

Operating Instructions of EtherCAT Displacement Sensor

Taking TwinCAT3 as an example, this manual introduces the operation of EtherCAT displacement sensor.

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一. Installation and use of TwinCAT3

TwinCAT3 can be downloaded from the website. The download address in official website is <https://www.beckhoff.com.cn/zh-cn/support/download-finder/software-and-tools/>.

For TwinCAT3, please refer to help documents of Beckhoff for installation steps and basic use.

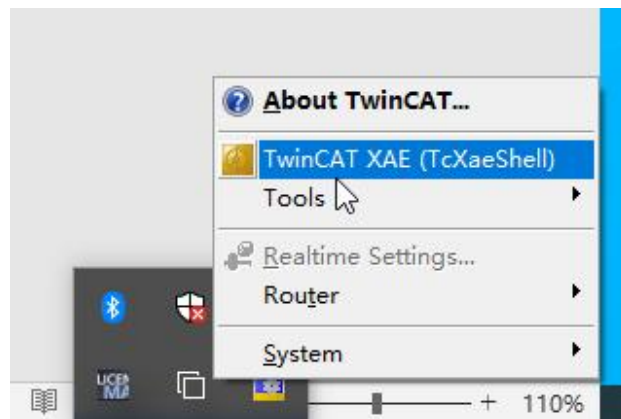
二. Configuration example: TwinCAT System Manager

1. Copy the XML file

Copy the sensor's configuration file "TEC_EtherCat_E101.xml" to the summary directory of the TwinCAT3 xml, such as: C:\TwinCAT\3.1\Config\Io\EtherCAT

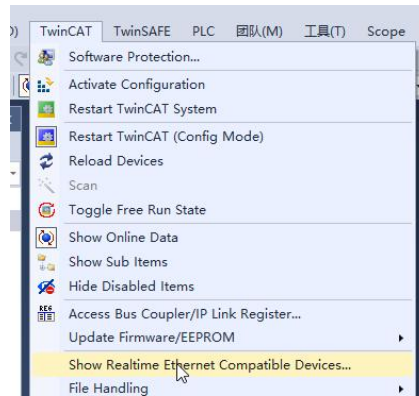
2. Start TwinCAT3 System Manager

Right-click the TwinCAT3 icon and select System Manager.

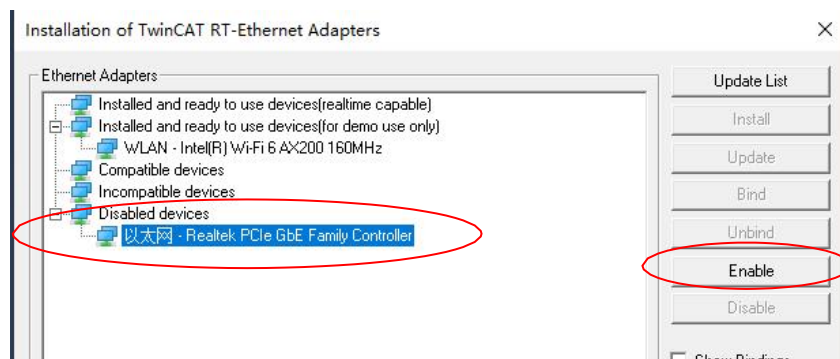


3. Scan the sensor

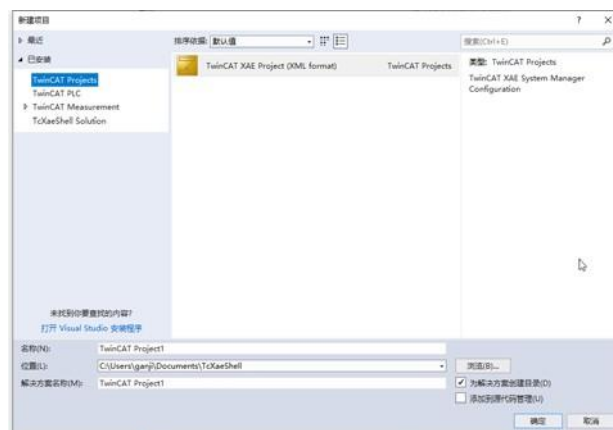
(1) Configure the network card menu "TwinCAT"->"show Realtime Ethernet Compatible Devices..."



Select your own network card and enable it.

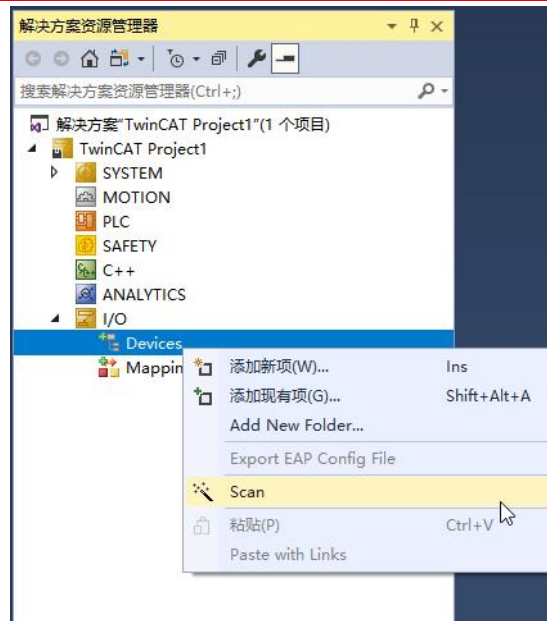


(2) To create a new project, menu "File" -> "New Project"

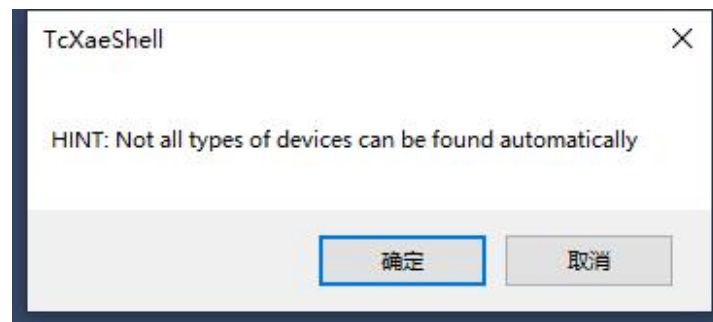


(3) In the new project I/O-> Devices, right-click and select the "Scan" tab to scan the device.

Note: The data cable of the sensor should be connected with the network card configured above.



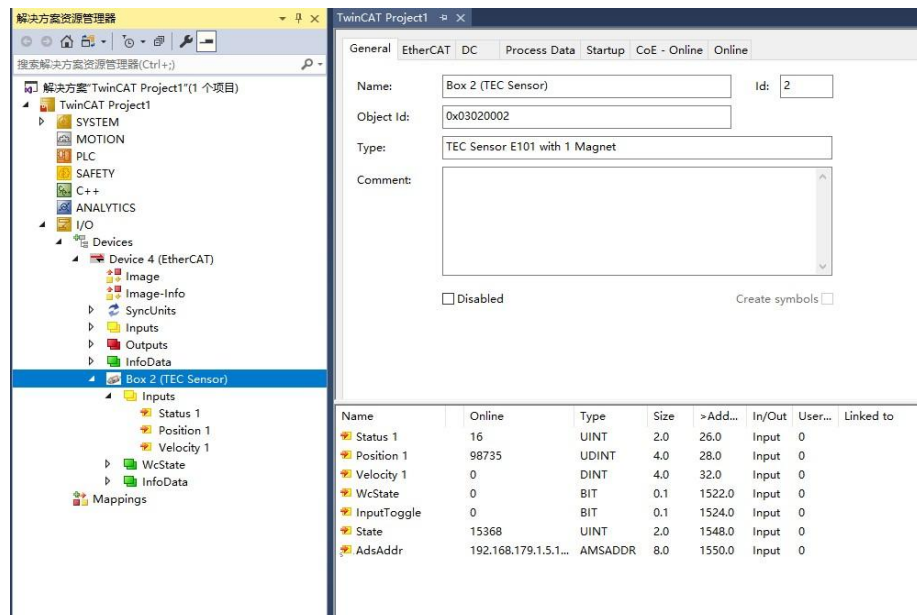
(4) Click OK in the pop-up dialog box



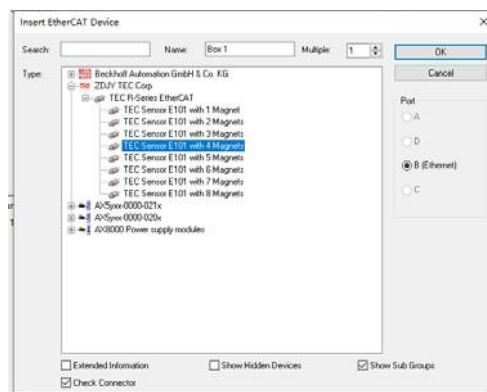
In the new pop-up dialog box, follow the following actions, different systems may be slightly different.



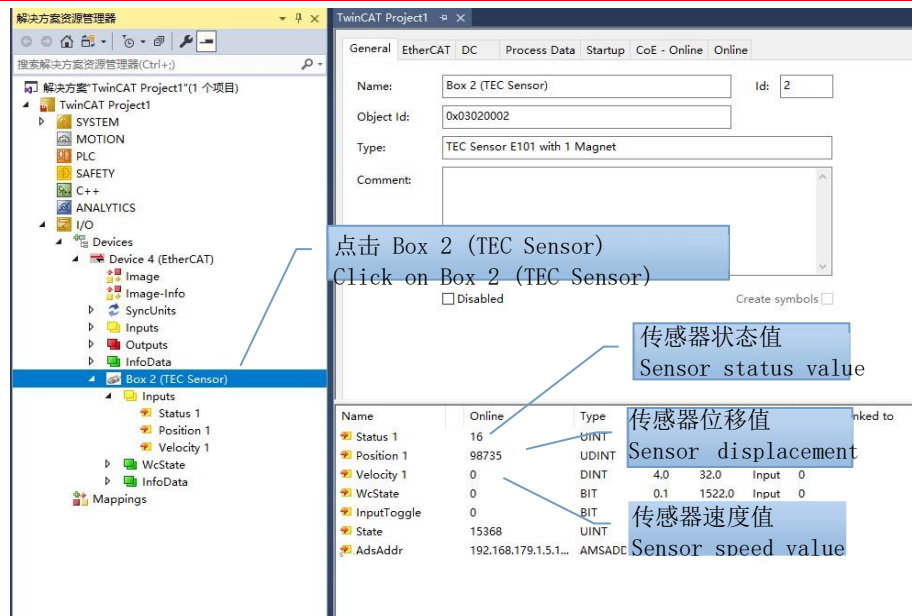
(5) After scanning successfully, expand the I/O Devices tree structure, and you can see all local and remote I/O modules and devices at the bottom. Box 2 (TEC Sensor) is the sensor device.



Modify boxes by right-clicking to add new items.



(6) If there is no error in the above operation, point Box 2 (TEC Sensor), and you can see the status value, displacement value and velocity value of the sensor.



These three values are explained below:

Status value

The status value is an unsigned number of 2 bytes. Identify magnets and indicate errors.

Example: 0x0010 = No.1 magnet is normal. 0x0018 = For No. 1 magnet, display the error bit.

Displacement value

The displacement value is an unsigned number of 4 bytes. This value has no unit and must first be multiplied by the displacement resolution in microns (μm).

Example: Magnet No.1 provides a displacement value of 0x0001886D (100461). Selecting a displacement resolution of 1 μm yields 100.461 mm.

Velocity value

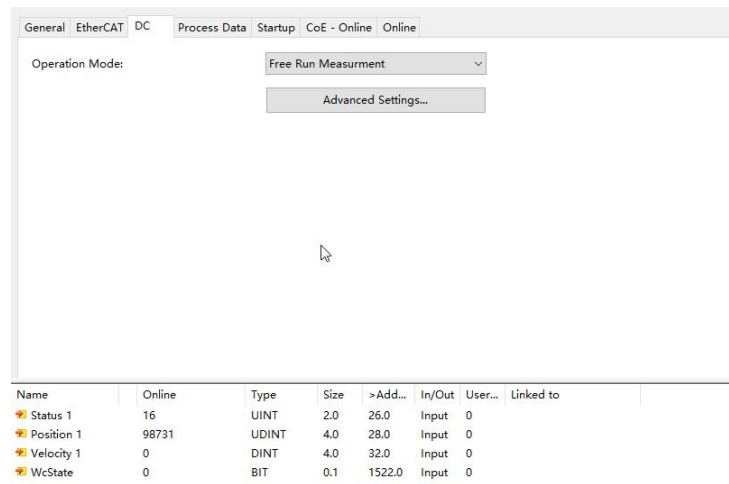
The velocity value is a signed number of 4 bytes. If the magnet is moved away from the sensor head, the velocity value is positive and negative in the opposite direction. This value has no unit and must first be multiplied by $\mu\text{m/s}$.

Example: Magnet No. 1 provides a velocity value of 0xfffff38 (-200), and the selected displacement resolution of 1 μm will produce a velocity of -200 $\mu\text{m/s}$.

4. Configure the sensor

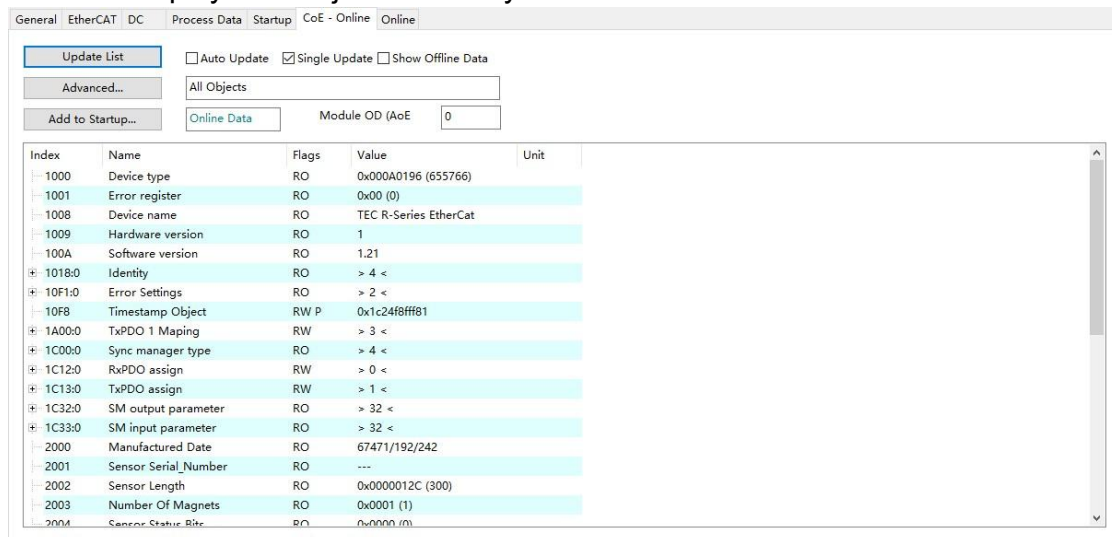
(1) DC (Distributed Clock)

This column configures the working modes of the sensor: Free Run Mode and Distributed Clock Mode.



(2) CoE-Online (CANopen over EtherCAT)

This column displays the object dictionary inside the sensor.



There are several object dictionaries that are more important to users, so explain them here:

2009-Sensor Resolution: Displacement Resolution

200A-Measuring Direction Reversed: Measuring direction, 0 for forward direction, 1 for reverse direction

200B-Prediction Buffer Size: Number of Smooths

200C-Save Configuration: Save parameters, write 1 to save parameters

200D-Noise Window (um): Noise window, keep default

200E-Velocity Window: Velocity Window

(3) Online

This column can view and control the EtherCAT state machine of the sensor.

General EtherCAT DC Process Data Startup CoE - Online Online

State Machine

Init Bootstrap

Pre-Op Safe-Op

Op Clear Error

Current State: OP

Requested State: OP

DLL Status

Port A: No Carrier / Closed

Port B: Carrier / Open

Port C: No Carrier / Closed

Port D: No Carrier / Closed

Name	Online	Type	Size	>Add...	In/Out	User...	Linked to
Status 1	16	UINT	2.0	26.0	Input	0	
Position 1	99116	UDINT	4.0	28.0	Input	0	
Velocity 1	-200	DINT	4.0	32.0	Input	0	
WcState	0	BIT	0.1	1522.0	Input	0	
InputToggle	0	BIT	0.1	1524.0	Input	0	
State	15368	UINT	2.0	1548.0	Input	0	
ΔdcΔAddr	192 168 179 1 5 1	ΔMSADDR	8.0	1550.0	Input	0	

The green indicator of the sensor indicates the state of the EtherCAT state machine in which the sensor is located:

Init-Green Indicator 2 sec velocity flashing

Pre-OP-Green Light 500 millisecond velocity flashing

Safe-OP-Green Indicator 1 sec velocity flashing

Op-Green Indicator 100 millisecond velocity flashing

Only when the state of the sensor's EtherCAT state machine is Op can the sensor's displacement value be uploaded to the controller.

The red indicator of the sensor indicates whether the sensor is faulty, such as non-magnetic ring.