



Tuff Tilt 420 4-20mA Clinómetro de Precisión

El Clinómetro **Tuff Tilt 420** combina precisión y estabilidad a largo plazo la durabilidad y robusto en un instrumento compacto y confiable. El elemento de detección interno es un sensor de inclinación de cerámica referido a la gravedad que entrega una alta gama dinámica y la mejor resolución que cualquier sensor en su clase. Ensamblado en un gabinete a prueba de mal tiempo, este clinómetro se puede utilizar al aire libre y en ambientes mojados.



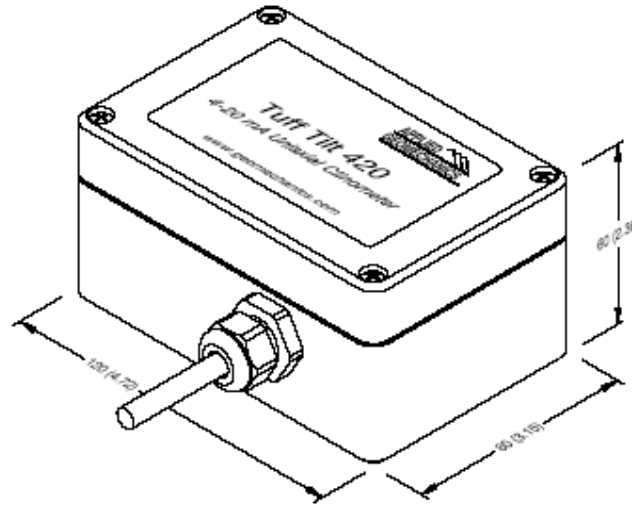
El **Tuff Tilt 420** genera un lazo de corriente, así que las mediciones de inclinación se pueden hacer con cables largos usando un par económico de dos hilos. Como un beneficio adicional, también mide temperatura usando un termistor incorporado. Los usos típicos incluyen:

- Supervisión del funcionamiento de puentes, presas y de otras estructuras grandes. supervisión de construcción (versión estándar)
- Nivelación de antena y buscador del zenith (versión high-gain)
- Medición de la posición angular de puertas y de otra maquinaria (versión gran angular)

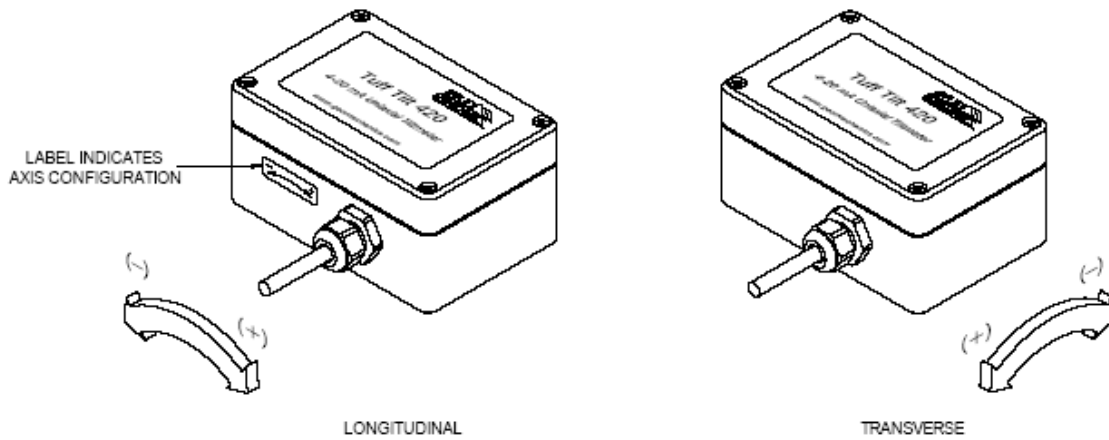
	High-Gain Version	Standard Version	Wide-Angle Version
ANGULAR RANGE	±0.5 degree (1 degree span)	±3 degrees (6 degrees span)	±50 degrees* (100 deg. span)
SCALE FACTOR	0.0625°/ mA typical	0.375°/ mA typical	6.25°/ mA typical
RESOLUTION	<0.0001 degree (<1.75 μradians)	0.0006 degree (10 μradians)	<0.01 degree
REPEATABILITY	<0.0002 degree	0.001 degree	0.02 degree
LINEARITY	1% of full span	<2% of full span	0.5% of full span
NATURAL FREQUENCY	3 Hz	3 Hz	7 Hz (critically damped)
TEMPERATURE COEF.	Scale factor: $K_s < 0.04\%/^{\circ}C$ typ. Zero shift: $K_z = \pm 0.0002$ degree/ $^{\circ}C$ typ.		$K_s < 0.1\%/^{\circ}C$ typ. $K_z = \pm 0.002$ degree/ $^{\circ}C$ typ.
TILT OUTPUT	4-20 mA two-wire current loop		
TIME CONSTANT, T	150 msec; output is proportional to $1 - e^{-t/T}$ where t time in seconds		
TEMPERATURE OUTPUT	Temperature is measured with a 2500 Ohm thermistor, -50 to +150°C range		
POWER REQUIREMENTS, V_s	$(0.02 \text{ Ampere} \times R + 10 \text{ VDC}) < V_s < 29 \text{ VDC}$ where R is the resistance of the shunt resistor and loop wiring in Ohms		
ENVIRONMENTAL	-40° to +85°C operating and storage		
ENCLOSURE & MOUNTING	Painted, die-cast aluminum box, 120 x 80 x 60 mm. Remove lid to access four mounting holes.		
CABLE	3m (10 ft), multiconductor + one overall shield, PVC jacket, tinned ends		
WEIGHT	1.1 lb (500 g)		

Useful Accessories	Part No.
Vertical mounting bracket	81439
Horizontal mounting plate	84051
Additional cable, specify length	70369
6-pin in-line receptacle	62204
6-socket in-line plug	62202

Tuff Tilt 420 Order Numbers			
	Transverse Tilt	Longitudinal Tilt	Biaxial
High Gain	98008-01	98008-04	98046-01
Standard	98008-02	98008-05	98046-02
Wide Angle	98008-03	98008-06	98046-03

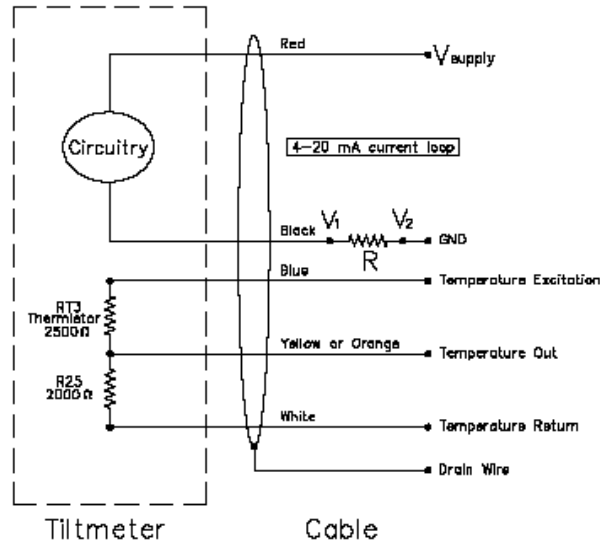


DIMENSIONS: mm (In.)



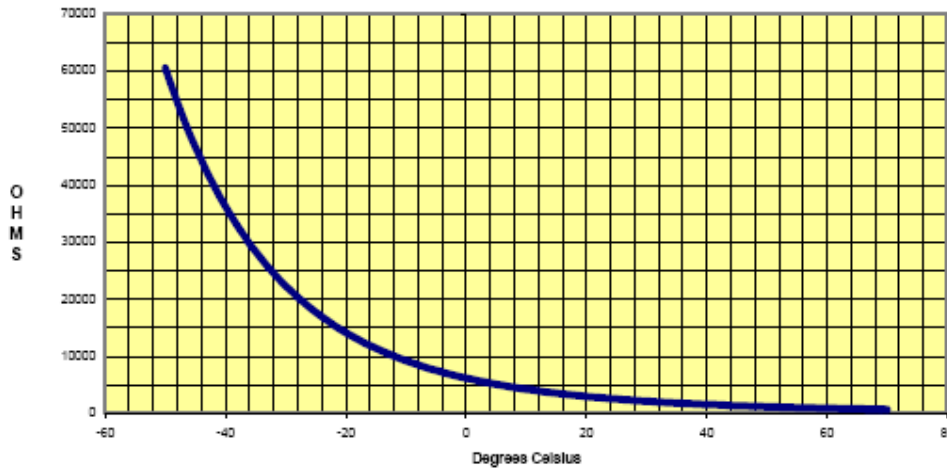
Uniaxial tiltmeters are available with longitudinal (Y) or transverse (X) tilt configuration.
Biaxial tiltmeters include both tilt directions (X and Y).

Tuff Tilt 420: Wire Color Code		
Function	Wire Color (Uniaxial)	Wire Color (Biaxial)
Loop Power (Vsupply)	Red	Red (X), Green (Y)
Loop Return (Ground)	Black	Black (X), White (Y)
Temperature Excitation (up to 12V)	Blue	Blue
Temperature Out	Yellow	Yellow
Temperature Return	White	No Connection
Drain Wire (Shield)	Bare (Clear)	Bare (Clear)



The **Tuff Tilt 420** current signal is measured indirectly using a shunt resistor, R . Ohm's Law states that $V_1 - V_2 = IR$, where I is current in Amperes, R resistance in Ohms, and V_1 and V_2 the voltages measured on opposite sides of the shunt resistor. The diagram above is for uniaxial tiltmeters. See the table on the preceding page for biaxial tiltmeters. Temperature measurement using the onboard thermistor is diagrammed below.

Resistance vs. Temperature for 2500 Ohm Thermistor with B Type Curve
(U.S. Sensors LR252B1K)

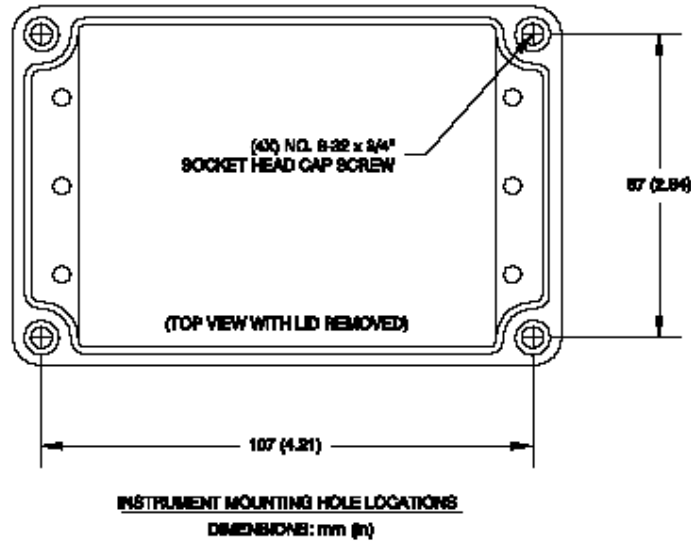


$$T = 1/[A + B \ln(RT3) + C \ln(RT3)^3 + D \ln(RT3)^5] - 273.15$$

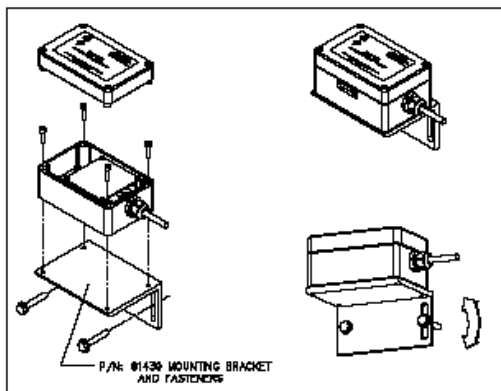
where T is in degrees Celsius and $RT3$ = thermistor resistance.

$$A = 7.34862E-04, \quad B = 3.38205E-04$$

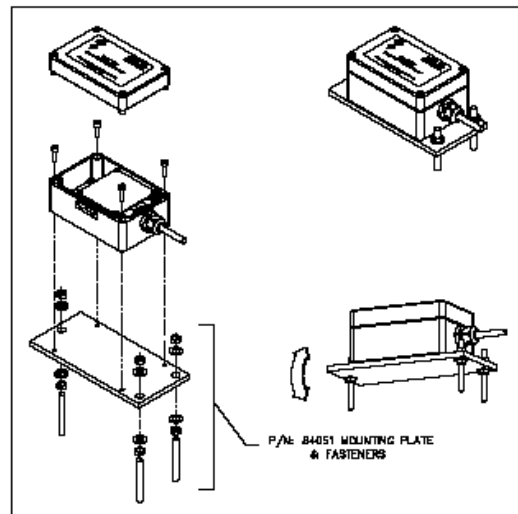
$$C = -1.30862E-07, \quad D = 1.21751E-09$$



Mounting holes are accessed by removing lid of tiltmeter.
Use 8-32 or 4 mm screws.



For mounting on vertical surfaces: Order the 81439 Mounting Bracket Assembly, which includes complete hardware.



For mounting on horizontal surfaces: Screw the tiltmeter directly to the surface, or order the 84051 Mounting Plate Assembly, which includes complete hardware.