

MANUAL

Absolute Rotary Encoders With EtherCAT Interface



EtherCAT 

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1 Introduction

Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Symbols used

The following symbols are used in this manual:



Note!

This symbol draws your attention to important information.



Handling instructions

You will find handling instructions beside this symbol

Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

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68307 Mannheim, Germany
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Email: fa-info@de.pepperl-fuchs.com



2 Declaration of Conformity

2.1 CE Conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.



Note!

A declaration of conformity can be requested from the manufacturer.

3 Safety

3.1 Symbols Relevant to Safety



Danger!

This symbol indicates an imminent danger.
Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.
Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.
Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

3.2 Intended Use

Absolute rotary encoders detect the rotation angle—and, in the case of a multiturn absolute rotary encoder, the revolutions of the rotary encoder shaft—with high precision and resolution. The absolute position value derived from this is provided by the rotary encoder via the EtherCAT interface in accordance with the EtherCAT communication profile CiA DS-301 and device profile CiA DS-406. The rotary encoder is to be integrated into an EtherCat network and should be used only in this way. Typical applications include positioning tasks and length measurement, for example, for cranes, construction machinery, elevators, and packaging machines.

Read through these instructions thoroughly. Familiarize yourself with the device before installing, mounting, or operating.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and plant is only guaranteed if the device is operated in accordance with its intended use.

3.3 General Safety Instructions

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Installation and commissioning of all devices may only be performed by trained and qualified personnel.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.



Note!

Disposal

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

4 Introduction

4.1 Using This Manual

This manual describes how Pepperl+Fuchs absolute rotary encoders equipped with a EtherCAT interface are integrated into a EtherCAT network.

The manual is valid for the following types of absolute rotary encoder:

- ES*58-...EC...
- EV*58-...EC...
- ENA58IL-...B21...

The descriptions for the following topic areas cover all the important aspects for a simple EtherCAT integration:

- Integration into the EtherCAT interface
- Configuration with TwinCAT
- Activating EtherCAT communication



Note!

More information on technical data, mechanical data, connection layouts, and available connection lines for the relevant absolute rotary encoder types "ES*58-...EC...", "EV*58-...EC...", and "ENA58IL-...EtherCAT" (B21) can be found in the corresponding datasheet.

4.2 Absolute Rotary Encoders

Absolute rotary encoders output a uniquely coded numerical value at each shaft position. Depending on the design type, the measured value is recorded via the optical scanning of a transparent code disc (ES*58...EC..., EV*58-...EC...) or via a magnetic sensing principle (ENA58IL...).

The maximum steps per revolution is 65,536 steps (16 bits). The multiturn version can detect up to 16,384 revolutions (14 bits). As such, the highest possible resolution is 30 bits.

4.3 Communication via EtherCAT

4.3.1 General Information on Communication via EtherCAT

EtherCAT® (Ethernet for **C**ontrol **A**utomation **T**echnology) is a standardized, open fieldbus that enables data exchange between PLCs, PCs, operating and observation devices, and also sensors and actuators.

EtherCAT is suitable for both central and decentralized system architecture. It supports master/slave, master/master, and slave/slave communication as well as the integration of lower-level fieldbuses. With the "EtherCAT Automation Protocol", it also covers the factory level and uses the existing infrastructure for this.

EtherCAT is an optimized industrial Ethernet technology and uses standard messages and physical layers from the Ethernet standard IEEE802.3. The EtherCAT processes the messages in an optimized way, resulting in quicker communication among the nodes and with the master. Therefore, EtherCAT enables quicker reaction times compared to standard Ethernet.

EtherCAT also supports the Internet technologies. The "Ethernet-over- EtherCAT protocol" transports FTP, HTTP, TCP/IP, and Co. without risking the real-time capability of the system.



Note!

The EtherCAT Technology Group (ETG) publishes various information brochures and an EtherCAT product catalog (<http://www.ethercat.org>).

Ease of handling

EtherCAT is easy to use in comparison to classic fieldbus systems. Address assignment is carried out automatically. Network tuning is not required. Built-in diagnostics with error localization make the detection of errors very easy. Similarly, no switch configuration or complex processing of MAC or IP addresses is needed as in the case of industrial Ethernet.

Functional principle and performance

EtherCAT's basic operating principle lies in the way that the participants (network node) process the messages. The message sent from the EtherCAT master passes through each participant. Generally, one message is sufficient to transmit the output information of the master (e.g., SPS) to all participants and to import the input information to all participants with the same message. Each network node reads the data intended for it from the message and adds its data. This is done "on the fly", meaning that a message is practically only delayed by the hardware lead times of a participant. This unique way to process the messages, makes EtherCAT the fastest industrial Ethernet technology. No other technology can reduce bandwidth usage or surpass the equivalent performance of EtherCAT. There is no need for network switches and hubs.

Topology

An EtherCAT network can support up to 65,535 participants without restrictions in the network topology. Line, Bus, tree, or star topology as well as combinations thereof are equally possible. An additional Ethernet port in the master and an additional cable from the last participant to this port extend the lines to a ring topology. With EtherCAT, cable redundancy is made possible with simple measures. A software extension in the master stack is used for detection if redundancy occurs.

Ease of handling

EtherCAT is easy to use in comparison to classic fieldbus systems. Address assignment is carried out automatically. Network tuning is not required. Built-in diagnostics with error localization make the detection of errors very easy. Similarly, no switch configuration or complex processing of MAC or IP addresses is needed as in the case of industrial Ethernet.

Cabling and flexible connection/disconnection of participants

Due to the quick Ethernet physics, the distance between 2 participants can be up to 100 m when using industrial Ethernet cable. Greater distances are possible with the use of fiber optic cables.

For example, modular machines or tool changers require the option to connect or disconnect individual participants or network segments during operation. For this, EtherCAT has additional functions, which can achieve further topology flexibility, such as the exchange (hot swap) or the connection (hot connect) of participants during operation.

Absolute rotary encoder and EtherCAT

The EtherCAT application layer communication protocol is based on the CANOpen communication profile according to CiA DS-301 and is called "CANOpen over EtherCAT" or shortened to "CoE." This protocol allows the use of the device profile DS 406 for the absolute rotary encoder.



4.3.2 Project Planning Using Device Description

You can carry out the project planning of the absolute rotary encoder using the TwinCAT EtherCAT master/system manager. The properties of the absolute rotary encoder are described in a device description file, the ESI file (EtherCAT Slave Information), based on XML. You must integrate the appropriate ESI file in the project planning tool.

Downloading the ESI File

You can find the relevant ESI file in the **Software** section of the product detail page for the device.

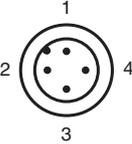
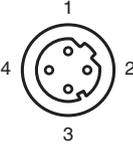
To access the product detail page for the device, go to <http://www.pepperl-fuchs.com> and type e.g., the product description or the item number into the search function.

5 Installation

5.1 Electrical Connection

The absolute rotary encoder is connected to the field environment via the "Power" connector along with "ECAT in" and "ECAT out" for the EtherCAT connection.

Connector and pin assignment

Connection	Power Connector plug, M12 x 1, 4-pin, A- coded	ECAT in, ECAT out Connector socket, M12 x 1, 4-pin, D- coded
1	Operating voltage +U _B	Tx +
2	-	Rx +
3	0 V	Tx-
4	-	Rx -
		

5.2 LED Indicators

The absolute rotary encoder features 4 LED indicators for displaying the operating status and diagnosis information in the case of a fault.

The LEDs indicate the following behavior, depending on their function:

- On
- Off
- Flashing



Figure 5.1 LED indicator with ENA58IL-R*** EtherCAT as an example

Port LEDs

LED	Color	Status	Description
L/A (Link/Act IN)	Green	On	LINK active for HUB port 1
		Flashes	Activity for HUB port 1
L/A (Link/Act OUT)	Green	On	LINK active for HUB port 2
		Flashes	Activity for HUB port 2

EtherCAT LEDs

LED	Color	Status	Description
Error	Red	Off	No error
		Flashes	Invalid configuration
		Single flash	Local fault
		Double flash	Watchdog process data timeout/watchdog EtherCAT timeout
		Flickers	Boot error
		On	Application error
Run	Green	Off	Initialization
		Flashes	Preoperational
		Single flash	Safe operational
		Flickers	Initialization or bootstrap
		On	Operational

5.3 Instructions for Mechanical and Electrical Installation



Note!

More installation-relevant information on technical data, mechanical data, and available connection lines for the relevant absolute rotary encoder types "ES*58-...EC...", "and "EV*58-...EC..." as well as "ENA58IL-...B21..." (EtherCAT) can be found in the corresponding datasheet.

Please observe the following instructions to ensure safe operation of the absolute rotary encoder:



Warning!

Work must only be performed by trained and qualified personnel!

Commissioning and operation of this electrical equipment must only be performed by trained and qualified personnel. This means individuals who are qualified to commission (in accordance with safety technology), connect to ground, and label devices, systems, and circuits.



Warning!

Only perform work when the system is in a de-energized state!

De-energize your device before performing work on the electrical connections. Short circuits, voltage peaks, and similar events can lead to faults and undefined statuses. This presents a significant risk of personal injury and property damage.



Warning!

Check electrical connections before switching on the system!

Check all electrical connections before switching on the system. Incorrect connections present a significant risk of personal injury and property damage. Incorrect connections can lead to malfunctions.



Caution!

Do not remove the rotary encoder housing!

Do not remove the rotary encoder housing under any circumstances, as damage and contamination can occur as a result of taking improper action. It is, however, permitted to remove connector covers.



Caution!

Do not perform any electrical modifications!

It is not permitted to perform electrical modifications on the rotary encoders. If you open or modify the device yourself, not only are you endangering yourself and others, but you will also void any warranty and absolve the manufacturer of any liability.



Caution!

Ensure that the data cable and power supply cable are physically separate!

Route the cordset of the rotary encoder so that it is a suitable distance away from power supply cables to avoid faults. Shielded cables must be used to ensure reliable data transfer. A perfect ground connection must also be ensured.



Do not allow the rotary encoder to fall or expose it to strong vibrations. The rotary encoder is a precision instrument.



Rotary encoders from Pepperl+Fuchs are robust; however, they should nevertheless be protected against damage from the environment by taking appropriate protective measures. In particular, the devices must not be installed in a location where they could be misused as a handle or climbing aid.



Do not make any alterations to the drive shaft or the housing of the rotary encoder.



Note!

The drive shaft on the rotary encoder must be connected to the drive shaft on the part to be measured via a suitable coupling. The coupling is required to protect the drive shaft on the rotary encoder against excessive levels of force, to compensate for shaft offset, and to reduce the impact of vibrations. Suitable couplings are available as accessories from Pepperl+Fuchs.

6 Data Model for the Device Configuration

6.1 Communication objects according to communication profile DS-301

The EtherCAT application layer communication protocol is based on the CANOpen communication profile according to CiA DS-301 and is called "CANOpen over EtherCAT", or "CoE " for short.

This communication protocol specifies the object directory as well as the communication objects for the exchange of process data and acyclic messages. The communication objects described below are supported by the rotary encoder.

Object	Description	Data type	Access
1000h	Device type	Unsigned 32	r
1001h	Error register	Unsigned 8	r
1008h	Manufacturer device name	String	r
1009h	Hardware version	String	r
100Ah	Software version	String	r
1010h	Store application parameter	Unsigned 32	r/w
1011h	Restore application parameter	Unsigned 32	r/w
1018h	Identity Object	Record	r

6.1.1 Object 1000h: Device type

This object specifies which device type it relates to. The absolute rotary encoders are available in the variants singleturn absolute rotary encoder or multiturn absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Device type	Unsigned 32	<ul style="list-style-type: none"> ■ For singleturn: 0001 0196h ■ For multiturn: 0002 0196h 	r

6.1.2 Object 1001h: Error register

This object specifies which device type it relates to. The absolute rotary encoders are available in the variants singleturn absolute rotary encoder or multiturn absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Error register	Unsigned 8	0h	r

6.1.3 Object 1008h: Manufacturer device name

This object specifies the manufacturer-specific device name for the EtherCAT absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Manufacturer device name	String	P+F EtherCAT	r

6.1.4 Object 1009h: Hardware version

This object specifies the status of the hardware version of the absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Hardware version	String	x.y (depending on the current version)	r

6.1.5 Object 100Ah: Software version

This object specifies the status of the software version of the absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Software version	String	x.y (depending on the current version)	r

6.1.6 Object 1010h: Store application parameters

This object causes the storage of all parameters in the non-volatile memory.

Subindex	Description	Data type	Default	Access
0h	Save all parameters	Unsigned 32	65766173h	r/w

6.1.7 Object 1011h: Restore application parameters

This object causes the parameter 6000 ... 6003 to be overwritten by the factory default values and to be stored in non-volatile memory.

Subindex	Description	Data type	Default	Access
0h	6000 ... 6003, overwrite with factory default values	Unsigned 32	64616F6Ch	r/w

6.2 Communication objects according to device profile DS-406

With the protocol "CANOpen over EtherCAT (CoE)," EtherCAT enables the use of the entire CANOpen profile family. CANOpen describes the properties of devices in the device profiles. The supported parameters according to device profile DS 406 for rotary encoders are described below.

Object	Description	Data type	Access
6000h	Operating parameters	Unsigned 16	r/w
6001h	Measuring units per revolution	Unsigned 32	r/w
6002h	Total measuring range in measuring units	Unsigned 32	r/w
6003h	Preset value	Unsigned 32	r/w
6004h	Position value	Unsigned 32	r/w
6500h	Operating status	Unsigned 16	r
6501h	Singleturn resolution	Unsigned 32	r
6502h	Number of distinguishable revolutions	Unsigned 32	r
6507h	Profile and software version	Unsigned 32	r
6509h	Offset value	Unsigned 32	r

6.2.1 Object 6000h: Operating parameters

This object shows the functions for the code sequence, the commissioning of the diagnostic control, and the control panel for the scaling function.

Subindex	Description	Data type	Default	Access
0h	Operating parameters	Unsigned 16	4h	r/w

Code sequence

The code sequence determines whether rising or falling position values are output when the encoder shaft rotates clockwise or counterclockwise as viewed from the perspective of the shaft.

Controlling the scaling function

The scaling function converts the encoder number value in software to change the physical resolution of the encoder. The units per revolution (object 6001h) and the total measuring range in units (object 6002h) are the scaling parameters. The bit of the scaling function is set in the operating parameters. If the bit of the scaling function is set to zero, the scaling function is deactivated.



Note!

To save all parameters in the non-volatile memory, you must transmit object 1010h to the absolute rotary encoder. See Chapter "Communication objects according to communication profile DS-301," object 1010h: store application parameters.

Bit structure of operating parameters

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Use	MS	MS	MS	MS	R	R	R	R	R	R	R	R	MD	SFC	CD	CS

MS Manufacturer-specific function (not available)

R Reserved for future applications

MD Measuring direction (not available)

SFC Scaling function (0 = enable, 1 = disable)

CD Commissioning diagnostics control (not available)

CS Code sequence (0 = clockwise, 1 = counterclockwise)

6.2.2 Object 6001h: Measuring units per revolution

This object specifies the number of desired measuring steps per revolution. The value that is written in object 6001h must be smaller than the value defined in object 6501h.

Subindex	Description	Data type	Default	Access
0h	Measuring steps per revolution	Unsigned 32	See nameplate	r/w



Note!

The ESI file contains a default value of 2000h for the object. You must adapt this value to the specific rotary encoder value using the project tool. The correct value for the absolute rotary encoder is taken from the nameplate of the encoder in conjunction with the type code in the datasheet.

Use object 1010h to save the parameters in the non-volatile memory.

6.2.3 Object 6002h: Total measuring range in measuring units

This object specifies the number of distinguishable measuring steps across the entire measuring range.

The value written in object 6002h may not exceed the value of object 6501h multiplied by the value of object 6502h.

$$\text{Object 6002h} \leq \text{Object 6501h} * \text{Object 6502h}$$

Subindex	Description	Data type	Default	Access
0h	Absolute number of measuring steps	Unsigned 32	See nameplate	r/w



Note!

The ESI file contains a default value of 1000h for the object. You must adapt this value to the specific rotary encoder value using the project tool.

To do so, observe the information on the nameplate of the rotary encoder and the type code in the corresponding datasheet. Use object 1010h to save the parameters in the non-volatile memory.



Note!

Important application note

Dividing the "Total resolution" (as a decimal number) by "Measuring steps per revolution" must result in an integer.

The total resolution must also fit into an integer multiple of 4096 for a rotary encoder with 12 bits per revolution. This means that 100 or 325 revolutions, for example, could result in faults.

Therefore, the following equation must be observed:

$$(4096 \times \text{measuring steps per revolution}) / \text{total resolution} = \text{integer value}$$

6.2.4 Object 6003h: Preset value

This object specifies the preset value for the output position value. You can assign a desired output value to a rotary encoder position using the preset value.

Subindex	Description	Data type	Default	Access
0h	Preset value	Unsigned 32	-	r/w



Note!

After setting the preset value, you must still store this in the non-volatile memory via object 1010h, otherwise it will no longer be present after the rotary encoder is turned off.

6.2.5 Object 6004h: Position value

This object contains the process value of the absolute rotary encoder.

Subindex	Description	Data type	Default	Access
0h	Process value	Unsigned 32		r-map

r-map (read only MAPable): Parameter can be queried by PDO.

6.2.6 Object 6500h: Operating status

This object provides information on the operating status of the absolute rotary encoder. It contains information about internally programmed parameters.

Subindex	Description	Data type	Default	Access
0h	Operational status	Unsigned 16	4h	r

6.2.7 Object 6501h: Singleturn resolution

This object specifies the maximum possible number of measuring steps per revolution. The value that is written in object 6001h must be smaller than or equal to the value defined in object 6501h.

Subindex	Description	Data type	Default	Access
0h	Singleturn resolution	Unsigned 32	See nameplate	r

6.2.8 Object 6502h: Number of distinguishable revolutions

This object contains the maximum possible number of revolutions. The value written in object 6002h may not exceed the value of object 6501h multiplied by the value of object 6502h.

$$\text{Object 6002h} \leq \text{Object 6501h} * \text{Object 6502h}$$

Subindex	Description	Data type	Default	Access
0h	Number of revolutions	Unsigned 32	See nameplate	r

6.2.9 Object 6507h: Profile and software version

This object contains information about the implemented rotary encoder device profile and the software version.

Subindex	Description	Data type	Default	Access
0h	Device profile and software version	Unsigned 32	xxyy0302h	r

The value is divided into one part for the device profile version and one part for the software version. Each of these areas is again divided into a higher and a lower version.

MSB		LSB	
Software version xx.yy		Device profile version 3.2	
Higher version part	Lower version part	Higher version part	Lower version part
xx	yy	03h	02h

6.2.10 Object 6509h: Offset value

This object contains the offset value. It is calculated from the difference between the physical value and the displayed process value. The calculation is affected by the preset function.

Subindex	Description	Data type	Default	Access
0h	Offset value	Integer 32	-	r

7 Configuring the Rotary Encoder Using TwinCAT

7.1 Introduction

The following pages provide an example of how to configure a Pepperl + Fuchs absolute rotary encoder using the "TwinCAT" project planning and development environment from Beckhoff. Version "TwinCAT 3 XAE" (eXtended Automation Engineering) is used for this.

To create the configuration, device description files for the devices used are required, so-called ESI (EtherCAT Slave Information). They are available from the respective device manufacturer in the form of XML files.

You can download the ESI file for your Pepperl + Fuchs absolute rotary encoder from the product details page at Pepperl + Fuchs. To access the product detail page for the device, go to <http://www.pepperl-fuchs.com> and type e.g., the product marking or the item number into the search function. You can find the GSDML file in the **Software** area of the product detail page.

Prior to starting the configuration, ensure that the ESI file of the EtherCAT absolute rotary encoder "Pepperl+Fuchs_ECATE_V01-05.xml" is in the TwinCAT installation directory.

For TwinCAT 3, the default for the installation directory is:

C:\TwinCAT\3.1\Config\lo\EtherCAT

7.2 Configuration with TwinCAT 3

There are two possibilities for the configuration of the EtherCAT absolute rotary encoder:

- 1. **Offline configuration**, for example, if the configuration is to take place before the plant creation, e.g., on a laptop as a programming system
- 2. **Online configuration** via a scan of the existing network (preferred), if the control panel is already connected to the EtherCAT system and all components of the EtherCAT network are ready for operation.

Online configuration as an example

The following describes the online configuration only.

Here, all available slaves are automatically integrated into the EtherCAT network by the master.



Integrate Absolute Rotary Encoder in TwinCAT 3

Prerequisite: An ESI file from the absolute rotary encoder is available in C:\TwinCAT\3.1\Config\IO\EtherCAT.

1. Start TwinCAT XAE.

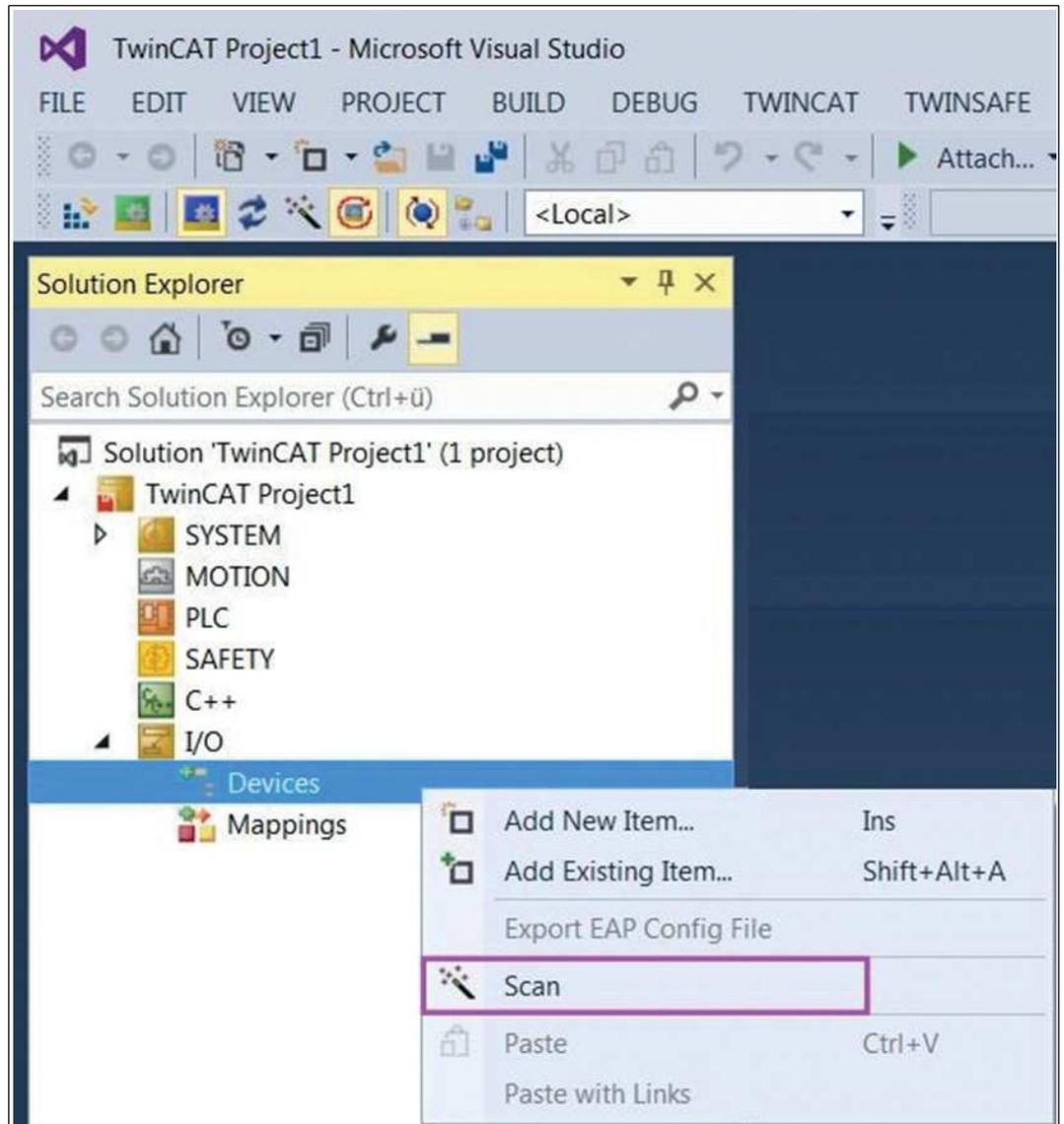


Figure 7.1

2. In the project folder explorer within the "E/A" element, select the entry "Devices", and activate by right-clicking on the "Scan" function.

↳ However, not all devices can be found automatically, therefore the following message appears:

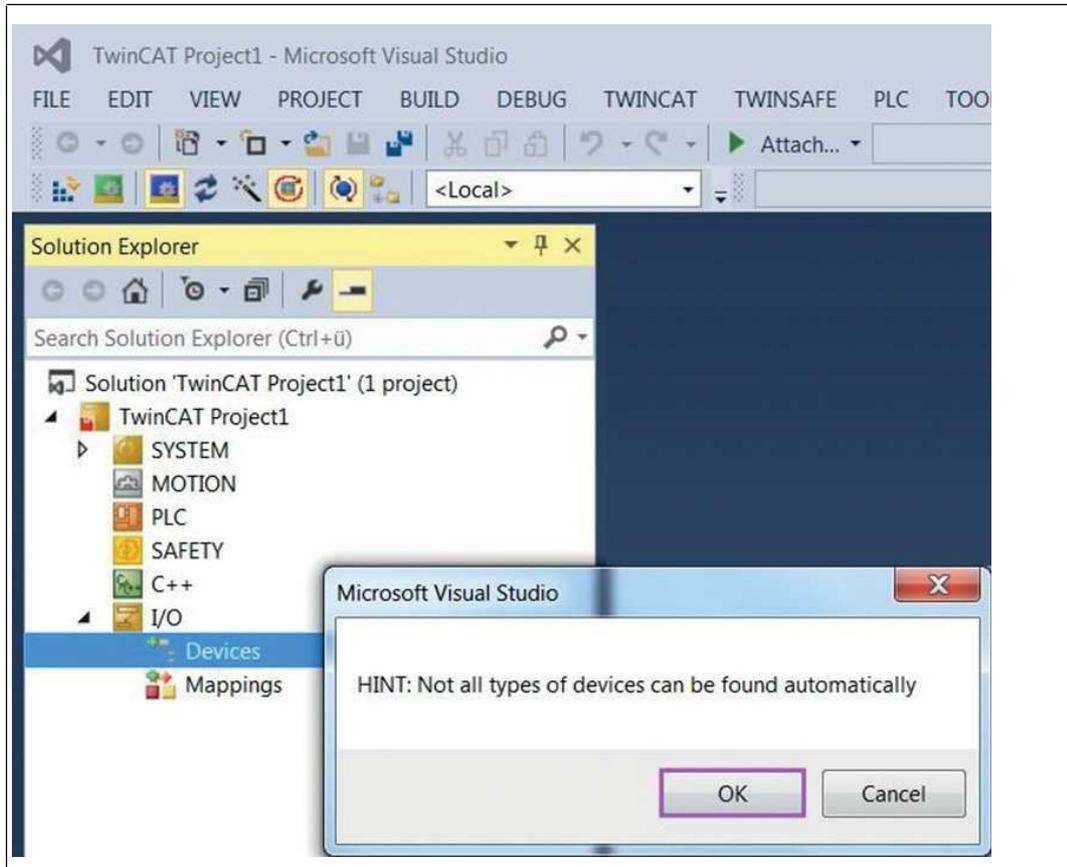


Figure 7.2

3. Confirm this message with "OK", the scan is then started.

↳ If the scan agent recognizes an Ethernet port with an installed TwinCAT real-time driver, this is displayed as a device. In this example, as "Device 2 (EtherCAT)."

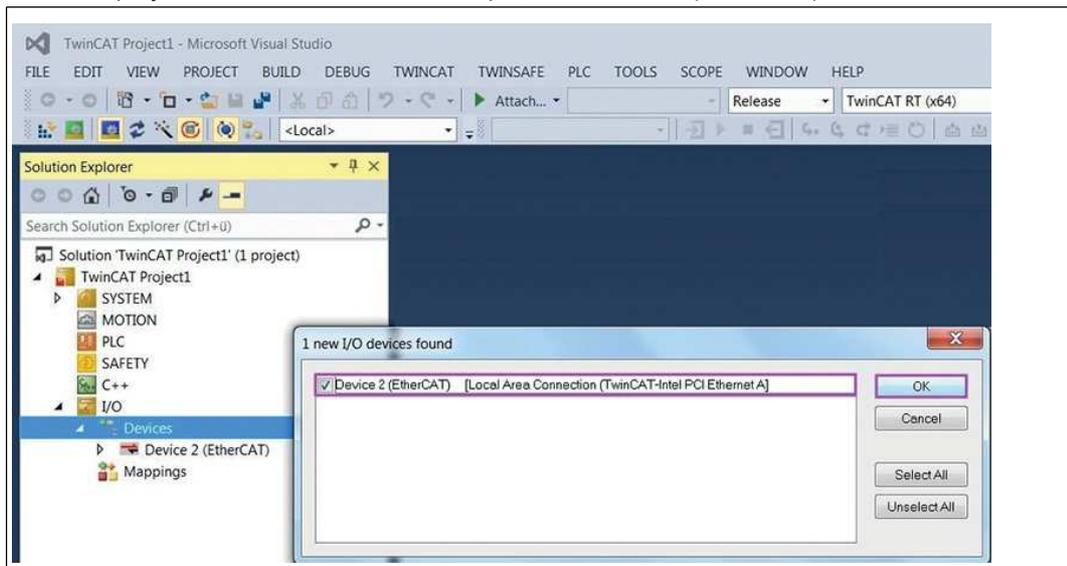


Figure 7.3

4. Click "OK" to confirm the dialog box.

↳ The EtherCAT device is created and a scan for other participants/slaves, so-called boxes, is suggested.

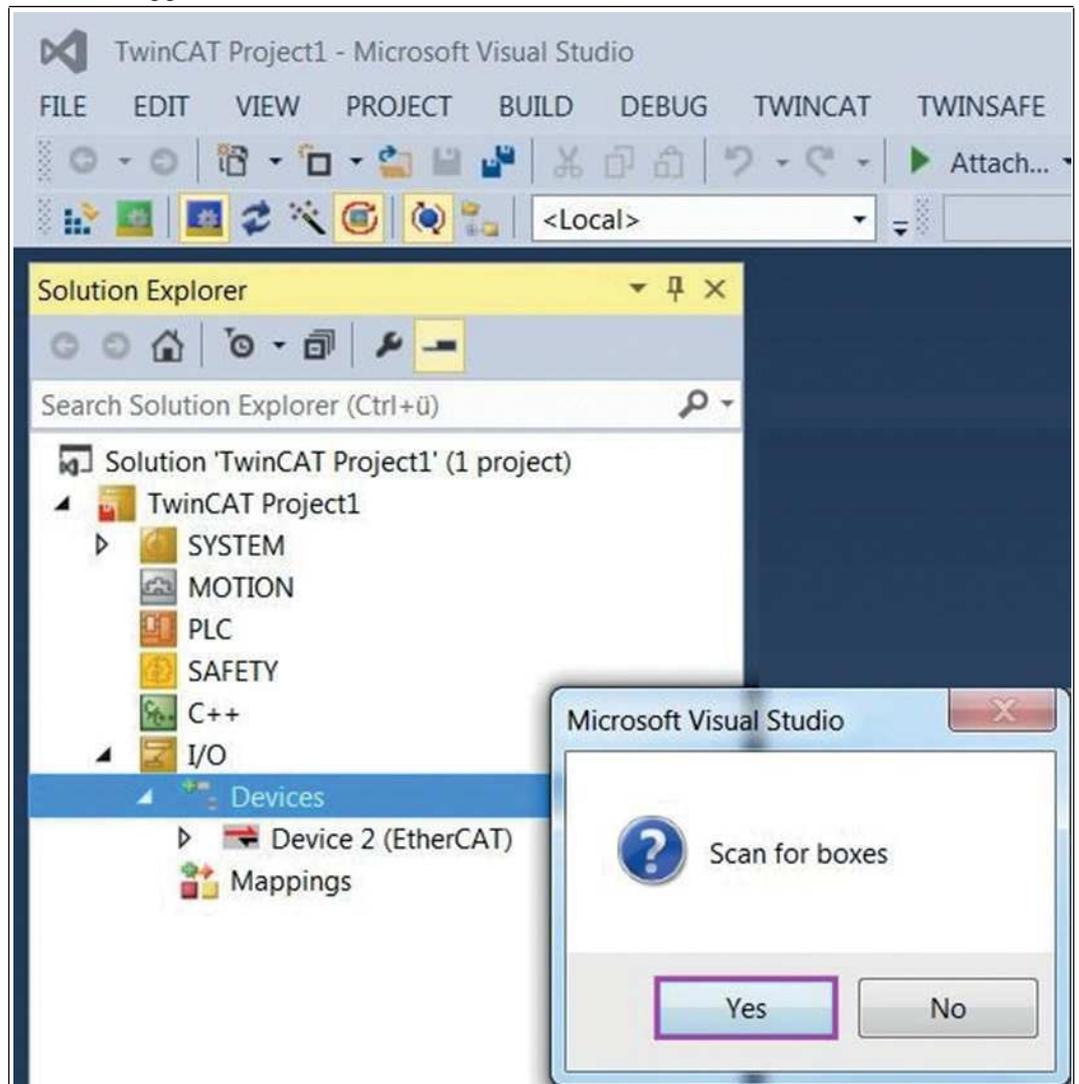


Figure 7.4

5. Confirm this message with "Yes" to establish the EtherCAT absolute rotary encoder and, where appropriate, other connected devices.

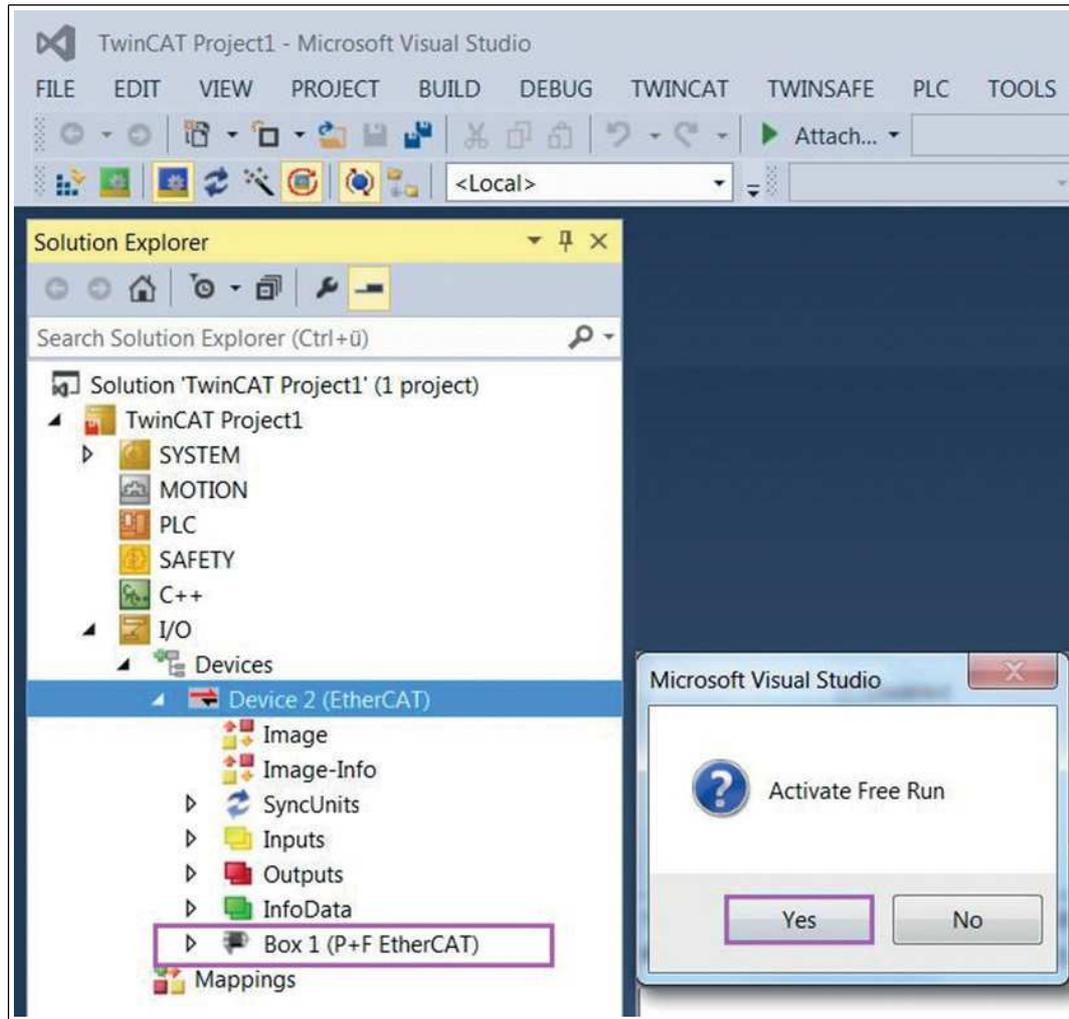


Figure 7.5

↳ The EtherCAT absolute rotary encoder found is now displayed in the project folder as entry "Box 1 (P+F EtherCAT)." At the same time, the message "Activate Free Run" appears.

6. Confirm the dialog with "Yes" to allow the manipulation of input and output values during the configuration.
7. Then click on the entry "Box 1 (P+F EtherCAT)" using the left mouse button.

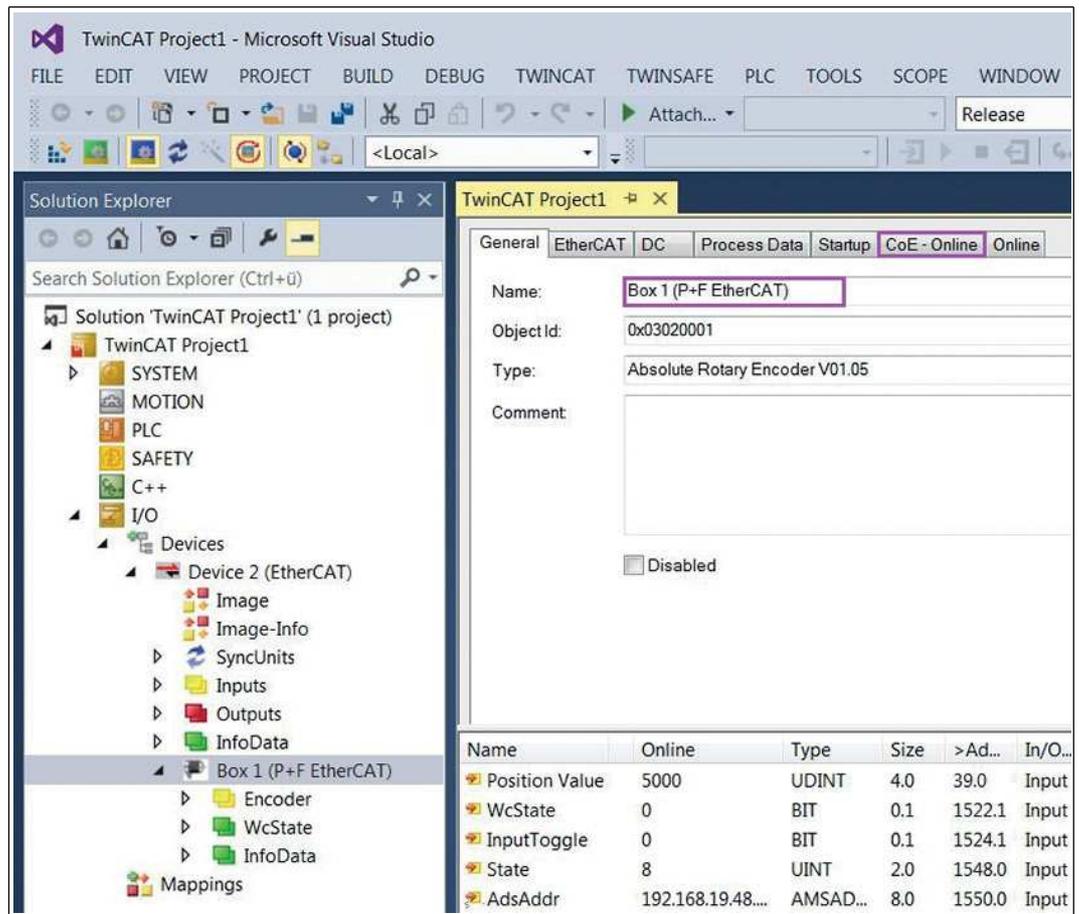


Figure 7.6

- ↳ The menu "TwinCAT Project 1" is displayed.
- 8. Enter a name for your absolute rotary encoder in this project. For example, "Box 1 (P+F EtherCAT)" has been entered here.
- 9. Go to the "CoE Online" tab.
 - ↳ This calls up the parameter management for the EtherCAT devices.

Configure Parameters

The CoE interface is the parameter management for EtherCAT devices. The CoE parameters (CoE object directory) of the EtherCat absolute rotary encoder are displayed in the now open window.

For example purposes, changing the "Position value", index 6004, is described. Other parameters can be changed in the same way. To permanently save the changes in the absolute rotary encoder, you must double-click object 1010 "Store application parameters" at the end of parameterization.

Example: set preset value in object 6003h

The position value is before setting the preset value 0x00002CBC (11452).

1. Double-click the parameter "6003 Preset Value."

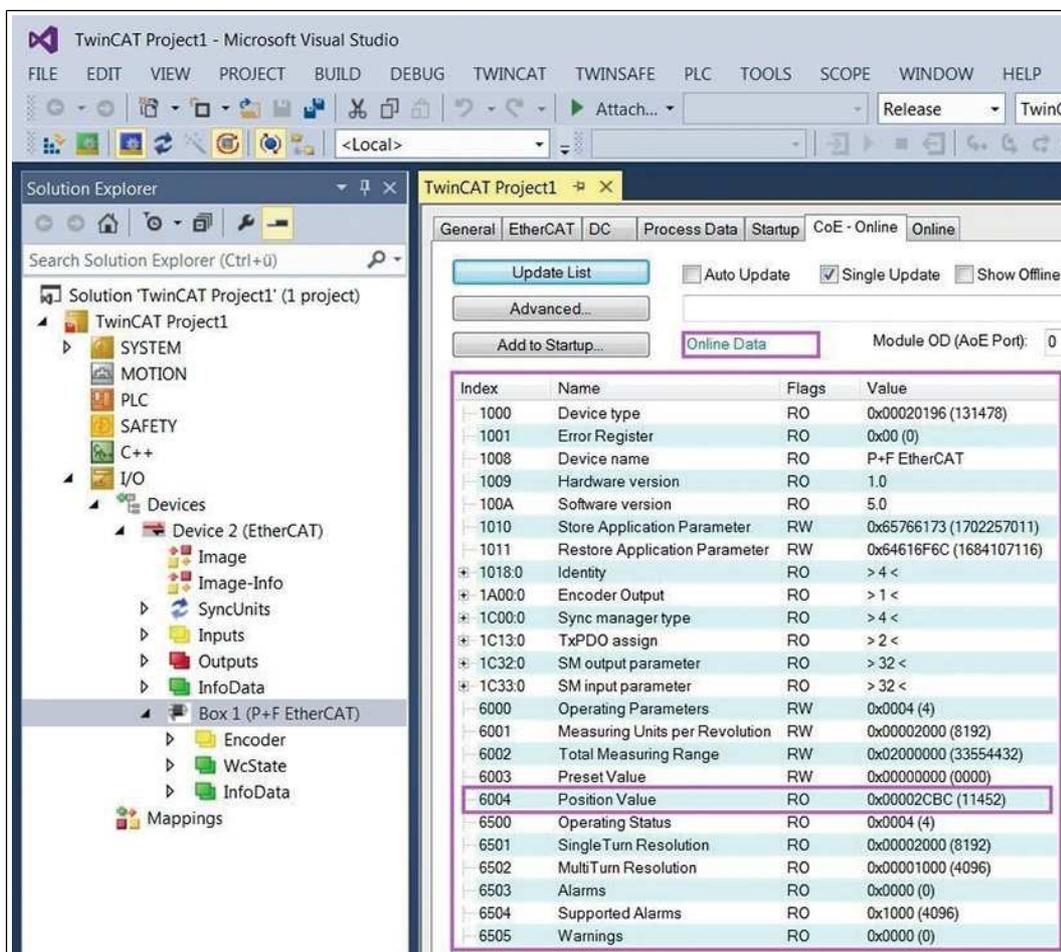


Figure 7.7

↳ The entry dialog box for setting the preset value is displayed.

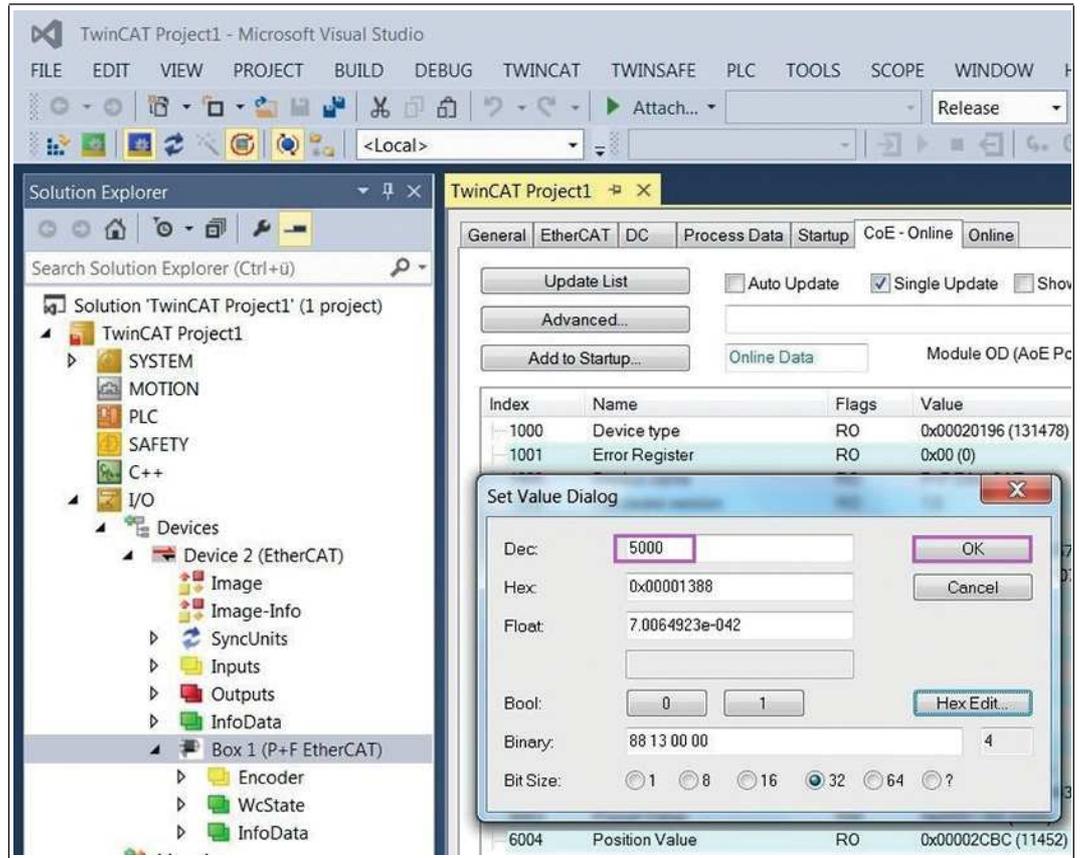


Figure 7.8

2. Enter the value "5000" and confirm by clicking "OK."

↳ The preset value "5000" is transferred to the absolute rotary encoder and is taken as the new position value.

The screenshot shows the TwinCAT Project1 interface in Microsoft Visual Studio. The Solution Explorer on the left shows the project structure, with 'Box 1 (P+F EtherCAT)' selected. The main window displays the 'EtherCAT' configuration tab, which includes a table of device parameters. The 'Preset Value' (Index 6003) and 'Position Value' (Index 6004) are highlighted with a purple box, indicating that the value 5000 has been set for the absolute rotary encoder.

Index	Name	Flags	Value
1000	Device type	RO	0x00020196 (131478)
1001	Error Register	RO	0x00 (0)
1008	Device name	RO	P+F EtherCAT
1009	Hardware version	RO	1.0
100A	Software version	RO	5.0
1010	Store Application Parameter	RW	0x65766173 (1702257011)
1011	Restore Application Parameter	RW	0x64616F6C (1684107116)
1018.0	Identity	RO	> 4 <
1A00.0	Encoder Output	RO	> 1 <
1C00.0	Sync manager type	RO	> 4 <
1C13.0	TxPDO assign	RO	> 2 <
1C32.0	SM output parameter	RO	> 32 <
1C33.0	SM input parameter	RO	> 32 <
6000	Operating Parameters	RW	0x0004 (4)
6001	Measuring Units per Revolution	RW	0x00002000 (8192)
6002	Total Measuring Range	RW	0x02000000 (33554432)
6003	Preset Value	RW	0x00001388 (5000)
6004	Position Value	RO	0x00001388 (5000)

Figure 7.9



Note!

If the preset value or other parameters are to be permanently transferred, you must still store the parameter "Store Application Parameters" in object 1010h.

3. Double-click on the object "1010 Store Application Parameters."

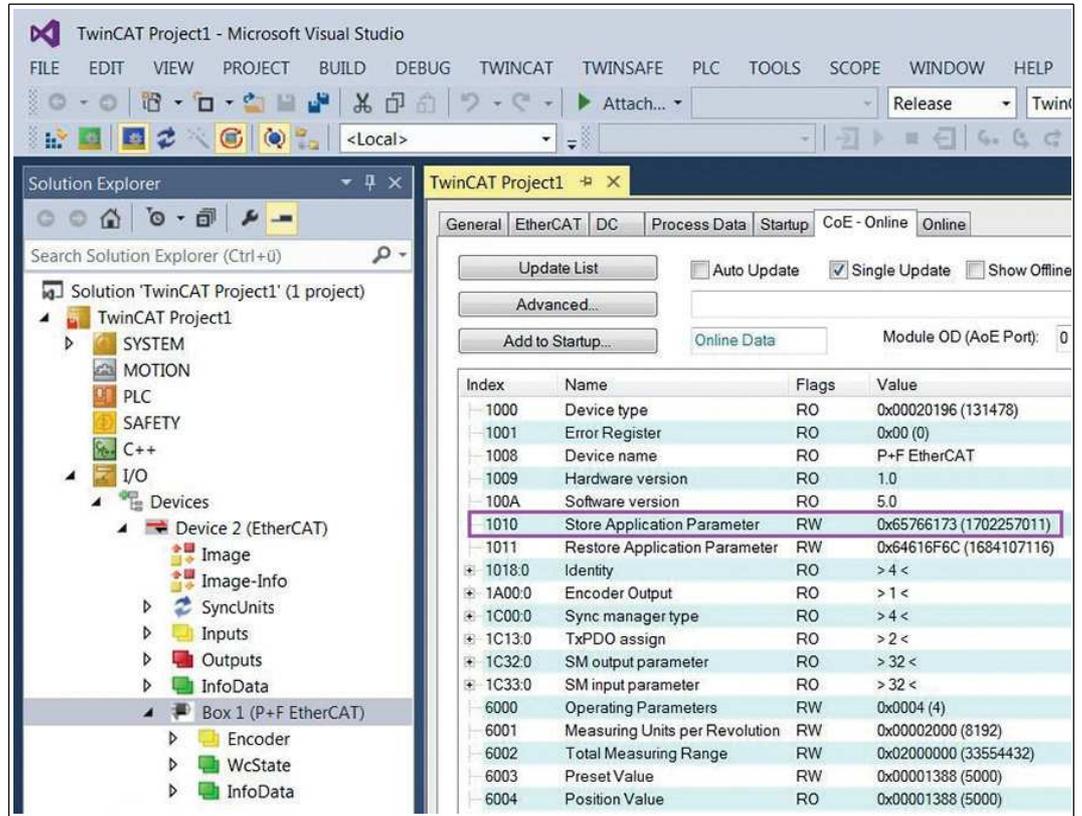


Figure 7.10

- Object 1010h is already prepopulated with the value "0x65766173", allowing you to store the parameters by simply clicking "OK."

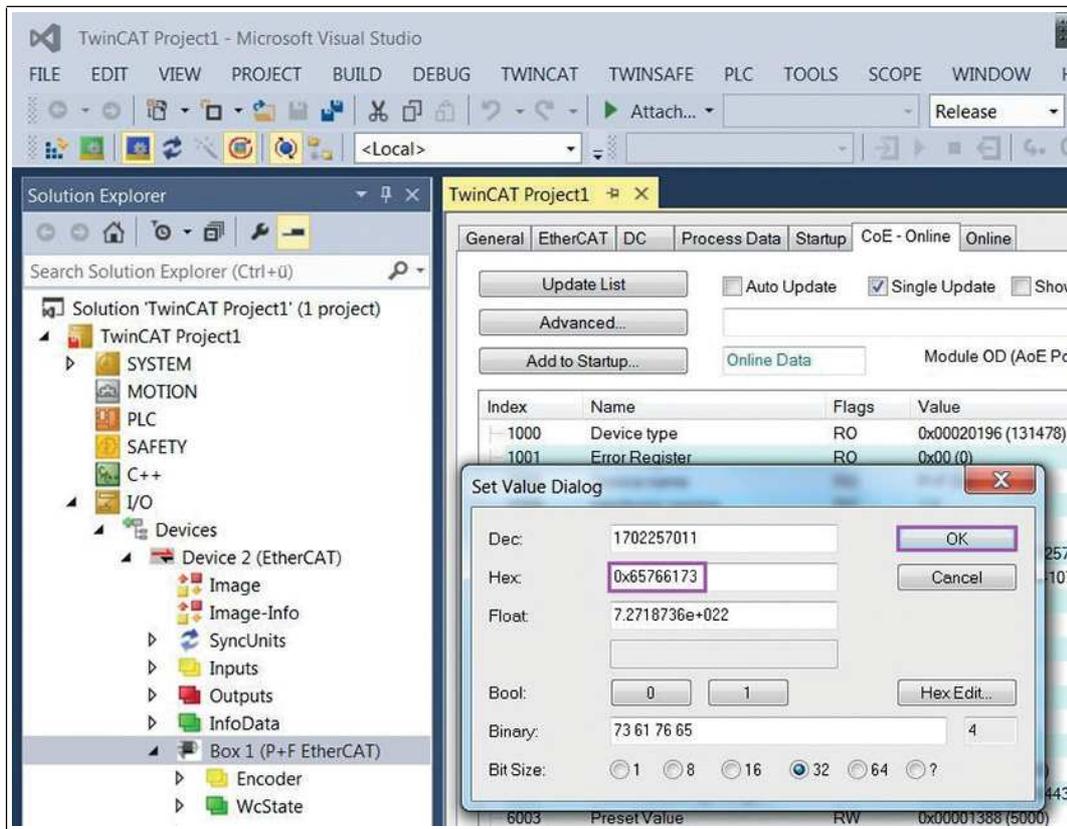


Figure 7.11



Note!

As there is no external EtherCAT master and the PC/laptop is used as the EtherCAT master in this example, an additional task is required.

5. To do so, navigate to the "SYSTEM" element in the project folder explorer and select the entry "Tasks." Right-click to activate the drop-down list, and select "Add New Item...."

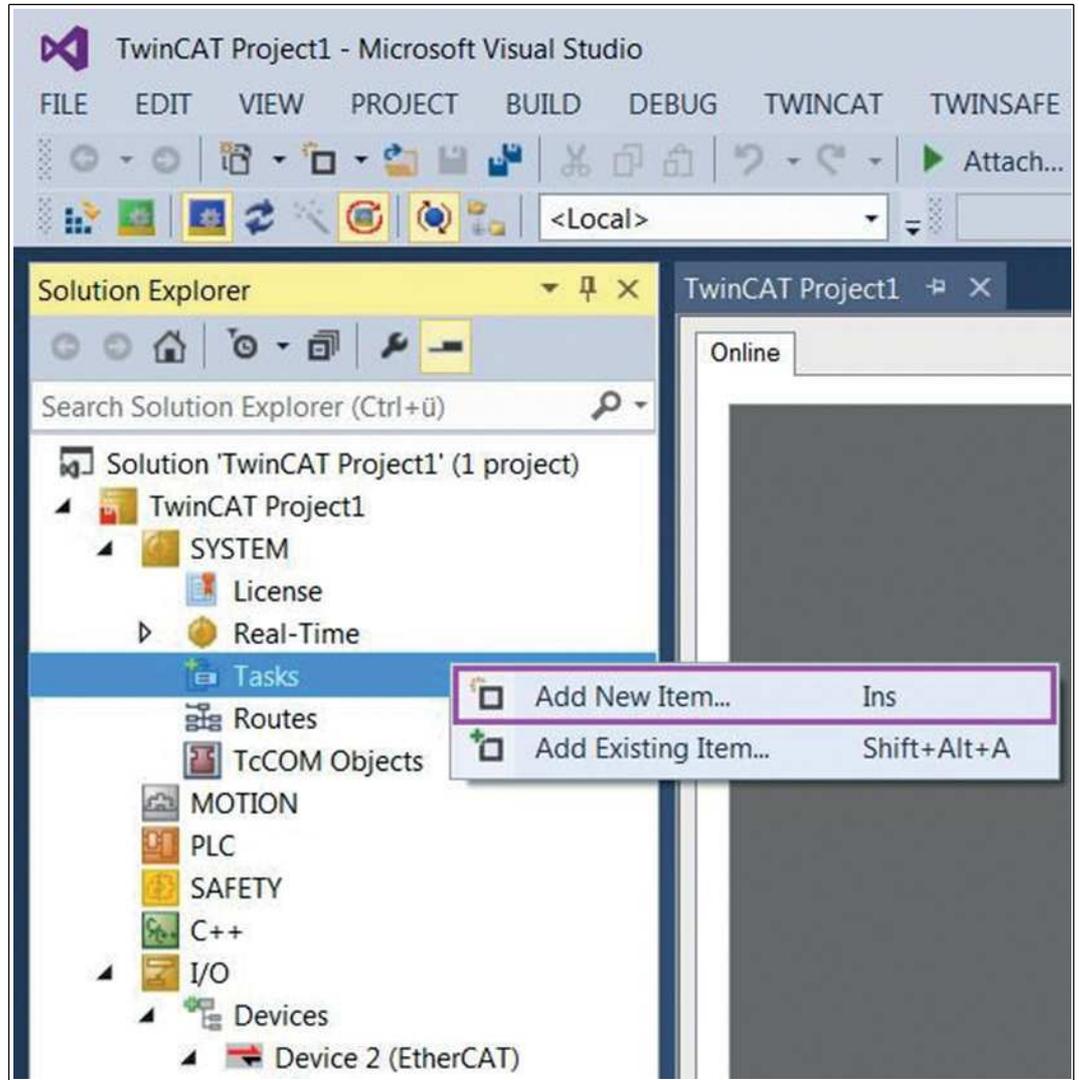


Figure 7.12

6. In the dialog, activate the type "TwinCAT Task with Image" and confirm this with "OK."

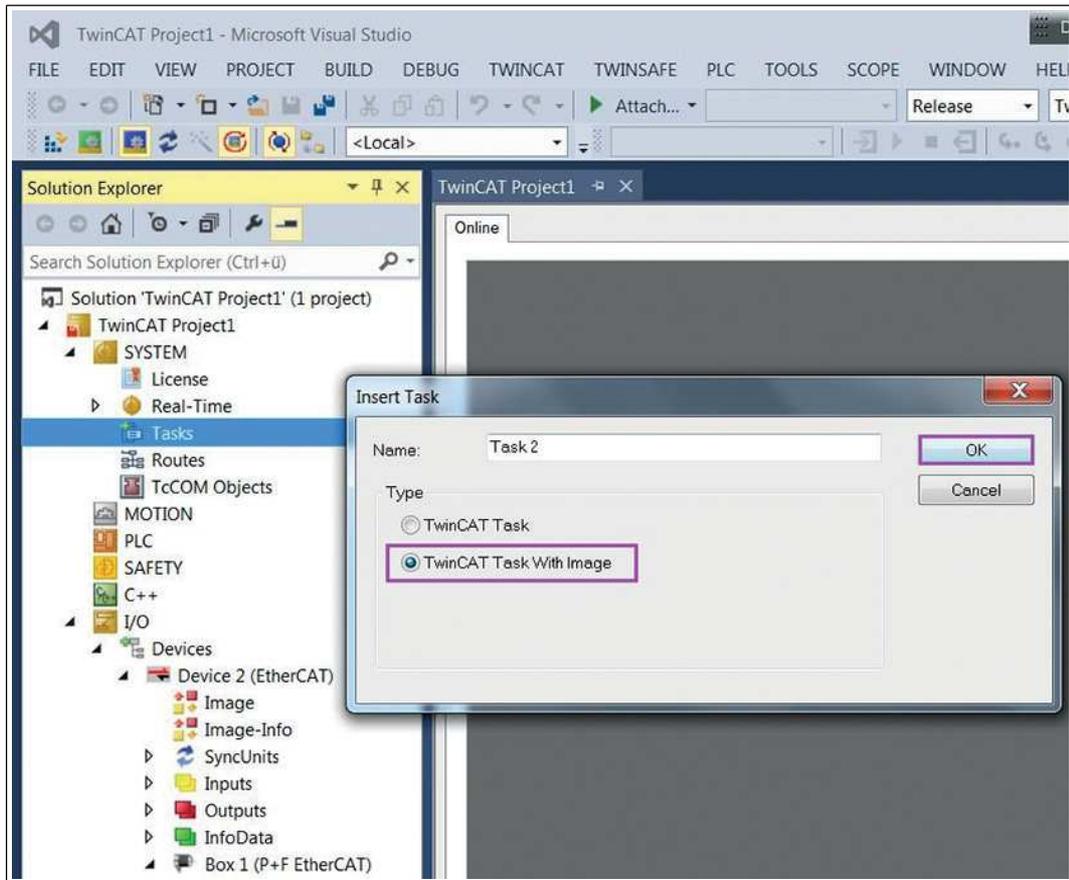


Figure 7.13

7. Now activate the option "Auto-start" for the newly created task. Thus, this task is started automatically with each restart of TwinCAT.

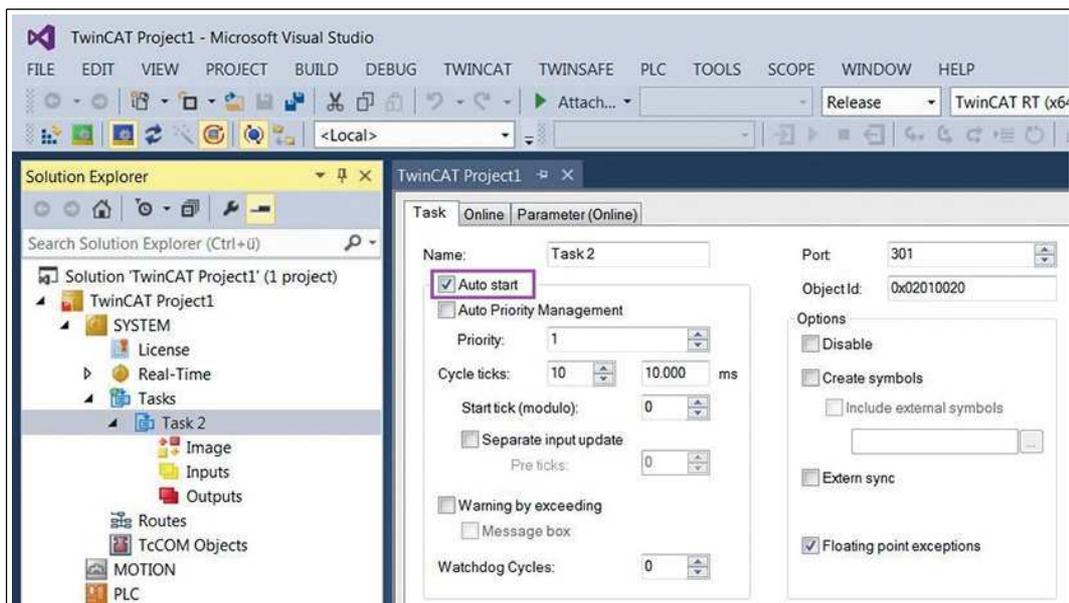


Figure 7.14

8. In the project folder explorer, navigate to the entry "Inputs" under the newly created task (in this case task 2) and right-click to select "Add New Item"

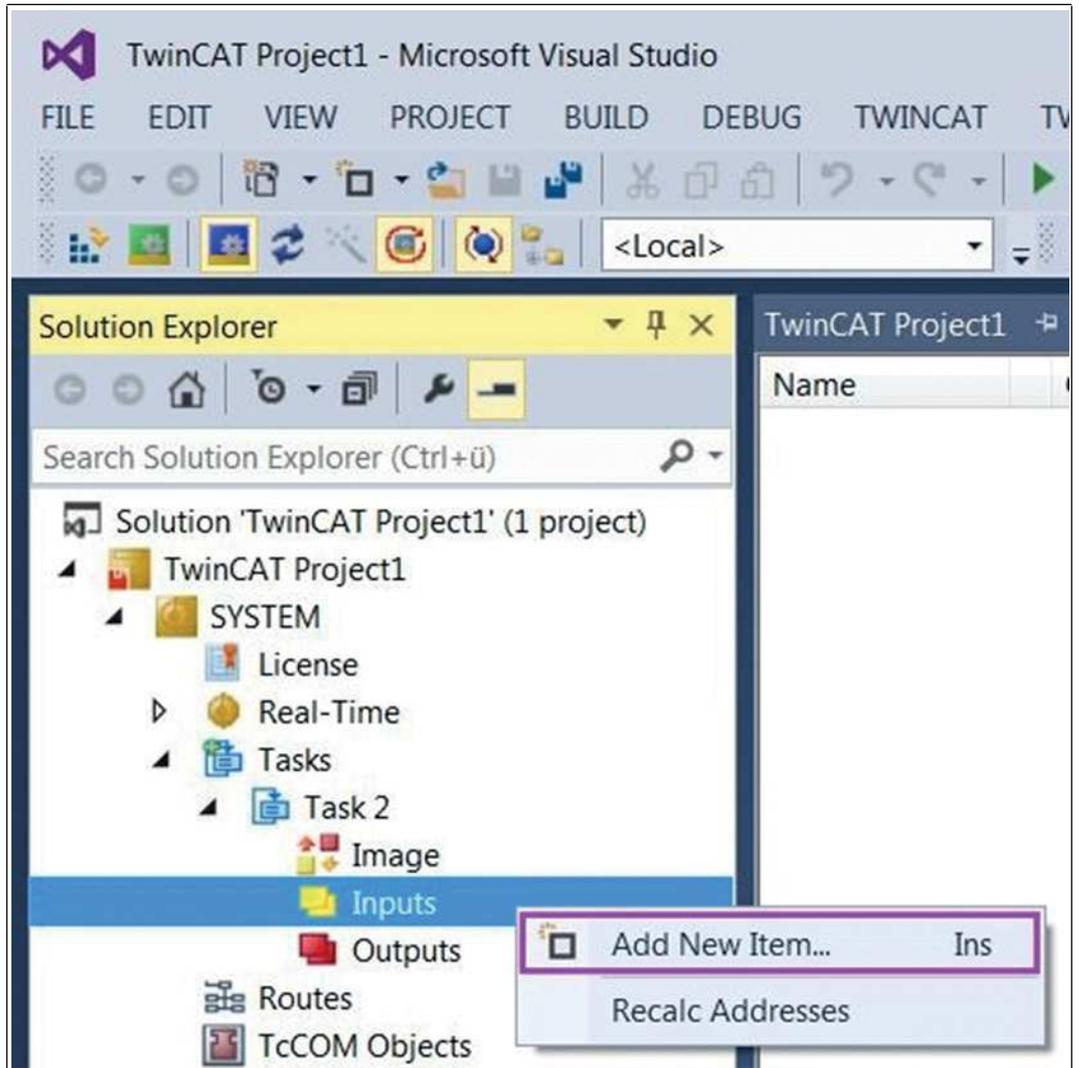


Figure 7.15

9. In the dialog box for the inputs, select data type "DWORD" and confirm the selection by clicking "OK."

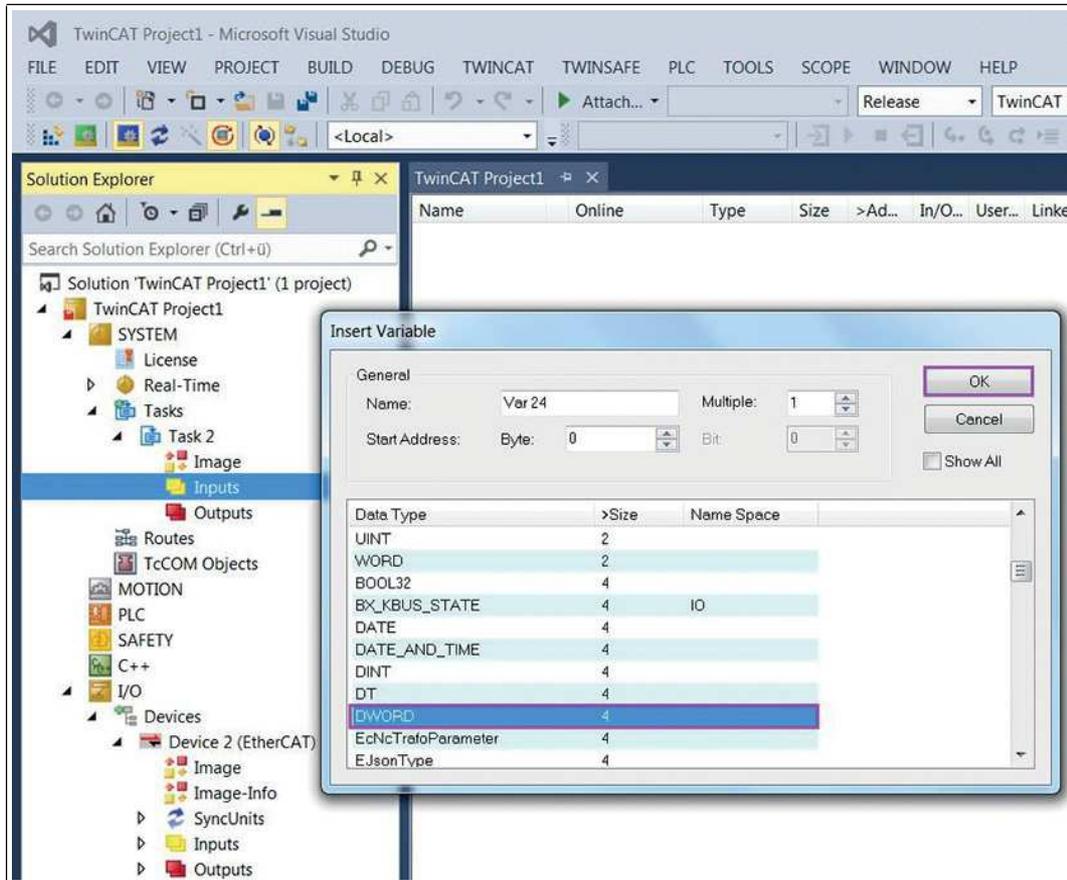


Figure 7.16

10. Now click the newly created variable (in this case Var 24) in the project folder window.

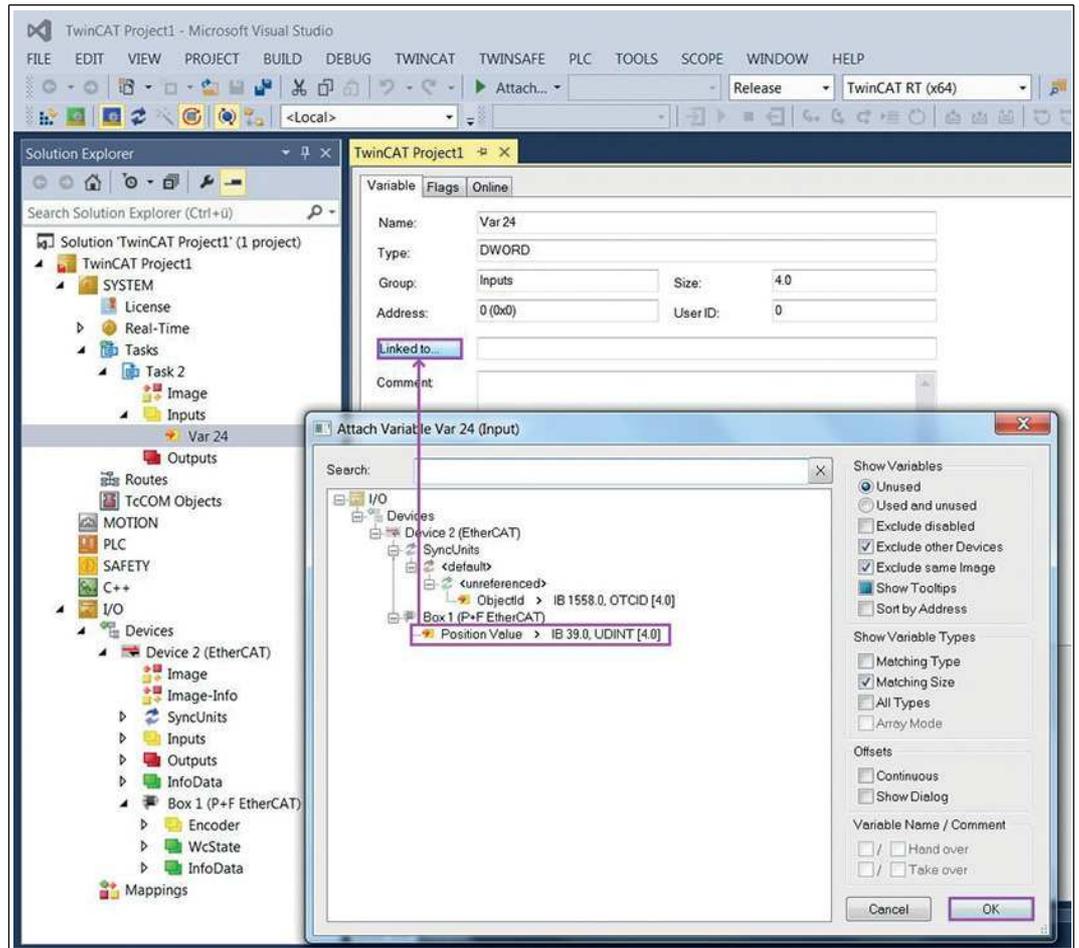


Figure 7.17

11. In the TwinCAT project window, click "Linked to...."
 12. In the window that opens, "Variables link Var 24 (input)," select the entry for "Position value" (here "Position value > IB 39.0, UDINT [4.0].")
 13. Confirm the entry with "OK."
- ↳ This means that the link between the position value and variable is created.

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