

## ENGINEERED SENSOR SOLUTIONS

### Geotechnical & Structural Engineering

Tilt monitoring is a low cost, high accuracy monitoring method for geotechnical and structural engineering. Using tiltmeters, geotechnical engineers can directly monitor tilt deflection on structural components, sag on bridge decks and girders, settlement on building foundations, landslide slope stability, pitwall failures, and many other modes of structural movement. Because tiltmeters measure absolute position with respect to gravity, engineers can directly monitor and evaluate structural movement and performance over time. Tilts are also easily converted to mm/m displacement to create linear movement profiles. With no internal moving parts to break or wear-out, tiltmeters maintain excellent repeatability over time, and many Jewell tiltmeters have been in service for over 15 years! Jewell's high precision tilt sensors deliver reliable, high accuracy performance for geotechnical monitoring projects worldwide; contact us today about your engineering project.



### Specialized Research

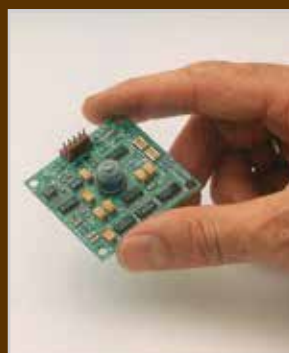


For over 30 years, Jewell tilt sensors have delivered high performance for scientific research applications. Our 500-Series products deliver unrivaled performance in the fields of geophysical and geodetic research, with up to 5 nanoradian resolution, while our 700 Series is the instrument of choice for volcanology research. Jewell's miniature tilt sensor packages offer similar precision for high-energy physics applications on synchrotrons and linear accelerator labs, where small size and peak performance are key. When precision and accuracy are essential, scientists choose Jewell Instruments.

Jewell's high precision tiltmeters and inclinometers are preferred by volcanologists, seismologists, geophysicists, high-energy physics researchers, synchrotron laboratories and radio telescope engineers worldwide.

### OEM & Industrial

Jewell Instruments offers a variety of low cost, high performance tilt sensors, ideal for OEM and industrial applications. With analog, digital, and 4-20mA output options you can customize Jewell sensors to your specific application requirements. Small and lightweight, Jewell's OEM sensor packages mount directly to critical system components without affecting performance. Our digital sensors also come with advanced, built-in firmware features including sample/hold, null-set, and high/low tilt switch & trigger functions. Jewell sensors are the instruments of choice for OEM providers worldwide; applications include robotics, industrial milling machinery, 4-20mA PLC systems, hydropower & dam gate equipment, and specialized scientific instrument packages.



### Custom Sensor Solutions



Jewell Instruments designs and manufactures a large selection of custom tilt sensor solutions for customers worldwide. From the enclosure to the electronics, our skilled engineering and sales staff can customize the ideal tilt sensor for your application. Jewell Instruments has provided custom sensor setups for deep-ocean research, offshore oil platforms, aerospace equipment, satellite testing facilities, radar positioning and control and more. No matter the requirements Jewell Instruments can design a sensor package to meet all your needs. Call us and see how our precision sensor solutions can help you make sense out of motion!

### Other Product Groups Available:



**Rail Transportation  
Selector Guide**



**Force-Balanced Precision  
Inclinometer Selector  
Guide**



**Force-Balanced Precision  
Accelerometer 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:



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## Electrolytic Tilt Sensors and Accessories Selector Guide



## RELIABLE, HIGH PERFORMANCE PRODUCTS — EXCEPTIONAL SERVICE

### FEATURING: Electrolytic Tilt Sensors and Accessories

Jewell's electrolytic tiltmeters and inclinometers are high performance, rugged tilt transducers designed to measure angle and deflection using an absolute gravity reference. Our precision electrolytic sensors respond to changes in slope as small as 5 nanoradians (0.01 arcsec), delivering exceptional performance for scientists, geotechnical engineers, measurement and control equipment, and industrial machinery. All Jewell tiltmeter packages also come with available DC analog, 4-20mA, or digital ASCII output, for peak signal performance.

### 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





## 900 Series

**A900**  
Analog Clinometer



**C900**  
Tulip 420



**MD908**  
IRIS Tilt-switch & Controller



**A904-T**  
Clinometer



**C904**  
Clinometer 420



**MD900-T**  
Digital Clinometer



**A906**  
Little Dipper



- Small modular design
- User programmable sampling features
- Analog, digital, or 4-20mA output available
- Convenient OEM package

- GPS Compatible – Trimble, NMEA XDR
- Robust IP65 housing
- Precision meets affordability
- Analog, 4-20mA, or digital output available

- Waterproof to 72 psi
- High accuracy, low drift
- Embeds directly into soil, concrete, or slurry walls

- Machine control systems
- ROV's, Robotics, Autonomous vehicle control
- Scientific instrument packages
- Data buoy pitch and roll measurement

- Platform leveling & positioning
- Machine/construction equipment, position & guidance
- Construction monitoring
- PLC control systems

- Slope stability studies
- Landslide monitoring
- Pit-wall and excavation stability
- Building foundation monitoring

## 800 Series

**A801**  
Tuff Tilt



**C801**  
Tuff Tilt 420



**D801**  
Tuff Tilt Digital



**A802**  
DeepWater



**C802**  
DeepWater 420



**D802**  
DeepWater Digital



**800P**  
Portable Tiltmeter



- Highly repeatable – up to 0.0002° or better
- Rugged IP65 waterproof design
- Excellent linearity over total range

- +3500 psi pressure rating
- Heavy duty 316 SS enclosure (6Al-4V Ti available)
- Highly corrosion resistant, excellent for marine applications

- <0.0002 mm/m sensitivity in a handheld package
- Out of the box "plug and play" operation
- Robust 304 SS, waterproof design

- High precision measurement and control
- Radial gate, radar platform, & industrial machinery positioning
- Geotechnical & structural engineering (building, bridge, & construction monitoring)

- Critical position/leveling on dry docks, offshore platforms, & marine equipment
- Subsea trenching and equipment positioning
- Deep ocean research
- Marine construction equipment guidance systems

## 700 Series

**A701-2**  
Platform Mount



**D701**  
Digital Platform Mount



**A711-2**  
Floor Mount



**D711**  
Digital Floor Mount



- High precision, to <0.000005° or better
- Powerful electronics drive cables to 1000m in length
- Available in floor and wall mount configurations
- IP65 waterproof versions available

- Radio telescope & radar antenna/platform leveling and positioning
- Advanced physics, astronomy, and geophysical research
- High accuracy geotechnical engineering; bridge deflection, sag, and pier monitoring
- Precision component alignment and metrology applications

## 500 Series

**520M**  
Geodetic Tiltmeter



**LILY**  
Self-Leveling Borehole Tiltmeter



- Ultra-high 5-10 nanoradian resolution
- Excellent signal to noise ratio for precision measurements
- Micrometer leveling legs deliver first class leveling performance

- Precision metrology
- Geodetic and earth movement research

- Ultra-high 5 nanoradian resolution
- +/-10 Self-Leveling range
- Powerful firmware: selectable sample/hold, on-board memory, and power mode features

- Geodetic, Volcano, and Geophysical Research
- Micro-deformation monitoring, fracture engineering
- Ground subsidence

## Performance Specs

Angular Range <sup>1</sup>	±10° ±25° ±50°	±10° ±25° ±50°	±10° ±25° ±50°	±10° ±25° ±50°	±10° ±25° ±50°	±10° ±25° ±50°	±12° ±30°	±0.5° ±3° ±50°	±0.5° ±3° ±50°	±3° ±50°	±3° ±50°	±3° ±50°	±5° ±50°	±5°	±0.46° ±8°	±0.5° ±5°	±0.46° ±8°	±0.5° ±5° ±70°	±1400 µrad	±330 µrad
Resolution	0.005° 0.01° 0.02°	0.005° 0.01° 0.02°	0.005° 0.012° 0.025°	0.005° 0.01° 0.02°	0.005° 0.01° 0.02°	±5.0° ±5.0° ±5.0°	0.005° 0.01°	.0001° 0.0006° 0.01°	0.0001° 0.0006° 0.01°	0.0001° 0.002°	0.0006° 0.01°	0.0006° 0.01°	0.002° 0.02°	0.0001°	.000005° .00005°	0.00005° 0.0005°	.000005° .00005°	.000005° 0.00005° 0.0001°	< 0.01 µrad	0.005 µrad
Repeatability	0.01° 0.02° 0.04°	0.01° 0.02° 0.04°	0.01° 0.01° 0.02°	0.01° 0.02° 0.04°	0.01° 0.02° 0.04°	0.01° 0.01° 0.02°	0.01° 0.01°	0.0002° 0.001° 0.02°	0.0002° 0.001° 0.02°	0.0003° 0.004°	0.001° 0.02°	0.001° 0.02°	0.002° 0.02°	0.004°	.000057° .00011°	<0.0002° 0.0005°	.000057° .00011°	<0.0002° 0.0005° 0.001°	0.01 µrad	0.005 µrad
Scale Factor	4.0 10.0 25.0	1.25 3.125 6.25	-	4.0 10.0 25.0	1.25 3.125 6.25	-	4.0 10.0	0.1 0.6° 10.0°	.0625° 0.375° 6.25°	- -	0.6 10.0	0.001° 0.02°	0.001° 0.02°	-	0.005 1.0	- -	0.005 1.0	- - -	2.0	-
Scale Factor Unit	°/V	°/mA	-	°/V	°/mA	-	°/V	°/V	°/mA	-	°/V	°/mA	°/mA	-	°/V	-	°/V	-	µrad/V	-
Non-Linearity, Half span (%) <sup>2</sup>	1.2	1.2	1.0	1.2	1.2	1.0	0.8	< 1.0 1.0 0.5	< 1.0 1.0 0.5	<0.1 <0.1	1.0 0.5	1.0 0.5	0.02° 0.02°	1.0	1.0 1.0	0.4 0.1	1.0 1.0	0.4 0.1 0.1	1.0	0.2
Time Constant (sec)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	1.75 1.75 0.15	0.15 0.15 0.15	0.15 0.15	1.75 0.15	0.15 0.15	0.15 0.15	0.40	7.5, 0.5 7.5, 0.5	0.15 0.15	7.5, 0.5 7.5, 0.5	0.15 0.15 0.15	10, 0.1	0.50
Natural Frequency (Hz)	10	10	7	10	10	7	10	3 3 7	3 3 7	3 7	3 7	3 7	3 7	-	0.8 1.3	3 3	0.8 1.3	3 3 7	0.8	0.8
Ks Temp Coefficient (%/°C) <sup>3</sup>	±0.03	±0.03	±0.03	±0.03	±0.03	±0.02	±0.03	±0.02 ±0.02 ±0.02	±0.02 ±0.02 ±0.02	±0.02 ±0.02	±0.02 ±0.02	±0.04 ±0.01	±0.02 ±0.02	±0.05	±0.05 ±0.05	±0.02 ±0.02	±0.05 ±0.05	±0.02 ±0.02 ±0.02	±0.05	±0.02
Kz Temp Coefficient (bias/°C) <sup>4</sup> (arc sec)	±10	±10	±10	±10	±10	±10	±5	±0.7 ±0.7 ±7.2	±0.7 ±0.7 ±7.2	±0.7 ±14.4	±0.7 ±7.2	±0.7 ±7.2	±0.7 ±14.4	±3.6 arc sec	±0.6 ±3.6	±0.72 ±0.72	±0.6 ±3.6	±0.72 ±0.72 ±14.4	±2.0 µrad	±3.0 µrad/°C

## Electrical

Available Channels	X-tilt, Y-tilt, °C	X-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, Y-tilt, °C	X-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, Y-tilt, °C	X-tilt, °C	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, °C	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, °C	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	X-tilt, Y-tilt, °C	X-tilt, Y-tilt, °C, S/N	
Sensor Output	±2.5V DC, 0-5V DC	4-20mA	±15 to ±10	±2.5V DC, 0-5V DC	4-20mA	ASCII, RS232/RS422	±3V DC	±5V DC	4-20mA	ASCII, RS232/RS422	±5V DC	4-20mA	ASCII, RS232/RS422	±5V DC	±8V DC	ASCII, RS232/RS422	±8V DC	ASCII, RS232/RS422	±8V DC	±8V DC	ASCII, RS232/RS422	±8V DC	ASCII, RS232/RS422
Power Requirements	8-24V DC	112-29V DC	±25	8-24V DC	12-29V DC	7-28V DC	8-24V DC	9-24V DC	12-29V DC	7-28V DC	9-24V DC	12-29V DC	7-28V DC	9-24V DC	±12V DC	7-28V DC	±12V DC	7-28V DC	±12V DC	±12V DC	7-28V DC	±12V DC	7-28V DC

## Environmental

Operating Temperature Range	-40° to +85°C	-40° to +85°C	-30°C to +70°C	-40° to +85°C	-40° to +85°C	-40° to +85°C	-25° to +70°C	-25° to +70°C	-40° to +85°C	-25° to +70°C	-25° to +70°C	-40° to +85°C	-25° to +70°C	-25° to +70°C	-8° to +70°C	-25° to +70°C	-8° to +70°C	-25° to +70°C	-25° to +70°C	-8° to +70°C	-8° to +70°C	-8° to +85°C
Storage Temperature Range	-40° to +85°C	-40° to +85°C	-40°C to +70°C	-40° to +85°C	-40° to +85°C	-40° to +85°C	-25° to +70°C	-30° to +100°C	-40° to +85°C	-30° to +100°C	-30° to +100°C	-40° to +85°C	-30° to +100°C	-30° to +100°C	-25° to +70°C	-30° to +100°C	-25° to +70°C	-30° to +100°C	-30° to +100°C	-8° to +70°C	-25° to +85°C	
Seal/Depth Rating	-	-	-	IP65	IP65	IP65	72 psi, Waterproof	IP65	IP65	IP65	3500 psi, Submersible	3500 psi, Submersible	3500 psi, Submersible	IP65, Waterproof	Waterproof Epoxy	IP65	Waterproof Epoxy	IP65	IP65	Nitrile O-ring	3000 psi, Submersible	

## Mechanical

Weight	0.5 oz. (15 g)	0.5 oz. (15 g)	1.1 oz. (31 g)	16 oz. (400 g)	16 oz. (400 g)	19 oz. (550 g)	12 oz. (350 g)	24 oz. (600 g)	17.6 oz. (500 g)	24 oz. (600 g)	11 lb. (5 kg)	11 lb. (5 kg)	11 lb. (5 kg)	6 lb. (2.7 kg)	3 lb. (1.4 kg)	3 lb. (1.4 kg)	3 lb. (1.4 kg)	3 lb. (1.4 kg)	10 lb. (4.5 kg)	10 lb. (4.5 kg)
Dimensions in cm (LxWxH)	5.1 x 5.1 x 1.6 11 x 2.3 x 2.3	11 x 2.3 x 2.3	6.7 x 6.7 x 2.5	12 x 8 x 6	12 x 8 x 6	12 x 8 x 6	24 x 3.9 O.D.	12 x 8 x 6	12 x 8 x 6	12 x 8 x 6	15.2 x 10.2 x 8.9	15.2 x 10.2 x 8.9	15.2 x 10.2 x 8.9	11.1 x 6.2 x 3.2	15 x 15 x 10	15 x 15 x 10	15 x 15 x 10	15 x 15 x 10	9.1 x 9.1 x 5.0 inches	91.5 x 5.1 O.D.
Enclosure	OEM	OEM	OEM	Powder Coated, Die-cast Al	Powder Coated, Die-cast Al	Powder Coated, Die-cast Al	ABS Plastic	Powder Coated, Die-cast Al	Powder Coated, Die-cast Al	Powder Coated, Die-cast Al	316 SS 6Al-4V Ti	316 SS 6Al-4V Ti	316 SS 6Al-4V Ti	304 SS, Powder Coated Plastic	Anodized, Painted Al	Anodized, Painted Al	Anodized, Painted Al	Anodized, Painted Al	Anodized Al	304 SS, 6Al-4V Ti

NOTE: Specifications are subject to change without notice. For complete specifications, instrument capabilities, and ordering information please visit www.jewellinstruments.com 1 - Custom Ranges also available on request 2 - Linearity represents maximum deviation from linear regression line, typical; <.05% linearity or better achievable using a 5th order polynomial 3 - Ks = % change in scale factor per °C 4 - Kz = bias shift per °C.