

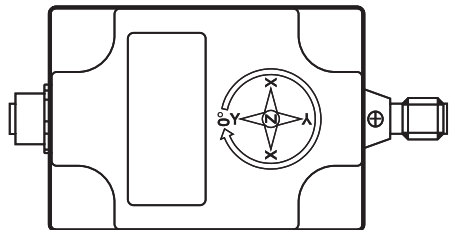


Device manual
Inclination sensor JD
with CANopen interface

UK

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80279676/00



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1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

1.1 Explanation of symbols

- ▶ Instructions
- > Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

2 Safety instructions

- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- That is why installation, electrical connection, set-up and operation of the unit must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

3 Functions and features

Dynamic MEMS inclination sensors detect and measure the angle of tilt (inclination/slope/elevation) of an object in relation to the force of gravity. This is possible while the object stands still (static) or while it is moving (dynamic).

The unit offers integrated linearisation and temperature compensation and ignores external accelerations.

This makes the sensor particularly apt for moving (dynamic) applications and versatile for harsh environments.

JD1xxx: Single axis inclination sensor with an angular range of 0...360°.

JD2xxx: Dual axis inclination sensor with an angular range of $\pm 90^\circ$.

Properties:

- high accuracy also during external accelerations
- CANopen device profile CiA DSP-410

Typical applications are:

- mobile machines
- agricultural machines
- elevating work platforms
- automated guided transport vehicles (AGV)

4 Installation

4.1 Fixing the sensor

- ▶ Choose a plane mounting surface.
- ▶ Fix the unit using 4 screws, tightening torque 1.5...2.5 Nm.

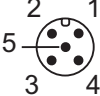
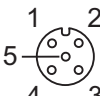
Recommendation:

M6 hex-head screws (steel or stainless steel)

- ▶ Adjust M12 connectors precisely and screw them fully into the unit, tightening torque 1.5 Nm.

5 Electrical connection

The inclination sensor is connected via a 5-pin M12 connector.

	<ul style="list-style-type: none">1: CAN_GND Ground2: CAN_V+ Supply voltage 24 V DC (+UB)3: GND4: CAN_H High bus cable5: CAN_L Low bus cable
M12 connector CAN-In	
	<ul style="list-style-type: none">1: CAN_GND Ground2: CAN_V+ Supply voltage 24 V DC (+UB)3: GND4: CAN_H High bus cable5: CAN_L Low bus cable
M12 socket CAN-Out	

5.1 Bus termination

One terminating resistor is required

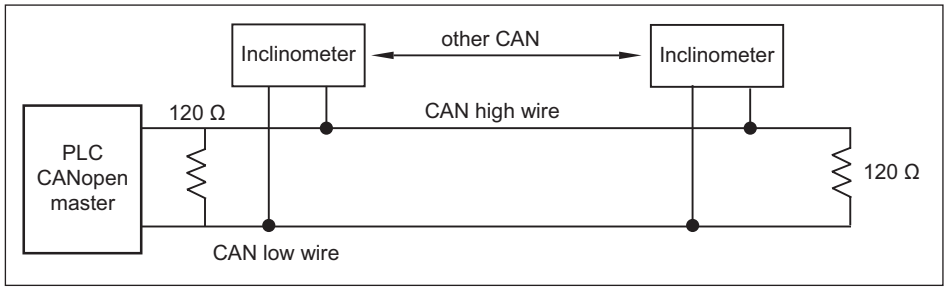
- if the sensor is connected at the end or the beginning of the bus.
- in case of a transmission rate ≥ 50 kBaud.

This prevents that information will be transmitted back to the CAN bus.

Dynamic ifm sensors have an integrated 120Ω termination resistor that can be activated (1) or deactivated (0) (\rightarrow 9.23 Object 3002h - Termination Resistor).

The bus wires can be routed in parallel or twisted, with or without shielding in accordance with the electromagnetic compatibility requirements. A single line structure minimises reflection.

The following diagram shows the components for the physical layer of a two-wire CAN bus.



6 CANopen interface

The inclination sensors have a standardised CANopen interface according to CiA DS-301 and a device profile according to CiA DSP-410. All measured values and parameters can be accessed via the object directory (OD). The individual configuration can be saved in the internal permanent memory (flash).

The unit supports

- Polled mode
The position value is transmitted only on request.
- Cyclic mode
The position value is sent cyclically (regular, adjustable intervals) on the bus.
- SYNC mode
The position value is sent after a synchronisation message (SYNC) is received. The position value is sent every n SYNCs ($n \geq 1$).
- State change mode
The position value is transmitted whenever the position of the inclination sensor changes (minimum time interval configurable).

The units can be set using the EDS configuration file (Electronic Data Sheet → www.ifm.com).

6.1 CANopen functions

The following CANopen functions are available

- Node ID
 - In the CAN network, each device has a node ID that is used to address the device in the network and to define its priority.
- EDS (Electronic Data Sheet)
 - An EDS file describes the communication properties of a device on the CAN network (baud rates, transmission types, I/O features, etc.). It is provided by the device manufacturer and is used in the configuration tool to configure a node (like a driver in an operating system).
- PDO (Process Data Object)
 - CANopen frame containing I/O data.

A distinction is made between

- Transmit-PDO (TPDO): data is provided by a node.
- Receive-PDO (RPDO): data is received by a node.

The transmission direction is always seen from the node's point of view.

- SDO (Service Data Object)
 - SDOs are used to read or write parameters while the application is running.
- COB-ID (Communication Object Identifier)
 - Each CANopen frame starts with a COB-ID working as the Identifier. During the configuration stage, each node receives the COB-ID in accordance with the Pre-Defined Connection Set, PDO + NodeID (Default: 18A and/or 28A).
- NMT (Network Management Transition)
 - The NMT protocols are used to issue state machine change commands (to start and stop the devices), detect remote device boot-ups and error conditions.

6.1.1 Pre-operational

If the unit is in the pre-operational mode, the configuration can be changed. Only SDOs can be used to read or write device-related data.

The unit is in the pre-operational mode

- when it is switched on.
- on receiving the Enter Pre-Operational NMT indication, if it was in Operational Mode beforehand.

If configuration is complete, the device goes into one of the following states on receiving the corresponding indication

- "Stopped" on receiving the "Stop Remote Node" NMT indication.

- "Operational" on receiving the "Start Remote Node" NMT indication.

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

Identifier	Byte 0	Byte 1	Meaning
0h	80h	00	NMT PreOp, all nodes
0h	80h	NN	NMT PreOp, NN

NN: node number

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6.1.2 Operational Mode

The device goes into the "Operational" state if it was in the "Pre-Operational" state on receiving the "Start Remote Node" indication. If the CANopen network is started using the "Node Start" NMT services in "Operational" state, all device functionalities can be used. Communication can use PDOs or SDOs.

Note: Modifications to the configuration in "Operational" mode may have unexpected consequences and should therefore only be made in "Pre-Operational" mode.

To set one or all nodes in "Operational" mode, the master has to send the following message

Identifier	Byte 0	Byte 1	Meaning
0h	01h	00	NMT start, all nodes
0h	01h	NN (in hex)	NMT start, NN

NN: node number

6.1.3 Stopped mode

The device goes into the "Stopped" mode on receiving the "Node Stop" indication (NMT service) if it was in "Pre-Operational" or "Operational" mode. In this mode, the device cannot be configured. No service is available to read and write device-related data (SDO). Only the slave monitoring function "Node Guarding" remains active.

To put one or all nodes in the "Stopped" mode, the master has to send the following message

Identifier	Byte 0	Byte 1	Meaning
0h	02h	00	NMT-Stop, all nodes
0h	02h	NN (in hex)	NMT stop, NN

NN: node number

6.1.4 Re-initialisation of the inclination sensor

If a node is not operating properly, it is advisable to carry out a re-initialisation. After re-initialisation, the inclination sensor accesses the bus in pre-operational mode.

Identifier	Byte 0	Byte 1	Meaning
0h	82h	00h	Reset communication
0h	082h	NN (in hex)	Reset node

Polled mode

By a Remote Transmission Request Telegram, the connected host calls for the current process value. The inclination sensor uses the current position value, calculates eventually set-parameters and returns the obtained process value by the same identifier.

Cyclic mode

The inclination sensor cyclically transmits the current process value, without being called by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.

Sync mode

The inclination sensor answers with the current process value after receiving a sync telegram. The parameter sync counter can be programmed to skip a certain number of sync telegrams before answering again.

Heartbeat function

A node signals its communication status by cyclically transmitting a heartbeat message. This message is received by one or any number of members (Heartbeat Consumers) in the bus and so they can control the dedicated node (Heartbeat Producer).

6.2 Boot-up procedure

The general boot-up process and a mapping view of the different modes are illustrated below (boot-up message for node ID 10 = 70Ah)

Number	Description
1	Module power-up
2	After initialisation, the module automatically goes into pre-operational mode
3	NMT: Start remote node
4	NMT: Pre-operational mode
5	NMT: Stop remote node
6	NMT: Reset node
7	NMT: Reset communication

6.3 Usage of the Layer Settings Service (LSS)

The integrated Layer Setting Services (LSS) functionality is designed according to the CiA normative DS305V200 CANopen Layer Setting Services.

These services and protocols can be used to enquire or to change settings of several parameters (of the physical, data link, and application layer) on a CANopen device with LSS slave capability by a CANopen device with LSS master capability via the CAN network.

If this is the case, the inclination sensor will be the LSS slave device and the PLC (control) has to support the LSS master device functionality. The LSS functionality of this series is restricted to the parameters of the application level (number of nodes and baud rate).

The LSS master device requests services that are performed by the inclination sensor (LSS slave devices). The LSS master device requests the LSS address from the LSS slave device. The LSS address is defined in the 1018h Identity Object and consists of a manufacturer ID, a product code, a revision number and a series number.

After receiving this information the control can identify the inclination sensor. The node number and baud rate can then be set. The exact procedure varies in detail, independently of the utilised PLC tool. This object provides the general identification of the inclination sensor.

Sub-index	Meaning	Data type	Default value
0	Number of entries	Unsigned 8	0x4
1	Vendor Id	Unsigned 32	0x69666D
2	Product Code	Unsigned 32	0x0 (JDxxxx)
3	Revision Number	Unsigned 32	-
4	Serial Number	Unsigned 32	-

7 Status LED

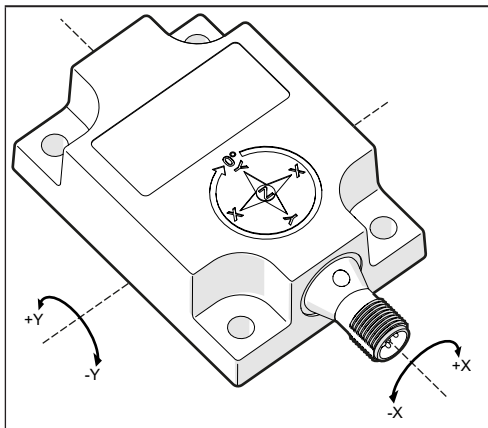
Since a dual colour LED is used, only the red LED is shown in cases where both green and red LED would light up.

LED colour	Flashing frequency	Meaning
green	off	No power supply
	single flash	The device is in the "Stopped" state
	on	Boot Up message sent, device configuration is possible The device is in the "pre-operational" state
	flashes	Normal operation mode The device is in the "operational" state
red	off	Normal operating mode
	single flash	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
	double flash	A guard event or a heartbeat event has occurred
	flashes	General configuration error (e.g. wrong baud rate)
	on	The CAN controller is in Bus Off mode. Communication is no longer possible. Too many error frames in the network.

8 Measurement axes

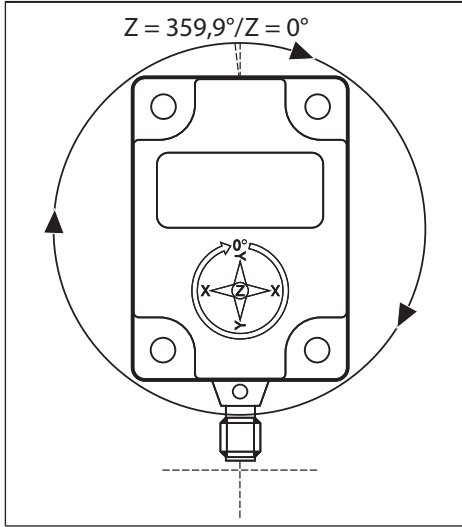
8.1 Dual axis inclination sensor $\pm 90^\circ$

The X-axis and the Y-axis measure the angle position in relation to the earth vector. Both axes are limited to $\pm 90^\circ$. The sensor is mounted horizontally. The X-axis and the Y-axis provide 0° if the inclination sensor is installed in a horizontal position.



8.2 Single axis inclination sensor ± 0...360°

The sensor is mounted vertically. A clockwise rotation around the Z-axis of the sensor increases the angle value from 0...360°. When the male connector is pointing downwards, the output is 0°.



8.3 Default Factory Settings

Meaning	Object	Value
Type of unit	1000h	0x2019A – two measurement axes 0x1019A – one measurement axis
Cyclic timer	2200h	0Ah (10ms)
Resolution	6000h	0Ah (0.01°)
Node number	3000h	0x9h (Node number 10)
baud rate	3001h	03h (125 kB)

The factory settings can be restored at any time. Only a few parameters need to be reprogrammed to make the inclination sensors compatible with the controller or the existing CAN bus (→ 9.11 Object 1011h - Restore Parameters).

8.4 Active Programming Objects

Active CANopen objects depending on the status of the unit. "Yes" in the table indicates which CANopen objects are active in the corresponding modes.

Initialisation	Pre-operational	Operational	Stopped	
PDO Object			yes	
SDO Object		yes	yes	
Boot-up	yes		yes	
NMT		yes	yes	yes

8.5 Programmable parameters

Objects are based on the CiA-DS410 CANopen profile for inclination sensors (www.can-cia.org). The following table gives a list of the command identifiers sent and received by the inclination sensor.

They are the standard commands for communication and transmission between a master and slave in a CAN bus. They can be used to analyse communication protocols between the master and the slave.

8.6 Command description

Command	Function	Message	Meaning
22h	Domain download	Request	Parameter to inclination sensor
60h	Domain download	Confirmation	Parameter received
40h	Domain upload	Query	Parameter query
43h, 4Bh, 4Fh 1)	Domain upload	Response	Parameter to master
80h	Warning	Response	Transmission error

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

8.7 Data length of commands

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

8.8 Frequently Used Commands

The following list shows the most frequently used objects while programming the unit. The whole list of objects is provided in the chapter "Object overview".

<p>Position value (Objects 6010h, 6020h)</p>	<p>The objects 6010h and 6020h are used to get the scaled and acceleration compensated tilt angle (integer 16 variables)</p> <p>For dual axis JD21xx</p> <ul style="list-style-type: none"> - Object 6010h refers to the X-axis - Object 6020h refers to the Y-axis <p>For one axis JD11xx</p> <ul style="list-style-type: none"> - Object 6010h refers to the Z-Axis
<p>Save parameters (Objects 1010h, 2300h)</p>	<p>Object 1010h is used to store either all parameters or only parts of the object dictionary if necessary. Whereas object 2300h stores and saves all current parameters with an additional NMT reset of the unit.</p>
<p>Resolution in degrees (°) (Object 6000h)</p>	<p>This parameter is used to program the required resolution.</p> <p>The resolution can be set to 1° (1000d), 0.1° (100d) or 0.01° (10d). (Default 10d – 0.01°)</p>
<p>Preset value (Objects 6012h, 6022h)</p>	<p>► Here, the value of the starting position can be set to a specific angle. For greater accuracy, this should be done when the machine is standing still.</p> <p>The offset value is set in the inclination sensor when the telegram has been sent and confirmed.</p> <p>If the preset is set dynamically, bus latency and internal cycle time of the inclination sensor are to be taken into consideration.</p> <p>For 2 axes</p> <ul style="list-style-type: none"> - Object 6012h is used to set the preset value for the X-axis and Object 6013h for the Y-axis. <p>For 1 axis</p> <ul style="list-style-type: none"> - Object 6012h is used for the Z-axis.
<p>Baud Rate (Object 3001h)</p>	<p>The baud rate can be programmed via SDO. (Default 125 kBaud)</p>
<p>Node Number (Object 3000h)</p>	<p>The node number can be set via the SDO-Object. Valid addresses range from 1...127, and each address can only be used once.</p> <p>The value set in this object is incremented by one to prevent setting Node Number 0.</p> <p>For inclination sensors programmed via SDO, the default is 09h = Node Number 10</p>

8.9 PDO Transmission

Process data objects (PDOs) communicate process information and data that is exchanged in real-time. The PDO set of a CANopen device describes the explicit exchange between the device and the communication partners in the network. The exchange of PDOs is only authorised if the device is in "Operational" mode.



PDOs can be directly mapped into memory locations on the controller and can be viewed upon reading those memory locations.

8.9.1 Object 1800h - 1st Transmit PDO Communication Parameter

This object contains the communication parameter of the 1st transmit PDO.

Sub-index 1)	Meaning	Data type	Default value	Access	Recovery after boot-up
00h	Number of sub-indices	Unsigned 8	5	ro	Yes
01h	COB ID	Unsigned 32	180h + Node ID10 (18Ah)	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	10 ms	rw	Yes

1) Sub-index: Second degree identifier used in combination with the object (follows the object number).

Programming example (for NN=10 (0A))

The inclination sensor is supposed to send the PDO every 100 ms (standard setting: The sensor responds to sync messages from the CANopen master)

Step 1

Set all sensors to pre-operational mode

Identifier	DLC	Byte 0	Byte 1
00	2	80	00

Step 2

Set Event Timer 1800Sub05 to 100ms (100dec = 64h)

Identifier	DLC	Command	Index		Sub-index	Service/process data			
						Byte 4	Byte 5	Byte 6	Byte 7
NN = 1		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	00	18	05	64	00	00	00

Step 3

Set Transmission Type (1800Sub2) to "Send PDO on event" (254dec = FEh)

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 1		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	00	18	02	FE	00	00	00

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Step 4

Set all sensors to operational mode

Identifier	DLC	Byte 0	Byte 1
00	2	01	00

8.9.2 Object 1801h - 2nd Transmit PDO Communication Parameter

This object contains the communication parameter of the 2nd transmit PDO.

Sub-index 1)	Meaning	Data type	Default value	Access	Restore after boot-up
00h	Number of sub-indices	Unsigned 8	5	ro	Yes
01h	COB ID	Unsigned 32	280h + Node ID10 (28Ah)	rw	Yes
02h	Transmission mode	Unsigned 8	1	rw	Yes
03h	Inhibit time	Unsigned 32	1	rw	Yes
04h	Not available				
05h	Event timer	Unsigned 32	10 ms	rw	Yes

1, sub-index: Second degree identifier used in combination with the object (follows the object number).

8.9.3 Transmission mode

The transmission mode (sub-index 2) for Objects 1800 and 1801 can be configured as described

Transmission value (Dec)	Transmission mode					Note
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR Only	
0		x	x			Send PDO on first sync message following an event
1...240	x		x			Send PDO every x sync messages
241...251	reserved					
252			x		x	Receive Sync and send PDO on remote request
253					x	Update data and send PDO on remote request
254				x		Send PDO on event
255				x		Send PDO on event

8.9.4 Inhibit time

The inhibit time is the minimum interval for PDO transmission if the transmission type is set to 254d (FEh) and 255d (FFh). The value is defined as a multiple of 100 μ s. The Inhibit Time cannot be changed while the respective PDO is in operation.

Calculation of inhibit time

The inhibit time sets the minimum time between two process values. The value is defined as multiples of 100 μ s.

Example

- ▶ Set the inhibit timer (object 1800h/1801h) sub-index 3 to 1000d (03E8hex).
- ▶ Set the inhibit time to 100 ms (1000 x 100 μ s). It is not allowed to change the inhibit time while the PDO exists.

Read Only: Slope Long16, Slope Lateral16, Slope Long16 Offset, Slope Lateral16 Offset, Slope Long32, Slope Lateral32, Slope Lateral32 Offset, Slope Lateral32 Offset.

8.9.5 Event timer

The event timer only works in asynchronous transmission mode (transmission mode 254d and 255d). The value is defined as a multiple of 1 ms. A transmit PDO is sent after the Event Timer expires (for values > 0).

The range is 1 – 65536 ms. The event timers of TPDO1 and TPDO2 are hard-wired, i.e. if one timer is changed, the other one is adjusted accordingly.

8.9.6 Cyclic timer

The cyclic timer is hardwired with both event timers of TPDO1 and TPDO2.

Due to the fact that it is possible to save either communication parameters (Event Timers) or manufacturer parameter (Cyclic Time), the parameters could hold different values after a power off/on cycle.

The inclination sensor prevents this mismatch by checking these values during start-up. The event timer value is copied to the Cyclic Time if they do not match.

8.9.7 Object 1A00h - 1st Transmit PDO Mapping Parameter

This object contains the mapping parameter of the 1st transmit PDO.

Sub-index	Meaning	Data type	Default value	Access	Restore after BootUp
0	Number of sub-indices	Unsigned 8	2 - dual axis 1 - single axis	rw	Yes
1	Mapped object	Unsigned 16	0x60100010	rw	Yes
2	Mapped object	Unsigned 16	0x60200010	rw	Yes

8.9.8 Object 1A01h - 2nd Transmit PDO Mapping Parameter

This object contains the mapping parameter of the 2nd transmit PDO.

Sub-index	Meaning	Data type	Default value	Access	Restore after boot-up
0	Number of sub-indices	Unsigned 8	2 - dual axis 1 - single axis	rw	Yes
1	Mapped object	Unsigned 16	0x60100010	rw	Yes
2	Mapped object	Unsigned 16	0x60200010	rw	Yes

Programming example (for NN=1)

The sensor is supposed to transmit the X-axis rotation speed and the X-axis acceleration value via the 2nd PDO.

Step 1

Disable 2nd Transmit PDO

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	18	01	00	00	00	80

Step 2

Disable TPDO2 mapping

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	1 A	00	00	00	00	80

Step 3

Map gyro X 16 bit value (3400Sub0) to TPDO2 Object 1

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	1 A	00	10	00	00	34

Step 4

Map acceleration x 16 bit value (3403Sub0) to TPDO2 Object 2

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	1 A	02	10	00	03	34

Step 5

Enable TPDO mapping parameter again

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	1 A	00	02	00	00	00

Step 6
Enable 2nd Transmit PDO

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	18	01	82	02	00	00



Step 7
Save this configuration by writing "save" to 1010Sub01

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	10	10	01	73	61	76	65

8.9.9 Types of SDO

Service Data Objects (SDOs) allow a device's data to be accessed by 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

- Read SDOs (Download SDOs)
- Write SDOs (Upload SDOs)

The SDO protocol is based on a Client/Server model

Download SDO	The client sends a request indicating the object to be read. The server returns the data contained within the object.
Upload SDO	The client sends a request indicating the object to be written to with the required value. After the object has been updated, the server returns a confirmation message.
Unprocessed SDO	The server returns an error code (80) in both cases if an SDO could not be processed.

9 Object directory (OD)

9.1 Object 1000h - Device Type

The object at index 1000h describes the type of device and its functionality. It consists of a 16 bit field and describes the device profile in use. A second 16-bit field gives additional information about optional functionality of the device. The additional information parameter is device profile specific.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 32	0X2019A 1) 0X1019A 2)	ro

1) Dual axis

2) Single axis

9.2 Object 1001h - Error Register

This object is used by the device to display internal faults. If there is an error, the corresponding bit will be activated.

The following errors are supported

Bit	Meaning	Remarks
0	Generic Error	The generic error is signalled in any error situation

The object description for error register

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 8	N/A	ro

9.3 Object 1003h - pre-defined error field

The object contains the errors that have occurred on the device and were reported via the emergency object. The error code is located in the least significant word. Additional information is located in the most significant word. Sub-index 0 contains the number of recorded errors.

Sub-index	Meaning	Data type	Default value	Access
0	Number of recorded errors	Unsigned 8	0	rw
1	Most recent errors	Unsigned 32	–	ro

To clear Error Log: Write "0" into sub-index 0 of object 1003.

9.4 Object 1005h - COB-ID Sync

This object indicates the configured COB-ID of the synchronisation object. In operational mode, sensor sends process data if SYNC message with the same COB-ID is received. (Correct setting of transmission of TxPDO(s) implied).

Sub-index	Meaning	Data type	D	Access
0	–	Unsigned 32	0x80	rw

9.5 Object 1008h - Manufacturer Device Name

This object contains the device name.

Sub-index	Meaning	Data type	Default value	Access
0	–	String	–	ro

9.6 Object 1009h - Manufacturer Hardware Version

This object contains the hardware version of the circuit board.

Sub-index	Meaning	Data type	Default value	Access
0	–	String	–	ro

9.7 Object 100Ah - Manufacturer Software Version

This object contains the manufacturer software version.

Sub-index	Meaning	Data type	Default value	Access
0	–	String	–	ro

9.8 Object 100Ch - Guard Time

This object contains the 'guard time' in milliseconds.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 16	0	rw

9.9 Object 100Dh - Life Time Factor

This object contains the life time factor parameters. The life time factor multiplied with the guard time gives the life time for the node guarding protocol.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 8	0	rw

9.10 Object 1010h - Store Parameters

This object controls the saving of all writable parameters in non-volatile memory.

Sub-index	Meaning	Data type	Default value	Access
0	Number of sub-indices	Unsigned 8	4	ro
1	Save all parameters	Unsigned 32	-	rw
2	Save communication parameters	Unsigned 32	-	rw
3	Save application parameters	Unsigned 32	-	rw
4	Save manufacturer parameters	Unsigned 32	-	rw

Storing Procedure: To save the parameters to non-volatile memory, the access signature "save" has to be sent to the corresponding sub-index of the device.

	Most significant word		Least significant word	
ASCII	e	v	a	s
Hex value	65h	76h	61h	73h

9.11 Object 1011h - Restore Parameters

With this object, writable device and CANOpen related parameters are reset to factory settings.

Sub-index	Meaning	Data type	Default value	Access
0	Number of sub-indices	Unsigned 8	4	ro
1	Restore all parameters	Unsigned 32	-	rw
2	Restore communication parameters	Unsigned 32	-	rw
3	Restore application parameters	Unsigned 32	-	rw
4	Restore manufacturer parameters	Unsigned 32	-	rw

Loading procedure: To load the parameters from non-volatile memory, the access signature "load" has to be sent to the corresponding sub-index of the device.

	Most significant word		Least significant word	
ASCII	d	a	o	l
Hex value	64h	61h	6Fh	6Ch

Sub-index	Meaning	Data type	Default value	Access
0	-	Unsigned 16	0x80+Node-ID	rw

When the message has been transmitted, restart is required.

9.12 Object 1014h - COB-ID Emergency

This object indicates the configured COB-ID for the emergency write service. This has the highest priority among transmitted messages.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 32	0x81	rw

9.13 Object 1016h - Consumer Heartbeat Time

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

Sub-index	Meaning	Data type	Default value	Access
0	Number of indices	Unsigned 8	1	ro
1	Consumer heartbeat Time	Unsigned 32	0	rw

The context of sub-index 1 is as follows

Bit	31 to 24	23 to 16	15 to 0
Value	0h (reserved)	Address of monitored device (Node-ID)	Monitoring time (ms)

9.14 Object 1017h - Producer Heartbeat Time

The object contains the time interval in milliseconds in which the device has to produce a heartbeat message. The values are given in multiples of 1ms.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 16	0	rw

9.15 Object 1018 - Identity Object

This object provides the general identification of the inclination sensor.

Sub-index	Meaning	Data type	Default value	Access
0	Number of entries	Unsigned 8	4	ro
1	Vendor ID	Unsigned 32	0x69666D	ro
2	Product code	Unsigned 32	0x0 (JDxxxx)	ro
3	Revision number	Unsigned 32	-	ro
4	Serial number	Unsigned 32	-	ro

9.16 Object 2200h - Cyclic Timer

This object determines the transmission intervals in the cyclic transmission mode. It is directly connected to the event timers of TxPDO1 and TxPDO2. If the cyclic timer and the event timer of TxPDOs hold different values after power off/on cycle, the value of the event timers is copied to the cycle time.

Sub-index	Meaning	Data type	Default value	Access
0	–	Unsigned 16	0xA (10ms)	rw

9.17 Object 2300h - Save Parameter with Reset

This object stores all parameters in the non-volatile memory. All parameters are saved with an additional reset executed afterwards.

Sub-index	Meaning	Data type	Default value	Access
0	Access code	Unsigned 32	55AAAA55h	wo

9.18 Object 2600h - Preset X-Axis ($\pm 90^\circ$ Version) / Preset (360° Version)

In JD2xxx inclination sensors, this object sets the X-axis to the required value. In JD1xxx inclination sensors, this object sets the Z-axis to the required value. It is hard-wired with the objects 6012 and 6112.

Sub-index	Meaning	Data type	Default value	Access
0	-	Integer 16	-	rw

The valid preset value ranges depend on the current resolution of the inclination sensor. If the preset value is outside the range, an error message appears.

Resolution	Preset range (decimal)
Type	JD2xxx
1°	± 90
0.1°	± 900
0.01 (default)	± 9000

9.19 Object 2601h - Preset Y axis

This object sets the Y-axis to a required value. It is hard-wired with objects 6022 and 6122.

Sub-index	Meaning	Data type	Default value	Access
0	–	Integer 16	-	rw

The valid preset value ranges depend on the current resolution of the unit. If the preset value is outside the range, an error message appears.

After setting the preset value, a memory command is required to set the preset value permanently.

9.20 Object 2700h Fast Bootup Enable

This object can be used to change the time between the connection of the supply voltage and the point of time when the first angle values are sent.

After the power supply is switched on, it takes about 1200 ms before the sensor provides the angle values via CANopen.

The sensor can send the CANopen files earlier if the object is set to 1. This acti-

vates fast boot-up.

The sensor transmits the CANopen data after 600 ms, but the angle values for the following 600 ms are faulty.

Sub-index	Meaning	Data type	Default value	Access
0	Activate quick start	Unsigned 8	0	rw

9.21 Object 3000h - Node Number

This object contains the node number of the device. The ifm standard node number is 10 decimal. The valid node numbers range from 01 to 127.

Sub-index	Meaning	Data type	Default value	Access
0	Node number	Unsigned 8	0	rw

UK



To avoid the node number zero (0), one (1) will be added to the value of this object. E.g.: To set node number 32 decimal, write 1F hex to the object and save. $1Fh + 1h = 20h = 32$ (dec) will finally be set as the node number. The new node number is only adopted after the device is reset, i.e. the node number needs to be saved prior to the reset to have an effect.

9.21.1 Programming example (for NN=1): Set Node Number (NN) to 50 Decimal (32h)

Step 1

Write 31h in object 3000Sub0 (the saved value is increased by 1; $29h + 09h = 32h$ (= 50dez))

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	00	30	00	09	00	00	00

Step 2

Save this configuration by writing "save" to 1010Sub01

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	10	10	01	73	61	76	65

Step 3

The sensor will adapt the new node number after a reset.

9.22 Object 3001h - Baud rate

This object contains the baud rate of the device. Valid value ranges from 0 to 7.

Sub-index	Meaning	Data type	Default value	Access
-----------	---------	-----------	---------------	--------

0	Baud rate	Unsigned 8	-	rw
---	-----------	------------	---	----

Eight different baud rates are provided. To adjust the baud rate only one byte is used. The default baud rate is 125 kB (03h).

Baud rate in kB	Stored value in the object
20	00h
50	01h
100	02h
125	03h
250	04h
500	05h
800	06h
1000	07h

The new baud rate is only effective after a "save" command and a subsequent restart.

Programming example (for NN=10): Set baud rate to 500 kBaud

Step 1

Set baud rate 3001Sub0 to 500kBaud (05h)

Identifier	DLC	Command	Index		Sub-index	Service/Process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	01	30	00	05	00	00	00

Step 2

Save parameters and execute a reset. The reset is needed to restart the sensor with the configured baud rate

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	00	23	00	55	Article type	Article type	55

9.23 Object 3002h - Termination Resistor

This object is used to activate the termination resistor in case the unit is used at the edges of the transmission line (to avoid reflection of data back into the CAN bus) and/or high transmission rates (>50kB).

Sub-index	Meaning	Data type	Default value	Access
0	Activate Termination Resistor	Unsigned 8	0	rw

For activation ¹⁾, write 1 decimal to the sub-index 0 of the object

For de-activation, write 0 decimal to the sub-index 0 of the object

1) If activated, the termination resistor is only enabled while the device is powered. The termination resistor is deactivated per default.

9.24 Object 3005h - Auto BootUp Enable

With this object, the start-up behaviour of the encoder is defined.

Sub-index	Meaning	Data type	Default value	Access
0	Auto BootUp	Unsigned 8	0	rw

UK

True: After power up, the encoder enters the operational state autonomously without receiving an NMT start command.

False: After power up, the encoder enters the pre-operational state. This is the standard behaviour of CANopen devices.

9.25 Object 3100h - Moving Average Filter (MAF)

This object contains the number of determined values. If set to 0, the filter is deactivated. The filter is deactivated by default. The valid range of filter values accepted is from 0 to 250d.

Sub-index	Meaning	Data type	Default value	Access
0	Moving Average Filter	Unsigned 16	0	rw

Internal Calculation of position values when MAF is activated with value N

$\text{New_Sensor_Value}_x =$

$[\text{Sensor_Value}_x + \text{Sensor_Value}_{x-1} + \dots + \text{Sensor_Value}_{x-N}] / N$

9.26 Gyroscope signal

The sensor stores the measured rotation rates of the gyroscope in different objects. The values are calibrated and can be mapped via PDO and SDO. The maximum range of the gyroscope sensor is $\pm 500^\circ/\text{s}$.

9.27 Object 3400h - Gyro x axis 16

This object provides the calibrated rate of rotation in the X-axis (pitch). The value is given in degrees/second with the resolution of $0.1^\circ/\text{s}$. This value can be mapped to a PDO.

Sub-index	Meaning	Data type	Default value	Access
0	Gyro x axis 16	Integer16		ro

9.28 Object 3401h - Gyro y axis 16

This object provides the calibrated rate of rotation in the Y-axis (roll). The value is given in degrees/second with the resolution of $0.1^\circ/\text{s}$. This value can be mapped to a PDO.

Sub-index	Meaning	Data type	Default value	Access
0	Gyro y axis 16	Integer16		ro

9.29 Object 3402h - Gyro z axis 16

This object provides the calibrated rate of rotation in the Z-axis (yaw). The value is given in degrees/second with the resolution of $0.1^\circ/\text{s}$. This value can be mapped to a PDO.

Sub-index	Meaning	Data type	Default value	Access
0	Gyro z axis 16	Integer16		ro

9.30 Accelerometer signal

The sensor stores the measured acceleration forces of the accelerometer in different objects. These values are calibrated and can be mapped in a PDO. The maximum range of the acceleration sensor is $\pm 4000 \text{ mg}$. ($1 \text{ g} = 9.81 \text{ m/s}^2$).

9.31 Object 3403h - Acceleration x axis 16

This object provides the acceleration value in the X-axis. The value is given in mg with the resolution of 1 mg.

Sub-index	Meaning	Data type	Default value	Access
0	Acceleration x axis 16	Integer16		ro

9.32 Object 3404h - Acceleration y axis 16

This object provides the acceleration value in the Y-axis. The value is given in mg with the resolution of 1 mg.

Sub-index	Meaning	Data type	Default value	Access
0	Acceleration y axis 16	Integer16		ro

9.33 Object 3405h - Acceleration z axis 16

This object provides the acceleration value in the Z-axis. The value is given in mg with the resolution of 1 mg.

Sub-index	Meaning	Data type	Default value	Access
0	Acceleration z axis 16	Integer16		ro

9.34 Object 3411h - Temperature Gyro

This object indicates the temperature of the sensor (on the PCB) with a resolution of 0.1 °C and a precision of ± 5 °C.

Sub-index	Meaning	Data type	Default value	Access
0	Temperature Gyro	Unsigned 16	–	rw

9.35 Object 6000h - Resolution

This object shall indicate the resolution of Slope long16 (object 6010h) and Slope lateral16 (object 6020h) objects based on 0.01°.

Sub-index	Meaning	Data type	Default value	Access
0	Resolution	Unsigned 16	–	rw

Three possible resolutions can be used

Angular Resolution	Value decimal	Byte hex
0.01°	10	0Ah
0.1°	100	64h
1°	1000	3e8h

9.36 Object 6010h - Slope Long16

Position value X-axis / longitudinal axis (dual axis), Z-axis (single axis)

For dual axis inclination sensors, this object provides the X-axis position value, and for single axis inclination sensors, this object provides the Z-axis value.

This is a Read Only object; the position values are limited in relation to the set resolution.

Sub-index	Meaning	Data type	Default value	Access
0	-	Signed Integer 16 – dual axis Unsigned Integer 16 – single axis	–	ro

Angular Resolution	Position value range	
	JD21xx	
1°	± 90	
0.1°	± 900	
0.01°	± 9000	

9.36.1 Calculation of position / slope value from CANopen readout

Inclination (Degree) = Slope Long 16[Object 6010] x Resolution [Object 6000]



If the attribute "resolution" is changed, side effects will occur because the sensor is adapting the set parameters to the configured resolution. Rounding effects have to be taken into account.

Attributes affected

write/read:

- 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.

9.37 Object 6011h - Slope Long16 Operating Parameter

This object controls the scaling and inversion of the slope long16 values. If bit 0 is set, inversion of slope long16 is enabled.

If bit 1 is set, slope long16 offset and differential slope long16 offset are added to the slope long16.

Both bits can be set at the same time.

Sub-index	Meaning	Data type	Default value	Access
0	Position scaling and inversion	Unsigned 8	00	rw

9.37.1 Calculation of the position value based on the operating parameter

Slope Long16 = [(Physical inclination of slope long16 * Multiplier) + Slope long16 Offset + Differential Slope long16 Offset].

With

- Physical slope long16 (X)
- Multiplier: if inversion is disabled: 1, if inversion is enabled: -1
- Slope Long16 Offset (6013) = Slope Long16 Preset (6012) - (Physical inclination of slope long16 (X) at t_{acc} x Multiplier), with t_{acc} = preset acquisition time
- Differential slope long16 offset (6014): Adds an absolute value (positive or negative) to the sensor

Bit 1	Bit 0	Position calculation
0	0	X
0	1	-X
1	0	(X + Object 6013h + Object 6014h)
1	1	(-X + Object 6013h + Object 6014h)

For detailed explanation, please see the corresponding objects.

9.38 Object 6012h - Slope Long16 Preset Value

This object is used to define a new, required longitudinal slope value. The values will be set only according to the current resolution, so extreme care should be taken in order to be within the range of the position value limits.

Sub-index	Meaning	Data type	Default value	Access
0	Preset value	Integer 16	00	rw

Resolution	Preset Range (in decimal)
Type	JD21xx
1°	± 90
0.1°	± 900

Programming example (for NN=10): Preset Value - Set the current position to 1°

Step 1

Set preset value to 64h. If the resolution is set to 0.01°, 64h is equal to 1°.



If the resolution is set to 0.1°, the preset value must be set to Ah to set the current position to 1°.

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	00	26	00	64	00	00	00

Step 2

Save this configuration by writing "save" to 1010Sub01.

Identifier	DLC	Command	Index		Sub-index	Service/process data			
NN = 10		Download				Byte 4	Byte 5	Byte 6	Byte 7
60A	8	22	10	10	01	73	61	76	65

9.39 Object 6013h - Slope Long16 Offset

This is a read only parameter. The parameter is recalculated every time Slope Long16 preset (6012h), Slope Long32 Preset (6112) or Preset X (2600) objects are changed. This object does not exist for JD11xx.

Sub-index	Meaning	Data type	Default value	Access
0	Offset value	Integer 16	-	ro

9.39.1 Calculation of Slope Long16 Offset

Offset Value =

Preset Value - (Physical Value x Inversion)

[Inversion is -1 if activated; 1 if deactivated]

9.40 Object 6014h - Differential Slope Long16 Offset

This parameter adds an additional, independent offset to slope long16 if scaling of slope long16 is enabled.

Note that the values should be within the range of the position attribute according to the resolution already set.

Sub-index	Meaning	Data type	Default value	Access
0	Offset value	Integer 16	-	rw

Object 6013h is calculated automatically in relation to the preset value, Object 6014h is defined by the user.

9.41 Object 6020h - Slope Lateral16

Position Value Y-Axis (JD21xx Lateral Axis)

For dual axis inclination sensors, this object provides the Y-axis or roll-axis position value. This is a read only object. The position values are limited depending on the set resolution.

Important: This object will output 0 for a sensor with one axis output.

Sub-index	Meaning	Data type	Default value	Access
0	–	Signed Integer 16	–	ro

Resolution	Preset Range (in decimal)
Type	JD21xx
1°	± 90
0.1°	± 900
0.01°	± 9000

9.41.1 Calculation of position / slope value from CANopen readout

Inclination (Degree) = Slope Lateral 16[Object 6020] x Resolution [Object 6000]

9.42 Object 6021h - Slope Lateral16 Operating Parameter

This object controls the scaling and inversion of the slope lateral16 values. If bit 0 is set, inversion of slope lateral16 is enabled.

If bit 1 is set, slope lateral16 offset and differential slope lateral16 offset are added to the slope lateral16. Both bits can be set at the same time.

Sub-index	Meaning	Data type	Default value	Access
0	Position scaling and inversion	Unsigned 8	00	rw

9.42.1 Calculation of position value based on the operating parameter

$$\text{Slope Lateral16} = [(\text{Physical inclination of slope lateral16} \times \text{Multiplier}) + \text{Slope lateral16 Offset} + \text{Differential Slope lateral16 Offset}]$$

With

- Physical inclination of slope long16 (X)
- Multiplier
if inversion is disabled: 1, if inversion is enabled: -1
- Slope Lateral16-Offset (6023) = Slope Lateral16-Preset (6022)
- (physical inclination of slope lateral16 (X) at t_{acc} x multiplier),
with t_{acc} = preset acquisition time
- Differential slope lateral16 offset (6024)
Adds an absolute value (positive or negative) to the sensor output.

Bit 1	Bit 0	Position calculation
0	0	X
0	1	-X
1	0	(X + Object 6023h + Object 6024h)
1	1	(-X + Object 6023h + Object 6024h)

For detailed explanation please see the corresponding objects.

9.43 Object 6022h - Slope Lateral16 Preset Value

This object is used to define a new lateral slope value. These values are only set according to the current resolution.

- Ensure that the values are within the range of the position value limits.

Sub-index	Meaning	Data type	Default value	Access
0	Preset value	Integer 16	00	rw

Resolution	Preset range (in decimal)
Type	JD21xx
1°	± 80
0.1°	± 800
0.01°	± 8000

9.44 Object 6023h - Slope Lateral16 Offset

This is a read only parameter. The parameter is recalculated every time Slope Lateral16 preset (6022h), Slope Lateral32 Preset (6122) or Preset Y (2601) objects are changed.

Sub-index	Meaning	Data type	Default value	access
0	Offset value	Integer 16	–	ro

9.44.1 Calculation of Slope Lateral16 Offset

Offset Value =

Preset Value - (Physical Value x Inversion)

[Inversion is -1 if activated; 1 if deactivated]

9.45 Object 6024h - Differential Slope Lateral16 Offset

This parameter adds an additional, independent offset to slope lateral16 if scaling of slope lateral16 is enabled.

- Ensure that the values of the position attribute are within the range of the resolution that is used.

Sub-index	Meaning	Data type	Default value	Access
0	Offset value	Integer 16	–	rw

Object 6023h is calculated automatically in relation to the preset value, Object 6024h is defined by the user.

9.46 Object 6114h - Differential Slope Long32 Offset

This parameter adds an additional, independent offset to slope long32, but only if scaling of slope long32 is enabled.

- Ensure that the values are within the range of the position value limits.

Sub-index	Meaning	Data type	Default value	Access
0	Offset value	Integer 32	–	rw

Resolution	Differential Offset Range (in decimal)
Type	JD11xx
1°	-179 to 180
0.1°	-1799 to 1800
0.01°	-17999 to 18000

10 Object overview

Object name	Object no. ID (hex)	Access	Data type
Type of unit	1000	Read-only	UNSIGNED32
Error register	1001	Read-only	UNSIGNED8
Predefined error field	1003	–	ARRAY
Sub 0: Number of errors	1003.0	Read/write	UNSIGNED8
Sub 1: New error	1003.1	Read-only	UNSIGNED32
COB-ID SYNC	1005	Read/write	UNSIGNED32
Device name	1008	Read-only	VISIBLE_STRING
Hardware version	1009	Read-only	VISIBLE_STRING
Software version	100a	Read-only	VISIBLE_STRING
Guard time	100c	Read/write	UNSIGNED16
Life time factor	100d	Read/write	UNSIGNED8
Store parameters	1010	–	ARRAY
Highest sub-index supported	1010.0	Read-only	UNSIGNED8
Save all parameters	1010.1	Read/write	UNSIGNED32
Save communication parameters	1010.2	Read/write	UNSIGNED32
Save Application parameters	1010.3	Read/write	UNSIGNED32
Save Manufacturer parameters	1010.4	Read/write	UNSIGNED32
Restore default parameters	1011	–	ARRAY
Highest sub-index supported	1011.0	Read-only	UNSIGNED8
Restore all parameters	1011.1	Read/write	UNSIGNED32
Restore communication parameters	1011.2	Read/write	UNSIGNED32
Restore application parameters	1011.3	Read/write	UNSIGNED32
Restore manufacturer parameters	1011.4	Read/write	UNSIGNED32
COB-ID Emergency	1014	Read-only	UNSIGNED32
Consumer Heartbeat Time	1016	–	ARRAY
Sub 0: No. of Entries	1016.0	Read-only	UNSIGNED8
Sub 1: Consumer heartbeat Time	1016.1	Read/write	UNSIGNED32
Producer Heartbeat Time	1017	Read/write	UNSIGNED16
Identity Object	1018	–	RECORD
Number of Entries	1018.0	Read-only	UNSIGNED8
Vendor ID	1018.1	Read-only	UNSIGNED32
Product Code	1018.2	Read-only	UNSIGNED32
Revision Number	1018.3	Read-only	UNSIGNED32

Serial Number	1018.4	Read-only	UNSIGNED32
TxPDO1 Comm Parameter	1800	–	RECORD
Sub 0: No. of Entries	1800.0	Read-only	UNSIGNED8
Sub 1: 1st mapped object	1a01.1	Read/write	UNSIGNED32
Sub 2: 2nd mapped object	1a01.2	Read/write	UNSIGNED32
Cyclic Time	2200	Read/write	UNSIGNED16
Store parameters	2300	Write-only	UNSIGNED32
Preset X-Axis (dual axis), Preset Z-Axis (one axis)	2600	Read/write	INTEGER16
Preset Y-Axis (only dual axis)	2601	Read/write	INTEGER16
Node number	3000	Read/write	UNSIGNED8
Baud rate	3001	Read/write	UNSIGNED8
Termination Resistor	3002	Read/write	UNSIGNED8
Digital Recursive Filter	3022	Read/write	UNSIGNED16
Moving Average Filter	3100	Read/write	UNSIGNED16
Gyro x axis	3400	Read-only	INTEGER16
Gyro y axis	3401	Read-only	INTEGER16
Gyro z axis	3402	Read-only	INTEGER16
Acceleration x axis	3403	Read-only	INTEGER16
Acceleration y axis	3404	Read-only	INTEGER16
Acceleration z axis	3405	Read-only	INTEGER16
Resolution	6000	Read/write	UNSIGNED16
Slope long16	6010	Read-only	INTEGER16
Slope long16 operating parameter	6011	Read/write	UNSIGNED8
Slope long16 preset value	6012	Read/write	INTERGER16
Slope long16 offset	6013	Read-only	INTEGER16
Differential slope long16 offset	6014	Read/write	INTEGER16
Slope lateral16 (only 90° version)	6020	Read-only	INTEGER16
Slope lateral16 operating parameter (only 90° version)	6021	Read/write	UNSIGNED8
Slope lateral16 preset value (only 90° version)	6022	Read/write	INTEGER16
Slope lateral16 offset (only 90° version)	6023	Read-only	INTEGER16
Differential slope lateral16 offset (only 90° version)	6024	Read/write	INTEGER16
All 32-bit objects	61XX	-	-



If saving or restoring only part of the parameters (communication, application or manufacturer parameters), Cyclic Time (object 2200) and Preset X, Preset Y (80° version, objects 2600 and 2601) or Preset Z (360° version, object 2600) show a special behaviour.

Cyclic Time is hard-wired with the Event Timers of TxPDO1 and TxPDO2. If only the Event Timers (communication parameters) or Cyclic Time (Manufacturer parameter) is/are saved, the parameters would hold different values after a power off/on cycle.

Therefore if the values do not match, the value of the event timers is copied to the Cycle Time, too. Preset parameters work the same way, with the application parameters (objects 6xxx) having the higher priority.

11 Maintenance, repair and disposal

The device is maintenance-free.

- Dispose of the device in accordance with the national environmental regulations.

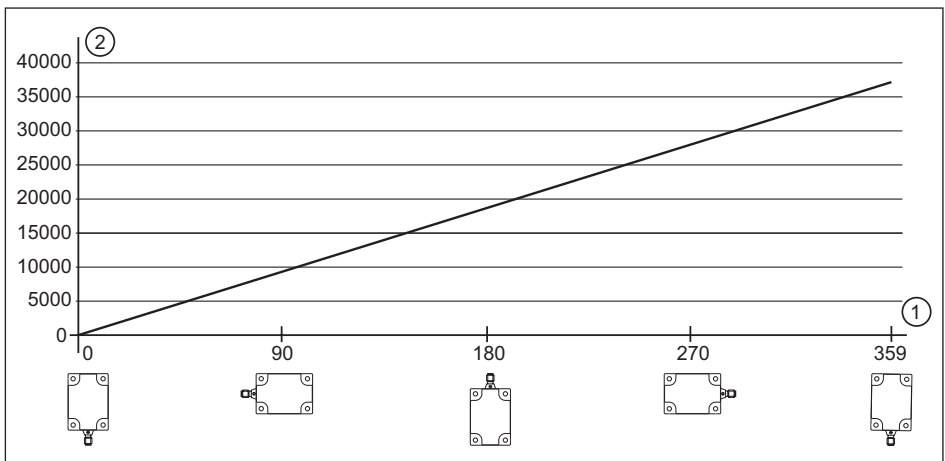
12 Approvals/standards

The CE declarations of conformity and approvals can be found at www.ifm.com.

13 Graphic representation of the output functions

13.1 CANopen Output Values JD11xx

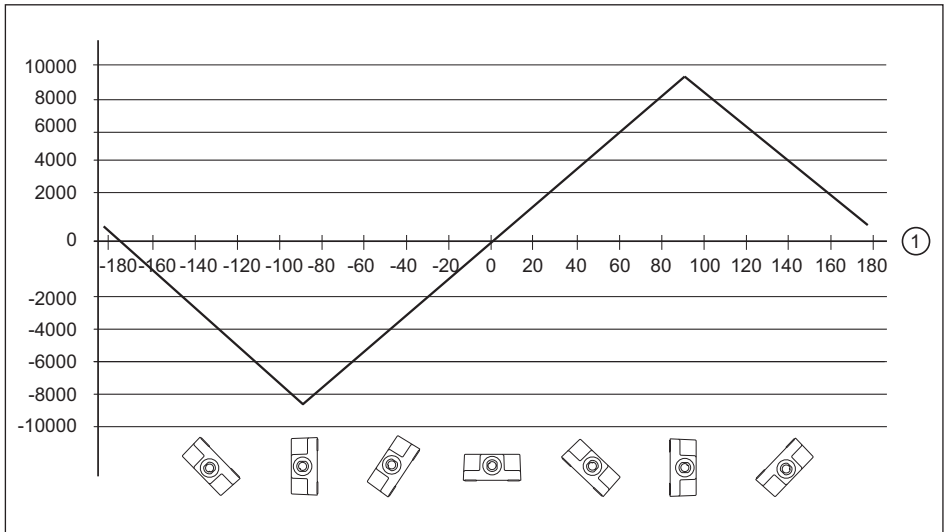
(Factory setting: resolution = 0.01)



- 1: X-axis rotation angle [°]
- 2: Y-axis counter value

13.2 CANopen output values JD21xx (X-axis)

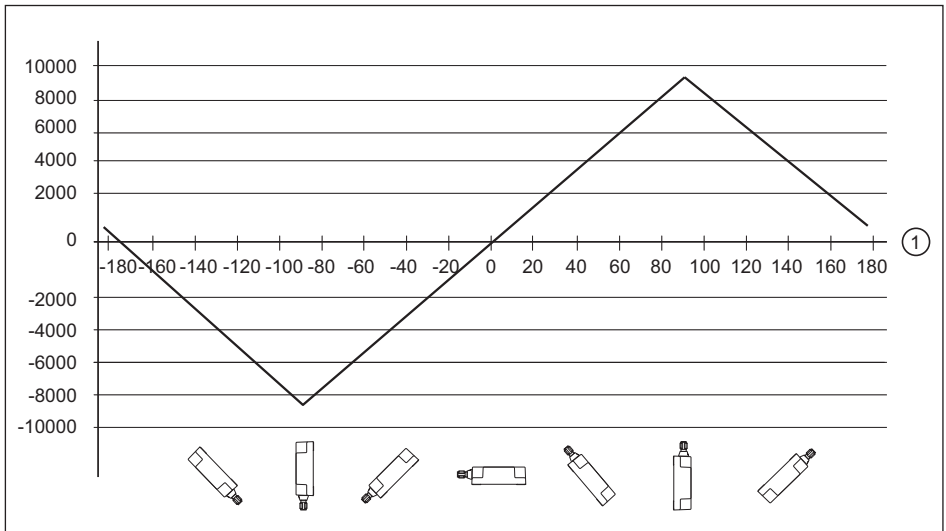
(Factory setting: resolution = 0.01)



1: X-axis rotation angle [°]

13.3 CANopen output values JD21xx (Y-axis)

(Factory setting: resolution = 0.01)

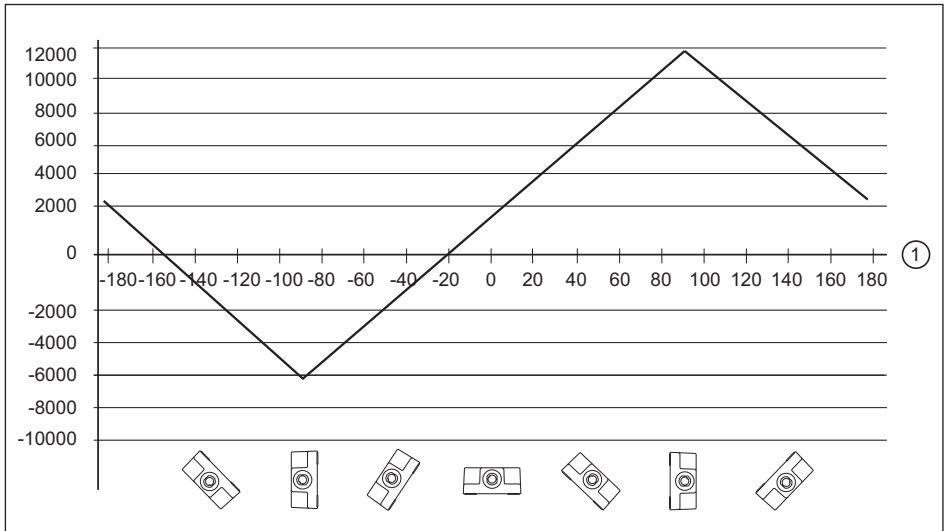


1: Y-axis rotation angle [°]

13.4 Output Graphs with Preset and Offset

Sensor with pre-programmed offset of 20° has an effect on the X and Y angle values.

X/Y/pitch axis output values (factory setting: resolution = 0.01)



1: X-axis rotation angle [°]

Declaration: The position limits are adjusted to $\pm 90^\circ + \text{offset}$.

If an offset of $+20^\circ$ is programmed, the overall output range will be adjusted to -70° to 110° as seen in the graph. The result is that the turning point where the graph switches from positive to negative slope stay at the physical position of $\pm 90^\circ$.

