ZCT CX300-S230

INCLINOMETER

USER MANUAL

iZC-TECH

Contents

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Overview

ZCT-CX300-S230 in-place inclinometer is a high-precision tilt sensing system developed by Zhichuan. The product has a maximum measuring range of ± 30 degrees and supports MODBUS RTU protocol. It is the best choice for geotechnical and structural monitoring.

Product Features

- Modbus RTU protocol compliant
- Wide range, high accuracy, stable performance Solid, durable, maintenance friendly

Product Applications

- Monitoring foundation pits, slopes, embankments etc.

Technical Parameters(at 25℃)

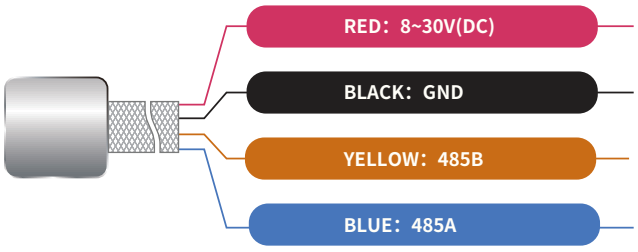
Item	Test Condition	Min	Type	Max	Unit
Power supply	DC	8	24	30	V
Quiescent current	VCC=24.00V		5	10	mA
Work temp		-30	0	+80	°C
Total range	Dual-axis		±30		°
Resolution (1			0.001		°
Accuracy(2	-15°~ +15°		±0.005	±0.01	°
	-30°~ +30°		±0.01	±0.02	°
Zero temp drift (3	-20~+60 ℃		±0.002		°/℃
				±0.1	°
Storage temp		-30		+80	°C
IP grade	Water depth of 100m		IP68		

* 1: Resolution is the smallest angle that can be detected by the inclinometer sensor.

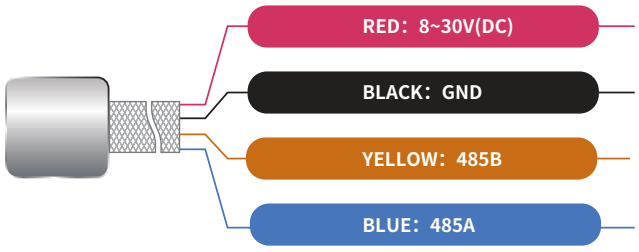
2: Accuracy is the differences between the real angle value and the measured value in total range.

3: At room environment, with fixed zero angle output, zero temp drift is the angle deviation with changes of temp.

Wiring Definition

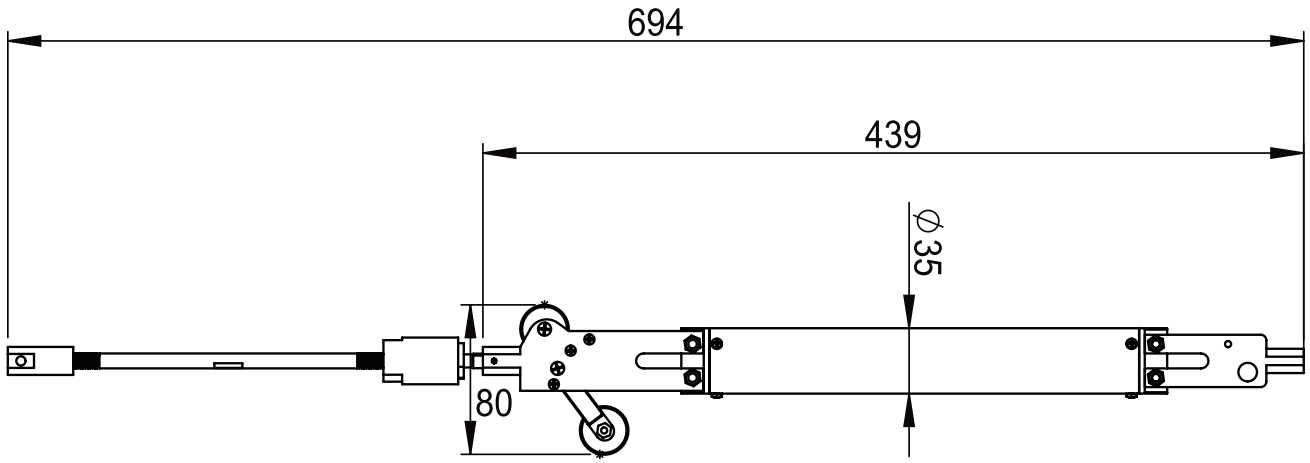


<Stripping terminal of the cable>

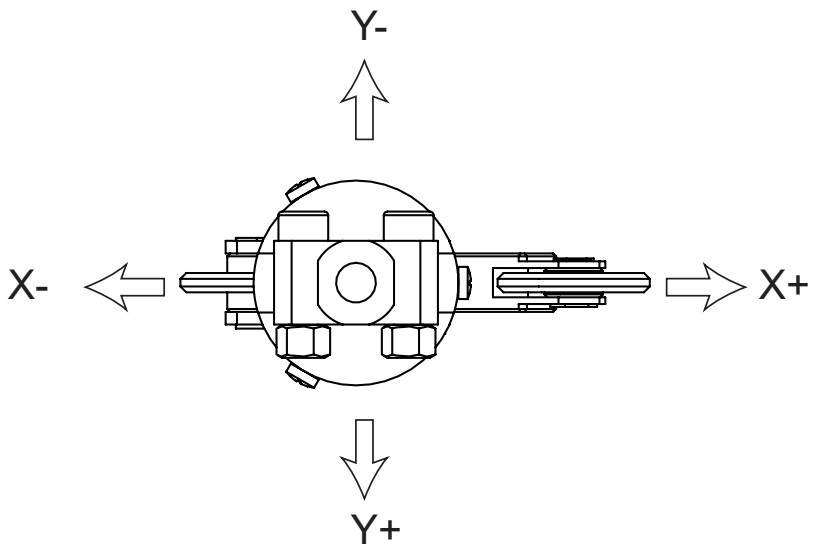


<Connection definition>

Housing Size（unit: mm）



Measurement



Communication protocol

◆ 1.The communication protocol is in compliance with Modbus RTU protocol, with baud rate of 9600bps, no parity bit, 8 data bits and 1 stop bit.

Register ADD	Data Value Name	Data Type	Range	W/R	Default Value
0000H	X-axis angle value---high position	User defined	Total range	R	
0001H	X-axis angle value---low position	User defined	Total range	R	
0002H	Y-axis angle value---high position	User defined	Total range	R	
0003H	Y-axis angle value---low position	User defined	Total range	R	
0006H	Enable / disable relative angle measuring	Int16U	0000H/ 5A5AH	R/W	0000H (relative angle measuring mode)
0007H	Sensor address	Int16U	0101H~ FFFFH	R/W	0101H（ADD is 01H）
0008H	Baud rate	Int16U	A0A0~A3A3	R/W	A2A2H（Baud rate is 9600）
0009H	Data format of angle and voltage output	Int16U	B0B0~ B3B3	R/W	B0B0H (Zhichuan Defined)
000CH	Sensor temp--- high position	User defined	Total range	R	
000DH	Sensor temp--- low position	User defined	Total range	R	

* R means Read. R/W means both read and write are available. 03H is for reading register, 06H is for writing register, and 42H is for reading sensor address.

1) 03H function code, read register value:

Request:

Device Add	Function code	Register start add high position	Register start add low position	Register qty high position	Register qty low position	CRC checkout
1byte	0x03	1byte	1byte	1byte	1byte	2byte

Response:

Device Add	Function code	Bytes	Register value	CRC checkout
1byte	0x03	1byte	N*1byte	2byte

2) 06H function code, write each register:

Request:

Device Add	Function code	Register start add high position	Register start add low position	Register qty high position	Register qty low position	CRC checkout
1byte	0x06	1byte	1byte	1byte	1byte	2byte

Response:

Device Add	Function code	Register start add high position	Register start add low position	Register qty high position	Register qty low position	CRC checkout
1byte	0x06	1byte	1byte	1byte	1byte	2byte

3) 42H function code, self-definition function code, read sensor address register:

Request:

Device Add	Function code	Register start add high position	Register start add low position	Register qty high position	Register qty low position	CRC checkout
1byte	0x03	1byte	1byte	1byte	1byte	2byte

Response:

Device Add	Function code	Bytes	Register value	CRC checkout
1byte	0x03	1byte	N*1byte	2byte

4) Abnormal response

After correctly receiving the complete information frame (correct CRC, address and function code), the illegal register address, the number of registers detected and when the parameter is illegally written, the abnormal code A5H is returned.

Add code	Error code	Abnormal code	CRC checkout
1 byte	0x80 | function code	A5H	2 bytes

◆ 2. Sensor command and functions

a) Read X axis angle data command: i.e.

send command: 01 03 00 00 00 02 C4 0B

return data : 01 03 04 **00 0C 62 05** CRC low CRC high return angle is 12.985°

(angle value = [(-1)^**0**]*[(**0*** 100) + (**0** * 16 + **12**) + (6 * 16+2) / 100+ (**0** * 16+**5)** / 1000]), 01 means the sensor 's address.

b) Read Y axis angle data command: i.e.

send command: 01 03 00 02 00 02 65 CB

return data : 01 03 04 **10 0C 62 05** CRC low CRC high return angle is -12.985°

(angle value = [(-1)^**0**]*[(**0*** 100) + (**0** * 16 + **12**) + (**6** * 16+**2**) / 100+ (**0** * 16+**5**) / 1000]), 01 means the sensor 's address.

Use function code 03 to read more than two register value, if the register is not readable, 0x00 is returned. i.e.

Read X and Y axis angle command at the same time Send command : 01 03 00 00 00 04 44 09

Return data: 01 03 08 **00 0C 62 05 10 0C 62 05** CRC low CRC high

Return angle is : X axis 12.985 ° ,Y axis -12.985 ° , command interpretation is the same as the way when X- and Y-axis are read separately.

c) Set sensor address command: i.e.

send command: 01 06 00 07 **05 05** CRC low CRC high

return data: 01 06 00 07 05 05 CRC low CRC high

sensor address is set as 0x05 by the command, and it becomes effective after restart.

1.The address becomes effective after successful response and restart.

d) Read sensor address: i.e.

send command: 00 42 00 07 00 01 CRC low CRC high

return data: 01 42 02 **01 01** CRC low CRC high the command will return to sensor address 0x01.

e) Set sensor baud rate: i.e.

send command: 01 06 00 08 **A1 A1** CRC low CRC high

return data: 01 06 00 08 A1 A1 CRC low CRC high

sensor baud rate is set as 4800bps by this command, and it becomes effective after restart.

1.After successful response and restart, the address becomes effective.

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f) Enable/disable relative angle measuring: i.e.

Send command: 01 06 00 06 **5A 5A** CRC low CRC high

Return data: 01 06 00 06 **5A 5A** CRC low CRC high

In response to the above command, the sensor turns on the relative angle measuring mode with the current sensor's angle as the relative angle zero point; sending the 01 06 00 06 **00 00** CRC low CRC high command can disable the relative angle measuring.

Note: It is suggested that the function of relative angle measuring (or zero setting) be realized by the upper computer software of the user and that the original data of the sensor be retained, so as to ensure the continuity and comparability of the data in different test periods before and after turning on the relative angle measuring (or zero setting).

g) Select angle / voltage data output format: i.e.

Send command: 01 06 00 09 **B0 B0** CRC low CRC high

Return data: 01 06 00 09 B0 B0 CRC low CRC high

Set the angle output format to Zhichuan format.

The supported data formats are: B0 = Zhichuan format (default); B1 = 32-bit int*10000; B2 = float large end; B3 = float small end.

Note: The data format parsed in command 1), 2) and 6) is Zhichuan format, which is also the default data output format. Other optional formats are 32-bit int type 10,000 times magnified format (that is, 32-bit integer type data magnified by 10,000 times), float large end format and float small end format. For non-Zhichuan data formats, the only thing should be done is to parse the four bytes of x-axis angle or y-axis angle or temperature data according to int32_t (angle and temperature magnified by 10,000 times) or float type, with increasing direction of the data storage (byte) address the same as that of the register address (for example, the angle is -5.0000 °, and the float large end format is 0xC0A00000).

Installation cautions

When installing the sensor, improper methods may lead to large measurement angle error. Please follow below procedures:

1.Tightly lock the two tightening screws that connect the sensor probe and the connection rod. The connection rod is standard 4-point stainless steel tube (thickness = 1.8mm).

2.Tightly lock the two connectors that connect the cables of adjacent sensor probes.

3.Tighten screws of the well head tool on top of the borehole.

4.Fix well the rescue wire.

Ordering information

Length of cable and spacing of sensor probes should be decided before ordering.

Guarantee Card

Product Name: INCLINOMETER

Part No.: ZCT-CX300-S230

Data of purchasing: _____

Time limit of Guaranteeing: _____

Company Purchasing: _____

Product SN: _____

Record of mending: _____

- Report Time: _____
- Reasons of fault: _____
- Reporter: _____
- Results of mending: _____

Information of customer holding this Guarantee Card:

Note: This card is the basis for user enjoying maintaining and upgrades service.

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