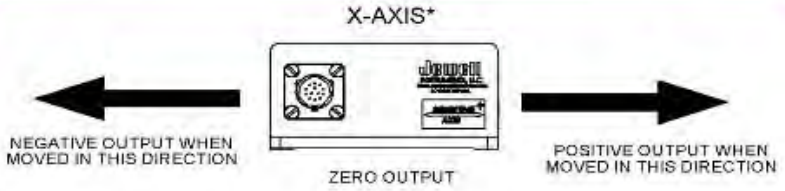
The Jewell **DXA-100/200-R Series** single or dual digital accelerometer takes Jewell's highly accurate analog closed loop sensor technology to the next level.

Features & Benefits

- Digital output
- Resolution 8 µg
- Mechanical Shock 1500g 1msec half sine
- Industry Standard EIA-RS485 and EIA-RS422 output
- For use in high shock and vibration environments
- High Precision and Performance
- Low Noise
- Meets CENELEC/AREMA Standards

See Spec Table page 2

Axis Orientation



*Standard DXA-100 includes X-axis only

Applications

- Radar/Antenna Control
- Structural Monitoring
- Linear Acceleration/Deceleration Measuring
- Automatic Train Position Control
- Seismic Monitoring
- Platform Leveling

Pin Out

Pin	Color	Pin Out
1	-	N/C
2	-	N/C
3	Green	Case Ground
4	Blue	+Serial Port
5	Yellow	-Serial Port
6	-	N/C
7	-	N/C
8	-	N/C
9	-	N/C
10	-	N/C
11	Black	Power Return
12	Red	+Power
13	-	N/C

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DXA-100/200-R Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance

Input Range[1], g	±0.25	±0.50	±0.87	±1.00	±2.00
Number of Axis	1,2	1,2	1,2	1,2	1,2
Non Linearity[2], %FRO, Max	0.02	0.02	0.03	0.05	0.03
Scale Factor Tolerance, % Max	0.05	0.05	0.05	0.05	0.05
Bias, mg	1.00	1.00	1.00	1.00	1.00
Bias Thermal Sensitivity, mg	90	90	90	90	90
Bandwidth (-3dB), Hz, Nom[3]	30	30	30	30	30
Transverse Axis Misalignment, °, Max	0.5	0.5	0.5	0.5	0.5

Digital Output

Interface	EIA-RS485 (default)/EIA-RS422				
Protocol	Proprietary (Custom)				
Output Representation	g's				
Baud Rate[4]	19200	38400	57600	115200	230400

Electrical

Supply Voltage, Volts DC		10 to 30
Input Current, mA, Max	Transmitting	DXA-100-R 32 mA/DXA-200-R 50 mA
	Not transmitting	DXA-100-R 22 mA/DXA-200-R 40 mA

Environmental

Operational Temp Range, °C	-40 to +85
Storage and Temp Range, °C	-40 to +85
Protection Class per IEC 529	IP67
NEMA Enclosure Rating	6
Shock Survival	1500g, 1msec, ½ sine
Vibration Survival, grms (20Hz to 2 KHz)	20

Enclosure

Housing Material	Anodized Aluminum
Weight	DXA-100-R 8 oz [226.80 g]/ DXA-200-R 10 oz [283.50 g]
Connector Type	MS27476Y10D35P
Recommended Mating Connector	MS27473T10B35S

NOTES:
1- Full range is defined as "from negative full input angle to positive full input angle"
2 - Non-linearity is specified as deviation of output referenced to a best fit straight line, independent of misalignment.
3 - In default condition without averaging.
4- Default Baud Rate is 38400
*Specifications subject to change without notice on account of continued product development

Meets CENELEC/AREMA Standards

CENELEC EN 55022:2010
CENELEC EN 50155:2007
CENELEC EN 61000-4-8:2010
AREMA Part 11.5.1

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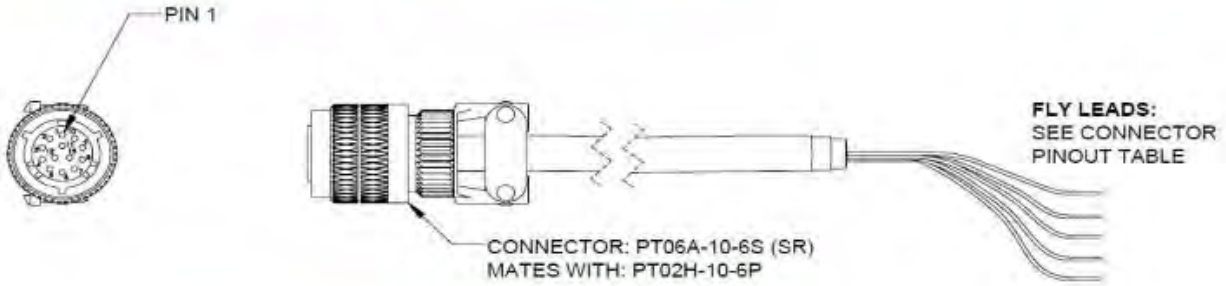
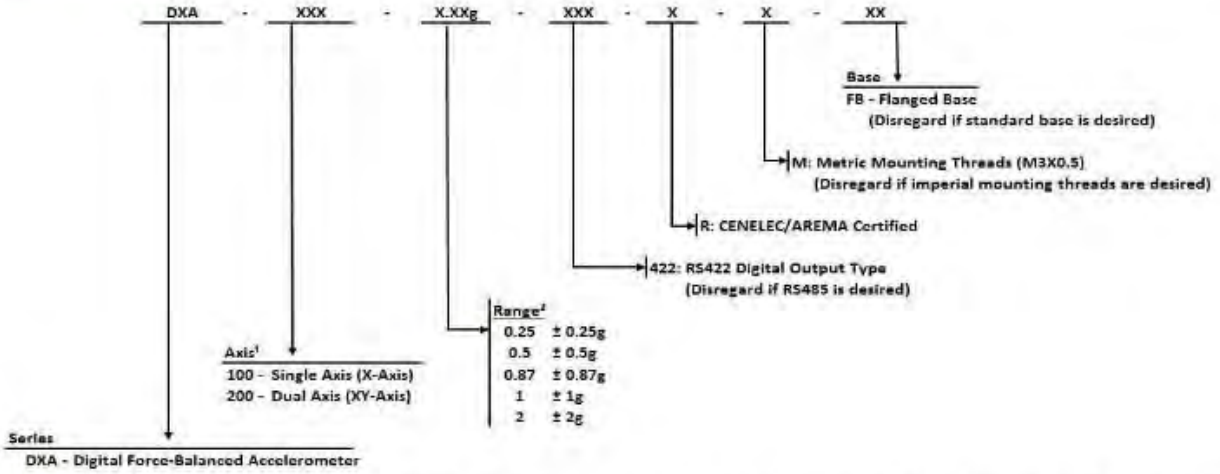
CABLE ACCESSORY (Part Number: 879839-XX)



CABLE CONFIGURATIONS & PART NUMBERS

Part Number	Length
879839-01	5 m
879839-02	3 m
879839-03	1.8 m

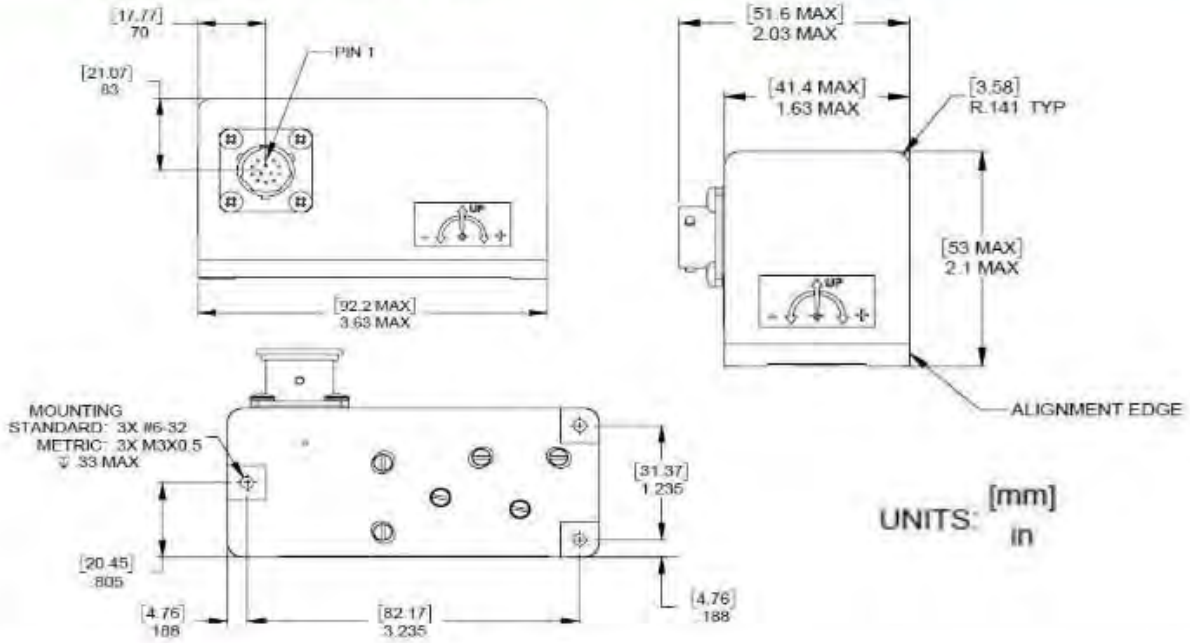
How to Order



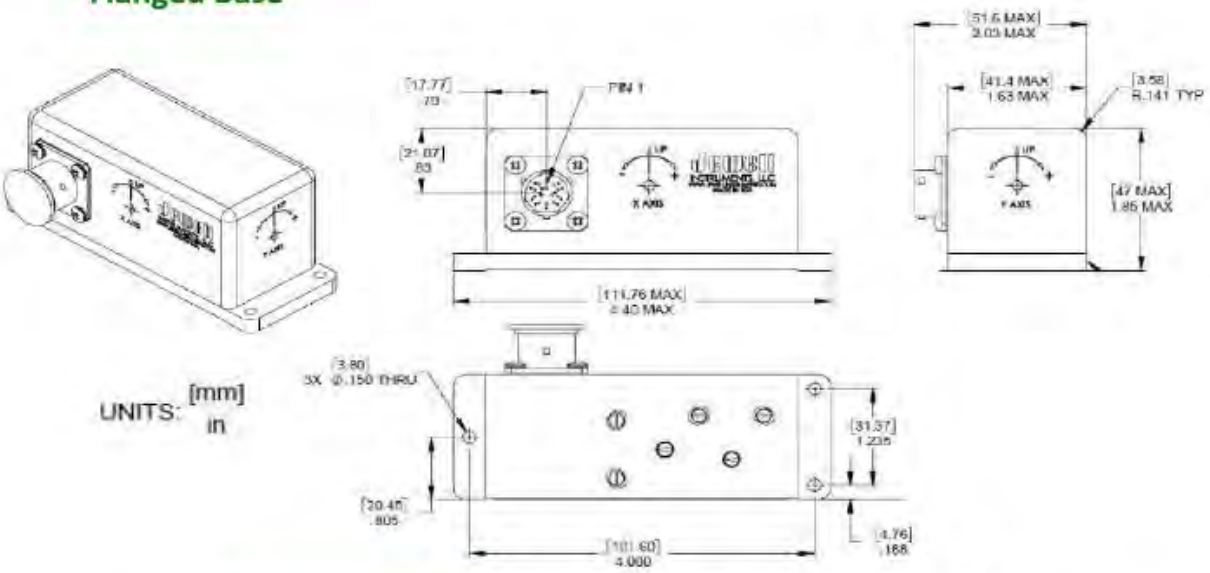
Example: DXA-100-0.25g-R = DXA series, single axis, ±0.25g range, RS485 output, CENELEC/AREMA certified, imperial mounting threads, standard base

¹Call factory for customized axis configurations
²For dual axis, include the range for both axes. Ex: 0.25/0.25g

Dimensions - Standard Base



Flanged Base



JMA-100/200/300-D MEMS Accelerometer Series
±5VDC Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced accelerometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

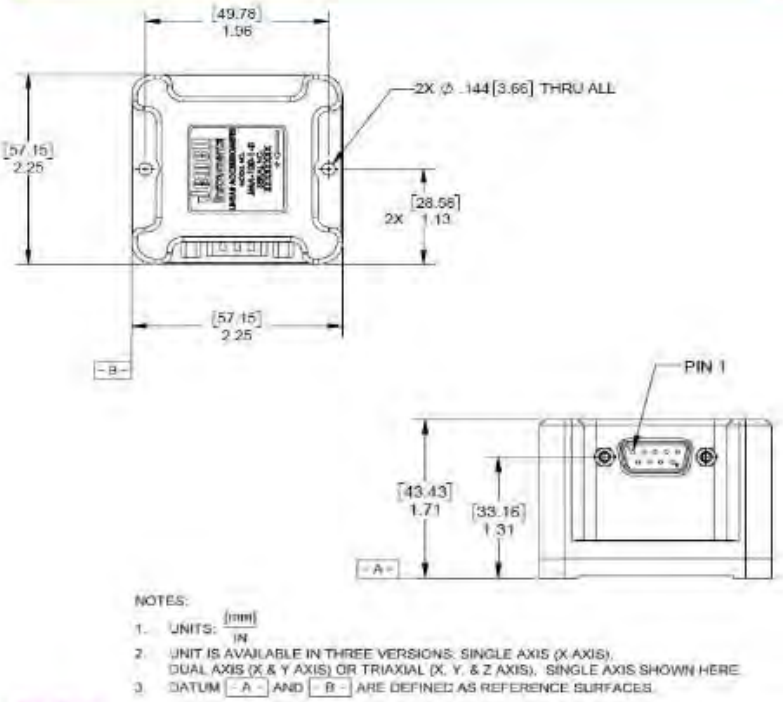
Features

- ±0.5 to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Dual Power Input
- ±5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN THREE VERSIONS: SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	-Vin
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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LCF-3500 Series Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

STATIC/DYNAMIC

Input Range (g) (Note 1)	± 0.50	± 2.0	± 5.0
Full Range Output (FRO), volts ± 0.5%	± 5.0	± 5.0	± 5.0
Non Linearity (%FRO' Max.) (Note 2)	0.05	0.05	0.05
Scale Factor, volts/g (Nominal)	10.0	2.50	1.00
Scale Factor Temp. Sens., (PPM/°C, Max.)	100	100	100
Bias, g (Max.)	0.005	0.005	0.005
Bias Temp. Sens., micro g/° (Max.)	100	100	100
Natural Frequency, Hz min (Note 3)	30	30	30
Bandwidth (-3dB), Hz min	30	30	30
Input Axis Misalignment, ° (Max.)	1.0	1.0	1.0
Resolution and Threshold, micro g (Max.)	10	10	10

ELECTRICAL

Input Voltage, VDC	±12 to ±18
Input Current (mA, Nominal):	±45
Output Impedance, ohms (Nominal)	100
Noise, Vrms (Max.)	0.002

ENVIRONMENTAL

Operating Temp Range	-40 to +80°C
Survival Temp Range	-60 to +90°C
Vibration	20 grms
Shock	1000g, 1 msec, ½ sine
Seal	Epoxy

Notes: 1 - Full range is defined as "from negative to positive full input acceleration."
2 - Referenced to best-fit straight line independent of misalignment.
3 - Output phase angle = -90°.

Custom Capabilities

- Unit Power Connections can be easily adapted for operations from single-ended, floating power supplies of 24 to 36 Volts DC
- Internal Temperature Sensor
- 4-20 mA output

How to Order

LCF-3500-.5g/.5g/.5g	Call for part number
LCF-3500-2.0g/2.0g/2.0g	Call for part number
LCF-3500-5.0g/5.0g/5.0g	Call for part number

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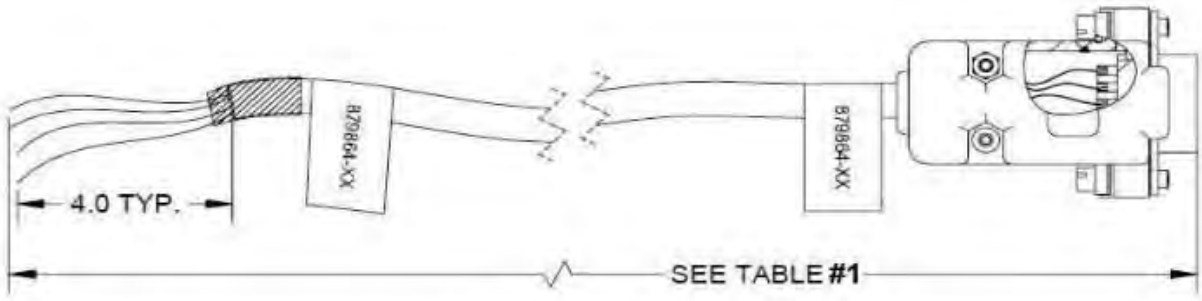
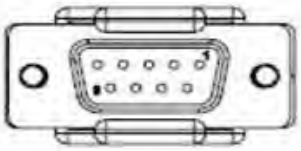
CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

JMA-100/200/300-L MEMS Accelerometer Series
4-20mA Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced accelerometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

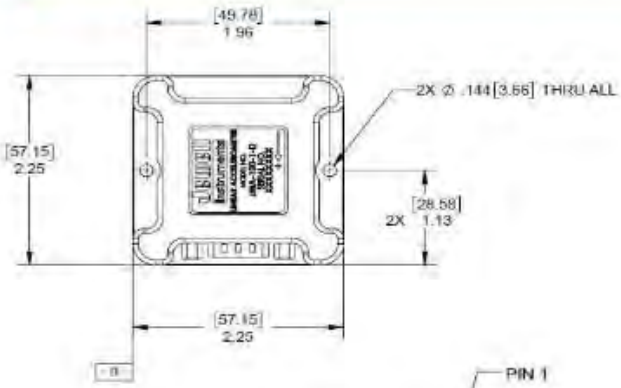
Features

- ±0.5 to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single Power Input
- 4-20mA Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN THREE VERSIONS: SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES
4. Height of JMA-300-L will be approximately 2.75 in (69.85 mm)

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

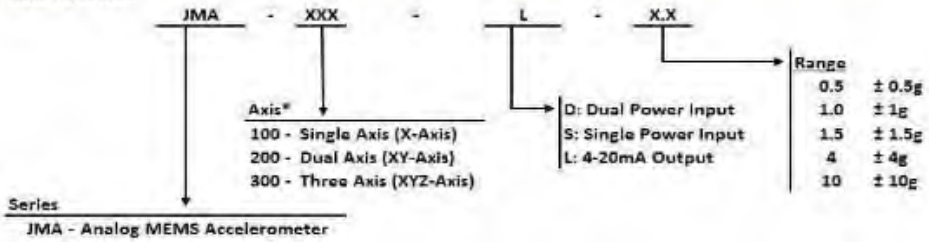
Measurement Range[1] (g)	±0.5	±1	±1.5	±4	±10
Output Current Range (mA)	4-20	4-20	4-20	4-20	4-20
Scale Factor Tolerance (mg)	±5	±10	±15	±20	±50
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150	100	100
Bias (g max)	±0.01	±0.01	±0.02	±0.01	±0.01
Bias Temp. Sensitivity (mg/°C max)	1	0.5	0.5	0.5	1
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5	±0.5	±0.5
Resolution and Threshold (mg max)	0.025	0.05	0.05	0.08	0.08
Non-linearity (% FRO max)	0.05	0.05	0.08	0.08	0.08
Nonrepeatability, Hysteresis (mg max)	0.07	0.07	0.07	0.10	0.10
Bandwidth (Hz nom) (-3 dB)	100	100	100	200	200
Cross Axis Sensitivity (g/g max)	0.01	0.005	0.005	0.005	0.005
Warm Up Time (Seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1, 2 or 3
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	28 (1-axis), 56 (2-axis), 84 (3-axis)
Output Noise (grms max)	0.01
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes), 180 (3 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request. *Specifications subject to change without notice on account of continued product development

How To Order:



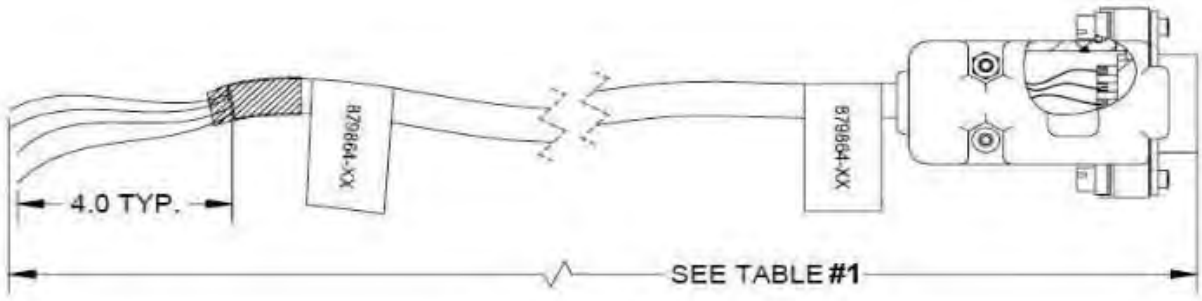
Example: JMA-100-L-0.5 = JMA series, single axis, 4-20mA Output, ±0.5g range

*Call factory for customized axis configurations

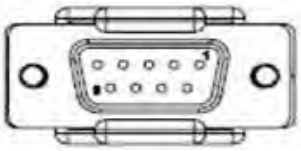
Single Axis Part Numbers		Dual Axis Part Numbers		Triple Axis Part Numbers	
JMA-100-L-0.5	02550360-132	JMA-200-L-0.5	02550360-232	JMA-300-L-0.5	02550360-332
JMA-100-L-1.0	02550360-133	JMA-200-L-1.0	02550360-233	JMA-300-L-1.0	02550360-333
JMA-100-L-1.5	02550360-134	JMA-200-L-1.5	02550360-234	JMA-300-L-1.5	02550360-334
JMA-100-L-4	02550360-136	JMA-200-L-4	02550360-236	JMA-300-L-4	02550360-336
JMA-100-L-10	02550360-138	JMA-200-L-10	02550360-238	JMA-300-L-10	02550360-338

CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

JMA-100/200/300-S MEMS Accelerometer Series
0-5VDC Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced accelerometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

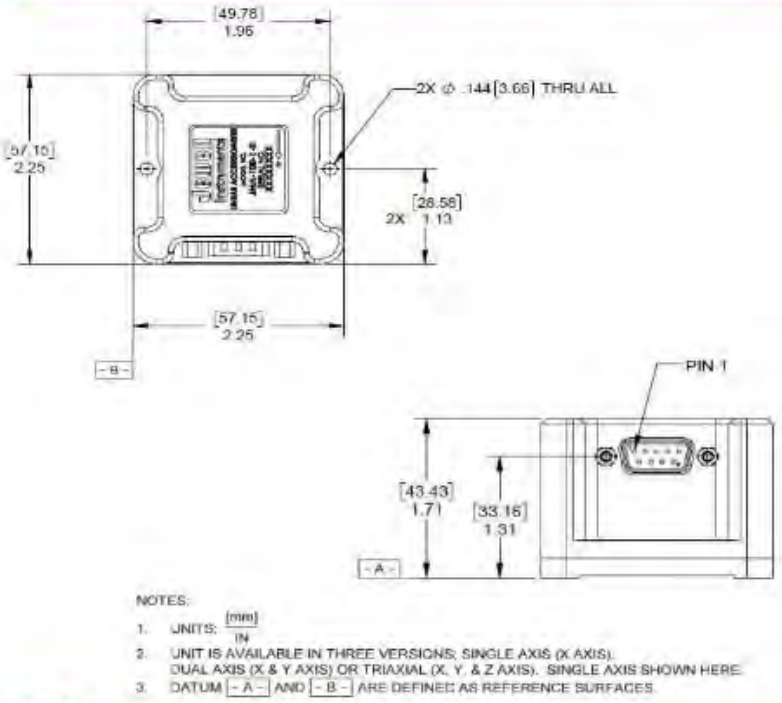
Features

- ±0.5 g to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single Power Input
- 0-5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
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2. UNIT IS AVAILABLE IN THREE VERSIONS; SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM [- A -] AND [- B -] ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

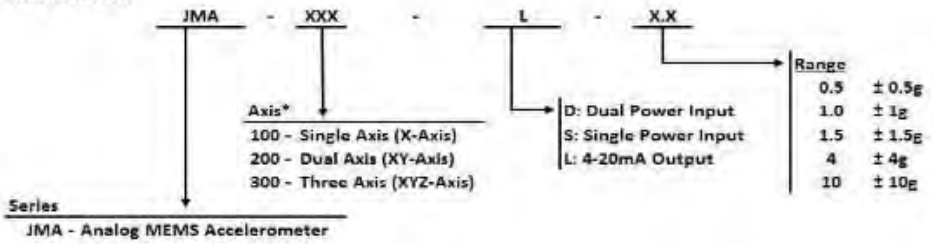
Measurement Range[1] (g)	±0.5	±1	±1.5	±4	±10
Output Voltage Range (VDC)	0-5	0-5	0-5	0-5	0-5
Scale Factor Tolerance (mg)	±5	±10	±15	±20	±50
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150	100	100
Bias (g max)	±0.01	±0.01	±0.02	±0.01	±0.01
Bias Temp. Sensitivity (mg/°C max)	1	0.5	0.5	0.5	1
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5	±0.5	±0.5
Resolution and Threshold (mg max)	0.025	0.05	0.05	0.08	0.08
Non-linearity (% FRO max)	0.05	0.05	0.08	0.08	0.08
Nonrepeatability, Hysteresis (mg max)	0.07	0.07	0.07	0.10	0.10
Bandwidth (Hz nom) (-3 dB)	100	100	100	200	200
Cross Axis Sensitivity (g/g max)	0.01	0.005	0.005	0.005	0.005
Warm Up Time (Seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1, 2 or 3
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	7 (1-axis). 14 (2-axis), 21 (3-axis)
Output Noise (grms max)	0.005
Output Impedance (Ohms nom)	1
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes), 180 (3 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request. *Specifications subject to change without notice on account of continued product development

How To Order:

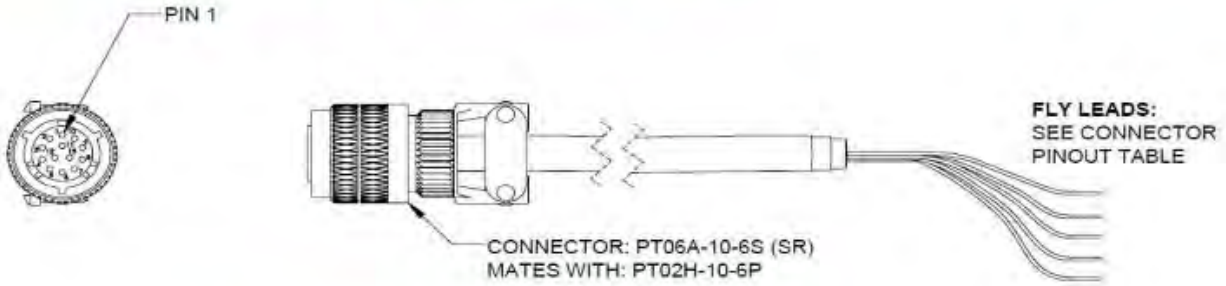


Example: JMA-100-L-0.5 = JMA series, single axis, 4-20mA Output, ±0.5g range

*Call factory for customized axis configurations

Single Axis Part Numbers		Dual Axis Part Numbers		Triple Axis Part Numbers	
JMA-100-S-0.5	02550360-112	JMA-200-S-0.5	02550360-212	JMA-300-S-0.5	02550360-312
JMA-100-S-1.0	02550360-113	JMA-200-S-1.0	02550360-213	JMA-300-S-1.0	02550360-313
JMA-100-S-1.5	02550360-114	JMA-200-S-1.5	02550360-214	JMA-300-S-1.5	02550360-314
JMA-100-S-4	02550360-116	JMA-200-S-4	02550360-216	JMA-300-S-4	02550360-316
JMA-100-S-10	02550360-118	JMA-200-S-10	02550360-218	JMA-300-S-10	02550360-318

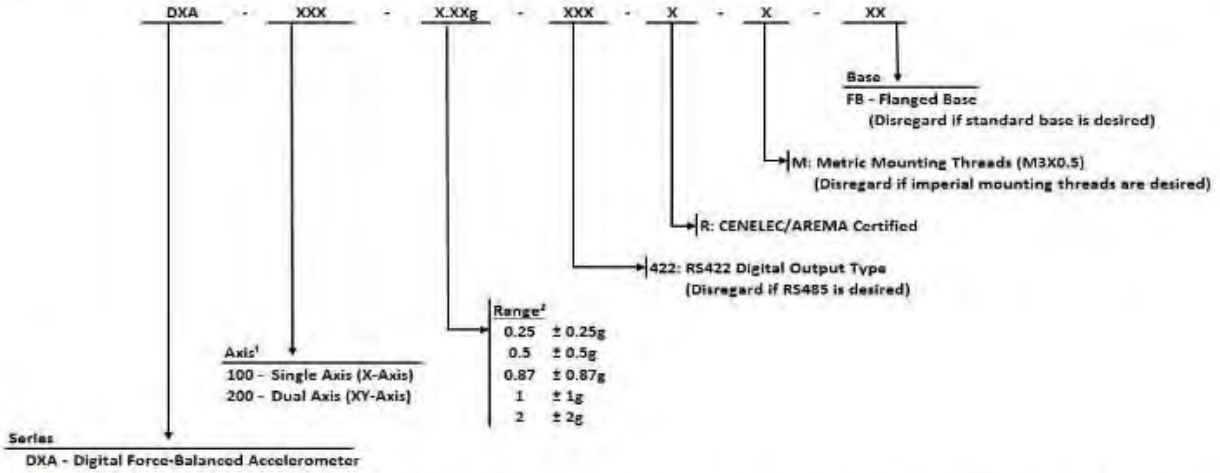
CABLE ACCESSORY (Part Number: 879839-XX)



CABLE CONFIGURATIONS & PART NUMBERS

Part Number	Length
879839-01	5 m
879839-02	3 m
879839-03	1.8 m

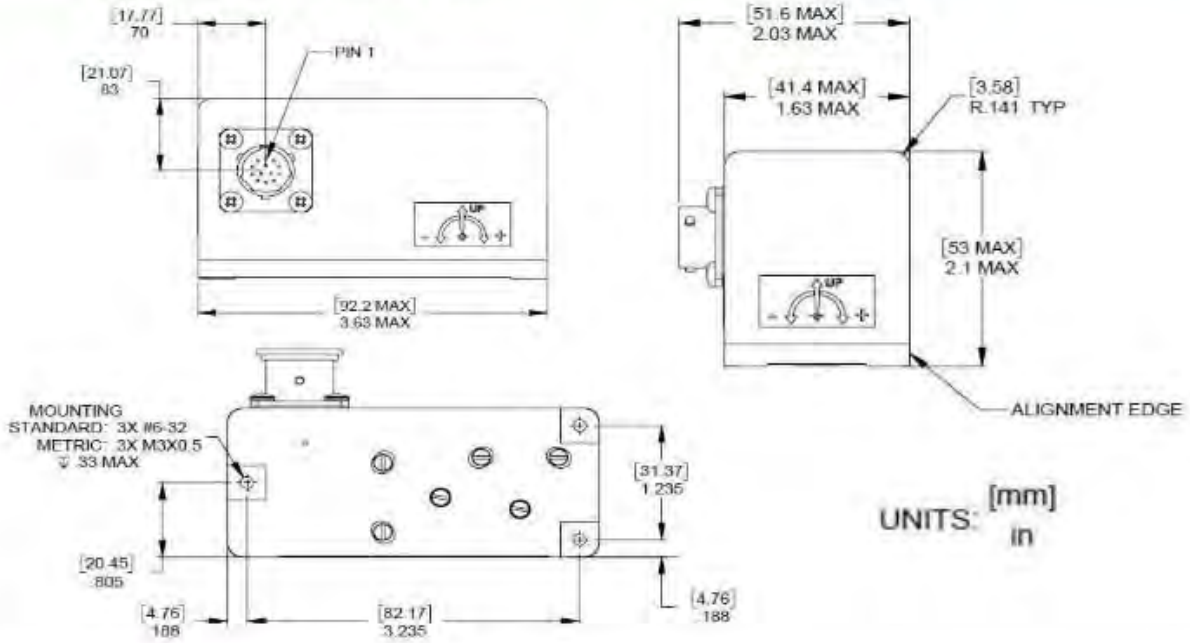
How to Order



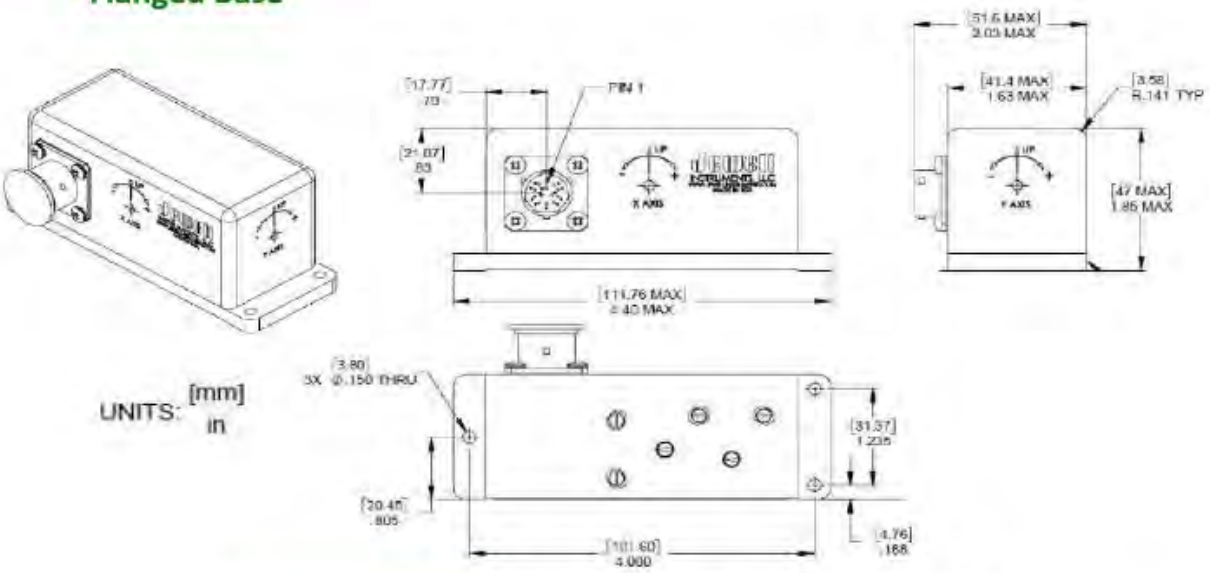
Example: DXA-100-0.25g-R = DXA series, single axis, ±0.25g range, RS485 output, CENELEC/AREMA certified, imperial mounting threads, standard base

¹Call factory for customized axis configurations
²For dual axis, include the range for both axes. Ex: 0.25/0.25g

Dimensions - Standard Base



Flanged Base



JMA-100/200/300-D MEMS Accelerometer Series
±5VDC Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced accelerometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

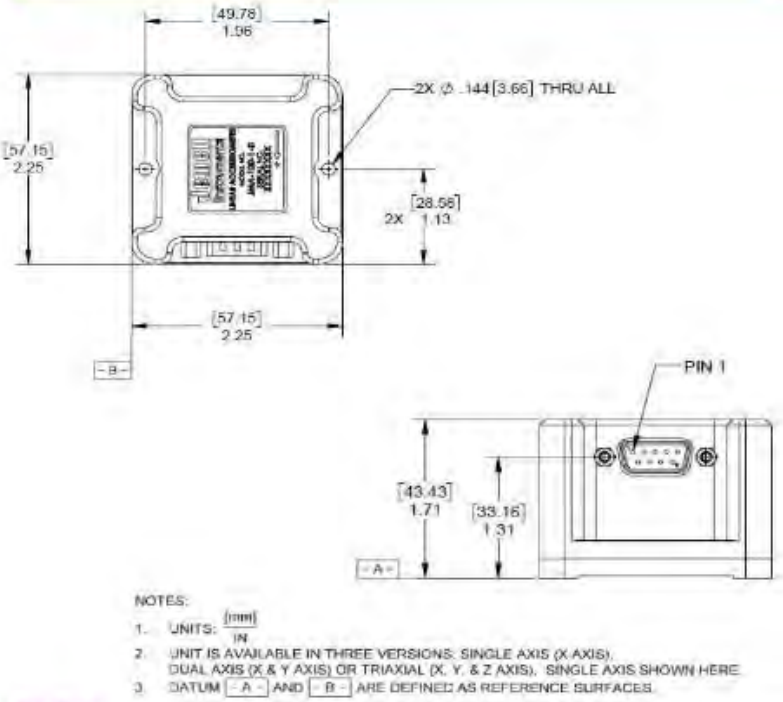
Features

- ±0.5 to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Dual Power Input
- ±5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN THREE VERSIONS: SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	-Vin
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

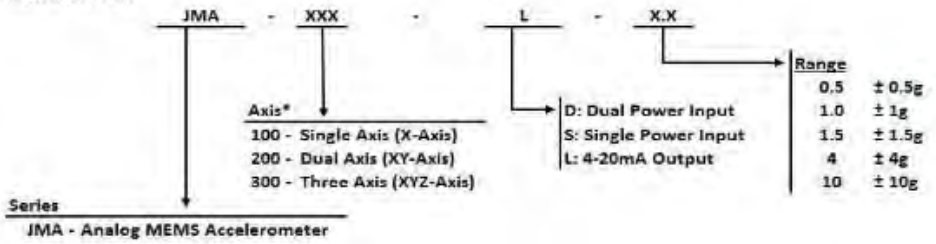
Measurement Range[1] (g)	±0.5	±1	±1.5	±4	±10
Output Voltage Range (VDC)	±5.00	±5.00	±5.00	±5.00	±5.00
Scale Factor Tolerance (mg)	±5	±10	±15	±20	±50
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150	100	100
Bias (g max)	±0.01	±0.01	±0.02	±0.01	±0.01
Bias Temp. Sensitivity (mg/°C max)	1.0	0.5	0.5	0.5	1.0
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5	±0.5	±0.5
Resolution and Threshold (mg max)	0.025	0.05	0.05	0.08	0.08
Non-linearity (% FRO max)	0.05	0.05	0.08	0.08	0.08
Nonrepeatability, Hysteresis (mg max)	0.07	0.07	0.07	0.10	0.1
Bandwidth (Hz nom) (-3 dB)	100	100	100	200	200
Cross Axis Sensitivity (g/g max)	0.01	0.005	0.005	0.005	0.005
Warm Up Time (Seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1, 2 or 3
Input Voltage Range (VDC)	±12 to ±18
Input Current (mA max)	8 (1-axis), 16 (2-axis), 24 (3-axis)
Output Noise (grms max)	0.005
Output Impedance (Ohms nom)	1
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes), 180 (3 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request. *Specifications subject to change without notice on account of continued product development

How To Order:



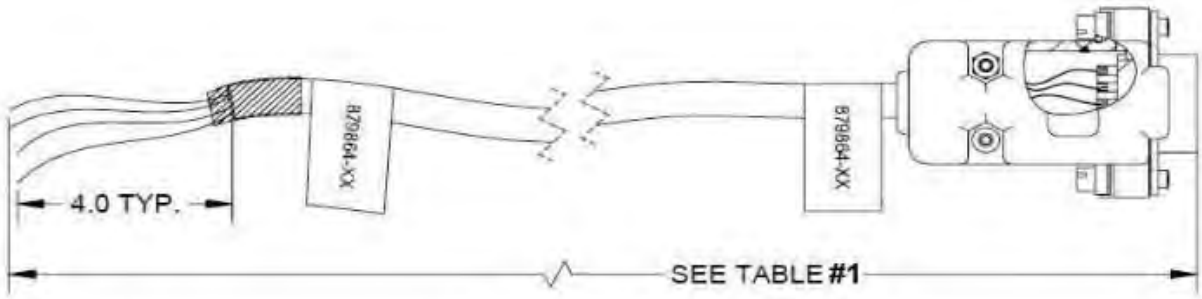
Example: JMA-100-L-0.5 = JMA series, single axis, 4-20mA Output, ±0.5g range

*Call factory for customized axis configurations

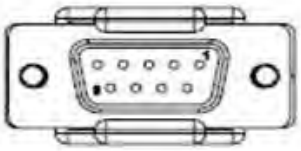
Single Axis Part Numbers		Dual Axis Part Numbers		Triple Axis Part Numbers	
JMA-100-D-0.5	02550360-122	JMA-200-D-0.5	02550360-222	JMA-300-D-0.5	02550360-322
JMA-100-D-1.0	02550360-123	JMA-200-D-1.0	02550360-223	JMA-300-D-1.0	02550360-323
JMA-100-D-1.5	02550360-124	JMA-200-D-1.5	02550360-224	JMA-300-D-1.5	02550360-324
JMA-100-D-4	02550360-126	JMA-200-D-4	02550360-226	JMA-300-D-4	02550360-326
JMA-100-D-10	02550360-128	JMA-200-D-10	02550360-228	JMA-300-D-10	02550360-328

CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

JMA-100/200/300-L MEMS Accelerometer Series
4-20mA Output

Making Sense out of Motion...

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The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

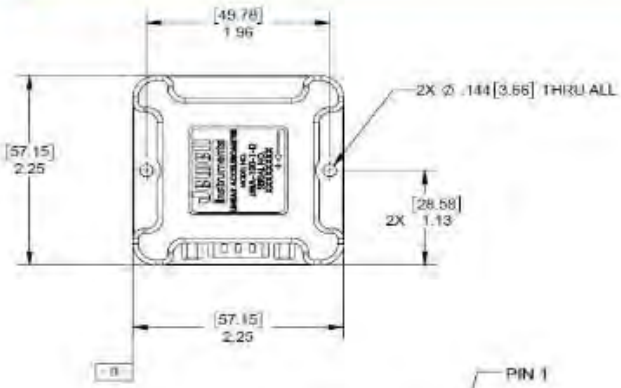
Features

- ±0.5 to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single Power Input
- 4-20mA Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN THREE VERSIONS: SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM - A - AND - B - ARE DEFINED AS REFERENCE SURFACES
4. Height of JMA-300-L will be approximately 2.75 in (69.85 mm)

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

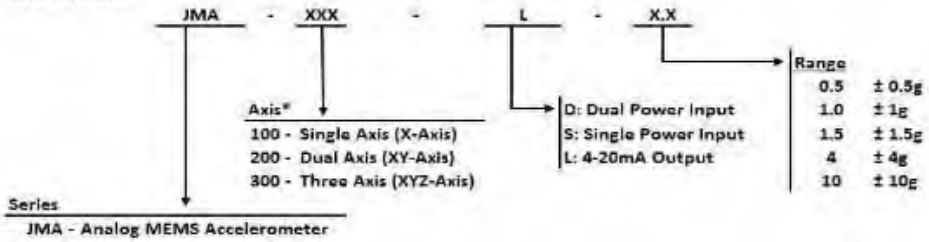
Measurement Range[1] (g)	±0.5	±1	±1.5	±4	±10
Output Current Range (mA)	4-20	4-20	4-20	4-20	4-20
Scale Factor Tolerance (mg)	±5	±10	±15	±20	±50
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150	100	100
Bias (g max)	±0.01	±0.01	±0.02	±0.01	±0.01
Bias Temp. Sensitivity (mg/°C max)	1	0.5	0.5	0.5	1
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5	±0.5	±0.5
Resolution and Threshold (mg max)	0.025	0.05	0.05	0.08	0.08
Non-linearity (% FRO max)	0.05	0.05	0.08	0.08	0.08
Nonrepeatability, Hysteresis (mg max)	0.07	0.07	0.07	0.10	0.10
Bandwidth (Hz nom) (-3 dB)	100	100	100	200	200
Cross Axis Sensitivity (g/g max)	0.01	0.005	0.005	0.005	0.005
Warm Up Time (Seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1, 2 or 3
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	28 (1-axis), 56 (2-axis), 84 (3-axis)
Output Noise (grms max)	0.01
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes), 180 (3 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request. *Specifications subject to change without notice on account of continued product development

How To Order:



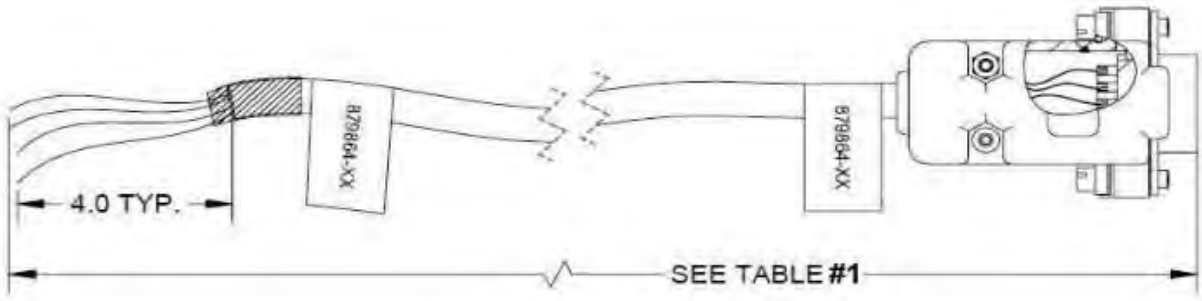
Example: JMA-100-L-0.5 = JMA series, single axis, 4-20mA Output, ±0.5g range

*Call factory for customized axis configurations

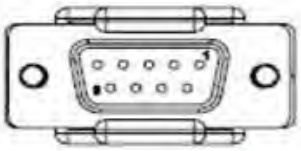
Single Axis Part Numbers		Dual Axis Part Numbers		Triple Axis Part Numbers	
JMA-100-L-0.5	02550360-132	JMA-200-L-0.5	02550360-232	JMA-300-L-0.5	02550360-332
JMA-100-L-1.0	02550360-133	JMA-200-L-1.0	02550360-233	JMA-300-L-1.0	02550360-333
JMA-100-L-1.5	02550360-134	JMA-200-L-1.5	02550360-234	JMA-300-L-1.5	02550360-334
JMA-100-L-4	02550360-136	JMA-200-L-4	02550360-236	JMA-300-L-4	02550360-336
JMA-100-L-10	02550360-138	JMA-200-L-10	02550360-238	JMA-300-L-10	02550360-338

CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

JMA-100/200/300-S MEMS Accelerometer Series
0-5VDC Output

Making Sense out of Motion...

Jewell has a 40+ year history of providing precision force-balanced accelerometers and is pleased to provide MEMS parts with the same attention to detail that our customers demand.

The JMA-100/200/300 series is available in single (JMA-100), dual (JMA-200) and triple (JMA-300) axis configurations. This presents a robust and rugged design for industrial use, but with the benefit of low-cost MEMS technology.

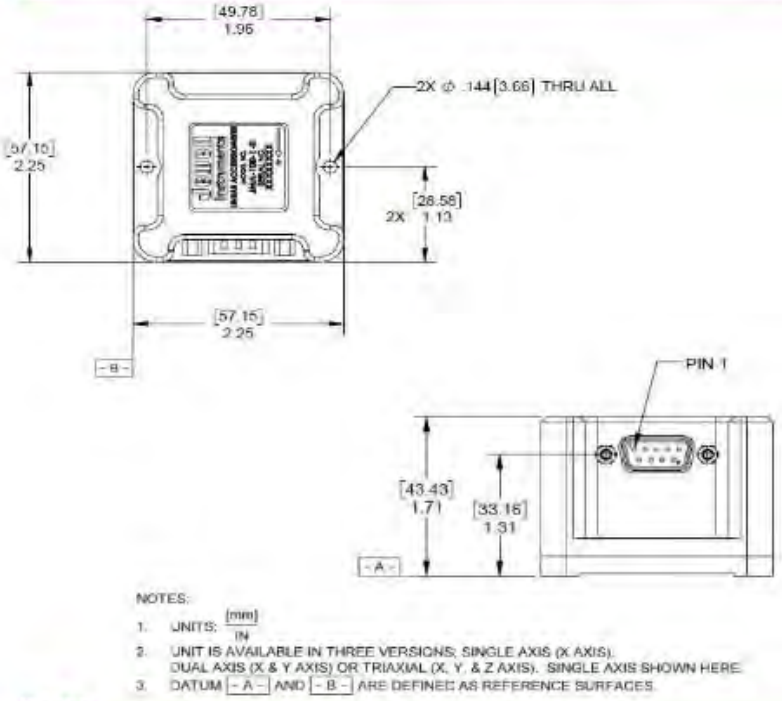
Features

- ±0.5 g to ±10 g ranges
- Robust and Rugged Enclosure
- Single, Dual and Tri-Axis Models Available
- Low-Cost MEMS Technology
- RoHS Compliant
- Filtering Available
- Single Power Input
- 0-5 VDC Output
- Temperature Sensor Option Available
- IP65 Seal

Applications

- Vehicle Testing
- Railway Maintenance & Testing
- Acceleration/Deceleration Control
- Aerospace/Space Craft Testing
- Lateral Train Control

Outline Diagram



NOTES:
1. UNITS: [mm] / IN
2. UNIT IS AVAILABLE IN THREE VERSIONS; SINGLE AXIS (X AXIS), DUAL AXIS (X & Y AXIS) OR TRIAXIAL (X, Y, & Z AXIS). SINGLE AXIS SHOWN HERE.
3. DATUM [- A -] AND [- B -] ARE DEFINED AS REFERENCE SURFACES.

Pin Out

Pin #	Function
1	+Vin
2	Pwr Gnd
3	N/C
4	X Out
5	Y Out
6	Z Out
7	Sig Rtn
8	Temp Out
9	N/C

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Performance Specifications

STATIC/DYNAMIC

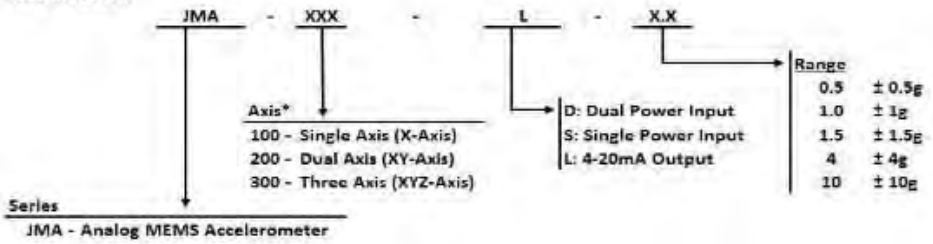
Measurement Range[1] (g)	±0.5	±1	±1.5	±4	±10
Output Voltage Range (VDC)	0-5	0-5	0-5	0-5	0-5
Scale Factor Tolerance (mg)	±5	±10	±15	±20	±50
Scale Factor Temp. Coefficient (PPM/°C max)	150	150	150	100	100
Bias (g max)	±0.01	±0.01	±0.02	±0.01	±0.01
Bias Temp. Sensitivity (mg/°C max)	1	0.5	0.5	0.5	1
Transverse Axis Misalignment (° max)	±0.5	±0.5	±0.5	±0.5	±0.5
Resolution and Threshold (mg max)	0.025	0.05	0.05	0.08	0.08
Non-linearity (% FRO max)	0.05	0.05	0.08	0.08	0.08
Nonrepeatability, Hysteresis (mg max)	0.07	0.07	0.07	0.10	0.10
Bandwidth (Hz nom) (-3 dB)	100	100	100	200	200
Cross Axis Sensitivity (g/g max)	0.01	0.005	0.005	0.005	0.005
Warm Up Time (Seconds max)	0.5	0.5	0.5	0.5	0.5

ELECTRICAL AND ENVIRONMENTAL

Number of Axes	1, 2 or 3
Input Voltage Range (VDC)	12 to 30
Input Current (mA max)	7 (1-axis). 14 (2-axis), 21 (3-axis)
Output Noise (grms max)	0.005
Output Impedance (Ohms nom)	1
Operating Temp. Range (°C)	-40 to +85
Storage Temp. Range (°C)	-40 to +95
Shock	100 g, 0.011 sec, ½ sine
Weight (grams)	165 (1 axis), 170 (2 axes), 180 (3 axes)
Seal	IP65

Notes: 1 - Custom ranges available on request. *Specifications subject to change without notice on account of continued product development

How To Order:



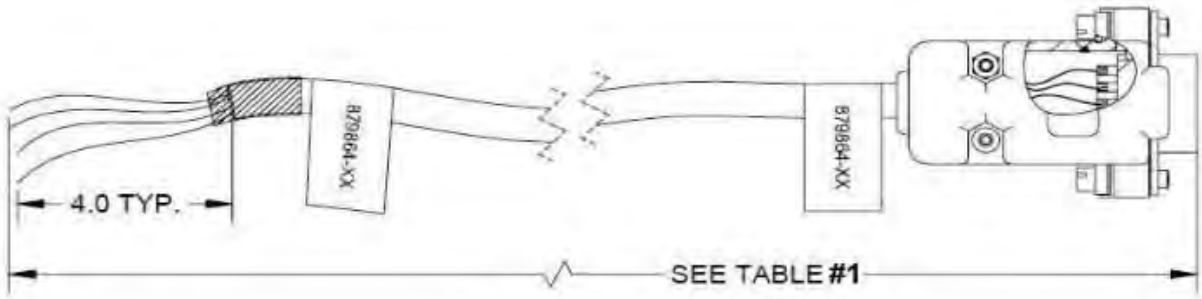
Example: JMA-100-L-0.5 = JMA series, single axis, 4-20mA Output, ±0.5g range

*Call factory for customized axis configurations

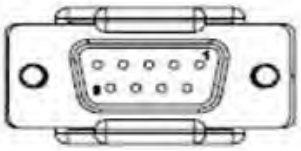
Single Axis Part Numbers		Dual Axis Part Numbers		Triple Axis Part Numbers	
JMA-100-S-0.5	02550360-112	JMA-200-S-0.5	02550360-212	JMA-300-S-0.5	02550360-312
JMA-100-S-1.0	02550360-113	JMA-200-S-1.0	02550360-213	JMA-300-S-1.0	02550360-313
JMA-100-S-1.5	02550360-114	JMA-200-S-1.5	02550360-214	JMA-300-S-1.5	02550360-314
JMA-100-S-4	02550360-116	JMA-200-S-4	02550360-216	JMA-300-S-4	02550360-316
JMA-100-S-10	02550360-118	JMA-200-S-10	02550360-218	JMA-300-S-10	02550360-318

CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

Affordable, Rail Certified Train Control

The JMA-165 is the industry's first MEMS accelerometer to be CENELEC/AREMA certified for rail transportation. This provides engineers a more affordable, yet high precision and reliable, sensor solution for railcar testing and control.

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DMA Series - Digital MEMS Accelerometers

Making Sense out of Motion...

Jewell Instruments DMA Series Accelerometers are an excellent choice for cost to performance trade off. The DMA is based on silicon micro-machined MEMS Capacitive Accelerometer technology and designed for low power and high stability.

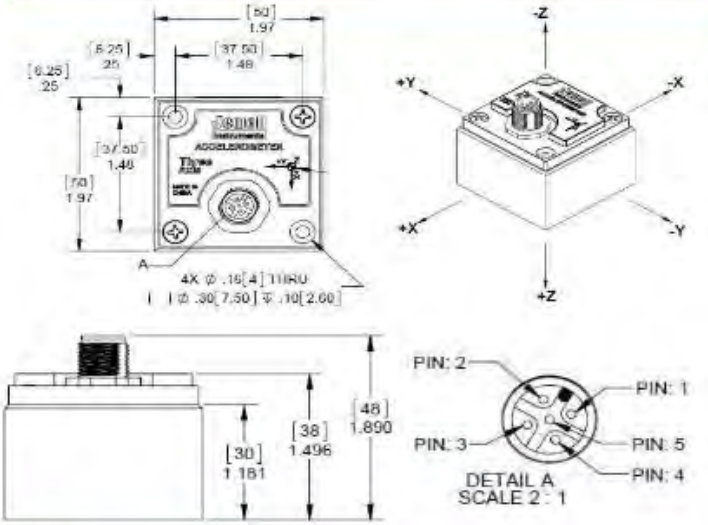
Features

- Single, Dual and Triaxial Configuration
- Excellent long term stability
- Ruggedized for harsh environment operation
- High Sensitivity
- 2m cable whip included

Applications

- Tower Cranes
- Robotics
- Low Frequency Vibration Measurement
- Automatic Control Systems
- Vehicle Testing

Outline Diagram



Pin Out

Pin	Function	
	RS232	RS485/UART TTL
1	+VDC	+VDC
2	RXD	D+
3	TXD	D-
4	Ground	Ground
5	N/A	N/A

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Performance Specifications

STATIC/DYNAMIC

Measurement Range, (g)[1]	±0.5	±1
Output Voltage Range (Volts)	±5.00	±5.00
Scale Factor Tolerance (mg)	±5	±10
Scale Factor Temp Coefficient (ppm/°C, Max.)	300	150
Bias (g, Max.)	±0.01	±0.01
Bias Temp Coefficient (mg/°C, Max.)	1	0.5
Transverse Axis Alignment (°Max.)	0.7	0.7
Resolution and Threshold (mg, Max.)	0.3	0.6
Nonlinearity (% of Full Scale, Max.)	0.2	0.1
Nonrepeatability (mg, Max.)	2	1
Bandwidth (Hz Nominal) (-3dB)	100	100
Cross Axis Sensitivity (g/g Max.)	0.01	0.005
Warm-Up Time (Seconds, Max.)	1	1

ELECTRICAL AND ENVIRONMENTAL

Input Voltage (Vdc)	±12 to ±18
Operating Current, mA, max	±8
Output Impedence (Ohms Nominal)	1
Noise (Broadband grms max)	0.005
Operating Temperature	-40°C to +70°C
Storage Temperature	-55°C to +85°C
Shock	10g (half sine, 0.011 sec)
Weight (grams)	85
Seal	IP65

Notes: 1 - Intermediate ranges available, please see model number structure below. Custom ranges available on request.

*Specifications subject to change without notice on account of continued product development

Meets CENELEC/AREMA Standards

CENELEC EN 50121:2015
CENELEC EN 50155:2007
CENELEC EN 6100:2010
AREMA Part 11.5.1 (2009)

Ordering Information

±0.5G Range → Model Number: JMA-165-0.5-R
Part Number: 02550357-002

±1.0G Range → Model Number: JMA-165-1-R
Part Number: 02550357-003

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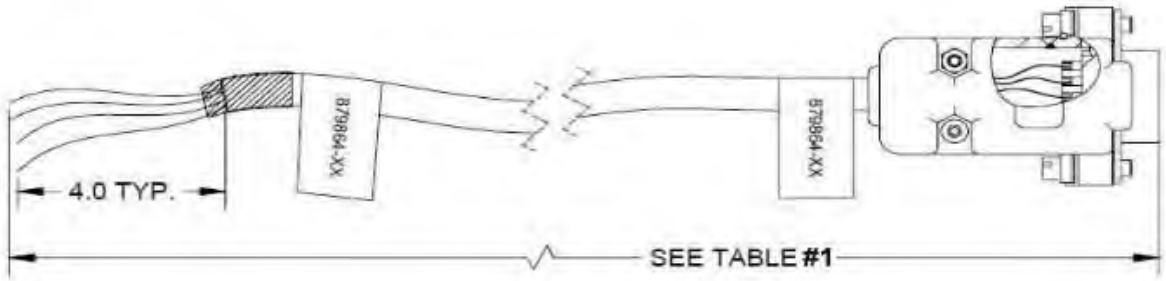
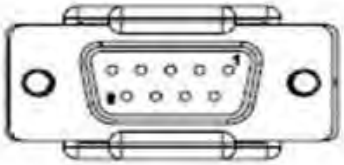
CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

QFA-125 Series High Temperature Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	40
Axis Alignment, mRad, Max. (@ 25° C)	1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+55°C to +125°C	±200
+100°C to +125°C	±170
Bias Temp. Sens, µg/°C, Max.	±100
Scale Factor Stability (1 month composite)	less than 250 ppm
Bias Stability (1 month composite)	less than 250 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current (quiescent), mA (Max.)	12
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +125°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Custom Capabilities

Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering.

How to Order

Model #	Part #
QFA-125-30G-SQ	848205-001
QFA-125-30G-RD	848206-001

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

Rev 12

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Performance Specifications

STATIC/DYNAMIC

Measurement Range, (g)[1]	±0.5	±1
Output Voltage Range (Volts)	±5.00	±5.00
Scale Factor Tolerance (mg)	±5	±10
Scale Factor Temp Coefficient (ppm/°C, Max.)	125	75
Bias (g, Max.)	±0.01	±0.01
Bias Temp Coefficient (mg/°C, Max.)	1	0.5
Transverse Axis Alignment (°Max.)	0.7	0.7
Resolution and Threshold (mg, Max.)	0.3	0.6
Nonlinearity (% of Full Scale, Max.)	0.2	0.1
Nonrepeatability (mg, Max.)	2	1
Bandwidth (Hz Nominal) (-3dB)	100	100
Cross Axis Sensitivity (g/g Max.)	0.01	0.005
Warm-Up Time (Seconds, Max.)	30	30

ELECTRICAL AND ENVIRONMENTAL

Input Voltage (Vdc)	±12 to ±18
Operating Current (mA, max)	150
Heater Preset (°C)	25.0
Output Impedence (Ohms Nominal)	1
Noise (Broadband grms max.)	0.005
Operating Temperature	-40°C to +70°C
Storage Temperature	-55°C to +85°C
Shock	10g (half sine, 0.011 sec)
Weight (grams)	85
Seal	IP65

Notes: 1 - Intermediate ranges available, please see model number structure below. Custom ranges available on request.

*Specifications subject to change without notice on account of continued product development

Meets CENELEC/AREMA Standards

CENELEC EN 50121:2015
CENELEC EN 50155:2007
CENELEC EN 6100:2010
AREMA Part 11.5.1 (2009)

Ordering Information

±0.5G Range → Model Number: JMA-165-0.5-RH
Part Number: 02550358-002

±1.0G Range → Model Number: JMA-165-1-RH
Part Number: 02550358-003

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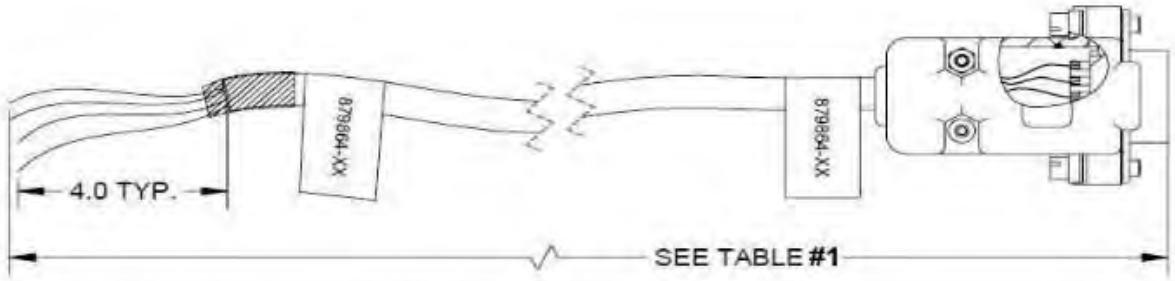
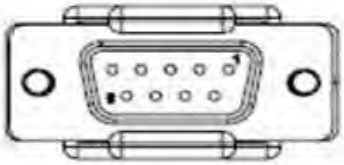
CABLE ASSEMBLY (PN 879864-XX)

DB9 FEMALE CONNECTOR



Dimensions in feet [m]



CONNECTOR PINOUT		
DB9 PIN	FLY LEADS	FUNCTION
1	RED	+PWR
2	BLACK	PWR RTN
3	VIOLET	N/C
4	GREEN	X OUT
5	ORANGE	Y OUT
6	YELLOW	N/C
7	BROWN	SIG RTN
8	BLUE	TEMP OUT
9	WHITE	N/C

Table #1

Cable Configuration	
Part #	Length
879864-10	[10m] 32.8 feet
879864-XX	Other length available (specify on order)

AMA Series - MEMS Analog Accelerometer

Making Sense out of Motion...

Jewell Instruments AMA Series Accelerometers are an excellent choice for cost to performance trade off. The AMA is based on silicon micro-machined MEMS Capacitive Accelerometer technology and designed for low power and high stability.

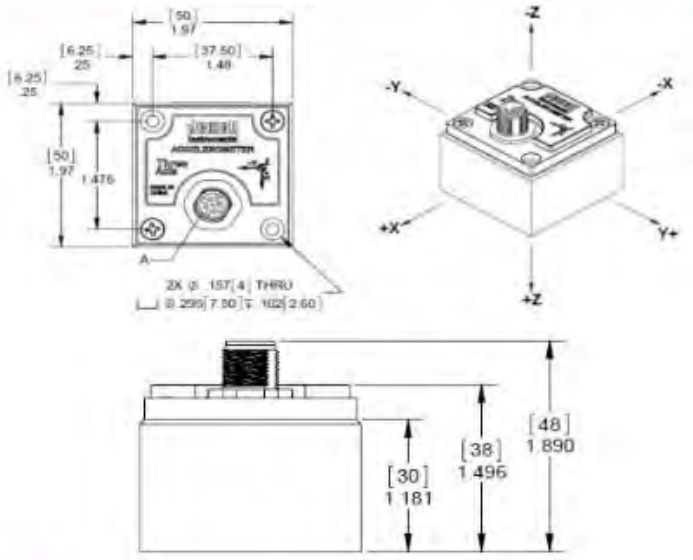
Features

- Single, Dual and Triaxial Configuration
- Excellent long term stability
- Ruggedized for harsh environment operation
- High Sensitivity
- 2m cable whip included

Applications

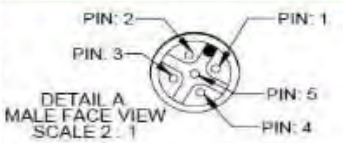
- Tower Cranes
- Robotics
- Low Frequency Vibration Measurement
- Automatic Control Systems
- Vehicle Testing

Outline Diagram



Pin Out

Pin	Function
1	+VDC 9V-36V
2	X Axis Output
3	Y Axis Output
4	Signal/Power Ground
5	Z Axis Output



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Performance Specifications

STATIC/DYNAMIC

Measurement Range, (g)[1]	±2	±10	±40
Output Options		0 - 5 Vdc or 4 - 20 mA	
Scale Factor Tolerance (mg)	10	50	150
Scale Factor Temp Coefficient (ppm/°C, typ.)	100	100	100
Bias (g, Max.)	0.02	0.05	0.15
Bias Temp Coefficient (mg/°C, typ.)	0.65	0.5	1.5
Axis Alignment (°)	≤1	≤1	≤1
Resolution and Threshold (mg, Max.)	0.1	0.6	2.8
Nonlinearity (% of Full Scale, Max.)	0.3	0.5	0.6
Nonrepeatability (mg, Max.)	2	10	20
Bandwidth (Hz, Max.)	400	400	400
Scale Factor Long Term Stability (1 yr. ppm, Max.)	300	300	300
Bias Long Term Stability (1 yr. mG, Max.)	1.5	7.5	22.0
Noise Spectral Density (µVolts/√Hz)	18	18	18

ELECTRICAL AND ENVIRONMENTAL

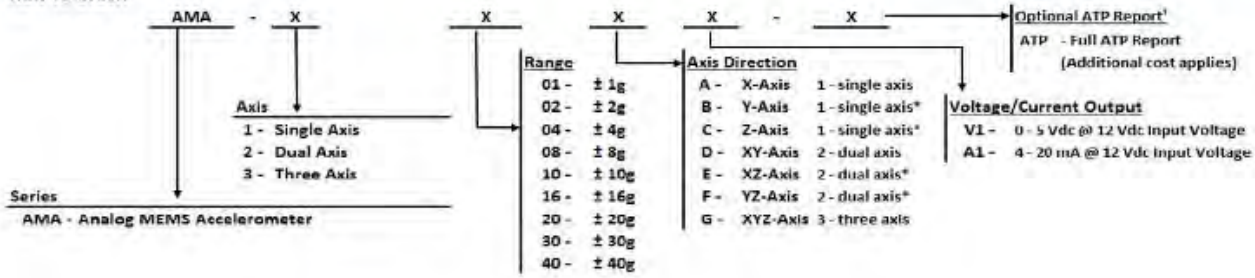
Input Voltage (Vdc)	9 to 36 Vdc
Operating Current	<3mA at 12Vdc
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Shock	100g (11msec ½ sine)
Vibration (grms random 20 to 2,000 Hz)	20
Weight (grams)	100
Seal	IP67

Notes: 1 - Intermediate ranges available, please see model number structure below. Custom ranges available on request.

2 - Output voltage 0-5 Vdc (- Full Scale to + Full Scale, Zero g = 2.5Vdc)

*Specifications subject to change without notice due to continued product development

How To Order:



Example:
AMA - 2 - 02 - D - V1 - ATP
AMA Series, dual axis, ±2° range, XY-axis, 0 - 5 Vdc Output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.
*Part number not included on datasheet, but available on request

Part Numbers

	Single-axis		Dual-axis		Triaxial	
	Model #	Part #	Model #	Part #	Model #	Part #
Voltage output (0-5Vdc)	AMA-1-01-A-V1	02550313-1111	AMA-2-01-D-V1	02550313-2141	AMA-3-01-G-V1	02550313-3171
	AMA-1-02-A-V1	02550313-1211	AMA-2-02-D-V1	02550313-2241	AMA-3-02-G-V1	02550313-3271
	AMA-1-04-A-V1	02550313-1311	AMA-2-04-D-V1	02550313-2341	AMA-3-04-G-V1	02550313-3371
	AMA-1-08-A-V1	02550313-1411	AMA-2-08-D-V1	02550313-2441	AMA-3-08-G-V1	02550313-3471
	AMA-1-10-A-V1	02550313-1511	AMA-2-10-D-V1	02550313-2541	AMA-3-10-G-V1	02550313-3571
	AMA-1-16-A-V1	02550313-1611	AMA-2-16-D-V1	02550313-2641	AMA-3-16-G-V1	02550313-3671
	AMA-1-20-A-V1	02550313-1711	AMA-2-20-D-V1	02550313-2741	AMA-3-20-G-V1	02550313-3771
	AMA-1-30-A-V1	02550313-1811	AMA-2-30-D-V1	02550313-2841	AMA-3-30-G-V1	02550313-3871
	AMA-1-40-A-V1	02550313-1911	AMA-2-40-D-V1	02550313-2941	AMA-3-40-G-V1	02550313-3971
Current output (4-20mA)	AMA-1-01-A-A1	02550313-1112	AMA-2-01-D-A1	02550313-2142	AMA-3-01-G-A1	02550313-3172
	AMA-1-02-A-A1	02550313-1212	AMA-2-02-D-A1	02550313-2242	AMA-3-02-G-A1	02550313-3272
	AMA-1-04-A-A1	02550313-1312	AMA-2-04-D-A1	02550313-2342	AMA-3-04-G-A1	02550313-3372
	AMA-1-08-A-A1	02550313-1412	AMA-2-08-D-A1	02550313-2442	AMA-3-08-G-A1	02550313-3472
	AMA-1-10-A-A1	02550313-1512	AMA-2-10-D-A1	02550313-2542	AMA-3-10-G-A1	02550313-3572
	AMA-1-16-A-A1	02550313-1612	AMA-2-16-D-A1	02550313-2642	AMA-3-16-G-A1	02550313-3672
	AMA-1-20-A-A1	02550313-1712	AMA-2-20-D-A1	02550313-2742	AMA-3-20-G-A1	02550313-3772
	AMA-1-30-A-A1	02550313-1812	AMA-2-30-D-A1	02550313-2842	AMA-3-30-G-A1	02550313-3872
	AMA-1-40-A-A1	02550313-1912	AMA-2-40-D-A1	02550313-2942	AMA-3-40-G-A1	02550313-3972

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

DMA Series - Digital MEMS Accelerometers

Making Sense out of Motion...

Jewell Instruments DMA Series Accelerometers are an excellent choice for cost to performance trade off. The DMA is based on silicon micro-machined MEMS Capacitive Accelerometer technology and designed for low power and high stability.

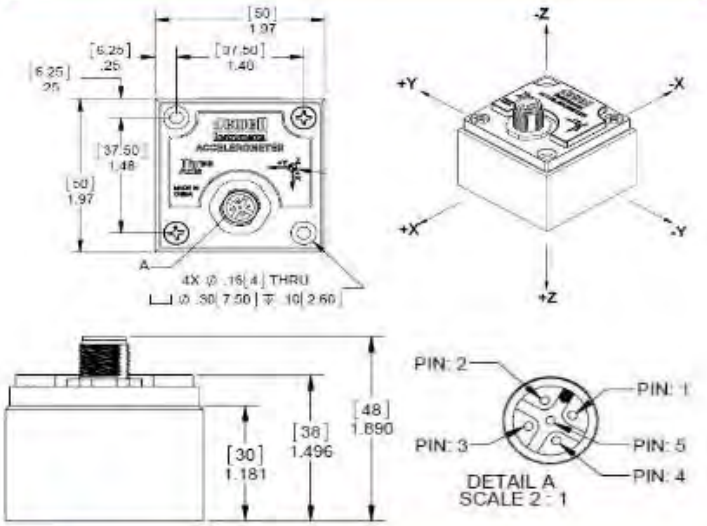
Features

- Single, Dual and Triaxial Configuration
- Excellent long term stability
- Ruggedized for harsh environment operation
- High Sensitivity
- 2m cable whip included

Applications

- Tower Cranes
- Robotics
- Low Frequency Vibration Measurement
- Automatic Control Systems
- Vehicle Testing

Outline Diagram



Pin Out

Pin	Function	
	RS232	RS485/UART TTL
1	+VDC	+VDC
2	RXD	D+
3	TXD	D-
4	Ground	Ground
5	N/A	N/A

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Performance Specifications

STATIC/DYNAMIC

Measurement Range, (g)[1]	±2	±10	±40
Scale Factor Tolerance (mg)	2	5	10
Scale Factor Temp Coefficient (ppm/°C, typ.)	100	100	100
Zero (g, Max.)	0.01	0.05	0.15
Zero Temp Coefficient (mg/°C, typ.)	0.1	0.5	1.5
Axis Misalignment (°)	≤1	≤1	≤1
Resolution and Threshold (mg, Max.)	0.1	0.6	2.8
Nonlinearity (% of Full Scale, Max.)	0.2	0.5	0.6
Nonrepeatability (mg, Max.)	2	10	20
Bandwidth (Hz, Max.)	400	400	400
Scale Factor Long Term Stability (1 yr. ppm, Max.)	300	300	300
Bias Long Term Stability (1 yr. mG, Max.)	1.5	7.5	22
Noise Spectral Density (µVolts/√Hz)	18	18	18

ELECTRICAL AND ENVIRONMENTAL

Input Voltage (Vdc)	9 to 36 Vdc
Operating Current	<3mA at 12Vdc
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Shock	100g (11msec ½ sine)
Vibration (grms random 20 to 2,000 Hz)	20
Weight (grams)	100
Seal	IP67

Notes: 1 - Intermediate ranges available, please see model number structure below. Custom ranges available on request.

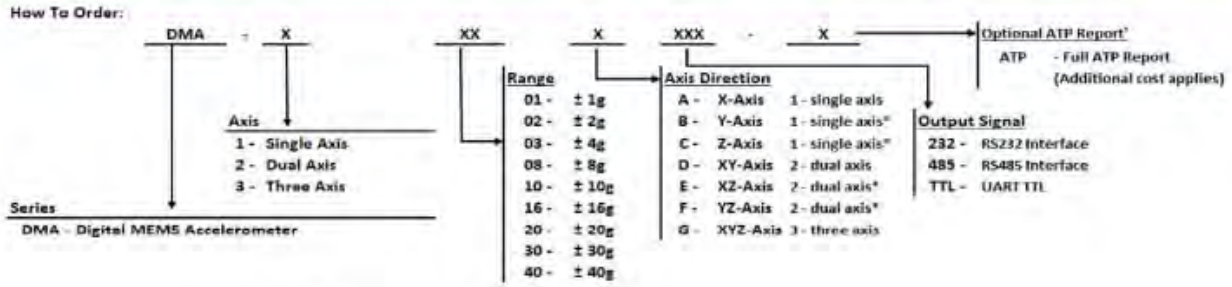
*Specifications subject to change without notice due to continued product development

DMA Series - Digital MEMS Accelerometers

Jewell Instruments

Making Sense out of Motion...

How To Order:



Example:
DMA-2-02-D-232-ATP
DMA Series, dual axis, ±2° range, XY-axis, RS485 Output, Full ATP Report

1 - Note: "ATP" must be added to the end of the part number for a full ATP report. An additional cost will apply.
ATP Report Includes: Scale Factor, Axis Misalignment, Bias, Linearity, Input Current.
*Part number not included on datasheet, but available on request

DMA Part Numbers

	Single-axis		Dual-axis		Triaxial	
	Model #	Part #	Model #	Part #	Model #	Part #
RS232 output	DMA-1-01-A-232	02550314-1111	DMA-2-01-D-232	02550314-2141	DMA-3-01-G-232	02550314-3171
	DMA-1-02-A-232	02550314-1211	DMA-2-02-D-232	02550314-2241	DMA-3-02-G-232	02550314-3271
	DMA-1-04-A-232	02550314-1311	DMA-2-04-D-232	02550314-2341	DMA-3-04-G-232	02550314-3371
	DMA-1-08-A-232	02550314-1411	DMA-2-08-D-232	02550314-2441	DMA-3-08-G-232	02550314-3471
	DMA-1-10-A-232	02550314-1511	DMA-2-10-D-232	02550314-2541	DMA-3-10-G-232	02550314-3571
	DMA-1-16-A-232	02550314-1611	DMA-2-16-D-232	02550314-2641	DMA-3-16-G-232	02550314-3671
	DMA-1-20-A-232	02550314-1711	DMA-2-20-D-232	02550314-2741	DMA-3-20-G-232	02550314-3771
	DMA-1-30-A-232	02550314-1811	DMA-2-30-D-232	02550314-2841	DMA-3-30-G-232	02550314-3871
	DMA-1-40-A-232	02550314-1911	DMA-2-40-D-232	02550314-2941	DMA-3-40-G-232	02550314-3971
RS485 output	DMA-1-01-A-485	02550314-1112	DMA-2-01-D-485	02550314-2142	DMA-3-01-G-485	02550314-3172
	DMA-1-02-A-485	02550314-1212	DMA-2-02-D-485	02550314-2242	DMA-3-02-G-485	02550314-3272
	DMA-1-04-A-485	02550314-1312	DMA-2-04-D-485	02550314-2342	DMA-3-04-G-485	02550314-3372
	DMA-1-08-A-485	02550314-1412	DMA-2-08-D-485	02550314-2442	DMA-3-08-G-485	02550314-3472
	DMA-1-10-A-485	02550314-1512	DMA-2-10-D-485	02550314-2542	DMA-3-10-G-485	02550314-3572
	DMA-1-16-A-485	02550314-1612	DMA-2-16-D-485	02550314-2642	DMA-3-16-G-485	02550314-3672
	DMA-1-20-A-485	02550314-1712	DMA-2-20-D-485	02550314-2742	DMA-3-20-G-485	02550314-3772
	DMA-1-30-A-485	02550314-1812	DMA-2-30-D-485	02550314-2842	DMA-3-30-G-485	02550314-3872
	DMA-1-40-A-485	02550314-1912	DMA-2-40-D-485	02550314-2942	DMA-3-40-G-485	02550314-3972
UART TTL output	DMA-1-01-A-TTL	02550314-1113	DMA-2-01-D-TTL	02550314-2143	DMA-3-01-G-TTL	02550314-3173
	DMA-1-02-A-TTL	02550314-1213	DMA-2-02-D-TTL	02550314-2243	DMA-3-02-G-TTL	02550314-3273
	DMA-1-04-A-TTL	02550314-1313	DMA-2-04-D-TTL	02550314-2343	DMA-3-04-G-TTL	02550314-3373
	DMA-1-08-A-TTL	02550314-1413	DMA-2-08-D-TTL	02550314-2443	DMA-3-08-G-TTL	02550314-3473
	DMA-1-10-A-TTL	02550314-1513	DMA-2-10-D-TTL	02550314-2543	DMA-3-10-G-TTL	02550314-3573
	DMA-1-16-A-TTL	02550314-1613	DMA-2-16-D-TTL	02550314-2643	DMA-3-16-G-TTL	02550314-3673
	DMA-1-20-A-TTL	02550314-1713	DMA-2-20-D-TTL	02550314-2743	DMA-3-20-G-TTL	02550314-3773
	DMA-1-30-A-TTL	02550314-1813	DMA-2-30-D-TTL	02550314-2843	DMA-3-30-G-TTL	02550314-3873
	DMA-1-40-A-TTL	02550314-1913	DMA-2-40-D-TTL	02550314-2943	DMA-3-40-G-TTL	02550314-3973

NOTE: If ATP report is required, please add "-ATP" to model & part numbers. Additional charges will apply

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QFA-125 Series Standard
Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-125 Series Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

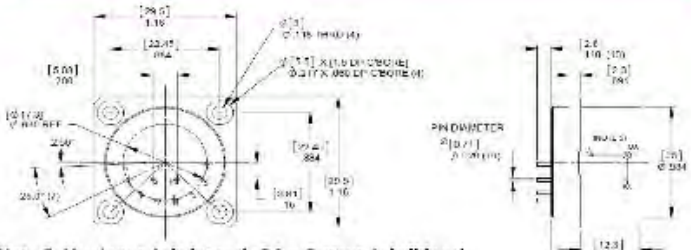
Features & Benefits

- Mid Range Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System

Applications

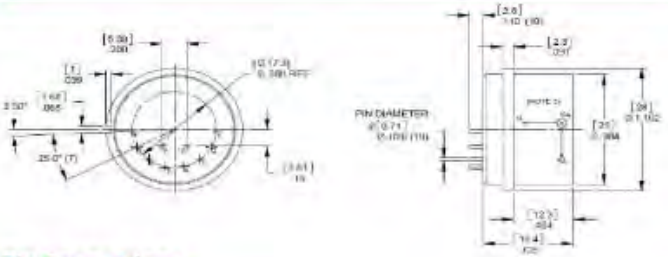
- Well borehole logging (Wireline)
- Measure While Drilling (MWD)
- Oil Drilling
- Orientation Systems for Drilling Applications
- Borehole Mapping

Square Flange - Outline Drawing

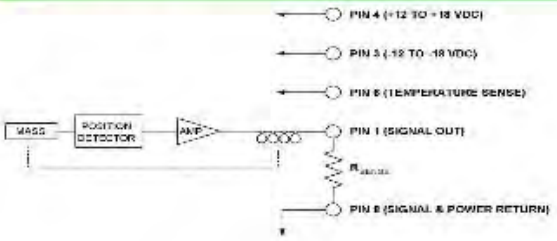


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



Rev 12

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QFA-125 Series High Temperature Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	40
Axis Alignment, mRad, Max. (@ 25° C)	1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+55°C to +125°C	±200
+100°C to +125°C	±170
Bias Temp. Sens, µg/°C, Max.	±100
Scale Factor Stability (1 month composite)	less than 250 ppm
Bias Stability (1 month composite)	less than 250 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current (quiescent), mA (Max.)	12
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +125°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Custom Capabilities

Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering.

How to Order

Model #	Part #
QFA-125-30G-SQ	848205-001
QFA-125-30G-RD	848206-001

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

Rev 12

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QFA-125-30-LC Series High Temperature, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-125-30-LC Series Accelerometer contains state of the art quartz flexure technology that provides high accuracy, repeatability and stability in extremely high temperature environments with a low current input.

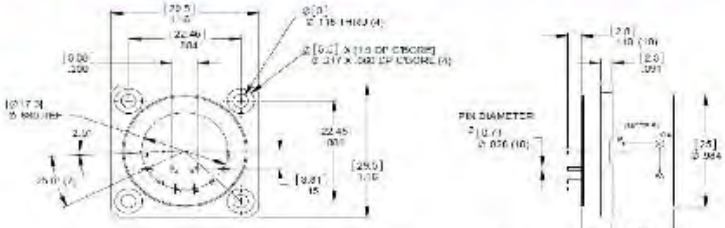
Features & Benefits

- High Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System
- Low current

Applications

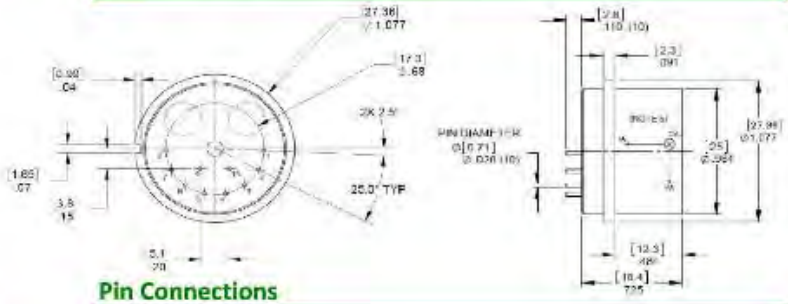
- Well borehole logging (Wireline)
- Measure While Drilling (MWD)
- Oil Drilling
- Orientation Systems for Drilling Applications
- Borehole Mapping

Square Flange - Outline Drawing

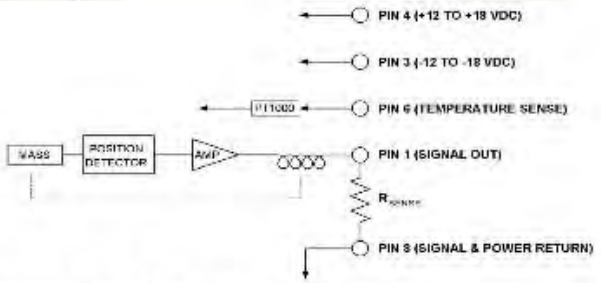


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



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Rev 2

QFA-125-30-LC Series High Temperature, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	40
Axis Alignment, mRad, Max. (@ 25° C)	1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max. (Note 3):	
+55°C to +180°C	±200
+100°C to +180°C	±170
Bias Temp. Sens, µg/°C, Max.	±100
Scale Factor Stability (1 month composite)	less than 250 ppm
Bias Stability (1 month composite)	less than 250 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current, mA	+/-13mA max @ +/-18Vdc input
	+/- 10mA nominal @ +/-15Vdc input
	+/- 8mA nominal @ +/-12Vdc input
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +125°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Note 3: Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering

*Specifications subject to change without notice on account of continued product development

How to Order

Model #	Part #
QFA-125-30G-SQ-LC	848 205-002
QFA-125-30G-RD-LC	848 206-002

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

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Rev 2

QFA-150 Series Standard
Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-150 Series Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

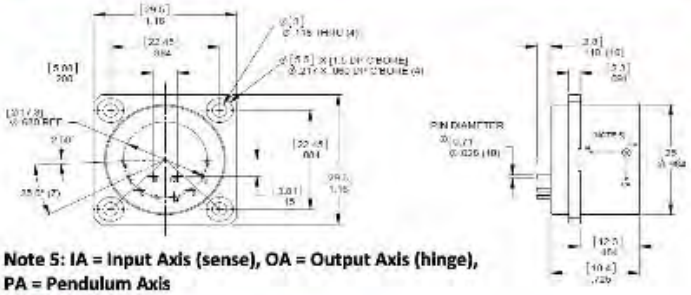
Features & Benefits

- Mid Range Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System

Applications

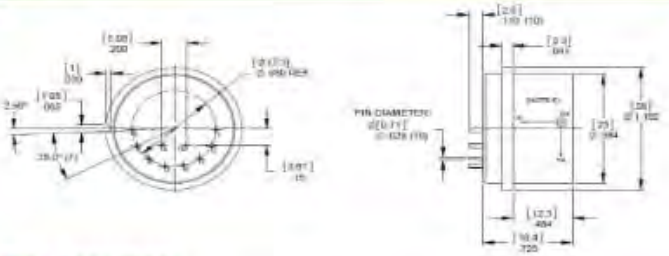
- Rail Maintenance Track Geometry
- Wind Tunnel Testing
- 3D Modeling Equipment for Large Scale Geometries
- Survey Applications
- Marine Instrumentation
- Borehole Mapping

Square Flange - Outline Drawing

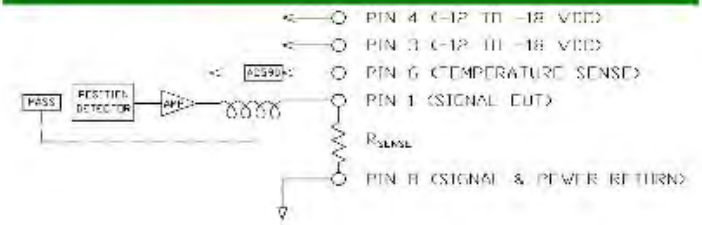


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



Rev. 3

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QFA-150 Series Mid Temperature Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max.	±30
Scale Factor, mA/g (Note 1)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	20
Axis Alignment, mRad, Max. (@ 25° C)	±1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+25°C to +100°C	±80
+100°C to +125°C	±150
+125°C to +150°C	±200
Bias Temp. Sens, µg/°C, Max.	±100
Scale Factor Stability (1 year composite)	less than 350 ppm
Bias Stability (1 year composite)	less than 500 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current (quiescent), mA (Max.)	12
Output Impedance, ohms (Note 2)	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +150°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Voltage output via customer supplied load resistor.

Note 2: Referenced to a best-fit stralght line independent of misalignment.

Custom Capabilities

Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering.

How to Order

Model #	Part #
QFA-150-30G-SQ	02550349-000
QFA-150-30G-RD	02550350-000

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

Rev. 3

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QFA-150-30G-LC Series, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-150-30G-LC Series Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

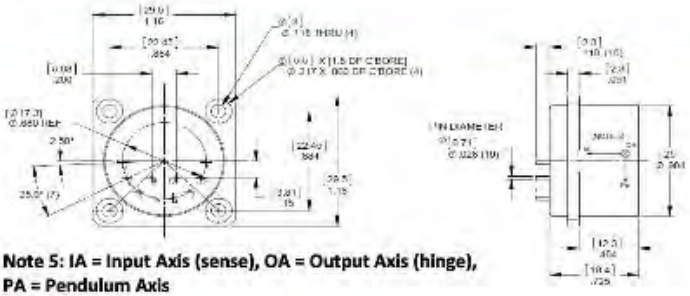
Features & Benefits

- Mid Range Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System

Applications

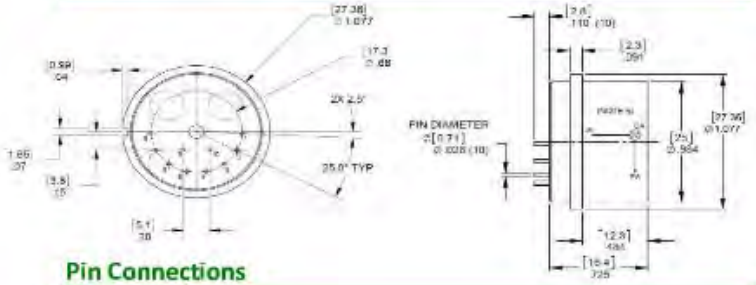
- Rail Maintenance Track Geometry
- Wind Tunnel Testing
- 3D Modeling Equipment for Large Scale Geometries
- Survey Applications
- Marine Instrumentation
- Borehole Mapping

Square Flange - Outline Drawing

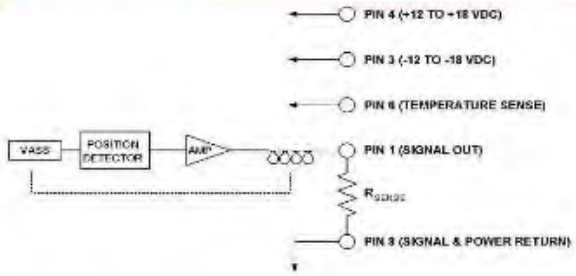


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



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Jewell Instruments LLC, 850 Perimeter Road, Manchester, NH 03103
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QFA-150-30G-LC Series, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	20
Axis Alignment, mRad, Max. (@ 25° C)	±1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+25°C to +100°C	±80
+100°C to +125°C	±150
+125°C to +150°C	±200
Bias Temp. Sens, µg/°C, Max.	±100
Scale Factor Stability (1 year composite)	less than 350 ppm
Bias Stability (1 year composite)	less than 500 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current, mA	+/-13mA max @ +/-18Vdc input
	+/- 10mA nominal @ +/-15Vdc input
	+/- 8mA nominal @ +/-12Vdc input
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +150°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

*Specifications subject to change without notice on account of continued product development

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering

Note 3: Voltage output via customer supplied load resistor.

How to Order

Model #	Part #
QFA-150-30G-SQ-LC	848786-002
QFA-150-30G-RD-LC	848787-002

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

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QFA-180 Series High Temperature Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-180 Series Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

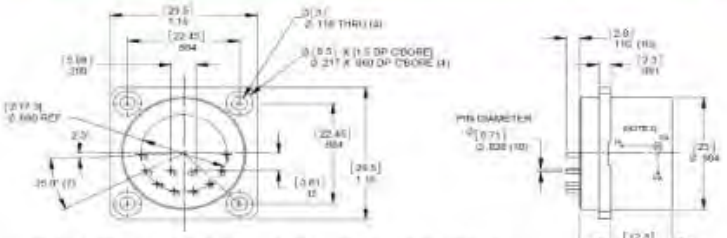
Features & Benefits

- High Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System

Applications

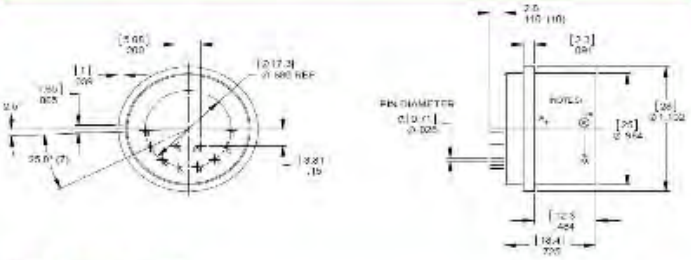
- Well borehole logging (Wireline)
- Measure While Drilling (MWD)
- Oil Drilling
- Orientation Systems for Drilling Applications
- Borehole Mapping

Square Flange - Outline Drawing

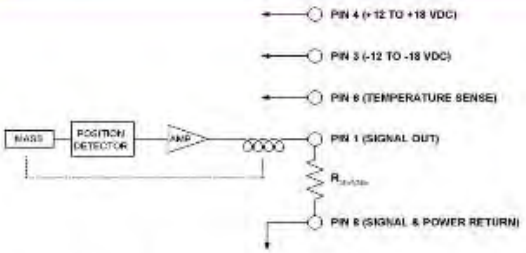


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



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QFA-180 Series High Temperature Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	40
Axis Alignment, mRad, Max. (@ 25° C)	1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+55°C to +180°C	±200
+100°C to +180°C	±170
Bias Temp. Sens, µg/°C, Max.	±150
Scale Factor Stability (1 month composite)	less than 250 ppm
Bias Stability (1 month composite)	less than 250 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current (quiescent), mA (Max.)	12
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +180°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Custom Capabilities

Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering.

How to Order

Model #	Part #
QFA-180-30G-SQ	848198-001
QFA-180-30G-RD	848199-001

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

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QFA-180-30G-LC Series, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFA-180-30G-LC Series Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

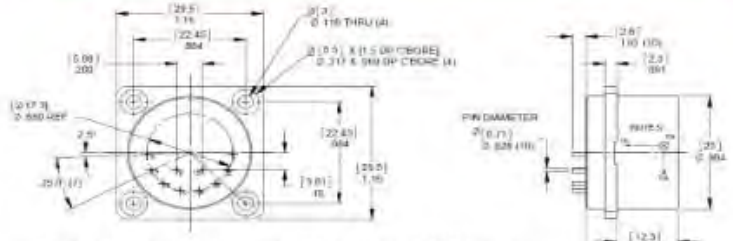
Features & Benefits

- High Temperature
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square or Round Mounting Flanges
- Small Compact Design
- Built-in Self Test System

Applications

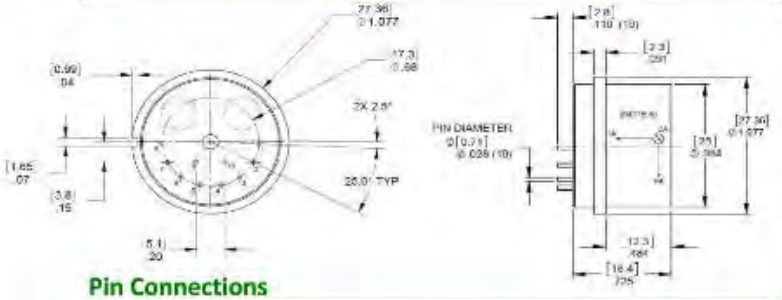
- Well borehole logging (Wireline)
- Measure While Drilling (MWD)
- Oil Drilling
- Orientation Systems for Drilling Applications
- Borehole Mapping

Square Flange - Outline Drawing

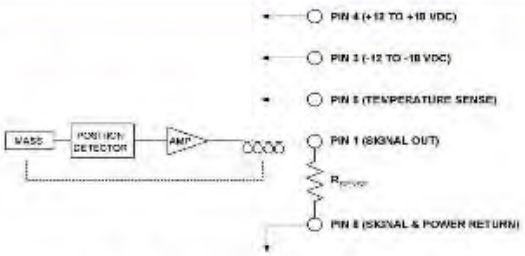


Note 5: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Circle Flange - Outline Drawing



Pin Connections



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QFA-180-30G-LC Series, Low Input Current Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1)	±30
Scale Factor, mA/g (Note 2)	1.1 to 1.4
Bias, milli-g, Max. (@ 25° C)	40
Axis Alignment, mRad, Max. (@ 25° C)	1.5
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	
+55°C to +180°C	±200
+100°C to +180°C	±170
Bias Temp. Sens, µg/°C, Max.	±150
Scale Factor Stability (1 month composite)	less than 250 ppm
Bias Stability (1 month composite)	less than 250 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	3
Weight (grams)	55

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current, mA	+/-13mA max @ +/-18Vdc input
	+/- 10mA nominal @ +/-15Vdc input
	+/- 8mA nominal @ +/-12Vdc input
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-55°C to +180°C
Vibration, (Sine)	25 Hz to 500 Hz, 25g
Vibration, (Random) Rectification, ug/g²rms	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

*Specifications subject to change without notice on account of continued product development

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±30g but at reduced accuracy.

Note 2: Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering

Note 3: Voltage output via customer supplied load resistor.

How to Order

Model #	Part #
QFA-180-30G-SQ-LC	848198-002
QFA-180-30G-RD-LC	848199-002

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

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QFM-180 Miniature Series
Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

The Jewell Instruments QFM-180 Series Miniature Accelerometers are state of the art quartz flexure technology that provides high accuracy, repeatability and stability even in the harshest of environments.

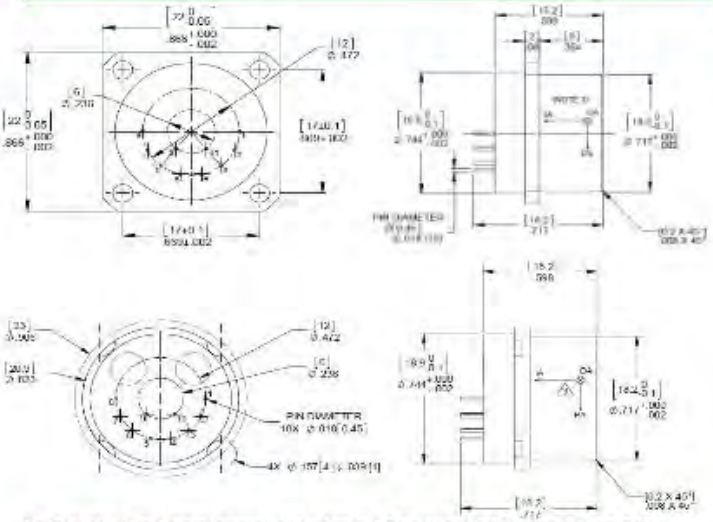
Features & Benefits

- High Temperature Range
- Excellent Repeatability
- High Accuracy
- Environmentally Rugged
- High Stability
- Square Mounting Flanges
- Miniature Design
- Industrial Grade Applications

Applications

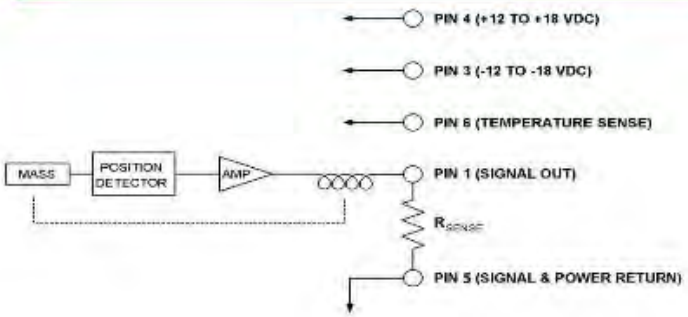
- Well borehole logging (Wireline)
- Measure While Drilling (MWD)
- Oil Drilling
- Orientation Systems for Drilling Applications
- Borehole Mapping

Outline Drawing



Note 3: IA = Input Axis (sense), OA = Output Axis (hinge), PA = Pendulum Axis

Pin Connections



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Rev 11

QFM-180 Miniature Series
Quartz Flexure Accelerometer

Jewell Instruments

Making Sense out of Motion...

Performance Specifications

Performance

Acceleration Range, g Max. (Note 1, 2)	±20
Scale Factor, mA/g (Note 2)	1.8 to 2.8
Bias, milli-g, Max. (@ 25° C)	20
Axis Alignment, mRad, Max. (@ 25° C)	4
Threshold and Resolution, µg, Max.	10
Bandwidth, Hz, Min.	300
Scale Factor Temp. Sens, PPM/°C, Max.:	±200
Bias Temp. Sens, µg/°C, Max.	±150
Scale Factor Stability (1 month composite)	less than 220 ppm
Bias Stability (1 month composite)	less than 220 ug
Noise, mgrms, Max. (0Hz to 10kHz) (Max.)	4
Weight (grams)	25

Electrical

Input Voltage, Vdc	±12 to ±18
Input Current (quiescent), mA (Max.)	20
Output Impedance, ohms	External Load Resistor Dependent

Environmental

Operational Temp Range, °C	-40°C to +180°C
Vibration, (Sine), Max.	25 Hz to 500 Hz, 30g
Vibration, (Random) Rectification, ug/g²rms, Max.	50 Hz to 500 Hz, 100 ug/g²rms
Shock, g (0.5 msec, 1/2 sine)	1000

Note 1: Specifications apply and are characterized up to ±1g range. The accelerometer is capable of supplying acceleration information up to ±20g but at reduced accuracy.

Note 2: Voltage output via customer supplied load resistor.

Custom Capabilities

Scale factor shown in mA/g as a standard. If you require scale factor in volts/g, please specify voltage range when ordering.

How to Order

Model #	Part #
QFM-180-20G-SQ	848213-000
QFM-180-20G-RD	848540-000

Accelerometers exported from the United States must be done in accordance with the Export Administration Regulations (EAR) and/or the International Traffic in Arms Regulations (ITAR) as applicable.

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Rev 11

Inertial Glossary

Roll:

Angular displacement about an axis that is parallel to the longitudinal axis of a body.

Root-Sum-Square (RSS) Error:

The resultant error for several error sources (bias, misalignment, thermal, etc.) evaluated with the root-sum-square mathematical expression, which involves squaring each error value, summing the squares and then taking the square-root of the sum.

Scale Factor (SF):

The ratio of a change in output to a change in the input intended to be measured. Scale Factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range. Jewell typically specifies scale factor as the sensor units of output per g, such as Volts/g for example. See the appendix for how to calculate scale factor.

Scale Factor Temperature Sensitivity (SFTS):

The sensitivity defined by the ratio of change in scale factor to a corresponding change in temperature. Refer to Temperature Sensitivity in the appendix for the equation used to calculate SFTS.

Scale Factor Voltage Sensitivity:

The scale factor change resulting from a change of the input voltage to the sensor.

Sensitive Axis:

See Input Axis.

Sensitivity:

The ratio of the sensor output to input range. It is usually in units of *Volts per g* (*V/g*) or other similar units of measure and is the basic sensor transfer function used in calculations such as a sensor output to its corresponding input acceleration or tilt.

Sensor:

A device used to measure a physical input, such as temperature, light, pressure, displacement, acceleration, tilt, etc. and generate a usable output that can be read or interpreted.

Inertial Glossary

Bias:

The output of a sensor with no acceleration or tilt applied, which is independent of misalignment. Bias of Jewell force-balanced devices results primarily from the combination of residual mechanical torque in the torquer suspension and electrical biases in the electronics circuitry. The basic Jewell equation is: $\text{Bias} = (\text{Output}_{0^\circ} + \text{Output}_{180^\circ}) / 2$. Bias in g is obtained by dividing the result by scale factor. The output of an inertial sensor held stationary on a flat surface is from bias combined with misalignment and noise.

Bias Temperature Sensitivity (BTS):

The sensitivity defined by the ratio of a change in output bias for a corresponding change in temperature. Refer to Temperature Sensitivity in the appendix for the equation used to calculate BTS.

Bias Voltage Sensitivity:

The bias change resulting from a change of the input voltage to the sensor.

Bias Uncertainty:

See Repeatability, Turn-on.

Bonding Resistance:

The resistance present between two specified conducting points, such as the sensor mounting base and the surface on which the sensor is mounted or the sensor mounting base and connector shell. It is usually measured in milliohms.

Capturing:

The restraint of a proof mass to a specific reference position using a torquer in a servo loop as the control. Jewell inclinometers and accelerometers employ capturing technology.

Case:

The enclosure of the transducer and the structure that provides the mounting surfaces to establish the reference axes.

Center of Gravity (CG)

The center of mass of a distribution of mass (of an object such as the proof mass) in space is the unique point at which the weighted relative position of the distributed mass sums to zero, meaning the distribution of mass is balanced around the center of mass.

Inertial Glossary

Center of Seismic Mass (csm):

The Center of Seismic Mass defines the physical location of the proof mass of an inertial transducer within its package. It is the point within the sensor where acceleration forces are summed to produce the output. Typically this applies to accelerometer applications.

Characteristic Time:

The time required for the output to reach 63% of its final value for a step input. It is also referred to as the time constant.

Cross Acceleration:

The acceleration applied in a plane normal to an accelerometer input reference axis.

Cross Axis Sensitivity:

The proportionality constant (*g/g*) that relates a variation of accelerometer output to cross acceleration. This sensitivity can vary, depending on the direction of cross acceleration.

Damping:

Damping is defined as the energy dissipating characteristic which, together with natural frequency, determines the limit of frequency response and the response time characteristics of an accelerometer/inclinometer. In response to a step change of input, an under-damped (periodic) system oscillates about its final steady value before coming to rest at that steady value; an over-damped (aperiodic) system comes to rest without overshoot; and a critically-damped system is at the point of change between the under- and over-damped conditions. Viscous damping uses the viscosity of fluids (liquids or gases) to produce damping. Magnetic damping uses current induced in electrical conductors by changes in magnetic flux to produce damping.

Damping Fluid:

A fluid, which can be either a liquid or gas, used to provide a viscous damping force or torque on an inertial sensing element.

Damping Ratio (ζ):

The ratio of actual damping compared to critical damping for a second-order system. Methods for calculating damping ratio can be found in the appendix.

Inertial Glossary Appendix

In this appendix are mathematical equations and other information associated with selected terms in the glossary.

Damping Ratio:

The damping ratio is determined by using one of three test methods: phase-angle, output amplitude in dB or output amplitude in Volts. The relative accuracy that can be expected for damping ratio results is in the order given for the test methods below. The equations for calculating damping ratio using the test methods follow.

Phase-Angle Method: $D.R. = -0.75 \times \tan \emptyset$

where $\tan \Phi$ equals the input-output phase angle measured at one-half natural frequency.

Amplitude dB Method: $D.R. = \frac{10^{\left[\left(A_f - A_n\right)/20\right]}}{2}$

where A_f is the output flat response and A_n is the output response at the natural frequency.

Amplitude Volts Method: $D.R. = \frac{R_x}{2R_n}$

where R_x is the output response at a frequency at least 5 times less than the natural frequency and R_n is the output response at the natural frequency. This is the short form of the equation and it is important that the two response frequencies be at least 5 times apart.

Nonlinearity:

Sensor nonlinearity for a set of measured data points is derived from the slope intercept form of the straight line equation $Y = B_0 + B_1X$. In the equation B_0 is the y-intercept that represents sensor bias and B_1 is the slope that represents sensor scale factor. The sensor's data points are scattered about the line with some of them lying above the line and the rest below. How far individual data points lie from the line represents the sensor nonlinearity. The technique used at Jewell to derive the straight line from a set of measured data points is the regression or curve fitting process called the method of least squares.

The regression process fits a line equation to a set of X and Y data such that the best-fit curve has the minimum sum of the deviations squared (least square error) from the set of data.

Inertial Glossary Appendix

From a set of sensor input-output (random) measurements, the data regression is estimated by $\hat{y} = b_0 + b_1 x$, where b_0 is a constant (sensor bias), b_1 is the regression coefficient (sensor scale factor), x is value of the independent variable (sensor input, typically in g's) and $\hat{y}$ is the *predicted* value of the dependent variable (sensor output, typically in Volts or mA).

The regression coefficient, b_1, is obtained with the equation

$$b_1 = \sum [(x_i - \overline{x})(y_i - \overline{y})] / \sum [(x_i - \overline{x})^2],$$

and the constant, b_0, is obtained with the equation

$$b_0 = y - b_1 x.$$

Nonlinearity for the sensor is reported either as the worst-point deviation (the data point that lies furthest from the regression line) or more commonly by the standard deviation (see below for its equation).

Scale Factor:

A good all-around equation for determining scale factor of an inertial sensor is: $SF = \frac{O_2 - O_1}{I_2 - I_1}$

where O_2 equals the output signal measured at the higher input acceleration level, I_2 (or other linear input term for the sensor) and O_1 equals the output signal measured at the lower input acceleration level, I_1.

Standard Deviation (*S*):

Nonlinearity data is commonly evaluated at Jewell using the standard deviation. The equation used to compute it is: $S = \sqrt{\frac{1}{n-2}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2}$

Applying the standard deviation is accomplished with the breakdown of the equation into steps as follows:

1. Compute the mean of the data set,
2. Compute the deviation by subtracting the mean from each data in the set,
3. Square each individual deviation,
4. Add up the squared deviations,
5. Divide the sum by the sample size less 2 (*n-2*), and
6. Apply the square root.

Temperature Sensitivity:

The temperature sensitivity of a Jewell sensor is normally determined over two segments of the operating temperature range, which are room-to-cold and room-to-hot. The higher sensitivity result is the one reported.

Bias Temperature Sensitivity (BTS) is calculated using the following equation.

$$BTS = \frac{Bias_{T2} - Bias_{T1}}{T2 - T1} = V/°C \qquad \textit{(or mA/°C or other units of measure)}$$

where Bias is the bias calculated as given in the glossary definition of Bias and T1 and T2 are the temperatures at which measurements were made, where T2 is the higher temperature.

BTS can also be calculated with the result in *g* units as follows.

$$BTS = \frac{Bias_{T2} - Bias_{T1}}{(SF)(T2 - T1)} 10^6 = \mu g/°C,$$

where SF is defined by the Scale Factor glossary term.

Scale Factor Temperature Sensitivity (SFTS) is calculated using the following equation.

$$SFTS = \frac{FSO_{T2} - FSO_{T1}}{(FSO_{RT})(T2 - T1)} 100 = \%Reading/°C,$$

where FSO is the full scale output measured at T1 and T2, the respective temperatures at which FSO measurements were made. FSO_{RT} is the full scale output measured at room temperature.

The same equation can be used to calculate SFTS in *ppm/°C* by multiplying the quotient by 10^6 (1,000,000) instead of 100.

Zero-Degree Output Temperature Sensitivity (ZTS) is calculated using the following equation.

$$ZTS = \frac{ZeroOut_{T2} - ZeroOut_{T1}}{T2 - T1} = V/°C \qquad \textit{(or mA/°C or other units of measure)}$$

where ZeroOut is the output at 0° tilt measured at T1 and T2, the temperatures at which measurements were made.

Inertial Glossary

Natural Frequency (Fn):

That frequency at which the sensor's output lags the input by 90 degrees. It generally applies to a second-order response and is often useable for a response that is approximately second-order.

Noise:

See Output Noise

Nonlinearity:

The systematic deviation from the least squares straight line for input-output data relationships which nominally can be represented by a linear equation. Refer to the appendix for more on nonlinearity and the mathematical equations involved.

Operating Life:

The accumulated time of operation throughout which an inertial sensor exhibits specified performance when maintained and calibrated in accordance with a specified schedule.

Operating Temperature Range:

The range in temperature as defined by the extremes, at which the sensor is intended to operate within its specified thermal performance limits. Within this range of temperature all tolerances for temperature performance including error band, gradient error, zero shift and sensitivity shift apply.

Output Axis:

An axis of freedom provided with a pickoff which generates an output signal as a function of the output axis angle.

Output Axis Misalignment (M_{OA}):

The angular deviation or alignment error the sensor has between its output axis (true sensing axis) and the output reference axis as defined by the case. The basic Jewell equation is: $\text{Output Axis Misalignment } (M_{OA}) = (\text{Output}_{0^\circ} - \text{Output}_{180^\circ}) / 2$. Dividing the result with Scale Factor gives the misalignment in *g*. The *g*-result is converted to misalignment in degrees using the arc-sin function.

Inertial Glossary

Output Noise:

The AC component (rms, peak, or peak-to-peak) of a sensor's DC output that is present when all sensor input variations, electrical and mechanical, are absent. When evaluating the level of output noise, it is important to minimize input variations by measuring noise at a location that is free of seismic disturbances. Accelerometers and inclinometers respond to even the slightest seismic disturbances within the pass-band and that can easily add to the noise measured at the output, increasing the overall broadband noise and resulting in an inaccurate output noise measurement. Lower input range units are particularly plagued with this measurement problem due to their increased sensitivity to seismic noise.

Output Impedance:

The internal impedance of a device that is seen at its output terminals.

Output Range:

The product of input range and scale factor.

Output Reference Axis:

The axis direction that is nominally parallel to the output axis as defined by the case mounting surfaces or external case markings, or both.

Output Span:

The algebraic difference between upper and lower values that define the output range.

Overload Capacity:

The maximum acceleration a sensor is able to tolerate without permanent change in the specified performance characteristics when exposed to accelerations beyond the normal operating range.

Pendulosity:

The product of the mass and the distance from the center of the mass to the center of the support or pivot measured along the pendulous axis.

Pendulous Accelerometer:

An accelerometer employing a proof mass which is suspended in a manner permitting it to rotation about an axis that is perpendicular to an input axis.

Inertial Glossary

Pendulous Axis:

The axis defined by a line through the mass center of the proof mass, perpendicular to, and intersecting the output axis in pendulous devices. The positive direction is defined from the output axis to the proof mass.

Pendulous Axis Misalignment (M_{PA}):

The angular deviation or alignment error the sensor has between the pendulous axis (true sensing axis) and the pendulous reference axis as defined by the mounting case. The basic Jewell equation is: $\text{Pendulous Axis Misalignment } (M_{PA}) = (\text{Output}_{-90^\circ} - \text{Output}_{+90^\circ}) / 2$. The misalignment may at times be measured at angles other than ±90 degrees.

Pendulous Reference Axis:

The axis direction that is nominally parallel to the pendulous axis as defined by the case mounting surfaces or external case markings or both.

Pendulosity

A pendulous accelerometer's pendulosity, p, is the proof mass multiplied by the length from the mass's Center of Gravity (CG) to the hinge (pivots or taut band).

Pickoff:

A device which produces a signal output as a function of the relative linear or angular displacement between two elements. It is also referred to as a position detector.

Piezoelectric Accelerometer:

A device that employs a piezoelectric material as the sensing element. It is generally used as a vibration sensor and will not respond to a static acceleration input.

Pitch:

Angular displacement about an axis that is parallel to the lateral axis of a body.

Proof Mass:

The effective mass whose inertia transforms an acceleration or tilt along, or about, an input axis into a force or torque. The effective mass takes into consideration flotation and contributing parts of the suspension.

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Proportional-Integral-Derivative (PID) Controller:

A PID Controller is used to measure a process variable in order to regulate the process with respect to a desired setpoint. In principle the controller reads a process output, compares it to the setpoint to calculate an error, and then adjusts the process to minimize the error. The process is controlled by the weighted sum of three separate constant parameters. There is the proportional (P) term, which is a multiple of the present error and is referred to as the proportional gain constant. The integral (I) term, which is proportional to both the magnitude and duration of the error, and is multiplied by the integral gain to accelerate process correction towards the setpoint. Finally, the derivative (D) term, determined by the slope of the change in error over time and multiplied by the derivative gain, slows the rate of change to reduce overshoot and improve stability of the control loop. The PID controller is synonymous with the servo loop that is used for control of the torquer in Jewell inertial sensors.

Range:

The physical values over which a sensor is intended to measure an input, specified by upper and lower limits. For example, an inclinometer with a range of 30° will measure tilt from -30° through +30°.

Rectification Error:

A steady state output error that occurs while vibratory disturbances are acting on a sensor. Anisoelasticity is one reason for rectification error.

Repeatability:

The closeness of agreement among repeated measurements of the same variable and at the same sensor conditions following changes in conditions or when non-operating periods occur between measurements. It is often referred to as non-repeatability.

Repeatability, Turn-on:

Uncertainty of an output from a sensor when it may yield different outputs under the same input conditions after the sensor has been powered off and then back on. This is referred to as Bias Uncertainty when the sensor is at zero g input and power cycled off and on.

Resolution:

The largest absolute value of the minimum change in input needed, for inputs greater than the threshold, to produce a change in output equal to at least 50% of the output expected using the nominal scale factor. Typically Jewell measures it at the full scale input or at one-half the full scale input.

Inertial Glossary

Roll:

Angular displacement about an axis that is parallel to the longitudinal axis of a body.

Root-Sum-Square (RSS) Error:

The resultant error for several error sources (bias, misalignment, thermal, etc.) evaluated with the root-sum-square mathematical expression, which involves squaring each error value, summing the squares and then taking the square-root of the sum.

Scale Factor (SF):

The ratio of a change in output to a change in the input intended to be measured. Scale Factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range. Jewell typically specifies scale factor as the sensor units of output per g, such as Volts/g for example. See the appendix for how to calculate scale factor.

Scale Factor Temperature Sensitivity (SFTS):

The sensitivity defined by the ratio of change in scale factor to a corresponding change in temperature. Refer to Temperature Sensitivity in the appendix for the equation used to calculate SFTS.

Scale Factor Voltage Sensitivity:

The scale factor change resulting from a change of the input voltage to the sensor.

Sensitive Axis:

See Input Axis.

Sensitivity:

The ratio of the sensor output to input range. It is usually in units of *Volts per g* (*V/g*) or other similar units of measure and is the basic sensor transfer function used in calculations such as a sensor output to its corresponding input acceleration or tilt.

Sensor:

A device used to measure a physical input, such as temperature, light, pressure, displacement, acceleration, tilt, etc. and generate a usable output that can be read or interpreted.

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Servo:

The name given to a type of feedback system or mechanism whose operation is self-regulating.

Shock:

A mechanical shock is a sudden acceleration of short duration typically caused by an impact or explosion. Shock is measured in the same units as acceleration. As a performance characteristic, shock is specified as the highest shock level that the device can be exposed to without causing a permanent change or damage to the unit. The specified shock can be applied an infinite number of times.

Standard Deviation (*S*):

The standard deviation of a data set indicates the amount of spread data has from a mean value. Jewell commonly uses the standard deviation to evaluate non-linearity data. Refer to the appendix for the mathematical expression.

Stiction:

Two solid objects pressing against each other (but not sliding) will require some minimum level of force parallel to the surface of contact to overcome static cohesion. Stiction is the force threshold that overcomes the cohesion but is not continuous. In the case where two surfaces having areas less than a micrometer come into close proximity (as in an accelerometer), they may adhere to one another, because, at this scale, electrostatic and/or Van der Waals and hydrogen bonding forces become significant. The phenomenon of two such surfaces being adhered together in this manner is called stiction. Stiction may also result from the presence of surface contamination.

Storage Temperature Range:

The range in temperature as defined by the extremes, within which the sensor can be exposed while being stored or in an unpowered state that will not cause damage or change in performance.

Survival Temperature Range:

The range in temperature as defined by the extremes, within which the sensor will operate without damaged or degradation of performance that is permanent. Although the sensor will survive exposure to this temperature range, specified performance is not guaranteed when outside the operating temperature range.

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Thermal Sensitivity:

Thermal sensitivity is the change in output of the sensor due to a change in temperature within the operating temperature range.

Threshold:

The largest absolute value of the minimum input needed to produce a change in output equal to at least 50% of the output expected using the nominal scale factor. It is measured at a nominally zero g or zero degree input.

Transducer:

A device that receives energy in one form and converts it to another. Transducers are often used as a device to convert a physical or mechanical input to an electrical output that can then be measured.

Transverse Axis:

A transverse axis is an axis perpendicular to the input or sensitive axis of the sensor. The output axis and the pendulous axis are both transverse axes.

Vibration:

Vibration is a mechanical back-and-forth motion consisting of a single frequency or a range of frequencies. A sensor will respond to vibration with what is considered a useable output over its specified bandwidth. As an environmental characteristic, vibration is typically specified as the largest level, sine or random, that the sensor can be exposed to without physical damage or a permanent change in performance.

Vibration Rectification:

See Rectification Error.

Yaw:

Angular displacement about an axis that is parallel to the vertical axis of a body. Gravity referenced transducers, or inertial sensors such as Jewell produces, will not respond to yaw.

Zero-Degree (0°) Output Temperature Sensitivity (ZTS):

The sensitivity defined by the ratio of change in output with the sensor at zero degrees to a corresponding change in temperature. Refer to Temperature Sensitivity in the appendix for the equation used to calculate ZTS.

Inertial Glossary Appendix

In this appendix are mathematical equations and other information associated with selected terms in the glossary.

Damping Ratio:

The damping ratio is determined by using one of three test methods: phase-angle, output amplitude in dB or output amplitude in Volts. The relative accuracy that can be expected for damping ratio results is in the order given for the test methods below. The equations for calculating damping ratio using the test methods follow.

Phase-Angle Method: $D.R. = -0.75 \times \tan \emptyset$

where $\tan \Phi$ equals the input-output phase angle measured at one-half natural frequency.

Amplitude dB Method: $D.R. = \frac{10^{\left[\left(A_f - A_n\right)/20\right]}}{2}$

where A_f is the output flat response and A_n is the output response at the natural frequency.

Amplitude Volts Method: $D.R. = \frac{R_x}{2R_n}$

where R_x is the output response at a frequency at least 5 times less than the natural frequency and R_n is the output response at the natural frequency. This is the short form of the equation and it is important that the two response frequencies be at least 5 times apart.

Nonlinearity:

Sensor nonlinearity for a set of measured data points is derived from the slope intercept form of the straight line equation $Y = B_0 + B_1X$. In the equation B_0 is the y-intercept that represents sensor bias and B_1 is the slope that represents sensor scale factor. The sensor's data points are scattered about the line with some of them lying above the line and the rest below. How far individual data points lie from the line represents the sensor nonlinearity. The technique used at Jewell to derive the straight line from a set of measured data points is the regression or curve fitting process called the method of least squares.

The regression process fits a line equation to a set of X and Y data such that the best-fit curve has the minimum sum of the deviations squared (least square error) from the set of data.

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From a set of sensor input-output (random) measurements, the data regression is estimated by $\hat{y} = b_0 + b_1 x$, where b_0 is a constant (sensor bias), b_1 is the regression coefficient (sensor scale factor), x is value of the independent variable (sensor input, typically in g's) and $\hat{y}$ is the *predicted* value of the dependent variable (sensor output, typically in Volts or mA).

The regression coefficient, b_1, is obtained with the equation

$$b_1 = \sum [(x_i - \overline{x})(y_i - \overline{y})] / \sum [(x_i - \overline{x})^2],$$

and the constant, b_0, is obtained with the equation

$$b_0 = y - b_1 x.$$

Nonlinearity for the sensor is reported either as the worst-point deviation (the data point that lies furthest from the regression line) or more commonly by the standard deviation (see below for its equation).

Scale Factor:

A good all-around equation for determining scale factor of an inertial sensor is: $SF = \frac{O_2 - O_1}{I_2 - I_1}$

where O_2 equals the output signal measured at the higher input acceleration level, I_2 (or other linear input term for the sensor) and O_1 equals the output signal measured at the lower input acceleration level, I_1.

Standard Deviation (*S*):

Nonlinearity data is commonly evaluated at Jewell using the standard deviation. The equation used to compute it is: $S = \sqrt{\frac{1}{n-2}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2}$

Applying the standard deviation is accomplished with the breakdown of the equation into steps as follows:

1. Compute the mean of the data set,
2. Compute the deviation by subtracting the mean from each data in the set,
3. Square each individual deviation,
4. Add up the squared deviations,
5. Divide the sum by the sample size less 2 (*n-2*), and
6. Apply the square root.

Temperature Sensitivity:

The temperature sensitivity of a Jewell sensor is normally determined over two segments of the operating temperature range, which are room-to-cold and room-to-hot. The higher sensitivity result is the one reported.

Bias Temperature Sensitivity (BTS) is calculated using the following equation.

$$BTS = \frac{Bias_{T2} - Bias_{T1}}{T2 - T1} = V/°C \qquad \textit{(or mA/°C or other units of measure)}$$

where Bias is the bias calculated as given in the glossary definition of Bias and T1 and T2 are the temperatures at which measurements were made, where T2 is the higher temperature.

BTS can also be calculated with the result in *g* units as follows.

$$BTS = \frac{Bias_{T2} - Bias_{T1}}{(SF)(T2 - T1)} 10^6 = \mu g/°C,$$

where SF is defined by the Scale Factor glossary term.

Scale Factor Temperature Sensitivity (SFTS) is calculated using the following equation.

$$SFTS = \frac{FSO_{T2} - FSO_{T1}}{(FSO_{RT})(T2 - T1)} 100 = \%Reading/°C,$$

where FSO is the full scale output measured at T1 and T2, the respective temperatures at which FSO measurements were made. FSO_{RT} is the full scale output measured at room temperature.

The same equation can be used to calculate SFTS in *ppm/°C* by multiplying the quotient by 10^6 (1,000,000) instead of 100.

Zero-Degree Output Temperature Sensitivity (ZTS) is calculated using the following equation.

$$ZTS = \frac{ZeroOut_{T2} - ZeroOut_{T1}}{T2 - T1} = V/°C \qquad \textit{(or mA/°C or other units of measure)}$$

where ZeroOut is the output at 0° tilt measured at T1 and T2, the temperatures at which measurements were made.

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