

# Accustar® Electronic Clinometer



## Introduction

The Accustar® Electronic Clinometer is an extremely accurate angle measurement device. This compact and rugged sensor is ideal where space is critical and environmental conditions are serious design concerns.

The heart of the system is a patented, capacitance based sensor without any moving parts. When rotated about its sensitive axis, this unique sensor provides a linear variation in capacitance, which is electronically converted into angular data. The sensor and low-power CMOS electronics are encased in a rugged plastic housing.

Designed for easy integration, with a choice of analog, ratiometric, digital or serial models, the clinometer produces an output signal corresponding to direction and magnitude of angular displacement.

The Accustar® Electronic Clinometer complies with International EMC and EMI Standards and is **CE** marked.

## Applications

- Wheel alignment
- Construction equipment
- Antenna positioning
- Robotics
- Stadium loudspeaker positioning
- Tilt safety systems



## Features

### Ratiometric Output

- Low power operation
- 3 wire operation

### Analog Output

- Internally regulated
- Bipolar input/output

### Serial Data Output

- Microcontroller compatible
- Ideal for noisy environments

### Digital Pulse Width Output

- Internally regulated
- Pulse width output



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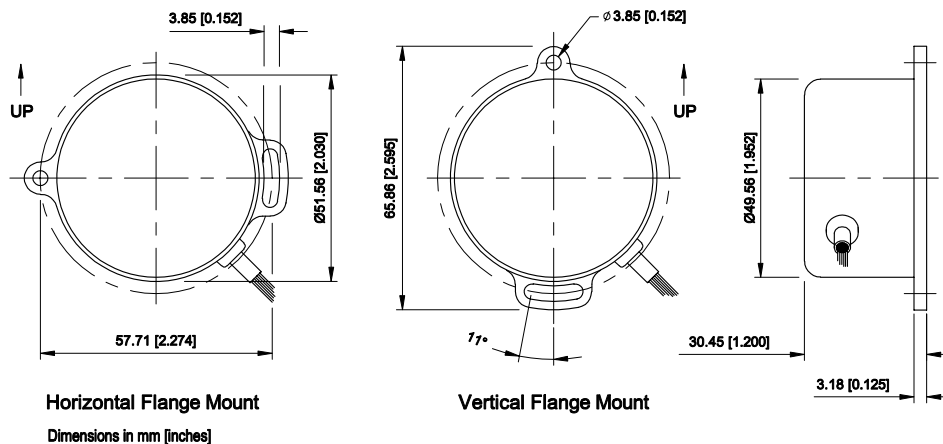


## General Specifications

Performance Specifications	
Total Range	± 60°
Linear Range	± 45°
Threshold	≤ 0.001°
Linearity 0 to 10°	≤ ± 0.1°
Linearity 10 to 45°	≤ ± 0.1%
Linearity 45 to 60°	Monotonic
Null Repeatability	≤ 0.05°
Cross Axis Error	≤ 1% up to 45°
Time Constant	0.3 sec (typ)
Frequency Response	0.5Hz (typ) (-3dB)
RF Susceptibility	≤ ± 2°
Cable Length, flying lead termination	0.45m (18")

Environmental Specifications	
Temperature Range - Operating	-30° to 65°C
Temperature Range - Storage	-55° to 65°C
Temperature Coefficient - Null	≤ ± 0.008°/°C
Temperature Coefficient – Scale Factor	≤ ± 0.1%/°C

EMC	
Emissions	EN55022 (CISPR 22) Limit B
Radiated Immunity	IEC 801-3 Level 3 (10V/m)
Burst Transients	IEC 801-4 Level 3 (2kV)
Electrostatic Discharge	IEC 801-2 Level 2 (8kV air, 6kV contact)
Conducted RF	MIL-STD-416D, CS114, Curve 2



## Detailed Specifications

Output Variant				
	Ratiometric Output	Analog Output	Serial Data Output	Digital Pulse Width Output
	The ratiometric clinometer is a signal-conditioned sensor that has been designed to operate like a potentiometer. This is a 3-wire device: power, power ground and signal; the signal is referenced to power ground. A regulated supply is required since the output is supply dependent. The mid scale output, zero degrees, is ½ the supply voltage whilst the scale factor is also supply dependent. With its low power consumption of 0.5mA, this device is ideal for battery applications. EMI and ESD suppression circuitry is provided on every line.	The analog output clinometer is a signal-conditioned sensor that has been designed for dc voltage, bi-polar operation. The clinometer requires a bipolar supply of ± 8 to ± 15 VDC and delivers an output of ± 3.6 VDC. This device is internally regulated for various applications. The output scale is fixed at a nominal 60mV per degree independent of supply voltage. The Analog clinometer has EMI and ESD suppression on every line.	The Serial Data clinometer is a signal-conditioned sensor that resolves the angle of tilt to 16 bits of information plus a polarity bit. This device was designed to transmit data to a microcontroller or to an I/O card of a PC through a 3-wire interface that will work at both TTL and CMOS logic levels. Complete handshaking is used to eliminate timing and transmission problems. The standard version operates on a +5 VDC regulated power supply while an internally regulated version is also available. The Serial Data Output clinometer was designed with EMI and ESD suppression on every line.	The Digital Pulse Width clinometer is a signal-conditioned sensor which resolves the angle of tilt to pulses, the length of which are directly proportional to the angle. When a trigger pulse is received on Trigger 1 or Trigger 2 a pulse is sent out on the corresponding PW1 or PW2 line. Comparing the length of the two pulses determines the angle of the sensor. Triggering both lines together allows the user to read Delta PW, which is the difference between PW1 and PW2. The polarity line will tell the user if the sensor is tilted clockwise or counter clockwise. The Digital Pulse Width clinometer was designed with EMI and ESD suppression on every line.
Voltage Supply (nom)	+9 VDC	±12 VDC		+12 VDC
Voltage Supply Range (regulated)	+5 to +15 VDC	±8 to ±15 VDC	+5 VDC ±5%	+8 to +15 VDC
Supply Current	≤ 0.5 mA	≤ 5 mA/supply	≤ 15 mA	≤ 5 mA
Scale Factor	30 mV/degree ±10% (at 9 VDC)	60 mV/degree ±10%	1000 counts/degree ± 10%	60 µsec/degree ± 10%
Load Resistance	≥10kΩ	≥10kΩ		≥10kΩ
Zero degree angle output	½ supply voltage	0 VDC	0 counts	DPW = 0 sec PW1 = PW2
Binary range			16 bits + 1 bit polarity (serial)	
Trigger Pulse				10 to 50 µsec @ 50 Hz max
PW1/PW2				0.5 to 5 mS
ΔPW				0 to 3.6 mS
Polarity				High (CW) Low (CCW)

Wire	Function	Function	Function	Function
Black	Power Ground	Power Ground	Power Ground	Ground
Red	Supply +	Supply +	Supply +	Supply +
Yellow	Signal		Data	ΔPW
Grey		Supply -	Ready / Wait	PW1
White			Request / Hold	PW2
Blue		Signal		Trigger 2
Brown				Trigger 1
Green				Polarity

Flange Type	Part Numbers	Part Numbers	Part Numbers	Part Numbers
Vertical	02110002-000	02111002-000	02113002-000	02112002-000
Horizontal	02110102-000	02111102-000	02113102-000	02112102-000