



V1.5

CANOPEN OUTPUT DYNAMIC TILT SENSOR

HDA446T-C1

Technical Manual

HDA446T CANOPEN OUTPUT DYNAMIC TILT SENSOR

○ Revision Date: 2025-7-29

Note: The function, parameters and appearance of the product will be adjusted with the technical upgrade. Please contact our pre-sales business for confirmation when purchasing.

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• PRODUCT INTRODUCTION

HDA446T-C1 is a new generation of digital MEMS dynamic inclination sensor. It can measure the attitude parameters (dual-axis inclination) of the moving carrier and is suitable for inclination measurement in motion or vibration state. HDA446T-C1 has built-in acceleration and gyro sensors and integrates the Kalman filter algorithm, so that it can measure the real-time motion data of the carrier in motion or vibration state. CANOPEN communication protocol is widely used.

This product adopts the non-contact measurement principle and can output the current attitude inclination in real time. It is simple to use and does not need to find the two relatively changing surfaces for installation. The internal integrated high-precision AD and gyro unit can compensate for nonlinearity, orthogonal coupling, temperature drift and centrifugal acceleration in real time, which can greatly eliminate the centrifugal error caused by motion acceleration interference, improve the dynamic measurement accuracy of the product, and can adapt to work in complex motion scenes and harsh environments for a long time. This product is a dynamic and static dual-mode measurement sensor with strong resistance to external electromagnetic interference. It is suitable for various large-scale high-intensity impact and vibration industrial environments. It is an ideal choice for industrial automation control posture measurement.

• MAIN FEATURES

- ★ Range (biaxial $\pm 90^\circ$)
- ★ Roll&Pitch Static accuracy: $\pm 0.05^\circ$
- ★ DC 9 ~ 36 V wide voltage input
- ★ IP67/IP68 protection grade optional
- ★ Dynamic accuracy: $\pm 0.1^\circ$
- ★ CANOpen communication protocol
- ★ Wide temperature working $-40 \sim +85^\circ\text{C}$

• APPLICATION FIELD

- ★ High vibration impact crushing equipment
- ★ Railway locomotive monitoring
- ★ Underground drilling rig attitude navigation
- ★ Ship navigation attitude measurement
- ★ Satellite communication vehicle attitude detection
- ★ Satellite antenna star search
- ★ Oil drilling equipment
- ★ Geological equipment tilt monitoring
- ★ Shield pipe jacking application



● SPECIFICATIONS

HDA446T-C1		Condition	Parameter
Measure Range		-	X $\pm 90^\circ$, Y $\pm 90^\circ$
Measure Axis		-	X-axis/Y-axis
Roll&Pitch Static Accuracy		@25°C	$\pm 0.05^\circ$
Roll&Pitch Dynamic Accuracy (RMS) ¹⁾		@25°C	$\pm 0.1^\circ$
Gyroscope	Gyroscope Range	-	$\pm 300^\circ/\text{s}$
	Zero-Bias Stability (10s smooth)	-	8.5°/h
	Angular Random Walk Coefficient (Allan)	-	0.25°/sqrt(h)
Acceleration	Acceleration Range	-	$\pm 4\text{g}$ $\pm 16\text{g}$ optional
	Zero-Bias Stability (10s Average)	-	0.02mg
	Zero-Bias Instability (Allan)	-	0.005mg
	Velocity Random Walk Coefficient (Allan)	-	0.005m/s/sqrt(h)
Zero Temperature Coefficient ²⁾		-40~85°C	$\pm 0.01^\circ/\text{°C}$
Temperature Coefficient Of Sensitivity ³⁾		-40~85°C	$\leq 100\text{ppm}/\text{°C}$
Power-On Start Time			$\leq 3.5\text{S}$
Response Time			0.01S
Output Signal			CANOpen
Electromagnetic Compatibility			According to EN61000 and GBT17626
MTBF			$\geq 98,000$ hours/time
Insulation Resistance			≥ 100 megohm
Impact Resistance			100g @ 11ms, triaxial (half sine wave)
Vibration Resistance			10grms / 10~1000Hz
Waterproof Grade			Standard IP67, optional IP68 and corrosion-resistant IP68 protection level
Weight			Single connector $\leq 165\text{g}$ / double connector $\leq 180\text{g}$ (excluding cable)

1) Accuracy: refers to the root mean square error between the measured value and the actual angle error after measuring the angle for many times (more than 16 times) at normal temperature.

2) Zero temperature coefficient: refers to the change rate of indication value relative to normal temperature within the rated working temperature range when the sensor is in zero state.

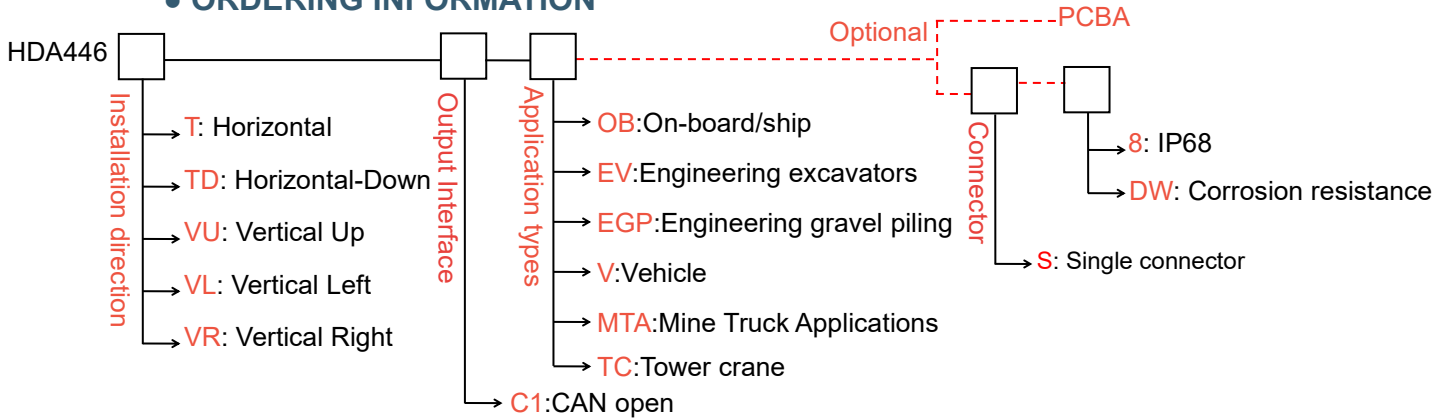
3) Sensitivity temperature coefficient: refers to the change rate of the percentage of the full-scale indicating value relative to the full-scale indicating value at normal temperature with the temperature within the rated working temperature range of the sensor.

● ELECTRICAL PARAMETERS

Parameter	Condition	Min	Typ		Max	Unit
Supply voltage	Standard	9	12	24	36	V
Operating current	No load		40mA(12V)			mA
Operating temp		-40			+85	°C
Storage temp		-40			+85	°C

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• ORDERING INFORMATION



E.g.:HDA446T-C1-OB: horizontal installation / CANOpen output interface / shipboard application.

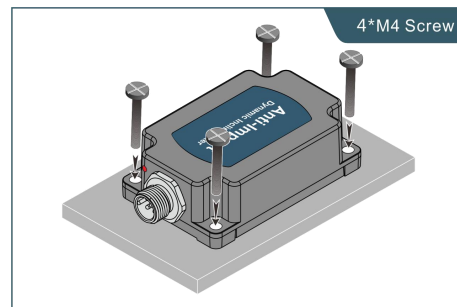
Note: 1. This product defaults to dual connectors. If you need a single connector, add **S** to the order model, example: HDA446T-OB-C1-S;

2. The protection level of this product defaults to IP67. If you need a higher protection level, add **8** to the order model, example: HDA446T-OB-C1-8;

3. This product defaults to shell. If you only need a PCBA board, add **PCBA** to the order model, example: HDA446T-OB-C1-PCBA.

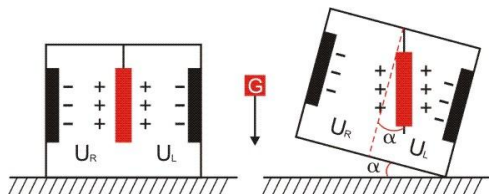
• MECHANICAL PARAMETERS

- Connector: M12 aviation plug 5P connector
- Degree of protection: IP67(Default)
- Shell material: aluminum alloy frosted and oxidized
- Installation: Four M4 screws



• WORKING PRINCIPLE

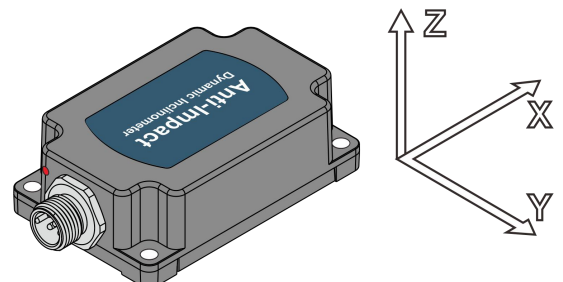
It adopts imported core control unit and uses the principle of capacitive miniature pendulum. According to the earth gravity principle, when the dip angle unit is inclined, the gravity of the earth can generate a gravity component on the corresponding pendulum, the corresponding capacitance can be changed, and the dip angle can be obtained by amplifying, filtering and converting the capacitance.



U_R , U_L are the voltage between the left and right pole plates of the pendulum and their corresponding electrodes, when the tilt sensor is tilted, U_R , U_L will change according to a certain rule, so $\int (U_R U_L)$ is a function on α of tilt angle : $\alpha = \int (U_R, U_L)$.

• INSTALLATION AXIAL

HDA446T uses the ENU coordinate system, a right-hand system. According to the rotation order of Z-X-Y, when the positive direction of the Y axis points to the front of the carrier, the angle rotated around the Z axis is the heading angle, the angle rotated around the X axis is the pitch angle and the angle rotated around the Y axis is the roll angle.



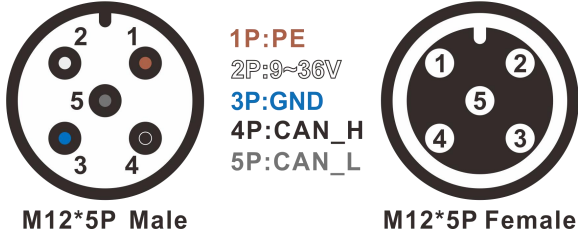
HDA446T CANOPEN OUTPUT DYNAMIC TILT SENSOR

• ELECTRICAL CONNECTION

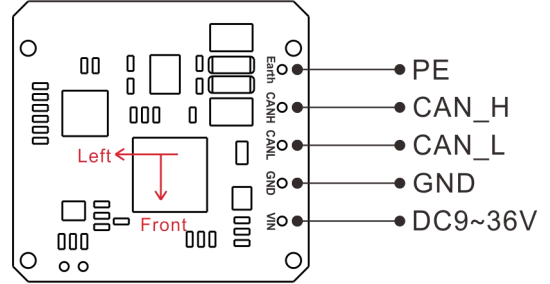
Definition of male wiring

Pin definition	1 PIN(BROWN)	2 PIN(WHITE)	3 PIN(BLUE)	4 PIN(BLACK)	5 PIN(GRAY)
	PE Protected land	9~36V Power supply positive	GND Power supply Negative	CAN_H	CAN_L

Connector pin definition diagram



PCBA board wiring definition diagram

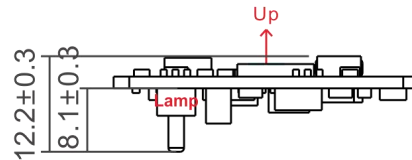
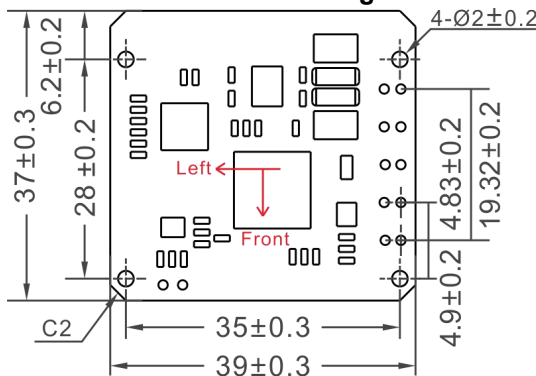


• WORKING INDICATOR LIGHT DESCRIPTION

1. The working indicator light flashes after the product is powered on;
2. The working indicator light is on when the product has data to send.

• SIZE

PCBA board dimensional drawing



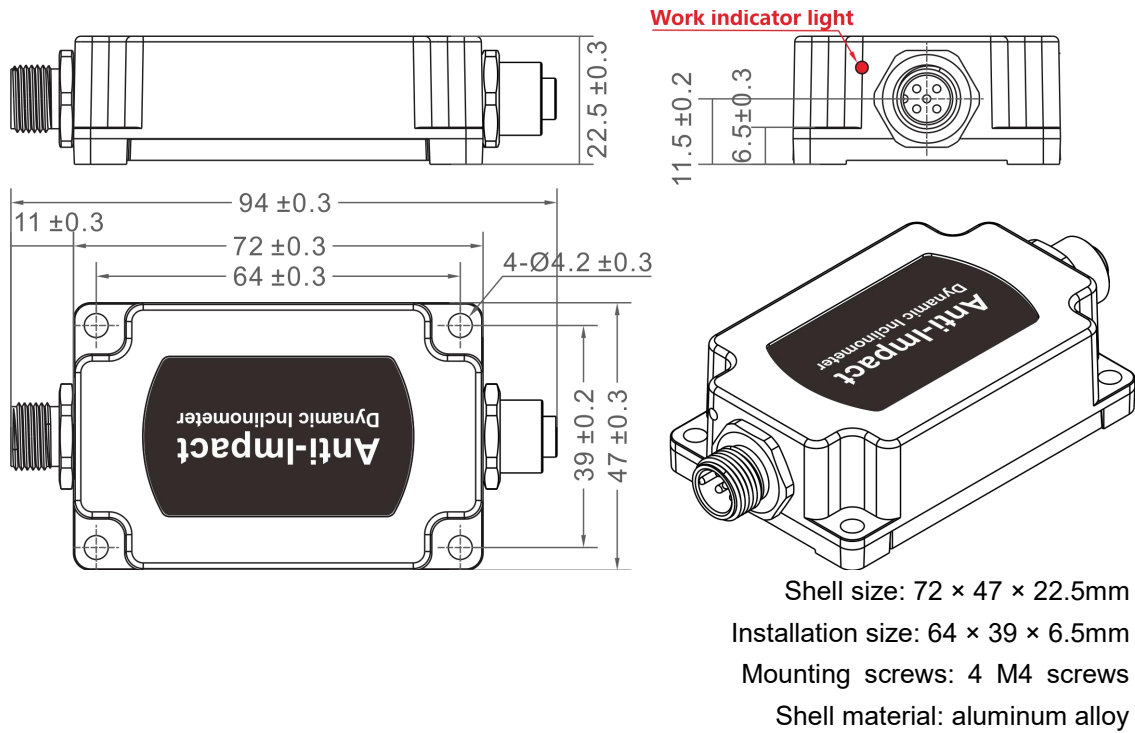
PCBA board size: 39 × 37 × 12.2mm

Installation size: 35 × 28mm

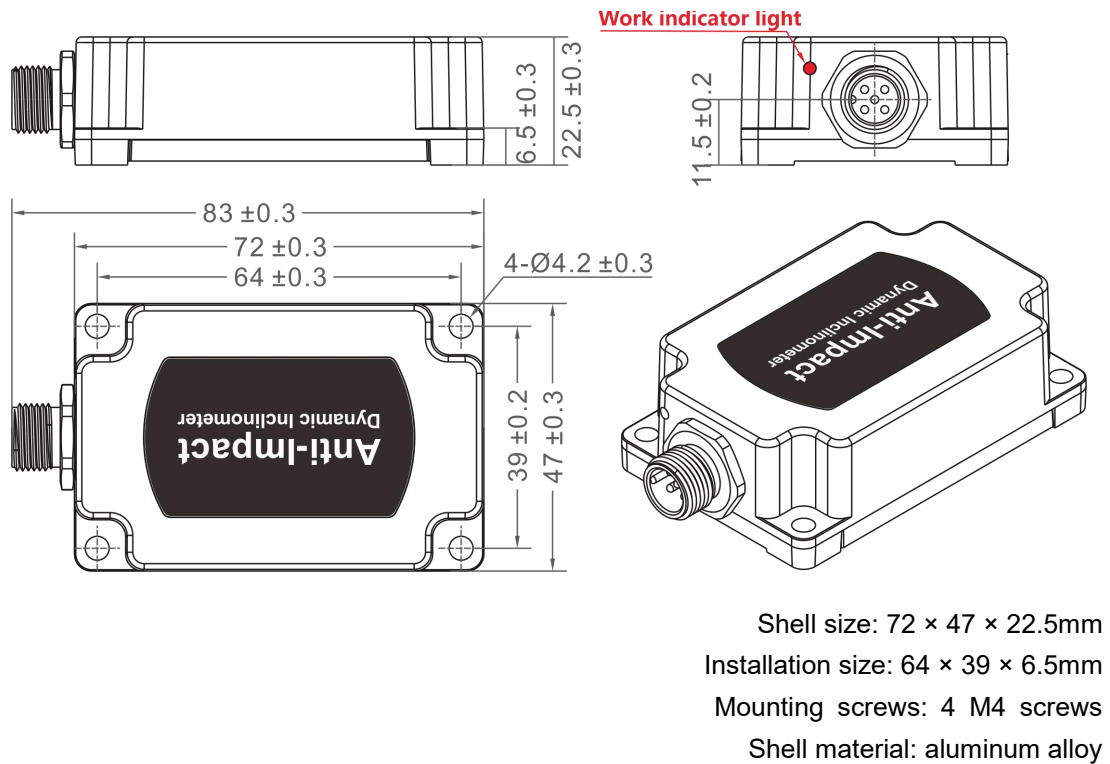
Mounting screws: 4 M2 screws

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Shell size of double connector

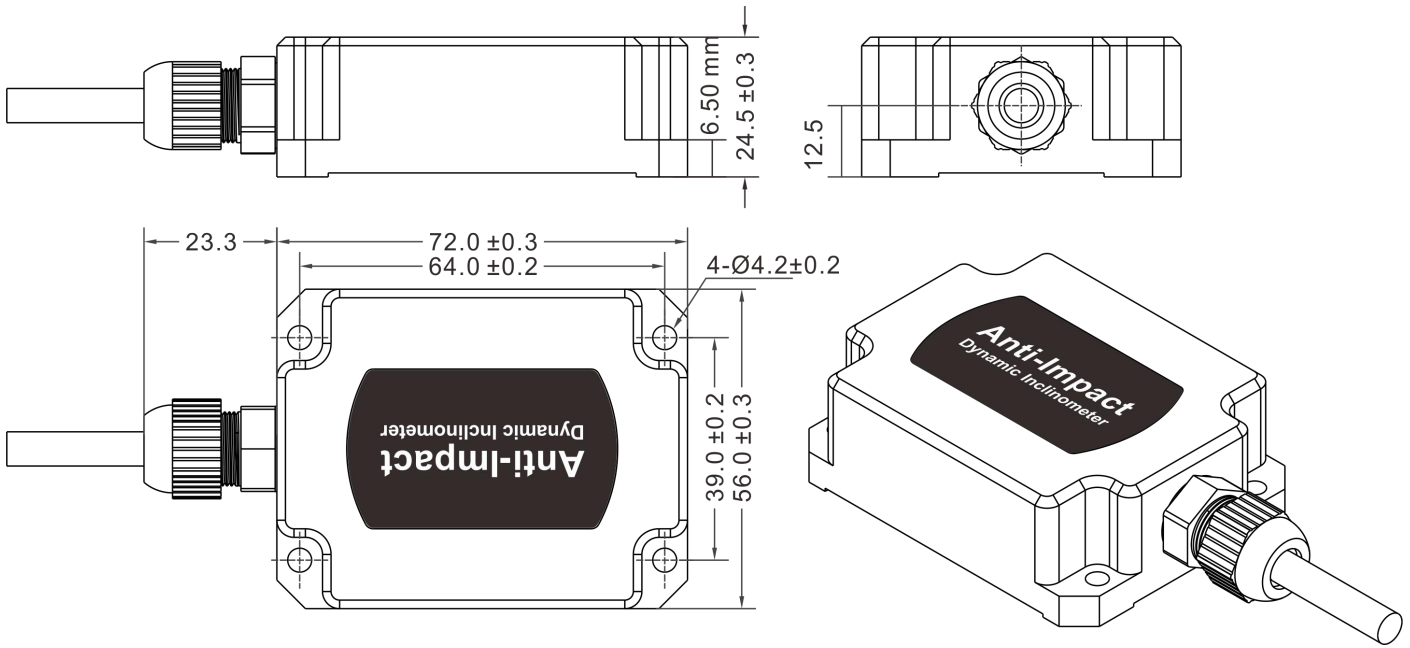


Size of single connector



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Size of corrosion-resistant IP68 protection direct outlet product



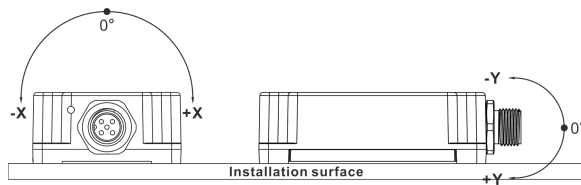
Shell size: 72 × 56 × 24.5mm

Installation size: 64 × 39 × 6.5mm

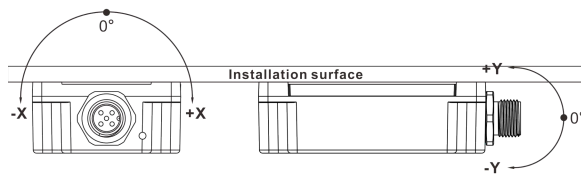
Mounting screws: 4 M4 screws

Shell material: 304 alloy steel

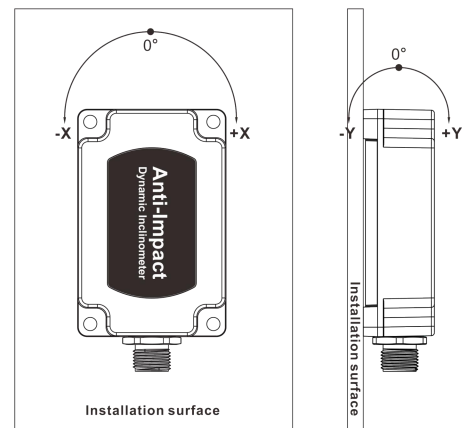
● MEASUREMENT DIRECTION



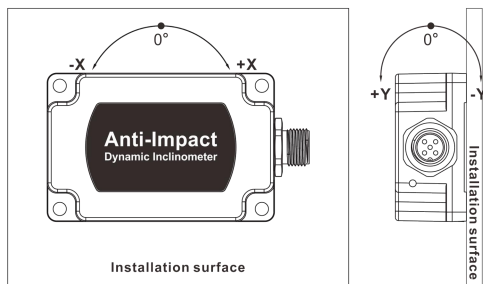
Horizontal Installation



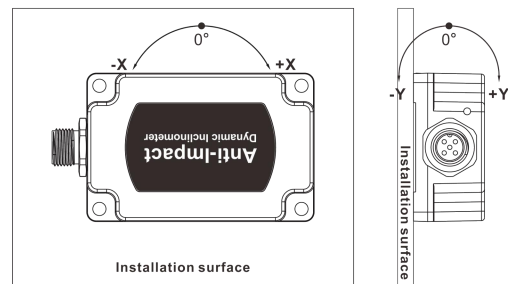
Horizontal-Down Installation



Vertical Installation



Vertical-Left Installation



Vertical-Right Installation

• OPERATION MODE

HDA446T CANopen is based on the DS410 standard. CANopen is based on the Controller Area Network (CAN) developed in the automotive industry in the 80s. The application protocol CANopen was introduced by the multi-vendor association CAN in Automation (CiA) to ensure full compatibility of industrial automation products. It is a multi-access system (up to: 127 devices), which means that all devices can access the bus. These devices are components of the CANopen bus. Simply put, CANopen is a client-server model. Each device checks whether the bus is idle, and if it is idle, the device can send a message. If two devices try to access the bus at the same time, the device with higher priority has the right to send its message first. The device with the lowest priority must cancel its data transmission and wait before it can retry to send its message.

The following operating modes are supported:

Polling mode: Angle values are transmitted only when requested. Cyclic mode: Angle values are sent cyclically on the bus (regularly, with adjustable intervals).

Synchronous mode: Angle values are sent after receiving a synchronization message (SYNC). Angle values are sent once every N synchronizations ($N \geq 1$).

• MODES AND PARAMETERS

1.1 The purpose of this chapter is to describe the configuration parameters available for the inclinometer of the CANopen interface:

Node ID	In a CAN network, each device has a node ID that is used to address the device in the network and define its priority.
EDS (Spreadsheet)	The EDS file describes the communication attributes (baud rate, transfer type, I/O characteristics, etc.) of the devices on the CAN network. It is provided by the device manufacturer and is used in the configuration tool to configure the node (just like the driver system in operation).
PDO (Process Data Object)	CANopen framework containing I/O data. We distinguish: Transfer-PDO (TPDO): Data provided by a node Receive-PDO (rpdo): The direction of data transfer to be used by a node is always from the node's perspective.
Service data object	SDOs are typically used to read or write parameters while the application is running.
COB-ID (Communication Object Identifier)	Each CANopen frame starts with a COB-ID as an identifier. In the configuration phase, each node receives its COB-ID as a provider (or consumer).
NMT (Network Management Translation)	The NMT protocol is used to issue state machine change commands (i.e., start and stop devices), detect remote device start and error conditions.

1.2 Pre-Operational Mode

If the device is in this state, you can modify its configuration. But only SDOs can be used to read or write device-dependent data.

The device enters the pre-operational mode:

-After power up

-If previously in operating mode, after receiving the NMT enter pre-operating mode command
If the configuration is complete, the device enters one of the following States upon receiving the corresponding indication:

"Stopped" receives "Stop Remote Node" NMT command

"Operational state" receives "Start remote node" NMT command

To set a node to pre-operational mode, the master node must send the following message:

Identifier	Byte 0	Byte 1	Description
0h	80 h	00	NMT-Pre-Action, All Nodes
0h	80 h	NN	NMT-Pre-Action, NN

NN: Node number

1.3 Operational Mode

If the device is in the Pre-Operations state when it receives the Start Remote Node command, the device enters the Operations state. If the CANOPEN network is in the "OPER" state with the "Node Start" NMT start, all device functions are available. Communication can use either PDO or SDO.

Note: Modifying the configuration in Operational mode can have unintended consequences and should only be done in Pre-Operational mode.

To place one or all nodes in Operational mode, the master node must send the following message:

Identifier	Byte 0	Byte 1	Description
0h	01h	00h	NMT-Start, All Nodes
0h	01h	NN (hex)	NMT-Start, NN

NN: Node number

1.4 Stopped mode

If the device is in Pre-Operational or Operational mode, the device enters Stopped mode when it receives a Node Stop indication (NMT service). The device cannot be configured in this mode. No device dependent data (SDO) service is available for read and writing. Only the slave monitoring function "Node Guarding" remains active.

To place one or all nodes in Stopped mode, the master node must send the following message:

Identifier	Byte 0	Byte 1	Description
0h	02h	00h	NMT-Stop, All Nodes
0h	02h	NN (hex)	NMT-Stop, NN

NN: Node number

1.5 Inclinometer Reinitialization

If the node is not functioning properly, it is recommended to perform a reinitialization. After reinitialization, the inclinometer operates in the pre-operational mode:

Identifier	Byte 0	Byte 1	Description
0h	82h	00h	Reset communication
0h	82h	NN (hex)	Reset the node

Query mode	The host queries the inclinometer for the current angle value by sending a remote request frame, and the inclinometer sends the angle frame with the same ID.
Cycle mode	The inclinometer transmits the current process value cyclically with a cycle period between 1ms and 65536ms, which can be set.
Synchronization mode	After the inclinometer receives the synchronous message and meets the condition of the synchronous message receiving counter, the inclination sensor sends the angle data frame.
The heartbeat function	A node informs its communication status by sending heartbeat messages in a loop. This message is received by one or any number of members of the bus (heartbeat consumers) so that the corresponding node (heartbeat generator) can be controlled.

1.6 Boot-Up Procedure

The general boot-up process of the HDA446T CANopen and the mapping of the various modes are as follows:

Order	Description
1	Power up the module
2	After initialization, the module automatically enters the pre-operational model
3	NMT: Start Remote Node
4	NMT: Pre-Operational Mode
5	NMT: Stop Remote Node
6	NMT: Reset Node
7	NMT: Reset Communication

1.7 Instructions for Layer Setup Service (LSS)

The integrated Layer Setup Service (LSS) feature is designed based on the CiA DS305V200 CANopen Layer Setup Service. These services and protocols can be used to query or change the settings of several parameters (physical layer, data link layer and application layer) on a CANopen device with LSS slave function by the CANopen device with LSS master function through the CAN network. The HDA446T inclinometer is an LSS slave and the PLC (control) supports the LSS master function. The HDA446T is limited to the application layer parameters of the LSS, namely the number of nodes and the baud rate. The LSS Master requests services to be performed by the inclinometer (LSS Slave). The LSS master requests an LSS address from the LSS slave. The LSS address is defined in the object 1018h Identification object; it consists of the vendor ID, product code, version number, and serial number, as shown in the following table. After receiving this information, the controller can identify the inclinometer and then set the node number and baud rate. Specific procedures vary in detail depending on the PLC tool used. This object provides a general identification of the inclinometer.

Subindex	Description	Data type	Default value
0	Number of entries	Unsigned8	0x04
1	Vendor ID	Unsigned32	0x42
2	Product code	Unsigned32	
3	Revision number	Unsigned32	
4	Serial number	Unsigned32	

1.8 Use of Bus Termination Resistors

If the inclinometer is connected at the end or beginning of the bus, or is used when the transmission baud rate is ≥ 50 kbps, a termination resistor of 120 ohms must be used to prevent information from being reflected back into the CAN bus. The bus may be wired in parallel or twisted, with or without shielding, depending on EMC requirements. The single line structure minimizes reflection.

1.9 LED definition

Red LED	Meaning
Red is off	No power or entering Stopped state
Flashing red	In Pre-Operational state
Red is always bright	In Operational pre-operational state

● SOFTWARE CONFIGURATION

The HDA446T is a very flexible device and all parameters can be set via the CAN bus. This chapter is divided into two main parts: the operational description of the HDA446T and the PDO/SDO programming of the HDA446T.

2.1 Factory Default Configuration

Description	Object	Value
Device type	1000h	0 x4019A (2-axis)
Cycle timer	2200h	00 hours (0 ms)
Resolution	6000h	0Ah (0.01°)
Node number	3000h	00h (Node No.: 1)
Baud rate	3001h	03h (125 kB)

Note: Factory settings can be restored at any time. An inclinometer that is compatible with the controller or the existing CAN bus by setting only a few parameters will be installed on the existing CAN bus.

2.2 Active programming objects

The active CanOpen Objects depend on the state of the inclinometer: a cross in the following table indicates whether the CANopen Object is active in each state.

Initialize	Pre-Operational	Operational	Stopped
PDO object			x
SDO object		x	x
Power-on	x		x
NMT		x	x

2.3 Programmable parameters

All objects are based on the inclinometer CiA-DS410 CANopen outline (www.can-cia.org). The following table shows the list of command identifiers sent and received by the inclinometer. These are the standard commands that are communicated and sent between the master and the slave in the CAN bus. It is useful for analyzing the communication logs between the master and the slave, and for better understanding the system.

2.4 Command description

Command	Function	Message	Description
22h	Domain	Request	Write parameters to
60h	Domain	Confirm	The parameter has
40h	Domain Upload	Request	Parameter request
43h/4Bh/4Fh ¹⁾	Domain Upload	Reply	Inclinometer reply
80h	Warning	Reply	Transmission error

1) The value of the command byte depends on the data length of the called parameter.

2.5 Data length of command

Command	Data length	Data length
43h	4 bytes	Unsigned 32
4Bh	2 bytes	Unsigned 16
4Fh	1 byte	Unsigned 8

2.6 Common commands

The following table shows the objects most commonly used for inclinometers:

Angle value (object 6010h, 6020h)	Objects 6010h and 6020h are used to obtain the biaxial tilt angle (integer 16 bits): Object 6010H refers to the X axis with a range of $\pm 90^\circ$ Object 6020H refers to the y-axis with a range of $\pm 90^\circ$
Storage parameters (object 1010h, 2300h)	Object 1010h is used to store all parameters or only a portion of the object dictionary, if necessary. While the object 2300h stores and saves all the current parameters and performs an additional NMT reset operation to make the new configuration parameters valid.
Resolution (degrees) (object 6000H)	This parameter is used to configure the desired resolution. The resolution can be set to 1° (1000 d), 0.1° (100 d) or 0.01° (10 d). (Default 10 d – 0.01°) Note: d is a decimal number
Preset Value (Object 6012H/6022H)	Set the inclinometer output angle value to the desired angle value. When the setup message is sent and acknowledged, the setup value in the inclinometer is valid. Setting this preset value must be done while the inclinometer application is stationary to improve accuracy. After setting, the device automatically subtracts an offset from the calculated angle value. It is not recommended to set the preset value in the dynamic process, because considering the bus delay time and the internal cycle delay time of the inclinometer, there will be a large error in the setting, which will affect the angle accuracy. The object 6012H is used to set the Preset Value of the X axis, and the object 6013H is used to set the Preset Value of the Y axis.

Baud rate (object 3001h)	The baud rate can be set via SDO. (Default baud rate is 125Kbps)
Node number (object 3000h)	The node number can be set by SDO-Object. The valid address range is 1-127. The same CAN bus cannot have the same node number. The node number is set by adding 1 to the value set when setting this node number to prevent the node number from being set to 0. For inclinometer programming via SDO, the default value is 0 H = node number 1H

2.7 PDO Transfer

Process Data Objects (PDOs) deliver real-time process information/data. The PDO set of a CANopen device describes the implicit exchange of information between the device and its communication devices on the network. PDO swapping is only allowed when the device is in Operational mode.

Note: The PDO object can be mapped directly to a memory address on the controller, and its value can be viewed by reading the contents of the corresponding memory address.

2.8 Object 1800h: 1st Transmit PDO Communication Parameters

This object contains the communication parameters for the first transfer PDO.

SubIndex	Description	Data type	Default value	R / W	Recovery after BootUp
00h	No. of Sub-Index	Unsigned 8	5	ro	Yes
01h	COB-ID	Unsigned 32	180h+NodeID	rw	Yes
02h	Transmission Mode	Unsigned 8	1	rw	Yes
03h	Inhibit Time	Unsigned 32	0	rw	Yes
04h	Not available				
05h	Event Timer	Unsigned 32	0	rw	Yes

Example (NN = 1: The inclinometer sends a PDO every 100 ms (the default setting is for the sensor to respond to a synchronization message from the CANopen master)).

Step 1: Set all sensors to the pre-operation mode;

Identifier	DLC	Byte 0	Byte 1
00	2	80	00

Step 2: Set the sub-index 05 in Event Timer 1800h to 100ms (100dec = 64h);

Identifier	DLC	Command	Index	Subindex	Service/process data			
NN = 1		Download			Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	00 18	05	64	00	00	00

Step 3: Set Transmission Type (1800h subindex 2) to Send PDO on event " (254dec = FEh)

Identifier	DLC	Command	Index	Subindex	Service/process data			
NN = 1		download			Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	00 18	02	FE	00	00	00

Step 4: Set all sensors to operating mode

Identifier	DLC	Byte 0	Byte 1
00	2	01	00

2.9 Object 1801h: 2nd Transmit PDO Communication Parameters

This object contains the communication parameters for the 2nd transfer PDO:

SubIndex	Description	Data type	Default value	R / W	Restore after Bootup
00h	No. of Sub-Index	Unsigned 8	5	ro	Yes
01h	COB-ID	Unsigned 32	280h+Node ID	rw	Yes
02h	Transmission	Unsigned 8	254	rw	Yes
03h	Inhibit Time	Unsigned 32	0	rw	Yes
04h	Not available				
05h	Event Time	Unsigned 32	0	rw	Yes

2.10 Transmission Mode/Transmission Type

The transmission mode (subindex 2) of the objects 1800h and 1801h may be configured as follows:

Transfer value (Decimal)	Transmission mode					Notice
	Cyclic	Acyclic	Synchronous	ASynchronous	RTR only	
0		X	X			PDO is sent on the first synchronization message following an event
1–240	X		X			PDO is sent every X number of sync message
241-253						Reserved
254				X		Send PDO when an event cycle occur
255				X		Send PDO when an event cycle occur

2.11 Inhibit Time

If Transmission Type is set to 254d (FEh) and 255d (FFH) cyclic mode, Inhibit Time is the minimum interval time between PDOs, which is defined as a multiple of 100 μ s. Inhibit Time cannot be changed while the corresponding PDO is running.

2.12 Event Timer

The event timer operates only in asynchronous transfer mode (transfer modes 254D and 255D). This value is defined as a multiple of 1 millisecond. The transmission PDO is sent after the event timer expires (for values > 0). The range is 1 – 65536 ms. The event timers for TPDO1 and TPDO2 are hardwired, that is, if one timer changes, the other timer adjusts accordingly.

2.13 Cyclic Timer

The cycle timer is hardwired to two event timers, TPDO1 and TPDO2. Since the communication parameter (Event Timer) or the manufacturer parameter (Cyclic Timer) may be saved, the values of the Event Timer and the Cyclic Timer may be different after power-up. If they are different, the value of the Event Timer is usually copied to the Cyclic Timer after power-up.

2.14 Object 1A00H: 1st Transfer PDO Mapping Parameters

This object contains the mapping parameters for the first transfer PDO.

SubIndex	Description	Data type	Default value	R / W	Restore after
0	Number of	Unsigned 8	2	ro	Yes
1	Map objects	Unsigned 32	0x60100010	rw	Yes
2	Map objects	Unsigned 32	0x60200010	rw	Yes

2.15 Object 1A01H: 2nd Transfer PDO Mapping Parameters

This object contains the mapping parameters for the 2nd transfer PDO.

SubIndex	Description	Data type	Default value	R / W	Restore after
0	Number of	Unsigned 8	2	ro	Yes
1	Map objects	Unsigned 32	0x60100010	rw	Yes
2	Map objects	Unsigned 32	0x60200010	rw	Yes

2.16 Types of SDOs

Service Data Objects (SDOs) allow you to access the device's data using explicit requests. The SDO service is available if the device is in the Operational or Pre-Operational state. There are two types of SDOs:

-Download SDOs

-Write SDOs (Upload SDOs)

The SDO protocol is based on a "client/server" model:

Download SDO	The client sends a request for an object to read. The server returns data for the object.
Upload SDO	The client sends an object request that contains the values it needs to write. After updating the object data, the server returns a confirmation message.
Unprocessed SDO	The server will return an error code (80) when the SDO cannot be processed.

3.Appendix A CANOpen Object List**3.1 Object 1000h: Device Type**

The object at index 1000h describes the type of device and its function. It consists of a 16-bit field that describes the device profile used and another 16-bit field that provides additional information about the optional features of the device. Additional information parameters are device profile specific.

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 32	0X2019A ¹⁾	ro

1) for biaxial

3.2 Object 1001h: Error Register

This object is used by the device to display internal faults. If a fault is detected, the corresponding bit is activated. The following errors are supported:

Bit	Description	Explain
0	General error	A general error signal is issued in any error condition

Object description of the error register:

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 8	N/A	ro

3.3 Object 1003h: Pre-Defined Error Field.

This object holds errors that occur on the device and signals them through the emergency object. The error code is in the low field and the additional information is in the high field. Child index 0 contains the number of record errors.

SubIndex	Description	Data type	Default value	R / W
0	No. of errors recorded	Unsigned 8	0	rw
1	Recent mistakes	Unsigned 32	–	ro

Clear the error log by writing data 0 to child index 0 of object 1003.

3.4 Object 1005H: COB-ID Synchronization

This object indicates the configured COB-ID of the synchronization object. In the operating mode, the sensor sends process data if the synchronization message is the same as the COB-ID received (e.g. the inclinometer is operating in the synchronization mode).

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 32	0x80	rw

3.5 Object 1008h: Manufacturer equipment name

This object contains the device name.

SubIndex	Description	Data type	Default value	R / W
0	–	String	–	ro

3.6 Object 1009H: Manufacturer Hardware Version

This object contains the hardware version of the board.

SubIndex	Description	Data type	Default value	R / W
0	–	String	–	ro

3.7 Object 100Ah: Manufacturer's software version

This object contains the manufacturer software version.

SubIndex	Description	Data type	Default value	R / W
0	–	String	–	ro

3.8 Object 100Ch: Guard Time

This object contains the guard time in milliseconds.

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 16	0	rw

3.9 Object 100Dh: Life Time Factor

This object contains the Life Time Factor parameter. The Life Time Factor multiplied by the Life Time gives the life time of the node protection protocol.

Subindex	Description	Data type	Default value	R / W
0	–	Unsigned 8	0	rw

3.10 Object 1010h: Store Parameters

This object controls whether all writable parameters are saved in non-volatile memory.

SubIndex	Description	Data type	Default value	R / W
0	The no. of subindexes	Unsigned 8	4	ro
1	Save all parameters	Unsigned 32	–	rw
2	Save the communication parameters	Unsigned 32	–	rw
3	Save Application Parameter	Unsigned 32	–	rw
4	Save the manufacturer parameters	Unsigned 32	–	rw

Save process: To save the parameters to non-volatile memory, the access signature "save" must be sent to the appropriate sub-index of the device.

	Most Significant Word		Least Significant Word	
ASCII	e	v	a	s
Hexadecimal value	65h	76h	61h	73h

3.11 Object 1011H: ReStore Parameters

This object is used to restore the writable parameters related to the device and CANopen to the default factory settings.

SubIndex	Description	Data type	Default value	R / W
0	The no. of subindexes	Unsigned 8	4	ro
1	Restore all parameters	Unsigned 32	–	rw
2	Recover communication parameters	Unsigned 32	–	rw
3	Restore Application Parameter	Unsigned 32	–	rw
4	Restore the manufacturer parameters	Unsigned 32	–	rw

Restore procedure: To load parameters from non-volatile storage, the access signature "load" must be sent to the appropriate sub-index of the device.

	Most Significant Word		Least Significant Word	
ASCII	d	a	o	l
Hexadecimal value	64h	61h	67h	6Ch

Note: After the message is sent, a power off/on is required to restore

3.12 Object 1014H: COB-ID Emergency

This object indicates the COB-ID configured for the Emergency Write Service. This has the highest priority among the transmitted messages.

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 32	0x81	rw

3.13 Object 1016h: Consumer Heart beat Time

Consumer heartbeat time defines the expected heartbeat cycle time in milliseconds. A device can monitor only one corresponding device. If the time is set to 0, monitoring is not active. The value of this object must be higher than the corresponding time of the monitored device (object 1017).

SubIndex	Description	Data type	Default value	R / W
0	No. of subindexes	Unsigned 8	1	ro
1	Consumer heartbeat time	Unsigned 32	0	rw

Consumer heart beat Time unsigned 32 value resolution:

Bit	31 to 24	23 to 16	15 to 0
value	0h (Reserved)	Address of the monitored device (Node ID No.)	Monitoring time (ms)

3.14 Object 1017h: Producer Heart beat Time

This object defines the time interval, in mS, at which the heartbeat message is generated.

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 16	0	rw

3.15 Object 1018h: Identifies the object

This object provides a general identification of the inclinometer

SubIndex	Description	Data type	Default value	R / W
0	Number of entries	Unsigned 8	0x4	ro
1	Vendor ID	Unsigned 32	0x42	ro
2	Product code	Unsigned 32	0x43415032	ro
3	Revision number	Unsigned 32	0x00010500	ro
4	Serial number	Unsigned 32	–	ro

3.16 Object 2200h: Cyclic Timer

This object is used to determine the transmission interval during the cyclic transmission mode. This object is hardwired to the event timers for TxPDO1 and TxPDO2. If the Cyclic Timer and the timer of the event TxPDO keep different values after power up again, the value of the event timer of TxPDO is copied to the Cyclic Timer.

SubIndex	Description	Data type	Default value	R / W
0	–	Unsigned 16	0	rw

3.17 Object 2300h: Save Parameter With Reset

All parameter for executing this object may be store in non-volatile memory. Save all parameters and perform an additional reset later.

SubIndex	Description	Data type	Default value	R / W
0	Access code	Unsigned 32	55AAAA55h	wo

3.18 Object 2600H: Preset X-Axis

This object sets the X axis to the desired value. It is hardwired to objects 6012 and 6112.

SubIndex	Description	Data type	Default value	R / W
0	–	Integer 16	–	rw

The range of valid preset values depends on the current resolution of the inclinometer. If the predicted value is outside the measurement range, an error message is displayed.

Resolution	Preset Range (Decimal)	
Type	Inclinometer ($\pm 90^\circ$)	Type
1°	± 90	1°
0.1°	± 900	0.1°
0.01°	± 9000	0.01°

3.19 Object 2601H: Preset Y-Axis

In an inclinometer, this object sets the Y axis to the desired value. It is hardwired to objects 6022 and 6122.

SubIndex	Description	Data type	Default value	R / W
0	–	Integer 16	–	rw

The range of valid preset values depends on the current resolution of the inclinometer. If the preset value is out of range, an error message is displayed.

Resolution	Preset Range (Decimal)	
Type	Inclinometer ($\pm 90^\circ$)	Type
1°	± 90	1°
0.1°	± 900	0.1°
0.01°	± 9000	0.01°

After you set a preset, you must issue a save command to set the preset permanently.

3.20 Object 3000h: Node ID

This object contains the node number of the device. The default node number is 01. The valid node number range is 1-127.

SubIndex	Description	Data type	Default value	R / W
0	Node number	Unsigned 8	0	rw

Note: To prevent the node number from being 0, the actual node number is based on the value of this object plus 1. For example: to set the node number 32 (decimal) – write 1F (hexadecimal) to the object and save it. The node numbers are 1FH + 1H = 20H = 32 (Dec). The new node number is valid only after the device is reset, that is, the node number needs to be saved before the device is reset.

Programming example (NN = 1): Set the node number (NN) to 50 (decimal)

Step 1: Write 31h in object 3000 sub0, (the saved value is increased by 1; 31h + 01h = 32h = 50 Dec).

Identifier	DLC	Command	Index		Subindex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	00	30	00	31	00	00	00

Step 2: Save this configuration by writing "save" to 1010 sub01.

Identifier	DLC	Command	Index		Subindex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	10	10	01	73	61	76	65

Step 3: The sensor will adjust the new node number after the reset.

3.21 Object 3001H: Baudrate

This object contains the baud rate of the device. Valid values range from 0 to 7.

SubIndex	Description	Data type	Default value	W/R
0	Baud rate	Unsigned 8	–	rw

Eight different baud rates are provided, and only one byte is used in order to adjust the baud rate. The default baud rate is 125 Kbps (03H).

Baud Rate (KB)	Stored value in object
20	00h
50	01h
100	02h
125	03h
250	04h
500	05h
800	06h
1000	07h

The new baud rate is valid only after the device is reset, that is, the baud rate needs to be saved before the device is reset.

Programming example (NN = 1): Set the baud rate to 500kbps

Step 1: Set the baud rate 3001 sub0 to 500kbps baud (05h)

Identifier	DLC	Command	Index		Subindex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	01	30	00	05	00	00	00

Step 2: Save the parameters and perform a reset (Reset Node). The new baud rate configuration is valid after the reset.

Identifier	DLC	Command	Index		Subindex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	00	23	00	55	AA	AA	55

3.22 Object 3100H: Moving Average Filter

This object contains the number n of the average number of output angle slides. If set to 0, the filter is disabled. By default, the filter is disabled. Valid filter values range from 0 to 250.

SubIndex	Description	Data type	Default value	R / W
0	Sliding average	Unsigned 16	0	rw

Internal calculation of the angle value when the moving average filter is activated:

New _ Sensor _ Value X = [Sensor _ Value X + Sensor _ Value X-1 + ... + sensor _ value X-n]/n

Gyroscope angular velocity value:

The sensor stores the measured rotation rate of the gyroscope in different objects. These values are calibrated and can be mapped to the PDO. The gyro sensor has a maximum range of +/-500°/s.

3.23 Object 3400H: Gyroscope X-Axis

This object provides the calibrated rotation rate on the X axis. The value is in degrees/second with a resolution of 0.1 °/s. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Gyroscope X axis	Integer 16		ro

3.24 Object 3401H: Gyroscope Y-axis

This object provides the calibrated rotation rate on the Y axis. The value is in degrees/second with a resolution of 0.1 °/s. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Gyroscope Y-axis	Integer 16		ro

3.25 Object 3402H: Gyroscope Z-Axis

This object provides the calibrated rotation rate on the Z axis. The value is in degrees/second with a resolution of 0.1 °/s. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Gyroscope Z-axis	Integer 16		ro

Accelerometer signal:

The sensor stores the accelerations measured by the accelerometer in different objects. These values are calibrated and can be mapped to the PDO. The maximum range of the acceleration sensor is +/-4G (1G = 9.8 m/S²).

3.26 Object 3403H: Acceleration X-axis

This object provides an acceleration value on the X axis. The value is in mg with a resolution of 1 mg. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Acceleration X axis	Integer 16		ro

3.27 Object 3404H: Acceleration Y-axis

This object provides an acceleration value on the Y axis. The value is in mg with a resolution of 1 mg. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Acceleration Y axis	Integer 16		ro

3.28 Object 3405H: Acceleration Z-axis

This object provides an acceleration value on the Z axis. The value is in mg with a resolution of 1 mg. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Acceleration Z axis	Integer 16		ro

3.29 Object 3411H: Sensor Temperature

This object provides the temperature value of the sensor. This value is given in degrees Celsius with a resolution of 0.1 °C. This value can be mapped to a PDO.

SubIndex	Description	Data type	Default value	R / W
0	Sensor temperature	Integer 16		ro

3.30 Object 6000H: Resolution

This object shows the resolution of the Slope Long16 (object 6010H) and Slope Lateral16 (object 6020H) objects.

SubIndex	Description	Data type	Default value	R / W
0	Resolution	Unsigned 16	—	rw

Three resolutions are available:

Angular resolution	Value Decimal	Byte hexadecimal
0.01°	10	0AH
0.1°	100	64H
1°	1000	3E8H

3.31 Object 6010H: Slope Long16

Angle Value X-Axis/Longitudinal (Dual Axis). For a dual-axis inclinometer, this object provides the X-axis angle value. The object is read-only, and the angle value is limited by the resolution setting.

SubIndex	Description	Data type	Default value	R / W
0	–	Integer 16	–	ro

Angular resolution	Range of angle values	
	Dual axis	Resolution
1°	± 90	1°
0.1°	± 900	0.1°
0.01°	± 9000	0.01°

Calculate the angle value from the CANopen reading:

Degree = Slope Long 16 [Object 6010] * Resolution [Object 6000]

Note: If you change the Resolution, there is a side effect because the sensor is at the configured resolution and rounding effects must be taken into account. Affected objects: read and write: preset slope long16, preset slope lateral16, differential slope long16 offset, differential slope lateral16 offset, preset slope long32, preset slope lateral32, differential slope long32 offset, differential slope lateral32 offset; Read-only: slope long16, slope lateral16, slope long16 offset, slope lateral16 offset, slope long32, slope lateral32, slope lateral32 offset, slope lateral32 offset.

3.32 Object 6011H: Slope Long16 Operating Parameter

This object controls the scaling and inversion of the Slope long16 value. If Bit0 is set, inversion is enabled and the value of Slope long16 is inverted. If Bit1 is set to 1, Slope Long16 Offset and differential Slope Long16 Offset are added to Slope Long16. Both bits can be set.

SubIndex	Description	Data type	Default value	R / W
0	X angle scaling and Inversion.	Unsigned 8	00	rw

Calculate the angle value based on the Operating parameter:

Slope Long16 = [(physical measured slope angle of Slope Long16 * Multiplier) + Slope Long16 Offset + Differential Slope Long16 Offset]

Physically measured inclination: Slope long16 (X).

Multiplier: 1 if inversion is not enabled; Is -1 if inversion is enabled.

Slope Long16 Offset (6013) = Slope Long16 Preset (6012)- (Physically Measured Slope Long16 (X) at tacc * Multiplier), tacc = the moment the PRESET request was executed.

Differential slope16 offset (6014): An absolute amount (positive or negative) to increase.

Bit 1	Bit 0	Angle calculation
0	0	X
0	1	-X
1	0	(X + object 6013H + object 6014H)
1	1	(-X + object 6013H + object 6014H)

See the corresponding object for a detailed description.

3.33 Object 6012H: Slope Long16 Preset Value

This object is used to define a new desired longitudinal slope value. This value will be set according to the current resolution, noting that the setting should ensure that the angle value is within the limits.

SubIndex	Description	Data type	Default value	R / W
0	Preset value	Integer 16	00	rw

Resolution	Preset Range (decimal)	
Type	Inclinometer	Type
1°	± 90	1°
0.1°	± 900	0.1°
0.01°	± 9000	0.01°

Programming example (NN = 1): Preset Value-sets the current angle to 1°

Step 1: Set Preset Value to 64H. If the resolution is set to 0.01°, 64H is equal to 1° (Note: if the resolution is 0.1°, you must set the Preset Value to 0 AH to set the current angle value to 1°)

Identifier	DLC	Command	Index		SubIndex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	00	26	00	64	00	00	00

Step 2: Save this configuration by writing "save" to 1010sub01

Identifier	DLC	Command	Index		SubIndex	Service/process data			
NN = 1		download				Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	10	10	01	73	61	76	65

3.34 Object 6013H: Slope Long16 Offset

This is a read-only parameter. This parameter is recalculated each time a Slope Long16 Preset (6012H), Slope Long32 Preset (6112), or Preset X (2600) object is changed.

SubIndex	Description	Data type	Default value	R / W
0	Offset value	Integer 16	–	ro

Calculation of Slope Long16 Offset: Offset Value = Preset Value- (Physical Value * Inversion) [Inversion is -1 if activated, otherwise is 1]

3.35 Object 6014H: Differential Slope Long16 Offset

This parameter will define an additional independent offset to be added to Slope Long16, but only if scaling of Slope Long16 is enabled. Note that the extra offset value should be within the angular range, depending on the resolution you have set.

SubIndex	Description	Data type	Default value	R / W
0	Offset value	Integer 16	–	rw

The main difference between objects 6013h and 6014h is that 6013 is automatically calculated based on the preset value, while object 6014h is user-defined.

3.36 Object 6020H: Slope Lateral16

Angle value Y-axis. The object provides the Y-axis inclination value. This is a read-only object, and the angle value is limited by the resolution setting.

SubIndex	Description	Data type	Default value	R / W
0	–	Integer 16	–	ro

Resolution	Preset Range (Decimal)
1°	±90
0.1°	±900
0.01°	±9000

Calculate the position/slope value from the CANopen reading:

Degree = Slope Lateral 16 [Object 6020] * Resolution [Object 6000]

3.37 Object 6021H: Slope Lateral 16 Operating Parameter

This object controls the scaling and inversion of Slope lateral 16 values. If Bit0 is set, inversion is enabled and the value of Slope lateral16 is inverted. If Bit1 is set, Slope Lateral16 Offset and differential Slope Lateral16 Offset are added to Slope Lateral16. Both bits can be set.

SubIndex	Description	Data type	Default value	R / W
0	The Y angle is scaling and Inversion.	Unsigned 8	00	rw

Calculate the position value according to the operating parameters:

Slope Lateral16 = [(Slope Lateral16 physical measured gradient * Multiplier) + Slope Lateral16 Offset + Differential Slope Lateral16 Offset]

Slope Lateral16 Physically measured inclination (Y).

Multiplier: 1 if inversion is not enabled; Is -1 if inversion is enabled.

Slope Lateral16 Offset (6023) = Slope Lateral16 Preset (6022) – Physically measured slope Slope Lateral16 (Y) at tacc * Multiplier, Tacc = the time at which the PRESET request was executed.

Differential Slope Lateral16 Offset (6024): An absolute amount of increase (positive or negative).

Bit1	Bit0	Angle calculation
0	0	Y
0	1	-Y
1	0	(Y + object 6023H + object 6024H)
1	1	(-Y + object 6023H + object 6024H)

See the corresponding object for a detailed description.

3.38 Object 6022H: Slope Lateral16 Preset Value

This object is used to define a new desired lateral slope value. This value will be set according to the current resolution, note that the setting should ensure that the angle value is within the limits.

SubIndex	Description	Data type	Default value	R / W
0	Preset Value	Integer 16	00	rw

Resolution	Preset Range (Decimal)
1°	±90
0.1°	±900
0.01°	±9000

3.39 Object 6023H: Slope Lateral16 Offset

This is a read-only parameter. This parameter is recalculated each time a Slope Lateral16 Preset (6022H), Slope Lateral32 Preset (6122), or Preset Y (2601) object is set.

SubIndex	Description	Data type	Default value	R / W
0	Offset value	Integer 16	–	ro

Calculate Slope Lateral 16 Offset: Offset Value = Preset Value- (Physically Measured Value * Inversion) [Inversion is -1 if activated; 1 (inactive)]

3.40 Object 6024H: Differential Slope Lateral 16 Offset

This parameter will define an additional independent offset to be added to Slope Lateral16, but only if scaling of Slope Lateral16 is enabled. Note that the extra offset value should be within the angular range, depending on the resolution you have set.

SubIndex	Description	Data type	Default value	R / W
0	Offset value	Integer 16	–	rw

Note: The main difference between objects 6023h and 6024h is that 6023h is automatically calculated based on preset values, while object 6024h is user-defined.

32-bit objects (61 XX)

Objects 6110 – 6114: Hardwired to the 16-bit Slope Long16 object.

Objects 6120 – 6124: Hardwired to the 16-bit Slope Lateral16 object.

4. PDO data analysis

The output type of PDO data is determined by the Mapping of TxPDO1 (1A00) and TxPDO2 (1A01), and the output cycle frequency is determined by the Event Time of TxPDO1 and TxPDO2 Comm Parameter.

PDO1 data (Resolution: 0.01)

ID	LEN	DO	D1	D2	D3	D4	D5	D6	D7
0x180+Node_ID	4	XL	XH	YL	YH	-	-	-	-

PDO2 data (Resolution: 0.01)

ID	LEN	DO	D1	D2	D3	D4	D5	D6	D7
0x280+Node_ID	4	XL	XH	YL	YH	-	-	-	-

The XH _ XL is composed of 16 signed bits (INT16), with the low-order bits first and the high-order bits second, multiplied by the resolution (the following resolution is 0.01).

For example: XL XH: E8 03 = 0x03E8 = 1000 * 0.01 = 10.00 degrees

YL YH: 15 FC = 0 xFC15 = -1003 * 0.01 = -10.03 deg

• OBJECT LIST

Object name	Object No. ID Hexadecimal	Visit	Data type
Device Type	1000	ro	Unsigned 32
Error Register	1001	ro	Unsigned 8
Predefined Error Field	1003	–	ARRAY
Sub 0: Number of errors	1003.0	rw	Unsigned 8
Sub 1: new error	1003.1	ro	Unsigned 32
COB-ID SYNC	1005	rw	Unsigned 32
Device Name	1008	ro	string
Hardware Version	1009	ro	string

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Software Version	100a	ro	string
Guard Time	100c	rw	Unsigned 16
Life Time Factor	100d	rw	Unsigned 8
Store Parameters	1010	–	ARRAY
Highest sub-index supported	1010.0	ro	Unsigned 8
Save all parameters	1010.1	rw	Unsigned 32
Save communication parameters	1010.2	rw	Unsigned 32
Save Application parameters	1010.3	rw	Unsigned 32
Save Manufacturer parameters	1010.4	rw	Unsigned 32
Restore Default Parameters	1011	–	Array
Highest sub-index supported	1011.0	ro	Unsigned 8
Restore all parameters	1011.1	rw	Unsigned 32
Restore communication parameters	1011.2	rw	Unsigned 32
Restore application parameters	1011.3	rw	Unsigned 32
Restore manufacturer parameters	1011.4	rw	Unsigned 32
COB-ID Emergency	1014	ro	Unsigned 32
Consumer Heartbeat Time	1016	–	ARRAY
Sub 0: No. Of Entries	1016.0	ro	Unsigned 8
Sub 1: Consumer Heartbeat Time	1016.1	rw	Unsigned 32
Producer Heartbeat Time	1017	rw	Unsigned 16
Identity Object	1018	–	RECORD
Sub0: Number of Entries	1018.0	ro	Unsigned 8
Sub1: Vendor ID	1018.1	ro	Unsigned 32
Sub2: Product Code	1018.2	ro	Unsigned 32
Sub3: Revision Number	1018.3	ro	Unsigned 32
Sub4: Serial Number	1018.4	ro	Unsigned 32
TxPDO1 Comm Parameter	1800	–	RECORD
Sub0: No. Of Entries	1800.0	ro	Unsigned 8
Sub1: COB-ID	1800.1	rw	Unsigned 32
Sub2: Transmission Type	1800.2	rw	Unsigned 8
Sub3: Inhibit Time	1800.3	rw	Unsigned 16
Sub5: Event Timer	1800.5	rw	Unsigned 16
TxPDO2 Comm Parameter	1801	–	RECORD
Sub0: No. of Entries	1801.0	ro	Unsigned 8
Sub1: COB-ID	1801.1	rw	Unsigned 32
Sub2: Transmission Type	1801.2	rw	Unsigned 8

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Sub3:Inhibit Time	1801.3	rw	Unsigned16
Sub5:Event Timer	1801.5	rw	Unsigned16
TxPDO1 Mapping	1a00	–	RECORD
Sub0: Number of Entries	1a00.0	ro	Unsigned8
Sub1:1 st mapped object	1a00.1	rw	Unsigned32
Sub2:2 nd mapped object	1a00.2	rw	Unsigned32
TxPDO2 Mapping	1a01	–	RECORD
Sub0: Number of Entries	1a01.0	ro	Unsigned8
Sub1: 1 st mapped object	1a01.1	rw	Unsigned32
Sub2: 2 nd mapped object	1a01.2	rw	Unsigned32
Cyclic Time	2200	rw	Unsigned16
Store Parameters	2300	rw	Unsigned32
Preset X-Axis	2600	rw	Signed16
Preset Y-Axis	2601	rw	Signed16
Node Number	3000	rw	Unsigned8
Baud rate	3001	rw	Unsigned8
Moving Average Filter	3100	rw	Unsigned16
Gyro x axis	3400	ro	Signed16
Gyro y axis	3401	ro	Signed16
Gyro z axis	3402	ro	Signed16
Acceleration x axis	3403	ro	Signed16
Acceleration y axis	3404	ro	Signed16
Acceleration z axis	3405	ro	Signed16
Sensor temperature	3411	ro	Signed16
Resolution	6000	rw	Unsigned16
Slope long16	6010	ro	Signed16
Slope long16 operating parameter	6011	rw	Unsigned8
Slope long16 preset value	6012	rw	Signed16
Slope long16 offset	6013	ro	Signed16
Differential slope long16 offset	6014	rw	Signed16
Slope lateral16	6020	ro	Signed16
Slope Lateral16 operating parameter	6021	rw	Unsigned8
Slope Lateral16 preset value	6022	rw	Signed16
Slope lateral16 offset	6023	ro	Signed16
Differential slope later16 offset	6024	rw	Signed16
All 32-bit objects	61XX	–	-