

The RDI Series of Digital Inclinometers is a Complete Angle Monitoring and Early Tilt Warning System



Features

- Single or Dual Axis Measurement
- Custom Input Ranges from $\pm 4^\circ$ to $\pm 100^\circ$
- LCD Displays Angle in Degrees
- 0.1° or 0.01° Display Resolution
- Relative Zero Function
- Minimum/Maximum Display

Options

- LCD Displays Angle in Percent Grade
- Analog 0...5VDC Output
- RS232 Serial Output
- Up to 4 Open Collector Switch Outputs
- Adjustable Trip Angle Settings
- High Current-Sink Capability
- Lamp/Solenoid/Relay Driver

Applications

- Slope Warning System
- Roll Over Early Warning
- Platform Leveling
- Pitch and Roll Monitoring
- Vehicle Tilt Monitoring
- Antenna Positioning
- Boom Angle Indicating
- Safe Curve Speed Assignment (Ball Banking)
- Sound System Remote Speaker Alignment
- Mining/Boring Equipment Leveling
- Bang-Bang Type Valve Controller

Description

The RDI provides single or dual axis inclination sensing in a rugged environmentally protected housing. This is a semi-custom unit where all subassemblies are stock but specific functions are customized. A modular design allows the customer to select the measurement range, output type, and temperature compensation that best suits the individual application. Standard input ranges $\pm 10^\circ$, $\pm 30^\circ$ and $\pm 70^\circ$ are available for both single and dual axis models - these can be scaled to specific ranges (ie: $\pm 45^\circ$) per axis. Special single axis ranges up to $\pm 100^\circ$ are available. Non-symmetrical (or scalable) ranges (ie: -10° to $+90^\circ$) are available for applications that only tilt in one direction.

The RDI can be supplied with multiple output configurations: Digital LCD Display, Analog Voltage output, Digital Serial RS232 output, and up to four (4) Open Collector Switch Outputs providing maximum functionality.

The LCD displays angle in degrees " $^\circ$ ", or optional percent grade "%", or inch per foot rise with either 0.1 or 0.01 degree resolution. The display models come standard with 3 built in LED's (1 green, 1 yellow, and 1 red). These can be activated to trip at predefined angles within the specified measurement range - providing the operator a bright visual warning signal. Optional field adjustable trip angle setting available.

Examples of LED programming:

For leveling applications - the LED function is set so the green LED turns on when level then switches to yellow or red when out of level; For indication of safe and unsafe conditions (such as preventing vehicle rollover) - the green light would indicate the vehicle is within the safe operating zone, the yellow light would indicate a warning zone, and the red light would indicate the vehicle is on a slope that exceeds the recommended safe operating zone - giving the operator a bright visual immediate danger signal to return to more even ground.

Optional Temperature Compensation can be added depending on the required accuracy over temperature (recommended based on operating temperature). For applications that require remote angle measurement (the sensor unit is mounted separately from the Display box) we offer remote display inclinometer packages.

Optional analog voltage (0.25...4.25V) output is available - a 12 bit digital to analog converter is used to perform the conversion.

Optional digital RS232 output is presented in decimal format in degrees, percent grade, or inch per foot rise. The output is formatted one reading per line for single axis units and two readings per line for dual axis units. The first reading for a dual axis unit represents channel 1 (typically side to side/roll) and the second reading represents channel 2 (typically front to back/pitch). The dual RDI can also be configured with both channels reading along the same axis for double redundancy.

Optional Open Collector Switch Outputs (up to 4) can be factory set to switch at a predetermined angle anywhere within the selected measurement range. The switching function can be configured for either Normally Open for out of range indication or Normally Closed for in range indication. The outputs can be used to drive an external buzzer, horn, lamp, solenoid, or relay allowing for audible and/or visual warnings and equipment shut down control. Each switch output can be delayed from 0 to 16 seconds to help eliminate false triggering. Available in both display and non-display models, with a display model the outputs are tied directly to the LED's on the front panel and are configured to indicate when switching occurs for the open collector switch outputs. Optional field adjustable trip angle settings available.

All RDI LCD display models provide a Relative Zero and a Minimum/Maximum Angle function as a standard feature, certain options selected may be substituted. The Relative Zero (REL) allows the operator to temporarily zero the digital readout to obtain relative slope changes. The operator will always know when the device is in the REL mode by the (*) symbol that is displayed after the angle. The Minimum/Maximum Angle (MIN/MAX) function provides the smallest and largest angle the device has sensed since the last reset.

Most all RDI packages are powered by external 8-30VDC non-regulated input supply (default), with optional 9V battery, 110VAC or 240VAC wall or cigarette lighter adaptor. Interface cables available for remote packages, special connectors available based on application and operating environment.

RDI Sample Models



RDR Remote Sensor Package



RDS7-BB Ball Bank Indicator



RAD Remote Angle Display



RAS Remote Angle Display



Non-Display Output Only



INPUT PARAMETERS			
Measuring Angle Ranges	Standard: $\pm 10^\circ$, $\pm 30^\circ$, $\pm 70^\circ$ Scalable: Symmetrical $\pm 4^\circ$ min to $\pm 70^\circ$ max (single axis up to $\pm 100^\circ$) Scalable: Non-Symmetrical anywhere within full scale of range (ie: -10° to $+90^\circ$)		
Measurement Axes	Single or Dual		
Axis Mounting	Any Direction		
Power Supply	8 to 30 VDC Non-Regulated, (5VDC Regulated optional)		
Current Consumption	Display Version (Without LED): 15mA typical Display Version (One LED): 35mA typical Max All Options: 100mA max.		
OUTPUT PARAMETERS			
Non-Linearity ¹	< 0.5% FR		
Null Repeatability	< 0.05°		
Transverse Sensitivity	< 1.0% at 30° Tilt		
Response Time	< 0.3 seconds (300mSec), (slower response times available)		
Temperature Drift of Sensitivity ²	< -0.17%/°C for $\pm 10^\circ$ models and lower < -0.12%/°C for models greater than $\pm 10^\circ$		
Temperature Drift of Zero ²	< ± 0.05 mV/°C for $\pm 10^\circ$ models and lower < ± 0.025 mV/°C for models greater than $\pm 10^\circ$		
Temperature Compensation Output Drift	< $\pm 1.0^\circ$ (over full operating temperature range)		
Output Units	Degrees, (Percent Grade optional)		
DISPLAY PARAMETERS			
LCD Display	Single Axis: Single Line Display, Dual Axis: Dual Line Display		
Display Resolution	Standard: 0.1°, (0.01° optional)		
Min / Max Readings	Stored in Volatile Memory		
Relative Zero	Stored in Volatile Memory		
Display LED ³	1 green, 1 yellow, 1 red (Activated per customer request)		
ANALOG VOLTAGE 0-5V OUTPUT			
Analog Voltage Output	2.25 \pm 2.0 VDC		
Voltage Resolution	$\pm 10^\circ$	$\pm 30^\circ$	$\pm 70^\circ$
	< 0.01°	< 0.02°	< 0.04°
DIGITAL SERIAL RS232 OUTPUT (DECIMAL OUTPUT)			
Baud Rate	9600		
Data Bits	8		
Parity	None		
Stop Bits	1		
OPEN COLLECTOR SWITCH OUTPUT			
Open Collector Outputs	Up to 4 available for activation		
Open Collector Current	1A each		
Switch Function	Normally Open: out of range indication, Normally Closed: in range indication		
Switch Trip Delay	0 to 16 seconds		
Switch Trip Angles	Factory set anywhere within range, (Adjustable Trip Setting optional)		

MECHANICAL CHARACTERISTICS		
Housing	Die Cast Aluminum – Painted Black	
Environmental Rating	Nema 4	
Mounting Holes	Two M4 x 0.7 or Two #8-32 (Mounting Feet Optional)	
Outline Dimensions	4.54" x 3.54" x 2.27" (115 x 90 x 56mm) See Drawing	
Electrical Connection	15 pin Din (Refer to Wiring); alternative connectors available	
Weight	16 ounces (not including cable)	
Operating Temperature	Display Models	Non-Display Models, Storage
	-20°C to +70°C, (-4°F to +158°F)	-40°C to +85°C, (-40°F to +185°F)

Notes: 1. Non-linearity generated by best fit straight line using least squares regression. Output is linear with respect to the input angle directly. 2. Sensor Temperature Drifts apply to Non-Temperature Compensated versions. 3. LED trip angles can only be set within the measuring range of the device and must match the open collector switch outputs if they are selected.

FIGURE 1: Dimensions (Inches [mm]) and Mounting Position (showing single and dual axis configurations)

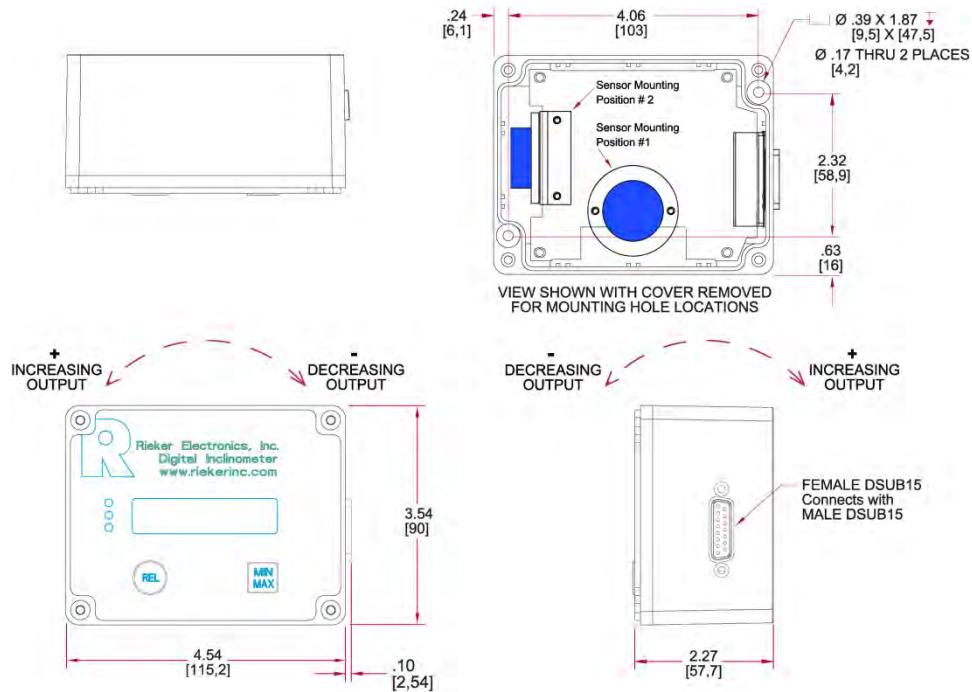


FIGURE 2: DSUB Wiring Connector for Input Power and Selected Outputs

