RELIABLE, HIGH PERFORMANCE PRODUCTS — EXCEPTIONAL SERVICE

FEATURING: Precision 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.

Custom Application-Specific Solutions

Jewell Instruments provides both standard and custom solutions for a diverse group of industries, such as aerospace, medical, industrial, telecommunications, and rail markets. We manufacture our components completely in-house and work directly with our clients, maintaining control over the entire development processes. Our legacy of experience and success, and the expertise of our engineering team, mean customers benefit from extensive resources at their disposal.

Connecting Experience, Quality & Expertise

For over 60 years, Jewell Instruments has provided commercial and industrial sensors and controls, meters and avionics, and industrial test equipment solutions to a range of global markets. Our ISO 9001:2008 certification ensures that our customers receive products and systems with the dependability and reliability that their applications demand. Jewell Instruments' experienced engineering team works with customers to produce high quality, reliable products that meet or exceed their requirements.

Exceptional Customer Service

We specialize in reliability, value and responsiveness. Cooperation and joint planning between our engineering groups and our clients drive our customer care experience. We work as an extension of our customers' engineering and manufacturing teams to solve problems, improve applications, shorten lead-times and bring more value to their products and services. Superb customer support is the cornerstone of our many successful, long-term customer relationships.

Jewell Facilities

Jewell offers two, fully modernized manufacturing facilities, one in Manchester, New Hampshire and one in Barbados, West Indies.

Manchester Facility

Barbados Facility

Other Product Groups Available:

Rail Transportation Selector Guide

Force-Balanced Precision Acceleromter Selector Guide

Electrolytic Tilt Sensors and Accessories Selector Guide

Jewell Instruments is a world leader in the manufacture and distribution of panel meters, avionics components, inertial sensors, and precision solenoids. From sales and design, manufacturing and testing, and delivery and support, Jewell Instruments offers complete customer care and engineering expertise. We also offer two, fully modernized manufacturing facilities, one in Manchester, New Hampshire and one in Barbados, West Indies to handle the most stringent manufacturing requirements with a cost-competitive advantage.

Distributed By:

Jewell Instruments

ISO9001 CERTIFIED

www.jewellinstruments.com

Force-Balanced Precision Inclinometer
Selector Guide

Jewell Instruments

Inclinometer Selector Guide

Single Axis Inclinometers

LSO 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

Applications

- Steel Processing & Casting
- Heavy Off-road Contruction
- Structural Monitoring
- Train Automated Controls
- Rail Leveling & Grinding

LSR Series

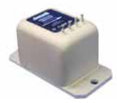
Features & Benefits

- ± 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 Mill Ladle Position
- Oil & Gas Well Bore Mapping
- Weapons Platform leveling
- Geophysical Monitoring
- Mobile Antenna Positioning

LCI Series[4]



Features & Benefits

- Std 5 Hz Bandwidth Cutoff
- <100 dB Signal to Noise
- Resolves Angles > 1mrad
- > 100 ppm/°C Temp Sens
- -55°C to +85°C Temp Range

Applications

- Laboratory Testing
- Telescope Vert Ref Cal
- Vehicle Wheel Align
- Educational Research
- Moment Detection Sys

LCF-100 Series

Features & Benefits

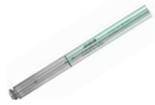
- Direct Bogie Mount
- Filtering Available 5-50 Hz Bandwidth
- Milli-g Bias & Scale Factor
- High level ±5Vdc Output
- -40°C to +80°C Temp Range

Applications

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

Dual Axis Inclinometers

LCF-196 Series



Features & Benefits

- Less > 0.02% Non-linearity
- Bias Temp Sens >50µg/°C
- Only 0.875" Dia Housing
- IP65 Sealed Housing
- 500g Shock Capability

Applications

- Strg Motion Data Logging
- Oil & Gas Well Logging
- Construction Monitoring
- Deviation Studies
- Test Platform Orientation

LCF-2330 Series

Features & Benefits

- ±1° to ±90° Input Full Range
- Micro Radian Resolution
- Available Internal Temp Sensor
- High level ± 5Vdc Output
- Low Impedance Output
- Fluid Damped

Applications

- 2-Axis Machine Tool Leveling
- Bridge Structural Monitoring
- Submersible Control Feedback
- Offshore Platform Stability
- Antenna Leveling & Orientation

LCF-2000 Series

Features & Benefits

- ±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

- Antenna Leveling
- Weapons Platforms
- Barge & Offshore Platform Leveling & Control
- Data Buoy Measurement
- Missile Launchers

Triple Axis Inclinometers

LCF-3000 Series

Features & Benefits

- ±1° to ±90° Input Full Range
- Tri-axis Applications
- Micro Radian Resolution
- High level ± 5Vdc Output
- Low Impedance Output
- Fluid Damped

Applications

- 3-Axis Machine Tool Leveling
- Bridge Structural Monitoring
- Antenna Leveling & Orientation
- Platform Orientation
- Geophysical Low Range Tilt Testing

Digital Inclinometers

DXI-100/200 Series

Features & Benefits

- Digital Output
- Resolution 8 µg
- Mechanical Shock 1500g 1msec ½ sine
- Industry Standard RS485 & RS422 Outputs
- High Precision and Performance
- Low Noise

Applications

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

Custom Applications

THE JEWELL INSTRUMENTS ENGINEERING TEAM PROVIDES THE FOLLOWING:

- Modifying or customizing an existing de-signed model series
- A new part number configured from existing model series part and subassemblies
- A new application-specific custom design requiring special features and specifications
- Customized sensor for harsh environments
- A first-time design solution requiring close interaction between Jewell's design engineer-ing team and customer's engineering team
- Design qualifications to industrial, military, and aerospace standards including FAA DO-160
- Sensors designed to meet EMC require-ments including lightning
- A customer proprietary sensors solution re-quiring non-disclosure agreement (NDA) be-tween Jewell Instruments and our customer

CUSTOM CAPABILITIES

- 4-20mA Output signal with single-ended 24 Vac Input
- Internal temperature sensor and thermal modeling for the highest levels of accura-cy over a wide temperature range
- Factory set zero biasing for non-horizontal measurements
- Solder terminals and flying leads in place of circular connector
- Custom inclinometer input ranges from +/-0.5 to +/-90.0 degrees available
- Custom accelerometer input ranges from +/- 0.017g to +/- 20.000g available
- Custom output impedance available
- Custom filtering to provide a bandwidth and response tailored to the application
- Custom mounting plates and mechanical assemblies

Performance Specs

	LSO					LSR					LCI				LCF-100				LCF-196			LCF-2330					LCF-2000					LCF-3000				DXI-100/200				
Input Range (°):	±1.0	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±90.0	±3.0	±14.5	±30.0	±90.0	±1.0	±14.5	±30.0	±90.0	±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	±3.0	±14.5	±30.0	±90.0	±1.0	±3.0	±14.5	±30.0	±60.0
Full Range Output (FRO V± 1.0%[4]):	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±5.0	±0.25	±0.50	±.87	±1.00	±2.00
Non Linearity (%FRO[2], Max.):	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.02	0.02	0.05	0.05	0.02	0.02	0.05	0.05	0.02	0.02	0.05	0.02	0.02	0.10	0.05	0.05	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.10	0.02	0.02	0.02	0.10	0.02	0.015	0.02	0.02	0.03
Scale Factor (V/g, Nom), %:	286.5	95.5	20.0	10.0	5.0	286.5	95.5	20.0	10.0	5.0	95.5	20.0	10.0	5.0	286.5	20.0	10.0	5.0	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	95.54	20.0	10.0	5.0	0.05	0.05	0.05	0.05	0.05
Scale Factor Temp Sens (PPM, %/°C, Max.):	400	300	100	60	60	400	300	100	60	60	100	100	100	100	100	100	100	100	100	100	100	300	300	100	60	100	200	100	100	100	100	100	100	100	100	0.01	0.01	0.01	0.01	0.01
Natural Frequency (Hz, Nom.[3]):	0.5	2.0	15.0	20.0	40.0	0.5	2.0	15.0	20.0	40.0	5.0	5.0	5.0	5.0	3.0	30.0	30.0	30.0	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	3.0	30.0	30.0	30.0	-	-	-	-	-
Bandwidth (-3db) (Hz, Nom.):	0.5	2.0	15.0	20.0	40.0	0.5	2.0	15.0	20.0	40.0	5.0	5.0	5.0	5.0	3.0	30.0	30.0	30.0	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	3.0	30.0	30.0	30.0	3.0	6.0	30.0	30.0	30.0
Input-Axis Misalignment (° Max.):	0.10	0.15	0.25	0.50	1.00	0.10	0.15	0.25	0.50	1.00	0.10	0.35	0.70	0.70	0.15	0.34	0.71	0.71	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	0.50	0.50	1.00	1.00	30.0	30.0	30.0	30.0	30.0
Output @ 0° Tilt (Bias) (V, Max), %/°C, m°/°C:	0.10	0.04	0.02	0.02	0.02	0.10	0.04	0.02	0.02	0.02	0.10	0.05	0.05	0.025	0.500	0.100	0.100	0.050	0.040	0.020	0.020	0.1	0.04	0.02	0.02	0.02	0.750	0.250	0.075	0.050	0.050	0.25	0.075	0.050	0.050	0.01	0.01	0.05	0.05	0.05
0° Output Temp Sensitivity (V/°C, Max.):	.005	.003	.001	.0005	.0003	.005	.003	.001	.0005	.0003	.0048	.0003	.0003	.0003	.015	.001	.0005	.0003	.0010	.0005	.0003	.0150	.0050	.001	.0005	.0003	.0150	.005	.0010	.0005	.0003	.005	.001	.0005	.0003	5.0	5.0	5.0	5.0	5.0
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	1.0	1.0	1.0	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	1.0	1.0	1.0	1.0	.001	.001	.001	.001	.001

Electrical

	LSO	LSR	LCI	LCF-100	LCF-196	LCF-2330	LCF-2000	LCF-3000	DXI-100/200
Number of Axis	1	1	1	1	2	2	2	3	1 or 2
Input Voltage (Vdc)	±12 to ±18	±12 to ±18	±12 to ±18	±12 to ±18	±12 to ±19	±12 to ±18	±12 to ±18	±12 to ±18	±10 to ±30
Input Current (mA, Nom.)	±15	±15	±25	±15	±15	±30	±30	±30	DXI-100 ±80 mA/DXI-200 ±100 mA
Output Impedance (Ohms, Nom.)	100	15000	100	100	100	100	100	100	-
Noise (Vms, Max.)	0.0020	0.0020	0.0005	0.0020	0.002 0.001 0.001	0.0020	0.0020	0.0020	0.005

Environmental

	LSO	LSR	LCI	LCF-100	LCF-196	LCF-2330	LCF-2000	LCF-3000	DXI-100/200
Operating Temperature Range	-18°C to +71°C	-18°C to +71°C	-55°C to +85°C	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C	-40°C to +70°C
Survival Temperature Range	-40°C to +71°C	-60°C to +90°C	-60°C to +90°C	-60°C to +90°C	-60°C to +90°C	-60°C to +90°C	-40°C to +90°C	-40°C to +90°C	-40°C to +70°C
Vibration	20 g	20 g		20 g	10 g	20 g	20 g	20 g	20 g
Shock	1500g, 0.5 msec, 1/2 sine	1500g, 0.5 msec, 1/2 sine	3 Foot Drop	1000g, 1 msec, 1/2 sine	500g, 1 msec, 1/2 sine	1000g, 1 msec, 1/2 sine	1000g, 0.001 msec, 1/2 sine	1000g, 1msec, 1/2 sine	1500g, 1msec, 1/2 sine
Seal	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Method 112	MIL-STD-202, Mtd 112	MIL-STD-202, Mtd 112

Mechanical

	LSO	LSR	LCI	LCF-100	LCF-196	LCF-2330	LCF-2000	LCF-3000	DXI-100/200
Weight	13.0 oz.	4.0 oz.	4.0 oz.	4.0 oz.	11 oz.	8.0 oz.	16 oz.	16.0 oz.	DXI-100 8.0 oz./DXI-200 10.0 oz.
Dimensions	1.60" W x 2.94" L x 1.70" H	1.43" Dia. x 1.60" H	1.50" W x 3.10" L x 1.50" H	1.50" W x 3.10" L x 1.50" H	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	2.88" W x 3.75" L x 2.75" H	1.62" W x 3.609" L x 1.83" H
Custom Ability	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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