Servo Inclinometer AILSO

Datasheet

AILSO

Extremely rugged Gravity-referenced Servo Inclinometer

- Ranges ±1° to ±90°
- Non-Linearity 0.02 % FRO to 0.08 % FRO, depends. on model and range
- Excitation Voltage ±12 ... ±18 VDC (V signal), 20 ... 30 VDC (mA signal)
- Output Signal ±5 V or 4 ... 20 mA

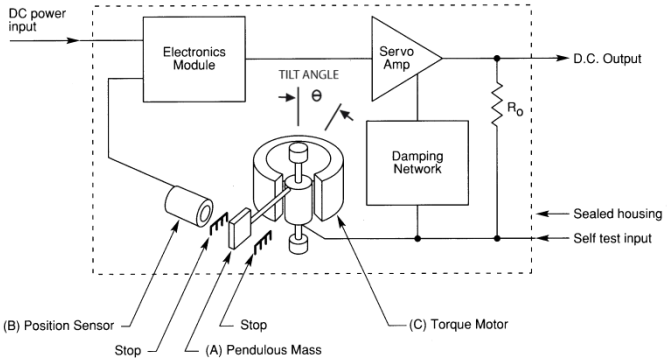
The AILSO Series is a high precision gravity referenced servo inclinometer that can be used for a wide variety of industrial and military applications. Models are available in a variety of ranges with low impedance output signal or with 4 to 20 mA output (version L). Electrical terminations are via 6-way connector (AILSOC) or solder pins (AILSOP).

Applications

- Bore-hole mapping, dam and rock shifts and other geophysical, seismic and civil engineering studies
- Ballast transfer systems for offshore barges, ships and other marine applications
- Level control and calibration systems
- Pipeline levelling, setting tilt of grading machines, crane overturning-moment alarms, and other heavy duty construction control requirements
- Large machinery installation and other electronic level applications

Principles of Operation

This type of inclinometer is a precision inertial instrument (accelerometer) that responds to the normal component of the gravitational acceleration vector (gravity). Pendulous mass (A) is attached to the torsionally suspended armature of torque motor (C). Stops on either side of the mass (A) limit its travel when the device is not powered. When the power is applied, the pendulous mass (A) automatically moves to its "zero" position.



As the inclinometer is tilted through some angle (θ) along its sensitive axis, mass (A) tries to move in the direction of tilt as a result of a force (torque) applied to the mass by normal component of gravitation acceleration. The resulting change in position of mass (A) is detected by position sensor (B), which produces an error signal output. This DC error signal is fed to a servo amplifier whose output is a DC current coupled to the armature of torque motor (C) through R_o. Current applied to the torque motor armature produces a torque that opposes the gravitational force acting on the mass (A) and moves it back toward its original position. When the torque developed by the servo system output current just balances the torque developed by the gravity vector component acting on pendulous mass (A), the mass no longer moves and is at rest almost in its original position, being displaced by some minute amount that produces the required error signal from position sensor (B). Because the gravity component's force is exactly equal in magnitude to the torque motor's output, which, in turn, is directly proportional to the applied current, this current, passed through R_o generates a voltage across R_o that is proportional to the normal component of the gravity vector. The normal component is the product of the essentially constant gravity vector times the sine of angle (θ). Therefore, the output voltage, E_o x across R_o is proportional to the sine of the tilt angle θ.

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General Specification for Voltage and Current Output

Operating Temperature Range	-18 ... +70 °C	
Survival Temperature Range	-40 ... +70 °C	
Constant Acceleration Overload	50 g	
Shock Survival	1500 g, 0.5 ms, ½ sine	
Vibration Endurance	35 g rms, 20 Hz to 2000 Hz sinusoidal	
Environmental Sealing	IP65	
EMC Directive	EN61326: 1998	
EMC Emissions	EN55022: 1998	30 MHz to 1 GHz
EMC Immunity	EN61000-4-2: 1995 inc A1: 1998 & A2: 2001 EN61000-4-3: 2002 EN61000-4-4: 2004 EN61000-4-6: 1996 inc A1: 2001 EN61000-4-6: 2007 EN61000-4-8: 1994 inc A1 : 2001	±4 kV 10 V/m ±1 kV 3 Vrms 10 Vrms 30 A/m

Specification for Voltage Output @ 20 °C

Range		**±1°**	**±3°**	**±14.5°**	**±30°**	**±90°**
Excitation Voltage	VDC	±12 to ±18				
Current Consumption	mA (nom)	±15				
Full Range Output (FRO)*1	VDC	±5				
Output Standardisation	% FRO	±1				
Output Impedance	Ω	less than 10				
Output Noise (DC to 10 kHz)	V rms (max)	0.002				
Non-Linearity *2	% FRO (max)	0.05	0.05	0.02	0.02	0.05
Non-Repeatability	% FRO (max)	0.04	0.02	0.004	0.002	0.001
Resolution	arc seconds	0.1	0.2	1.0	2.0	4.0
-3 dB Frequency	Hz	0.5	2	15	20	40
Sensitive Axis-to-Case Misalignment	deg (max)	±0.1	±0.15	±0.25	±0.5	±1.0
Cross-axis Sensitivity *3	% FRO (max)	0.2				
Zero Offset *4	VDC (max)	±0.05	±0.04	±0.03	±0.02	±0.02
Thermal Zero Shift	% FRO/K (max)	0.05	0.03	0.01	0.005	0.003
Thermal Sensitivity	% Reading/K (max)	0.04	0.03	0.01	0.006	0.006

Specification for Current 4 ... 20 mA Output @ 20 °C

Range		**±3°**	**±14.5°**	**±30°**	**±90°**
Excitation Voltage	VDC	20 to 30			
Current Consumption	mA (nom)	35			
Full Range Output (FRO) *1	mA (nom)	16			
Output Load Resistance	Ohm (max)	400			
Output Standardisation	% FRO	±1			
Output Noise (DC to 10 kHz)	mA	0.02			
Non-Linearity *2	% FRO (max)	0.08	0.05	0.05	0.08
Non-Repeatability	% FRO (max)	0.02	0.004	0.004	0.004
Resolution	arc seconds	0.4	2.0	4.0	8.0
-3 dB Frequency	Hz	2	15	20	40
Sensitive Axis-to-Case Misalignment	deg (max)	±0.15	±0.25	±0.5	±1.0
Cross-axis Sensitivity *3	% FRO (max)	0.2			
Output at Zero Angle	mA (nom)	12			
Zero Angle Output Tolerance*4	mA (max)	±0.1	±0.07	±0.07	±0.07
Thermal Zero Shift	% FRO/K (max)	0.05	0.02	0.01	0.01
Thermal Sensitivity	% Reading/K (max)	0.05	0.02	0.01	0.01

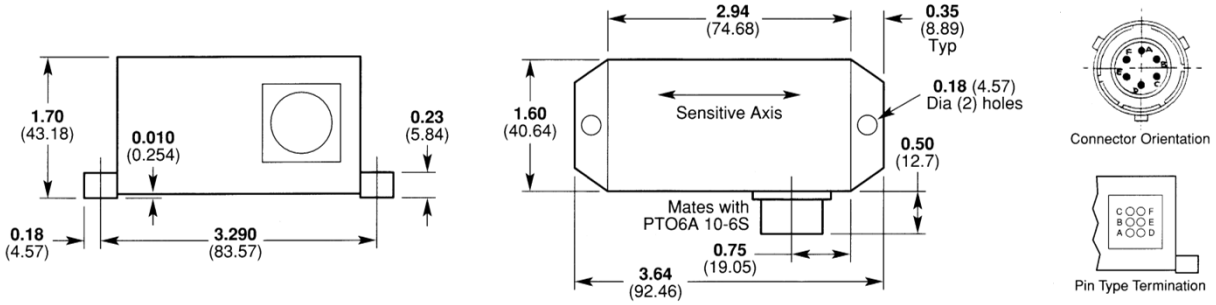
Notes

1. Full Range Output is defined as the full angular excursion from positive to negative, i.e. ±90° =180°
2. Non-linearity is determined by the method of least squares.
3. Cross-axis Sensitivity is the output of unit when tilted to full range angle in cross-axis.
4. Zero offset is specified under static conditions with no vibration inputs

Electrical Connections

	Voltage Output	Current Output (4 ... 20 mA)
Pin A	Supply +15 VDC	Supply 20 to 30 VDC
Pin B	0 V common	0 V common
Pin C	Supply -15 VDC	not used
Pin D	Output	Output 4 ... 20 mA
Pin E	not used	not used
Pin F	Self Test	not used

Dimensions



Model AILSOC: Connector Termination
Dimensions inch (mm), approx. values

Ordering Information

AILSO [ ] - [ ] [ ]

Series Number

C = Connector
P = Solder pins

Range

blank = Voltage Output
L = 4 ... 20 mA Output

Examples:

AILSOC-14.5: connector, ±14.5° range, output ±5 VDC

AILSOP-30: solder pins, ±30° range, output ±5 VDC

AILSOC-14.5L: connector, ±14.5° range, output 4 to 20 mA

AILSOP-90L: solder pins, ±90° range, output 4 to 20 mA

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