

作成日：2022年8月1日

设定安装手册

AZ系列 EtherCAT Drive profile对应

EtherCAT主站：倍福（BECKHOFF）
EPC(Embedded PC)、EK1110、CX2100
TwinCAT3 控制篇

通过基于CiA402的运动控制进行运行。

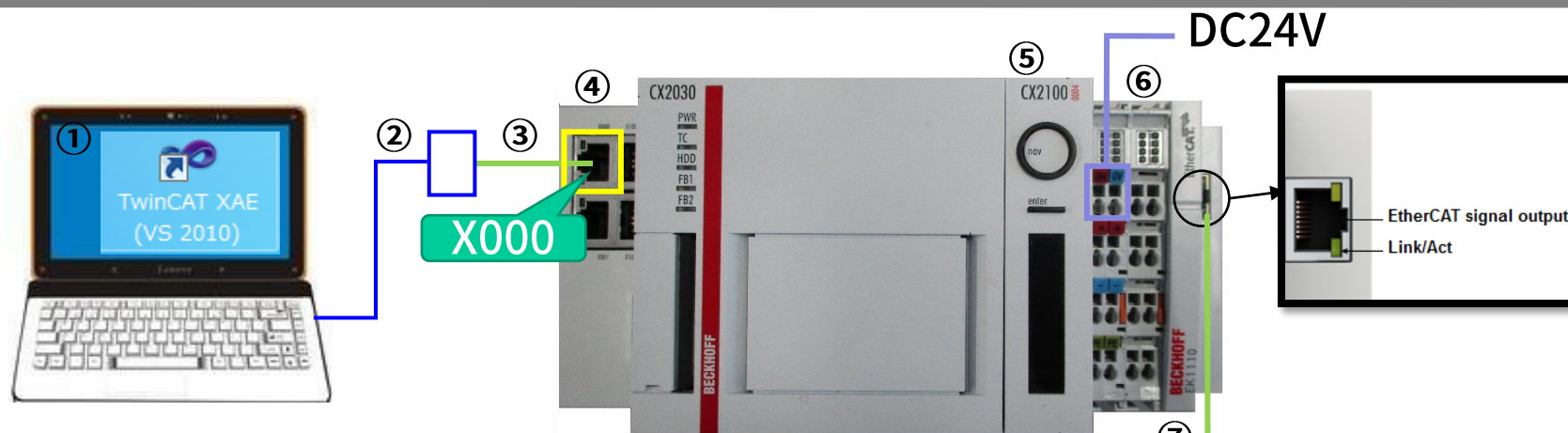
本书将介绍形成位置管理、位置指令的运动控制的设定以及简单操作的流程。

1. BECKHOFF TwinCAT 3 的通信设定
2. Cyclic同步位置模式（CSP）的运行方法
3. 通过SDO通信读写参数

初学者请从 1 开始,对EtherCAT产品有使用经验者请从2开始阅览。

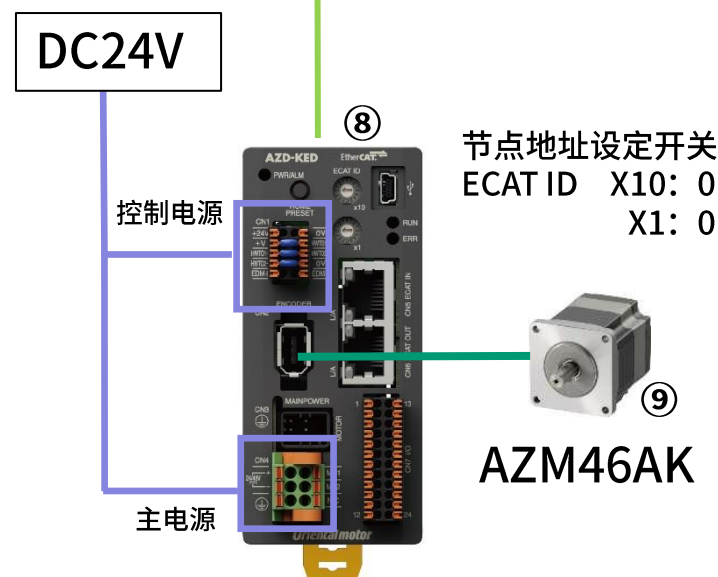
- (1) 在建立实际系统时,请确认好构成系统的各个机器・装置的规格后,采取在额定・性能上留有余地的用法、采取即使万一发生故障也可将危险降至最低的安全电路等安全对策。
- (2) 为安全使用系统,请获取构成系统的各个机器・装置的手册或使用说明书等,确认好「安全上的注意」「安全上的要点」等有关安全的注意事项、内容后使用。
- (3) 请客户自行确认系统应符合的规格・法规或限制。
- (4) 本资料的一部分或全部内容未经东方马达株式会社的许可,禁止复写、复制、再分发。
- (5) 本资料所记载的内容会因改良而有所变更,恕不另行通知。

系统构成图



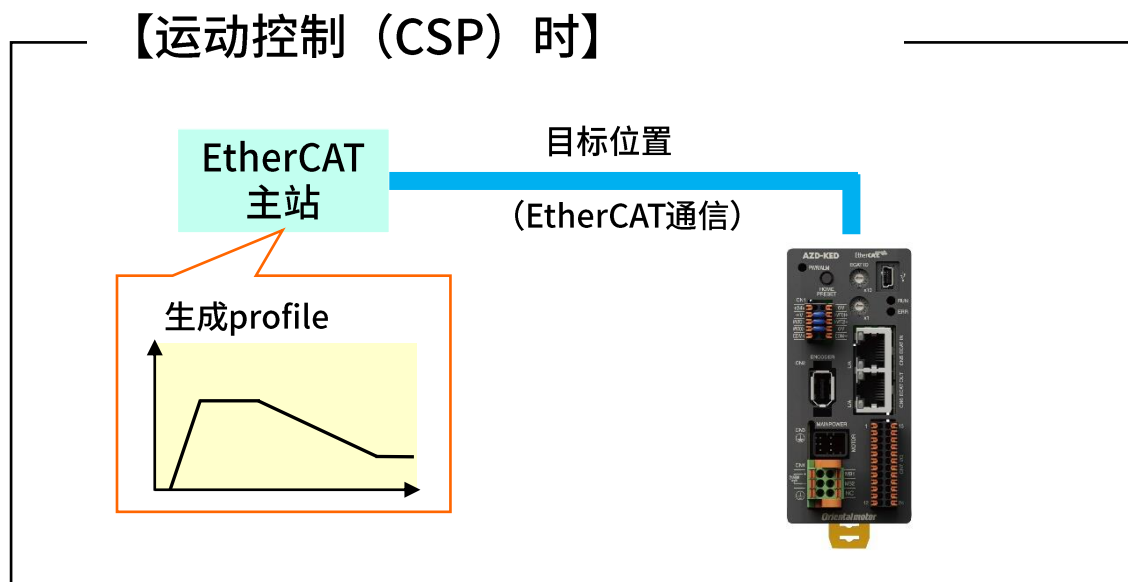
构成品一览 ※参考AZ系列 DC电源输入所记载。

Item	Name	Type/Model
①	PC Software	TwinCAT3 Ver.3.1.40.18
②	Ethernet Adapter(USB→Ethernet)	-
③	Ethernet Cable	-
④	EPC(Embedded PC)	-
⑤	Power supply units	-
⑥	EtherCAT extension	-
⑦	Ethernet Cable	-
⑧	Driver	AZD-KED
⑨	Motor (AZ)	AZM46AK



若在TwinCAT 3 上进行轴设定,则在主站侧形成位置指令和速度加减速等的profile。

- AZ驱动器的操作模式(operation mode)为Cyclic同步位置模式（CSP）或Cyclic同步速度模式（CSV）。
- 在EPC上设定运动轴时,可使用MC_POWER等的功能块（FB）。



CSP通过EtherCAT的Cyclic 通信（PDO通信）在每个通信周期都将目标位置（绝对值）发送到驱动器。

1. BECKHOFF TwinCAT 3 的通信设定

2. Cyclic同步位置模式（CSP）的运行方法

3. 通过SDO通信读写参数

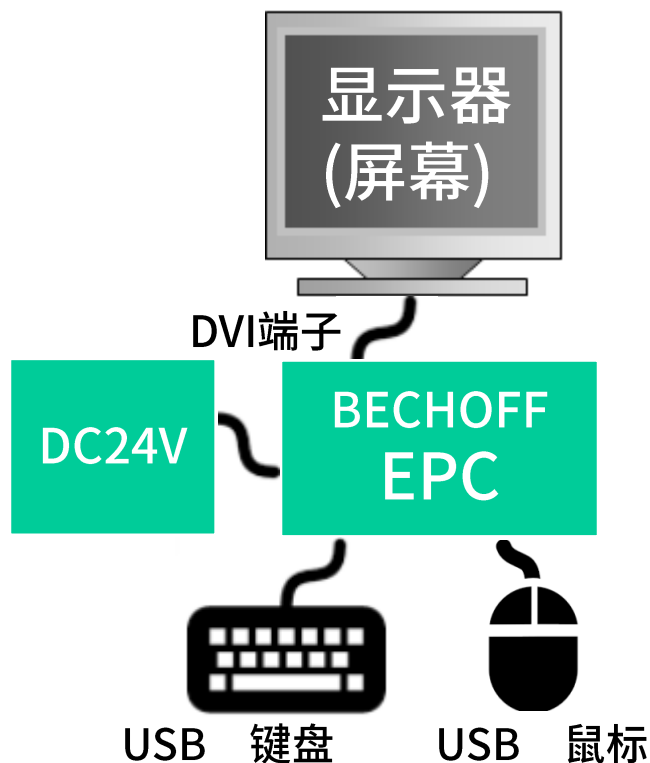
事前准备

EPC与外围设备的配线示例

AZ_EtherCAT_Beckhoff_CSP_B

- 要进行PC和EPC的通信，需要设定各自的IP。
要设定EPC的IP,首先**不要连接PC和EPC**,而要先将显示器(DVI)、键盘(USB)、鼠标(USB)等外围设备连接到EPC上。
- EPC与外围设备的连接示例如下所示。

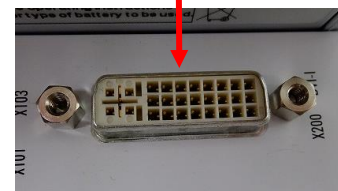
- 示意图



- 实际的连接环境（EPC接通电源时）



至显示器(屏幕)
*EPC的显示器输出是数字端子(DVI端子),因此请注意。



Target

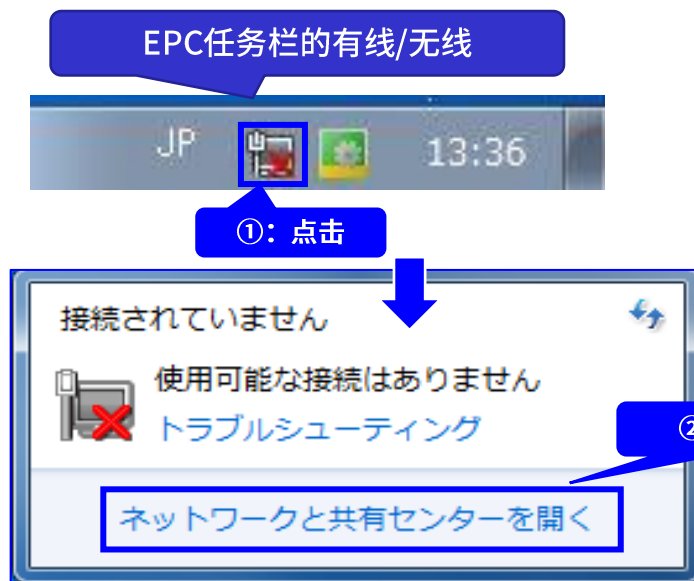
设定PC、EPC之间的通信,实施连接测试以确认能否正确通信。

EPC的Ethernet连接器:设定X000的IP地址和子网掩码。

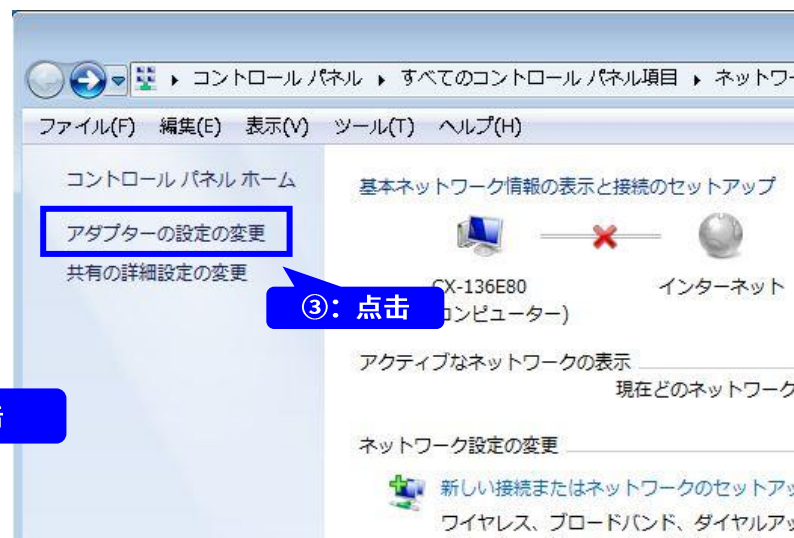
【注意】 设定之前,请与网络管理员确认IP地址。
请不要在同一网络上设定重复的IP地址。

■ 设定步骤(程序)

1. 网络和共享中心



2. 变更适配器的设定



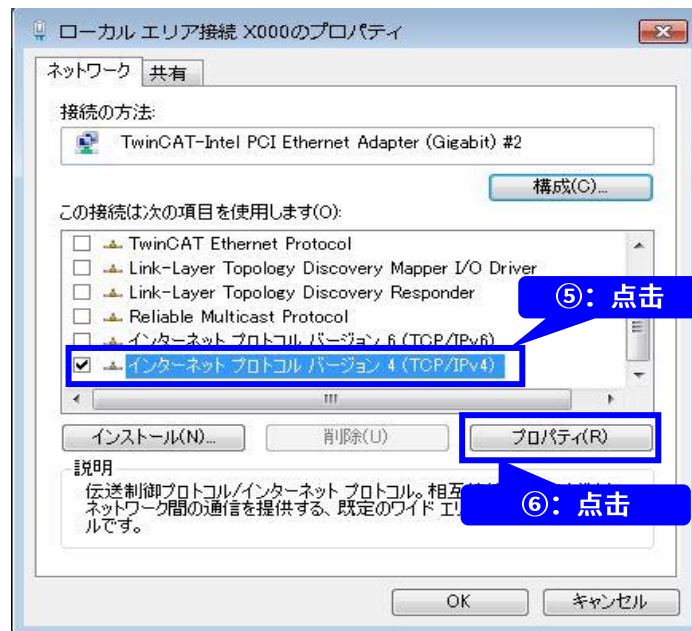
事前准备

设定PC与EPC间的通信 设定EPC的IP地址

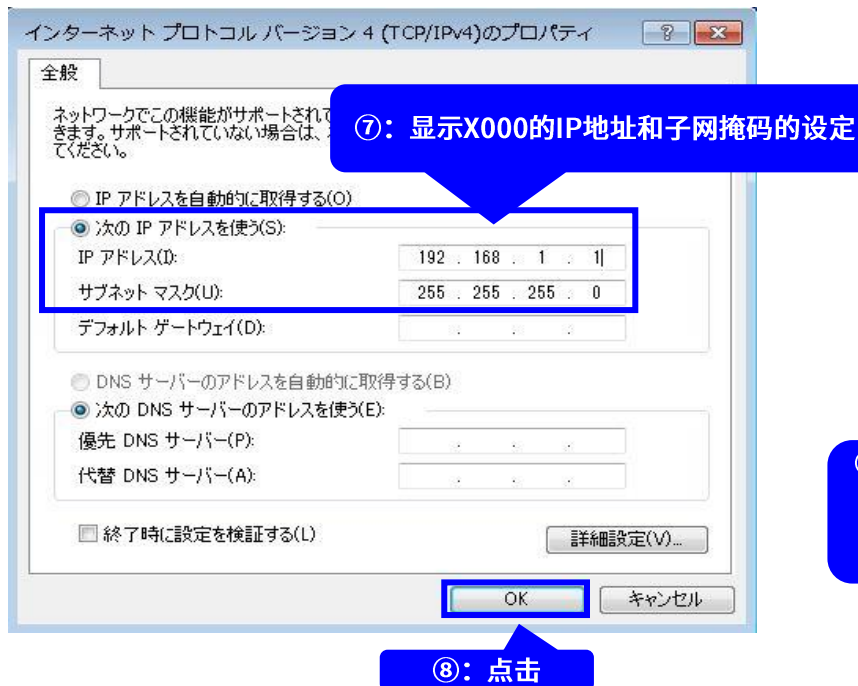
3. 选择本地连接X000,设定IP



4. 选择Internet协议版本4



5. 设定EPC的IP地址和子网掩码



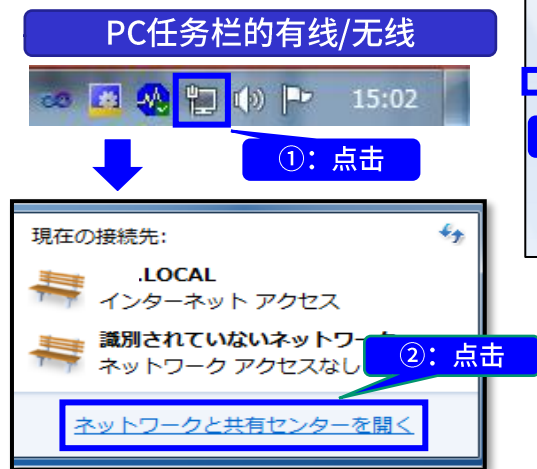
- ⑨: 不仅仅是PC,还要考虑连接到HMI上,
下面显示的是X001的IP设定示例。
- IP地址是192.168.1.2
 - 子网掩码: 255.255.255.0

事前准备

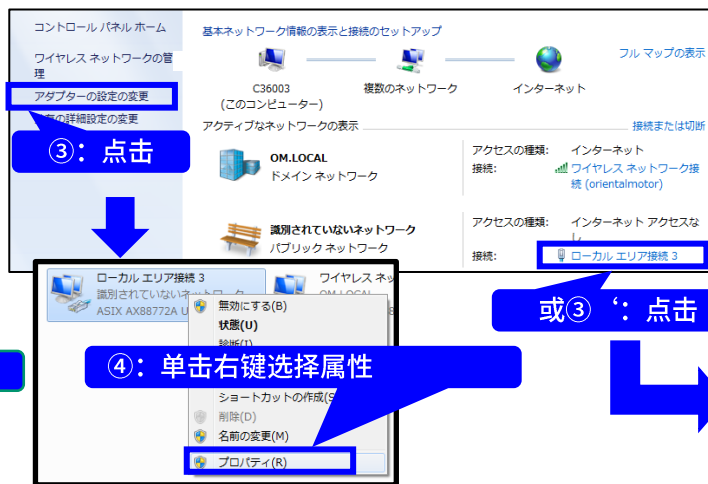
设定PC与EPC间的通信 设定PC的IP地址

设定PC端Ethernet Adapter的IP地址和子网掩码

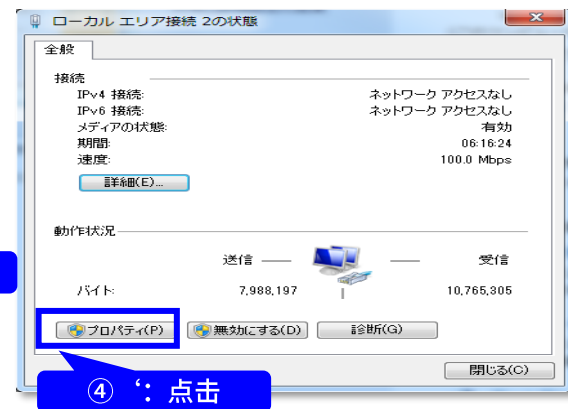
1. 打开网络和共享中心



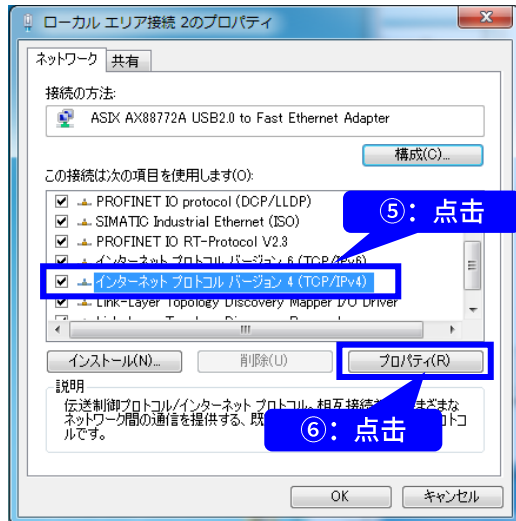
2. 选择Ethernet Adapter的网络



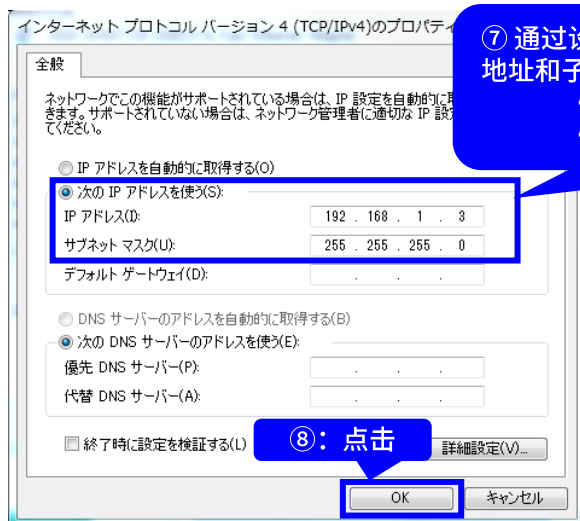
3. 选择Ethernet Adapter的连接状态的属性



4. Ethernet Adapter的属性



5. 设定要使用的Ethernet Adapter的IP地址和子网掩码



⑦ 通过设定EPC的IP地址来设定Ethernet Adapter的IP地址和子网掩码

- IP地址是192.168.1.3
- 子网掩码: 255.255.255.0

• EPC的X000 IP地址 (参考)



• EPC的X001 IP地址 (参考)



事前准备

下载ESI文件

Target

在TWINCAT 3 上确认PC与EPC之间的通信。

在PLC上安装ESI文件。

请从以下页面下载AZ驱动器的ESI文件。

AZD-KED: <https://www.orientalmotor.co.jp/products/detail.action?hinmei=AZD-KED>

AZD-AED: <https://www.orientalmotor.co.jp/products/detail.action?hinmei=AZD-AED>

AZD-CED: <https://www.orientalmotor.co.jp/products/detail.action?hinmei=AZD-CED>

仕様・特性

外形図

データダウンロード

その他仕様

規格

システム構成

データダウンロード

資料

CE適合宣言書

[CE-6701.pdf](#)

ESIファイル

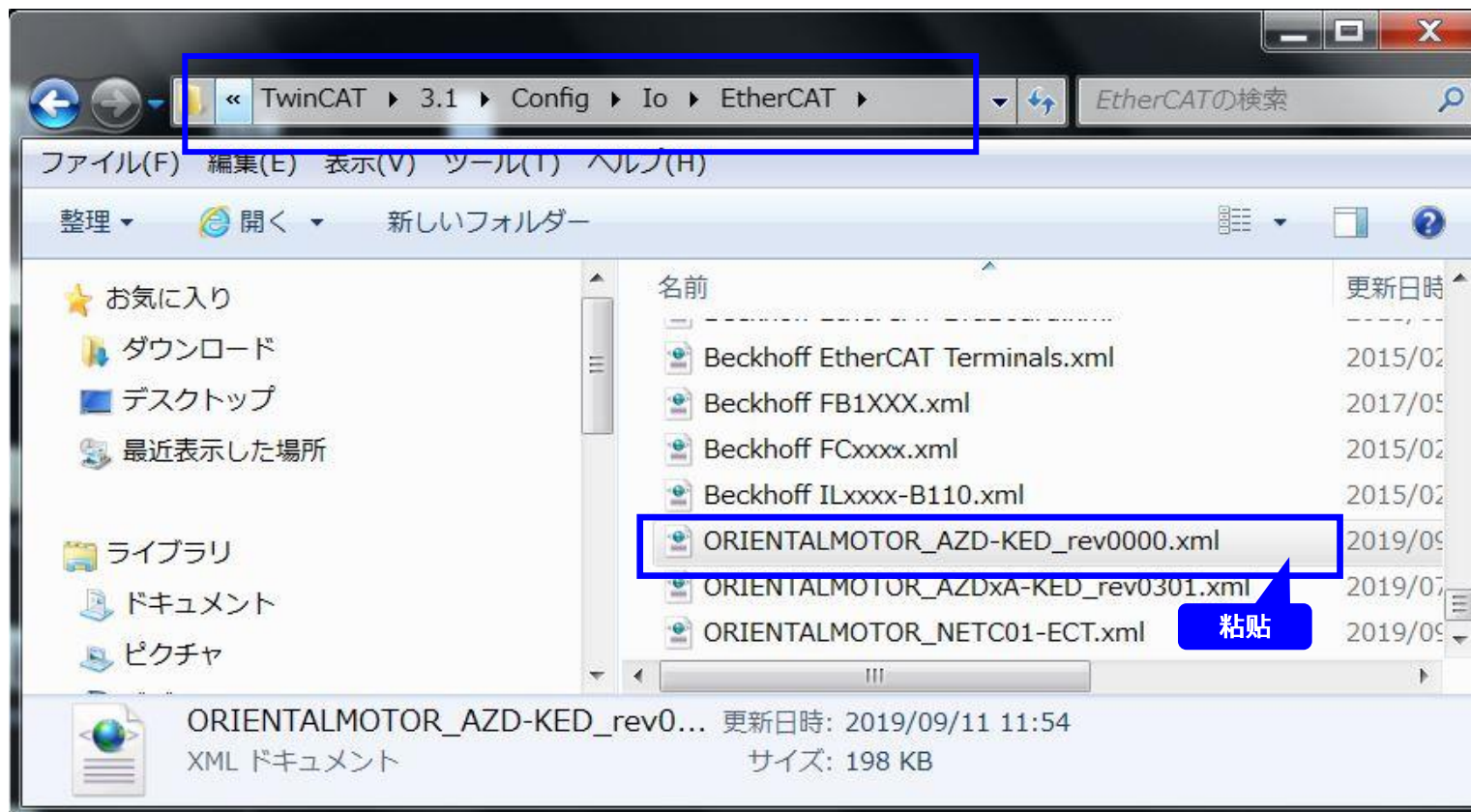
[ORIENTALMOTOR_AZD-KED_rev0000.xml](#)

サポートソフト MEXE02 (については[こちら](#)よりダウンロードしてください。)

事前准备

下载ESI文件

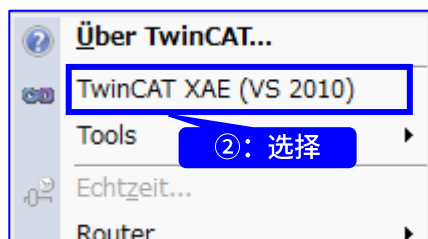
请将下载的ESI文件复制到安装了TwinCAT 3 的文件夹中。
(\\TwinCAT\\3.1\\Config\\Io\\EtherCAT)



启动TwinCAT 3,新建项目。

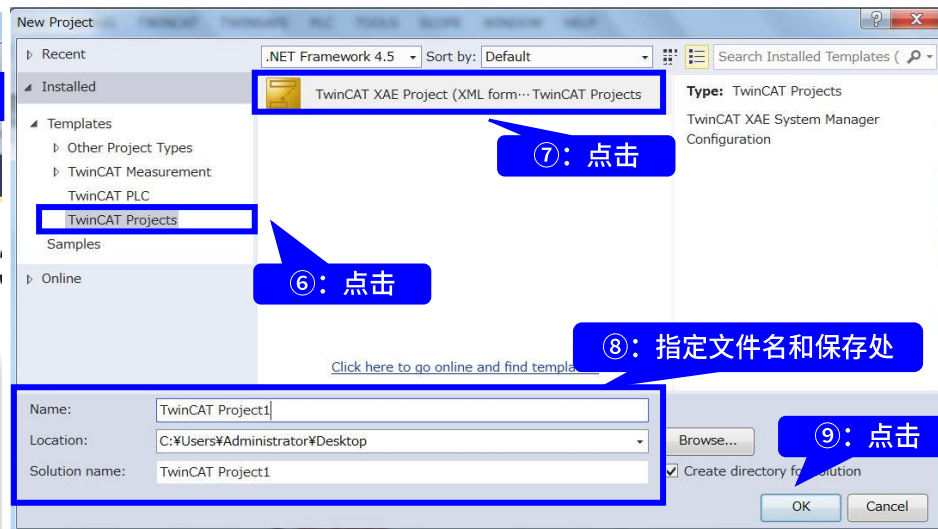
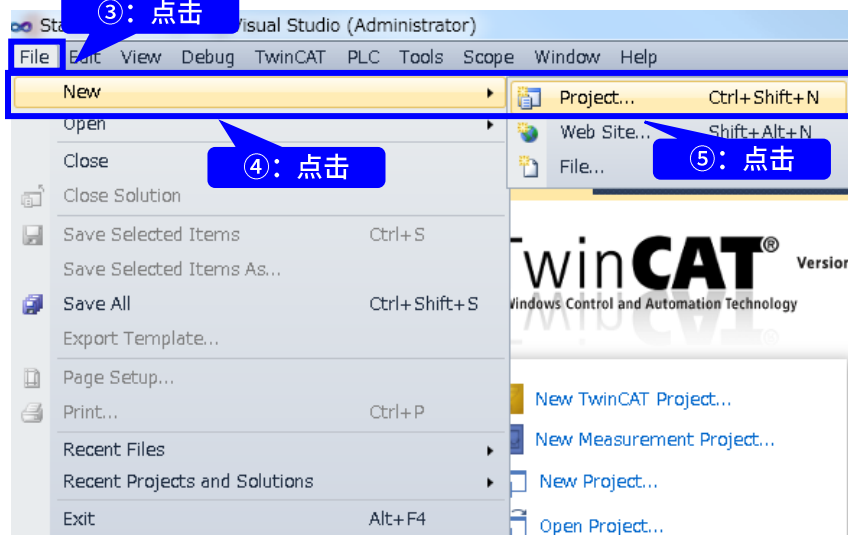
1. 从PC任务栏启动TwinCAT XAE(VS2010)

①: 点击

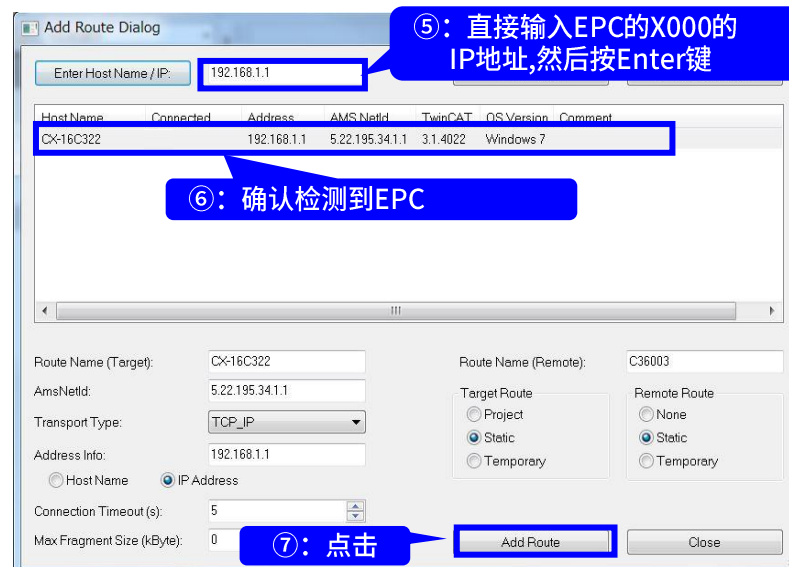
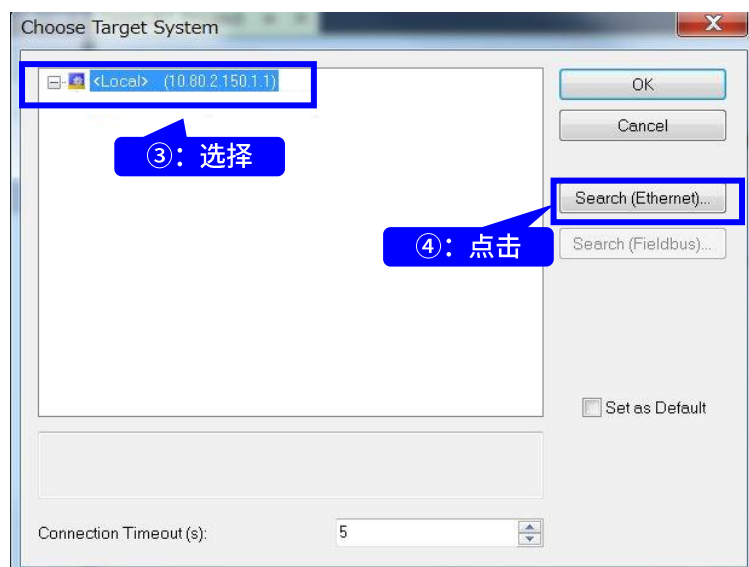
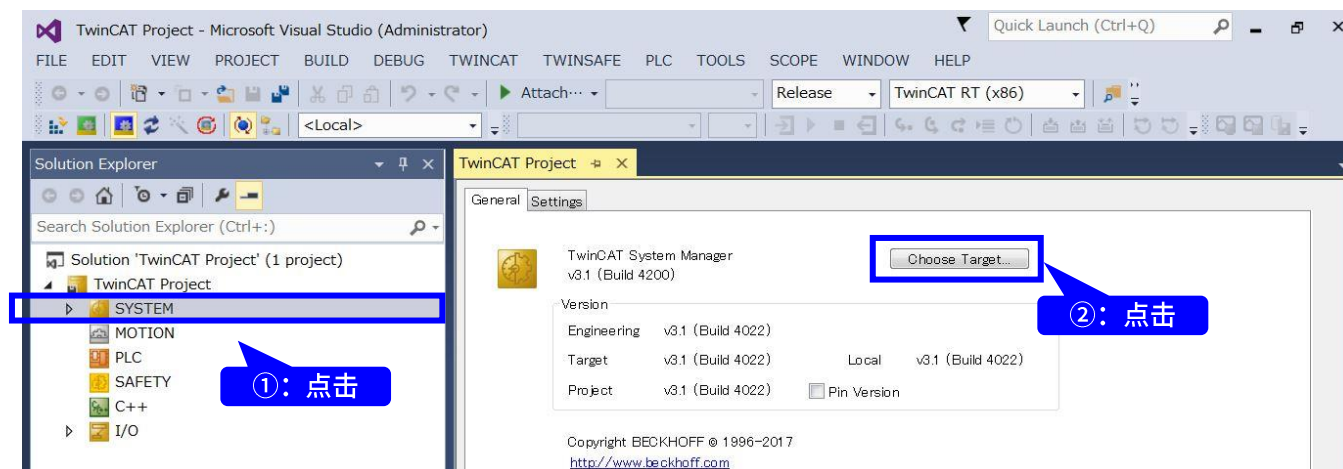


2. 新建项目

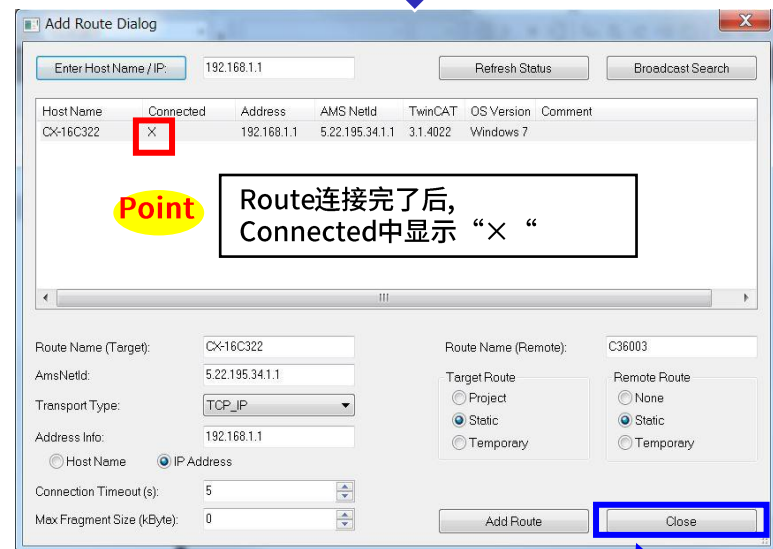
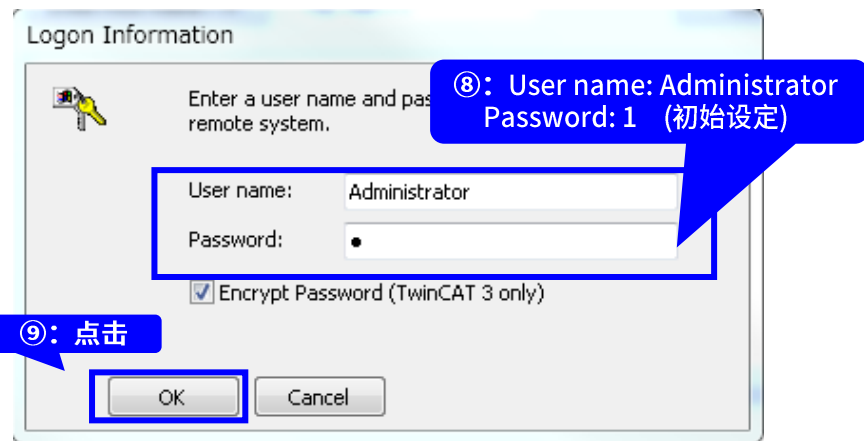
③: 点击



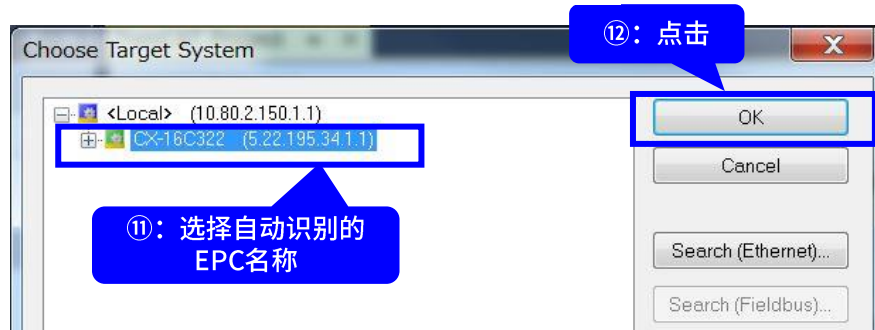
从TwinCAT 3 检测EPC。



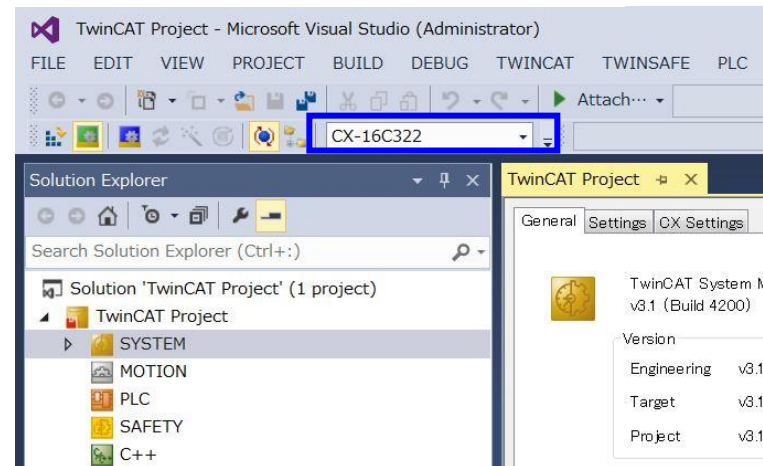
1. 按Add Route后的画面



2. 选择Target System



确认Target System



⑬: 确认显示前个画面所选择的“EPC名称”。
如仍是“Local”，请点击并选择。

PC与EPC之间的通信可通过EPC的TC的LED来确认

- 确认TC的LED的状态(绿：Run模式/蓝：Config模式)
- 点击「Restart TwinCAT (Config Mode)」 / 「Restart TwinCAT System」，
切换Config模式 / Run模式
- 确认切换后的TC的LED的状态

【例：Run模式→Config模式】

①: 点击「Restart TwinCAT(Config Mode)」

②: 点击

③: TC的LED
确认Status LED由“绿色”变为“蓝色”

Target

自动检测连接到EtherCAT的设备并确认通信状态。

设定EtherCAT的网络构成。在此介绍如何在线检测设备、构成网络的步骤。

由「Devices」
进行连接设备的Scan

①: 确认TwinCAT的「Config Mode」状态。
要执行Scan,需要处于「Config」状态。

②: 点击右键

③: 点击

④: 点击

Microsoft Visual Studio

HINT: Not all types of devices can be found automatically

OK キャンセル

网络构成的设定

登录EtherCAT主站并进行从站设备的Scan。

⑤ 执行Scan后，
登录EtherCAT主站。

⑥ 通过Scan(扫描)显示检测到的设备。
(可保留默认值)

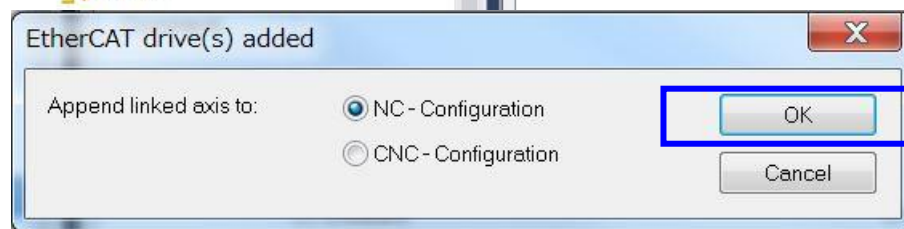
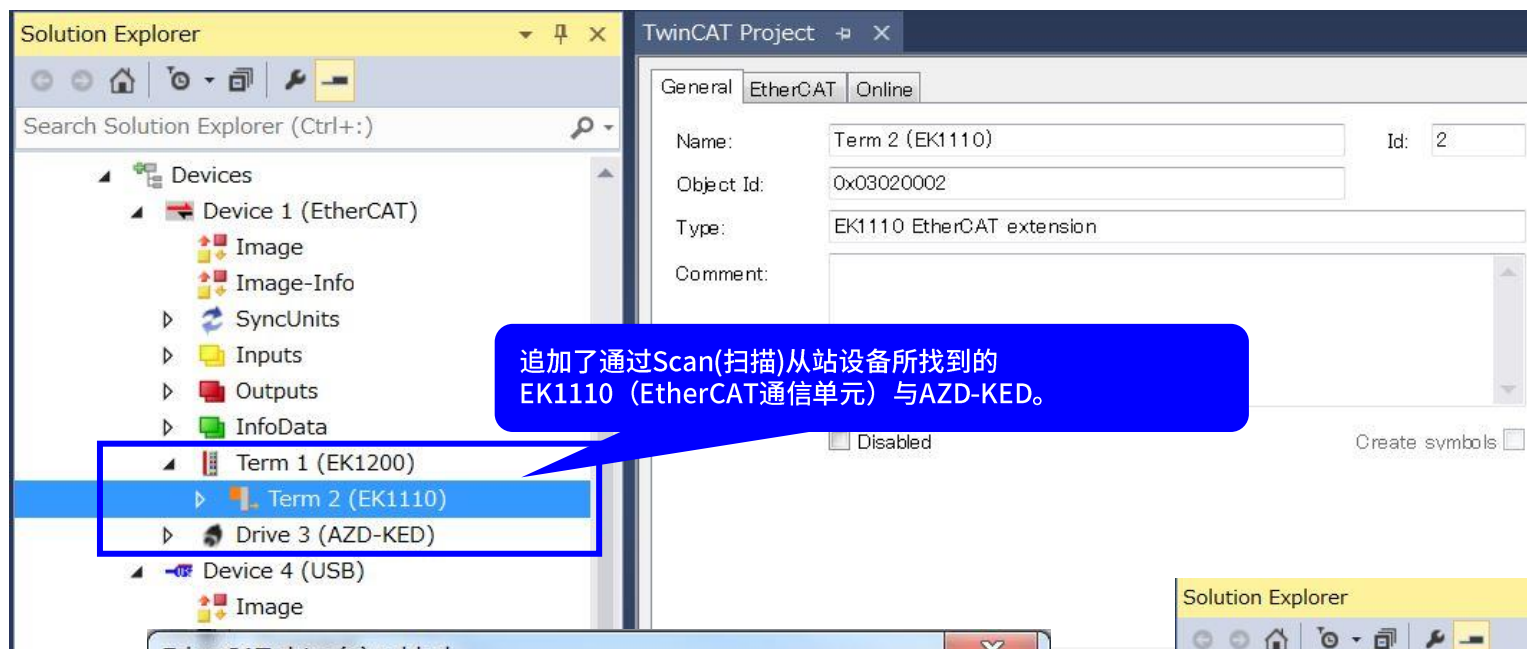
⑦: 点击

⑧: 点击

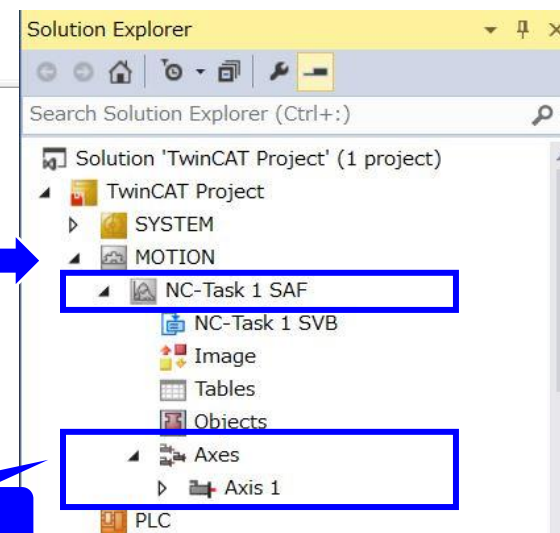
接下来执行EtherCAT从站设备的Scan(扫描)。

网络构成的设定

进行EtherCAT从站设备的登录。

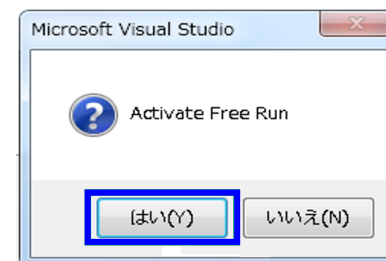


可确认是否追加到MOTION的NC、CNC。
此次,轴登录到MOTION的NC。



网络构成的设定

追加设备后,开始Active Free Run。
EPC与AZ驱动器的通信状态可通过EK1110和
驱动器的LED确认。



- EPC側



- AZ驱动器側



正常状态:
POWER/ALM: 绿色亮灯
RUN: 绿色亮灯
ERR: 灯灭
MAINPOWER: 绿色亮灯

网络构成的设定

可通过支援软件MEXE02（Ver.4）确认EtherCAT的通信状态和节点地址等。

New1 | AZ EtherCAT compatible : Motor/Actuator 10000P/R - MEXE02

File Edit View Communication Tool Support Help

ORIENTAL MOTOR/Common Virtual COM Port (COM3)
AZ EtherCAT compatible - Motor/Actuator 10000P/R

(a5) Navigation

- Currently open window
- Parameter
- Monitor
 - Operation
 - (m1) Remote operation
 - Monitor
 - (m2) Unit information monitor
 - (m3) Status monitor
 - (m4) D-I/O, R-I/O monitor
 - (m5) Internal I/O monitor
 - (m6) Alarm monitor
 - (m7) Information monitor
 - (m8) EtherCAT PDO monitor
 - (m9) EtherCAT status monitor

(m3) Status monitor

EtherCAT state machine	OP	Driver state machine	Ready to switch on
ECAT ID	0000 [h]		
ECAT ID SW(x10)	0 [h]	ECAT ID SW(x1)	0 [h]
Command position 32 bit counter	142100 [step]	Feedback position 32 bit counter	142100 [step]
Command Position	142100 [step]	Feedback Position	142100 [step]
Command Speed	0 [Hz]	Feedback Speed	0 [Hz]
Command Speed	0.00 [r/sec]	Feedback Speed	0.00 [r/sec]
Command Speed	0 [r/min]	Feedback Speed	0 [r/min]
Driver Temperature			
Main power volt.(DC)			
Cumulative load			
CST operating current			

主要监视项目	说明
EtherCAT state machine	表示 EtherCAT 通信的 state machine 状态。 EtherCAT 通信的 state machine 由主机控制。 【显示内容】 • INIT: 初始化中 • PREOP: Pre-Operational 状态 • SAFEOP: Safe-Operational 状态 • OP: Operational 状态
ECAT ID	显示当前使用的节点地址。节点地址在接通控制电源时确定。
ECAT ID SW	表示节点地址设定开关的状态。



您可以从东方马达网站免费下载。

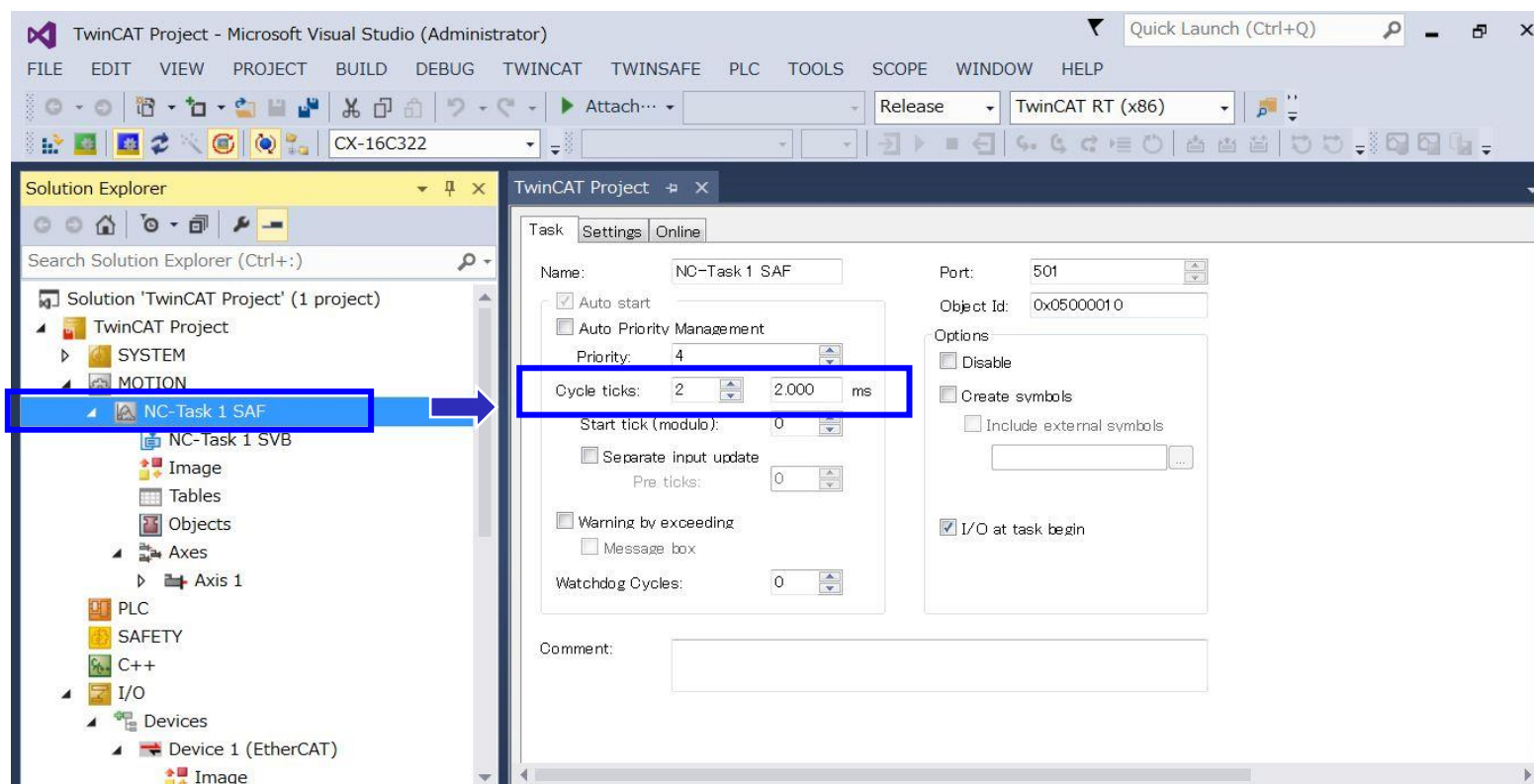
1. BECKHOFF TwinCAT 3 的通信设定

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运行前的各种设定

确认MOTION轴的登录



扫描从站设备后,确认轴已登录到MOTION的NC。
另外EtherCAT通信周期 (DC模式) 为0.5ms,1~8ms。
为此,MOTION要求Cycle ticks的设定小于8.0ms。
在此保留默认设定2.0ms。

运行前的各种设定

Target

进行CSP的测试运行。

确认AZD-KED 是否被登录到TwinCAT上的Axis 1。

① 点击 在 Solution Explorer 中点击 'Axis 1'。

② 点击 点击 'Settings' 选项卡。

③ 确认它是 "Drive3(AZD-KED)" 确认 'Link To I/O...' 下拉菜单中显示 'Drive 3 (AZD-KED)'。

④ 确认单位的设定 确认 'Unit' 设置为 'mm'，'Display (Only)' 中的 'Position' 为 'mm'，'Velocity' 为 'mm/s'，'Acceleration' 为 'mm/s²'，'Jerk' 为 'mm/s³'。

运行前的各种设定

MOTION运行时需要设定操作模式(Mode of operation)。

注意：MOTION不会自动设定。

操作模式(Mode of operation)的设定方法有以下两种。

- Startup设定
- PLC程序设定

本手册介绍在Startup下设定的方法、
在Cyclic同步位置模式(CSP)下使用梯形图和功能块的简易运行。

Operation mode 的设定值	Operation mode
0 (初始值)	运行功能无效
1	Profile 位置模式 (PP)
3	Profile 速度模式 (PV)
6	原点返回模式 (HM)
8	Cyclic 同步位置模式 (CSP)
9	Cyclic 同步速度模式 (CSV)

运行前的各种设定

默认设定时，“Mode of operation”已登录到PDO mapping。
不事先将其从PDO mapping中删除，则操作模式(Mode of operation)将被盖写为0。

① 点击

② 点击

③ 点击 PDO的index: 0x1600

④ 选择，单击右键

⑤ 选择

Process Data

Sync Manager:

SM	Size	Type	Flags
0	128	Mbx...	
1	128	MbxIn	
2	7	Out...	
3	7	Inpu...	

PDO List:

Index	Size	Name	Flags
0x1A00	7.0	Transmit PDO mapping 1	3
0x1A01	23.0	Transmit PDO mapping 2	0
0x1600	7.0	Receive PDO mapping 1	2 0
0x1601	13.0	Receive PDO mapping 2	0

PDO Assignment (0x1C12):

- ☒ 0x1600
- ☐ 0x1601 (excluded by 0x1600)

PDO Content (0x1A00):

Index	Size	Offs	Name	Type	Default (...)
0x604...	2.0	0.0	Statusword	UINT	
0x606...	4.0	2.0	Position actual value	DINT	
0x606...	1.0	6.0	Modes of operation displ...	SINT	

Predefined PDO Assignment: (none)

Load PDO info from device

Task List **Bookmarks** **Error List**

Ready

运行前的各种设定

从“Process Data”的设定删除“Modes of operation”后，通过“Startup”的设定直接设定“Modes of operation”的参数。

①点击

②点击

③输入「6060」

④输入「08」 (08: CSP)

⑤点击

■ “Modes of operation” — 览

Operation mode 的设定值	Operation mode
0 (初始值)	运行功能无效
1	Profile 位置模式 (PP)
3	Profile 速度模式 (PV)
6	原点返回模式 (HM)
8	Cyclic 同步位置模式 (CSP)
9	Cyclic 同步速度模式 (CSV)

运行前的各种设定

The screenshot shows the TwinCAT Project interface in Microsoft Visual Studio. The Solution Explorer on the left displays the project structure, including I/O, Devices, and Drive 3 (AZD-KED). The main window shows the 'Startup' tab of the 'TwinCAT Project' configuration. A table lists the startup entries, with the 'PS' entry selected. A blue callout box points to this entry with the text '⑥ “Mode of Operation” 被登录到 Startup'. Another blue callout box points to the 'PS' entry with the text '双击可确认内容'. A double-click action opens the 'Edit Startup Entry' dialog box, which shows the 'PS' entry selected. The 'Index (hex)' is set to 6060, and the 'Sub-Index (dec)' is set to 0. The 'Data (hexbin)' is set to 00. The 'Comment' field contains 'Modes of operation'. A table at the bottom of the dialog box shows the entry details:

Index	Name	Flags	Value	Unit
6060	Modes of operation	RWP	0	

运行前的各种设定

设定动作运行、原点返回运行时的速度。
默认设定的运行速度太快,请变更为适当的速度。

① 点击

② 点击

③ 设定此值

④ 可确认设定值的单位。

Parameter	Offline Value	Online Value	Unit
Manual Motion and Homing:			
Homing Velocity (towards plc cam)	30.0		F mm/s
Homing Velocity (off plc cam)	30.0		F mm/s
Manual Velocity (Fast)	600.0		F mm/s
Manual Velocity (Slow)	100.0		F mm/s
Jog Increment (Forward)	5.0		F mm
Jog Increment (Backward)	5.0		F mm

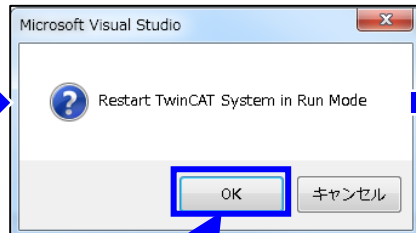
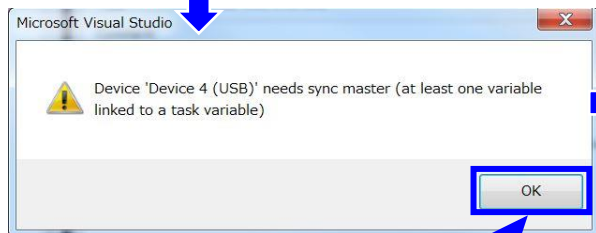
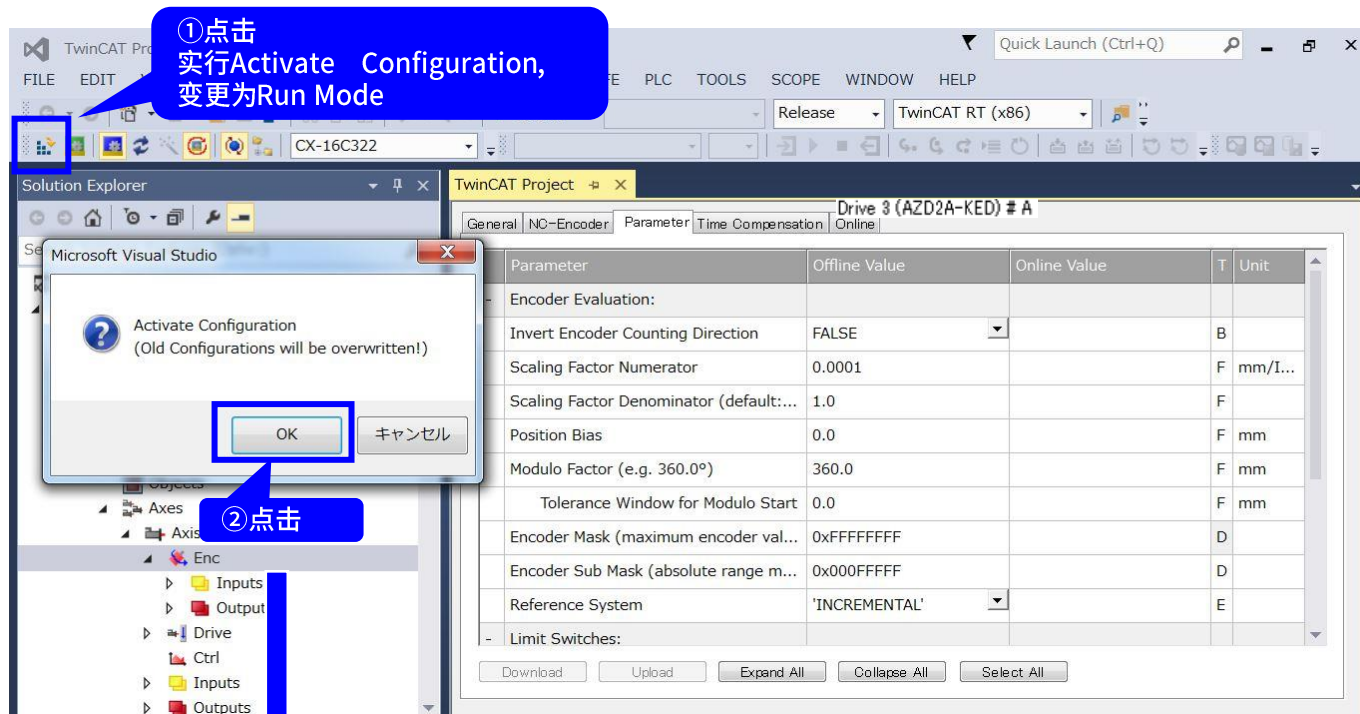
这意味着1step=0.0001mm,
根据该设定值,可如下换算电动机速度。
例:「Manual Velocity(fast)为15[mm/s]时,
实际电动机速度为15/0.0001=150[kHz]。

Parameter

Parameter	Offline Value
Encoder Evaluation:	
Invert Encoder Counting Direction	FALSE
Scaling Factor Numerator	0.0001
Scaling Factor Denominator (default:...	1.0
Position Bias	0.0
Modulo Factor (e.g. 360.0°)	360.0
Tolerance Window for Modulo Start	0.0
Encoder Mask (maximum encoder val...	0xFFFFFFFF
Encoder Sub Mask (absolute range m...	0x000FFFFFF
Reference System	'INCREMENTAL'

运行前的各种设定

为了使之反映PDO及Startup等变更了的参数的设定,实行“Activate Configuration”。



⑤ 请确认由“Config Mode” (蓝色) → 到“Run Mode” (绿色)了。

从运动轴的Online实行测试运行。

① 点击

② 点击

位置和速度信息

报警信息

设定电动机的当前ON/OFF、CW许可、CCW许可的区域

功能区域和各功能的说明

Function	Description
F1	Reverse travel with Manual Velocity (Fast)
F2	Reverse travel with Manual Velocity (Slow)
F3	Forward travel with Manual Velocity (Slow)
F4	Forward travel with Manual Velocity (Fast)
F5	Start a direct travel command •Enter the Target Position •Enter the Target Velocity •Start the travel command with F5
F6	Stop a direct travel command
F8	Reset the control (if hand control has stopped responding)
F9	Trigger homing (see TwinCAT documentation)

测试运行

The screenshot shows the 'Online' tab of the software interface. Key elements include:

- Position and Velocity:** Setpoint Position: 830.8455 [mm], Actual Velocity: -9.9910 [mm/s], Setpoint Velocity: -10.0000 [mm/s].
- Override:** 100.0000 %.
- Status (log):** Ready (checked), Calibrated (unchecked), Has Job (checked), NOT Moving (unchecked), Moving Fw (unchecked), Moving Bw (checked).
- Status (phys):** Coupled Mode (unchecked), In Target Pos. (unchecked), In Pos. Range (unchecked).
- Enabling:** Controller (checked), Feed Fw (checked), Feed Bw (checked).
- Controller Kv-Factor:** 1 [mm/s/mm].
- Reference Velocity:** 2200 [mm/s].
- Target Position:** 0 [mm].
- Target Velocity:** 0 [mm/s].
- Buttons:** F1, F2, F3, F4 (highlighted with a blue box), F5, F6, F8, F9.

④ 分别按F1、F2、F3、F4键进行测试运行。

① 点击

The 'Set Enabling' dialog box shows the following settings:

- Controller:** ☐ (unchecked)
- Feed Fw:** ☐ (unchecked)
- Feed Bw:** ☐ (unchecked)
- Override [%]:** 0

② 点击

The 'Set Enabling' dialog box shows the following settings:

- Controller:** ☒ (checked)
- Feed Fw:** ☒ (checked)
- Feed Bw:** ☒ (checked)
- Override [%]:** 100

③ 确认全部选中(打了对号),按「OK」。

注意：程序执行中无法进行测试运行

可通过支援软件MEXE02 (Ver.4) 确认各个运行信息及报警信息。

(a5) Navigation

- Currently open window
- Parameter
- Monitor
 - Operation
 - (m1) Remote operation
 - Monitor
 - (m2) Unit information monitor
 - (m3) Status monitor**
 - (m4) D-I/O, R-I/O monitor
 - (m5) Internal I/O monitor
 - (m6) Alarm monitor
 - (m7) Information monitor
 - (m8) EtherCAT PDO monitor
 - (m9) EtherCAT status monitor
 - (m10) EtherCAT monitor
 - (m11) Waveform monitor
 - Test
 - (m12) I/O test

(m3) Status monitor

EtherCAT state machine	OP	Driver state machine	Ready to switch on
ECAT ID	0000 [h]		
ECAT ID SW(x10)	0 [h]	ECAT ID SW(x1)	0 [h]
Command position 32 bit counter	142100 [step]	Feedback position 32 bit counter	142100 [step]
Command Position	142100 [step]	Feedback Position	142100 [step]
Command Speed	0 [Hz]	Feedback Speed	0 [Hz]
Command Speed	0.00 [r/sec]	Feedback Speed	0.00 [r/sec]
Command Speed	0 [r/min]	Feedback Speed	0 [r/min]
Driver Temperature	38.5 [deg C]	Motor temperature	34.8 [deg C]
Main power volt.(DC type)	23.8 [V]	Inverter voltage	23.7 [V]
Cumulative load	0	Elapsed time from boot	3107529 [ms]
CST operating current	0.0 [%]	Position deviation	0.00 [degree]
Torque	0.0 [%]	Odometer	13.3 [x1000 rev]
Motor Load factor	0.0 [%]	Tripmeter	13.3 [x1000 rev]
		Clear tripmeter	
		Alarm Condition	00:Alarm not prese
		Information condition	00000000

位置、速度信息

报警、Information信息

Alarm monitor

Information monitor

附： 搭载DG2-AZ产品/减速机组合使用时的循环坐标设定参考

说明：
由于BECKOFF PLC的循环坐标设定范围有限制，必须设定为2的n次方，AZ驱动器的循环设定坐标也必须设定为2的n次方。
不然BECKOFF PLC和AZ驱动器的坐标不一致，导致BECKOFF PLC出现位置偏差过大警报(0x4550)，或AZ驱动器出现脉冲指令异常警报(34h)；
不同减速比设定数值参考如下表(表一)：

减速比	电子减速机A 6091h-01h	电子减速机B 6091h-02h	马达分辨率 [step/rev]	减速机输出轴的分辨率	十六进制
				[step/rev]	
1	625	512	8192	8192	00002000h
3.6	1125	1024	9102.22	32768	00008000h
5	3125	2048	6553.60	32768	00008000h
7.2	1125	1024	9102.22	65536	00010000h
9	5625	4096	7281.78	65536	00010000h
10	3125	2048	6553.60	65536	00010000h
12	1875	1024	5461.33	65536	00010000h
15	9375	8192	8738.13	131072	00020000h
18	5625	4096	7281.78	131072	00020000h
20	3125	2048	6553.60	131072	00020000h
25	15625	8192	5242.88	131072	00020000h
30	9375	8192	8738.13	262144	00040000h
36	5625	4096	7281.78	262144	00040000h
50	15625	8192	5242.88	262144	00040000h
100	15625	8192	5242.88	524288	00080000h
120	9375	8192	8738.13	1048576	00100000h

附： 搭载DG2-AZ产品/减速机组合使用时的循环坐标设定参考

AZ驱动器侧设定：

- 设定条件：① 马达/驱动器参数恢复出厂设定数值后开始设定；
② 以DG2-AZ垂直安装面产品（搭载18比减速机）为例；
③ 以“脉冲”为单位设定。

设定内容1：参考上页表一，利用MEXE02软件修改电子减速机A、B数值：

(a5) 屏幕清单	
当前打开的屏幕	
(p1) Profile area的对象	
参数	
参数	
(p1) Profile area的对象	
厂家固有区域的对象	
(p2) 基本设定	
(p3) 电动机・机构(坐标/JOG/原点返回)设定	
(p4) ETO・Alarm・Info设定	
(p5) I/O动作・功能	
(p6) Direct-IN 功能选择(DIN)	
(p7) Direct-OUT功能选择(DOUT)	
(p8) Remote-I/O功能选择(R-I/O)	
(p9) EXT-IN・VIR-IN・USR-OUT功能选择(扩展)	
(p10) I/F功能	

(p1) Profile area的对象	
1 Quick stop option code (605Ah)	按照Quick stop deceleration(6085h)减速停止。停止后，变为Switch on disabled。
2 Shutdown option code (6058h)	按照Profile deceleration(6084h)减速停止。停止后，电动机变为无励磁。
3 Disable operation option code (605Ch)	按照Profile deceleration(6084h)减速停止。停止后，电动机变为无励磁。
4 Halt option code(605Dh)	按照Profile deceleration(6084h)减速停止。停止后，保持Operation enabled。
5 Modes of operation (6060h)	运行功能无效
6 Following error window (6065h)	3.00 rev
7 Position window (6067h)	1.8 °
8 Home offset (607Ch)	0 step
9 Min position limit (607Dh-01h)	-2147483648 step
10 Max position limit (607Dh-02h)	2147483647 step
11 Profile velocity (6081h)	10000 Hz
12 Profile acceleration (6083h)	300000 step/s^2
13 Profile deceleration (6084h)	300000 step/s^2
14 Quick stop deceleration (6085h)	1000000 step/s^2
15 Electronic gear A (6091h-01h)	5625
16 Electronic gear B (6091h-02h)	4096
17 Homing method (6098h)	利用原点传感器 (HOMES)执行原点返回，向正方向起动
18 Speed during search for switch (6099h-01h)[Hz]	10000 Hz
19 Speed during search for zero (6099h-02h)[Hz]	5000 Hz
20 Homing acceleration (609Ah)	300000 step/s^2

附： 搭载DG2-AZ产品/减速机组合使用时的循环坐标设定参考

设定内容2: DG2-AZ垂直安装面产品搭载18比减速机, 修改电机循环范围为18rev ,
循环偏置比例为0%:

▽ 当前打开的屏幕

(p3) 电动机・机构(坐标/JOG/原点返回)设定

(p1) Profile area的对象

▽ 参数

参数

(p1) Profile area的对象

厂家固有区域的对象

(p2) 基本设定

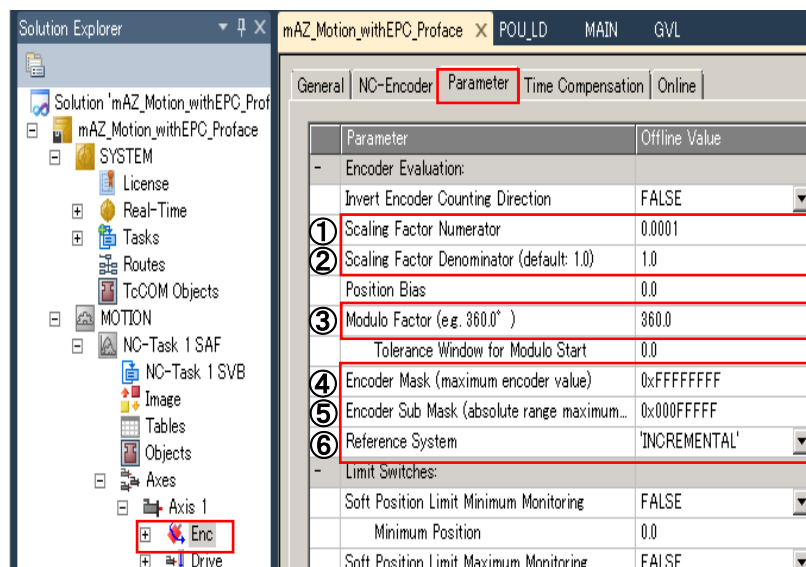
(p3) 电动机・机构(坐标/JOG/原点返回)设定

(p4) ETO・Alarm・Info设定

1	机构各条件设定	手动设定
2	电子减速机A	Electronic gear A (6091h-0...
3	电子减速机B	Electronic gear B (6091h-0...
4	电动机旋转方向	+侧=CW
5	减速比设定	0.00
6	初始坐标生成/循环坐标设定	手动设定
7	初始坐标生成/循环设定范围	18.0 rev
8	初始坐标生成/循环偏置比率设定	0.00 %
9	初始坐标生成/循环偏置值设定	0 step
10	循环设定	有效
11	RND-ZERO输出用RND分割数	1

附： 搭载DG2-AZ产品/减速机组使用时的循环坐标设定参考

BECKOFF PLC設定(必须)



请设定如下：

① Scaling Factor Numerator (分子) :0.0001

② Scaling Factor Denominator (分母) :1.0

③ Modulo Factor: 13.1072

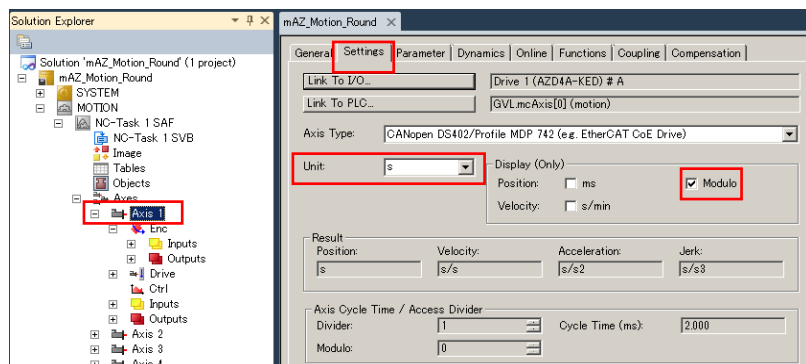
(参考表一“减速机输出轴的分辨率”数值, 由于上述①为0.0001, 因此设定“13.1072”实际上是“131072”。)

④ Encoder Mask (maximum encoder value) :0x0001FFFF

⑤ Encoder Sub Mask (absolute range maximum value) :
0x0001FFFF

⑥ Reference System: 'ABSOLUTE(modulo)'

※ 十六进制数0001FFFF=十进制数131071;
虽然 $2^{17}=131072$, 设定时需要按照 $(2^n)-1=131071$ 进行设定, 这是上位倍福的设定规则。



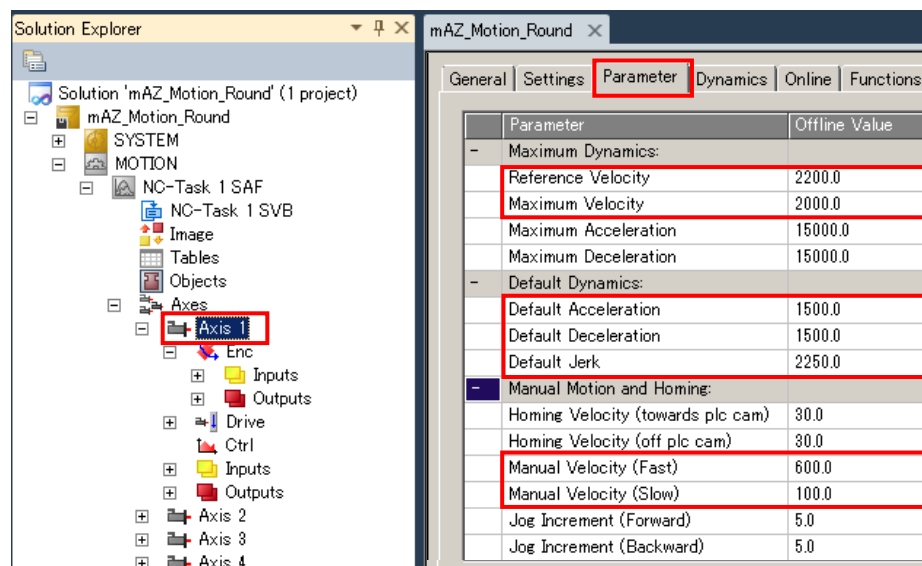
unit: s (设定例为STEP单位)

Modulo: 打勾

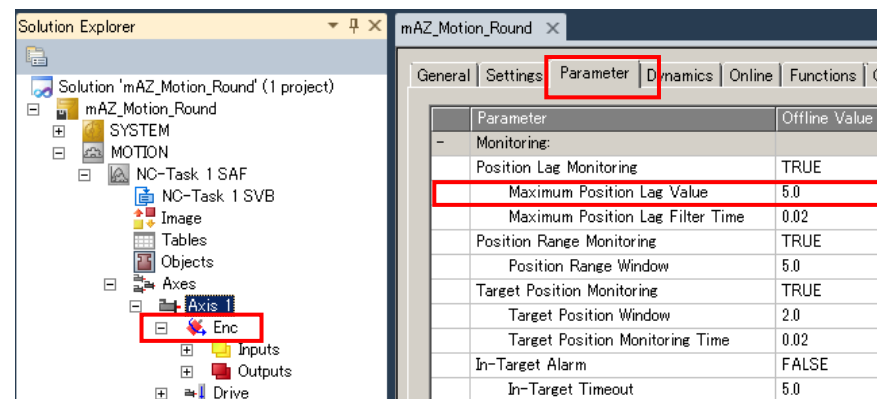
附： 搭载DG2-AZ产品/减速机组合使用时的循环坐标设定参考

BECKOFF PLC設定(注意)

修改上述参数后, 会影响速度、加减速设定, 以及警报的输出条件等;
请根据需要对其它参数进行修改(非必要):



Parameter	Offline Value
- Maximum Dynamics:	
Reference Velocity	2200.0
Maximum Velocity	2000.0
Maximum Acceleration	15000.0
Maximum Deceleration	15000.0
- Default Dynamics:	
Default Acceleration	1500.0
Default Deceleration	1500.0
Default Jerk	2250.0
- Manual Motion and Homing:	
Homing Velocity (towards plc cam)	30.0
Homing Velocity (off plc cam)	30.0
Manual Velocity (Fast)	600.0
Manual Velocity (Slow)	100.0
Jog Increment (Forward)	5.0
Jog Increment (Backward)	5.0



Parameter	Offline Value
- Monitoring:	
Position Lag Monitoring	TRUE
Maximum Position Lag Value	5.0
Maximum Position Lag Filter Time	0.02
Position Range Monitoring	TRUE
Position Range Window	5.0
Target Position Monitoring	TRUE
Target Position Window	2.0
Target Position Monitoring Time	0.02
In-Target Alarm	FALSE
In-Target Timeout	5.0

Target

MOTION运行的程序制作

PLC追加项目。

① 点击右键

② 点击

③ 选择

④ 指定文件名和保存地方

⑤ 点击

⑥ 项目追加后的 PLC 项目

PLC Templates

Online Templates

Standard PLC Project

Empty PLC Project

Name: MC

Location: C:\Users\%a2032007\Documents\Visual Studio 2010\Projects\%Tv

Add

Cancel

MC Project

External Types

References

DUTs

GVLs

POUs

VISUs

PlcTask (PlcTask)

MC Instance

程序制作

PLC程序要使用电动机控制用的功能块(FB),追加“TC2_MC2”的Library。

①展开点击右键

②点击

③点击

④点击

⑤确认Tc2_MC2已登录 Library

The screenshot shows the TwinCAT Project environment in Microsoft Visual Studio. The Solution Explorer on the left displays the project structure, including 'NC-Task 1 SAF', 'NC-Task 1 SVB', 'Image', 'Tables', 'Objects', 'Axes', and 'MC Project'. The 'References' folder under 'MC Project' is expanded, and the context menu is open, showing options like 'Add library...', 'Placeholders...', 'Library repository...', 'Set to Effective Version', and 'Set to Always Newest Version'. The 'Add Library' dialog box is open, showing a list of libraries categorized by function (Communication, Controller, Data Access, etc.). The 'Motion' category is selected, and 'Tc2_MC2' is highlighted. The 'OK' button is clicked. The Project Explorer on the right shows the 'MC Project' structure, with 'References' expanded, showing 'Tc2_MC2' and other libraries like 'Tc2_Standard', 'Tc2_System', 'Tc3_Interfaces', and 'Tc3_Module'.

新追加梯形图程序(LD)制作用POU。

The screenshot illustrates the process of adding a new POU (Program Organization Unit) to a TwinCAT project in Microsoft Visual Studio. The interface shows the Solution Explorer on the left, the Project Explorer in the center, and the 'Add POU' dialog box on the right. Blue callouts with numbers 1 through 6 guide the user through the steps:

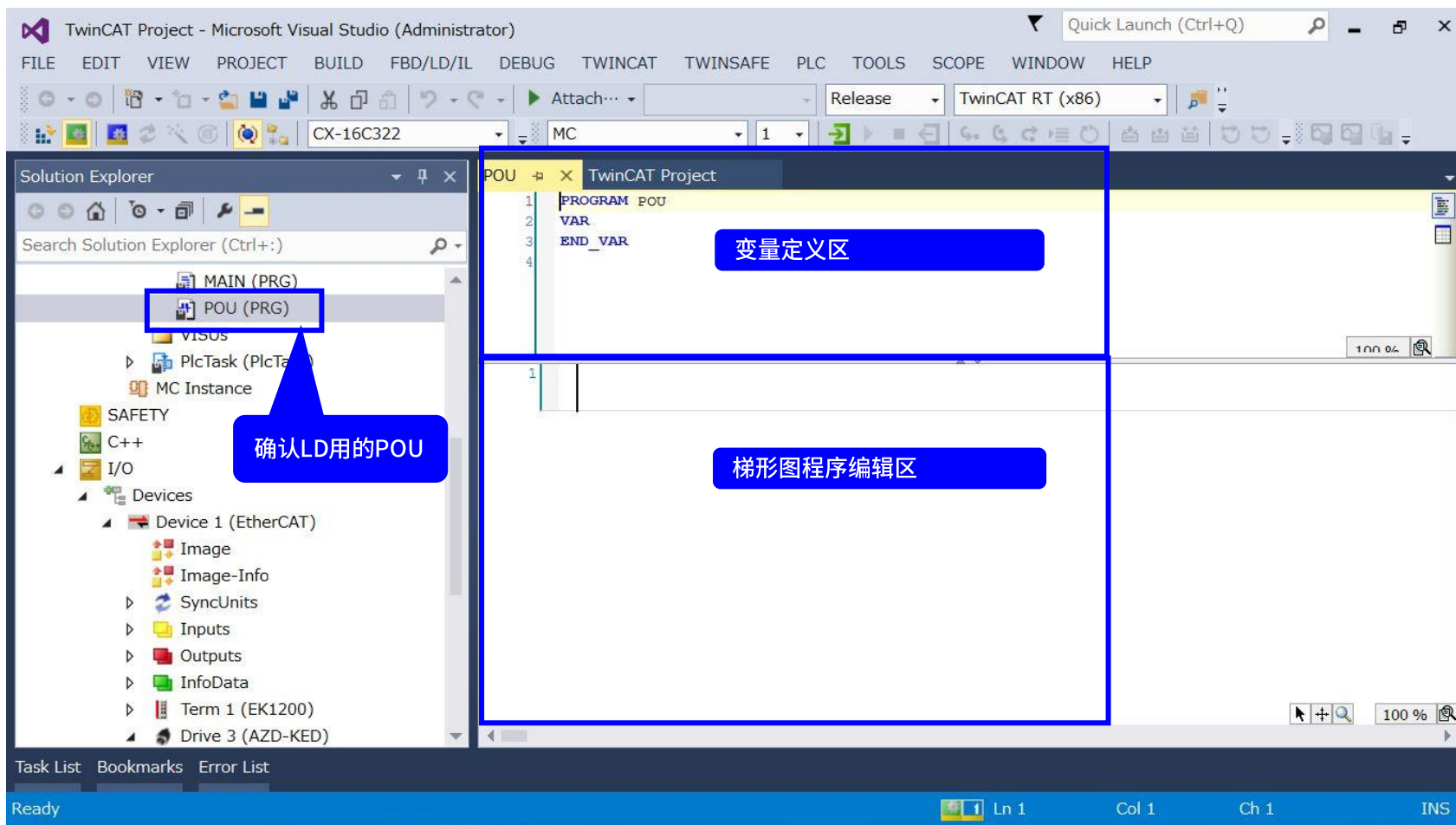
- ① 展开点击右键 (Expand and click right button): The 'POUs' folder in the Solution Explorer is expanded, and the right-click context menu is open.
- ② 点击 (Click): The 'Add' option in the context menu is selected.
- ③ 点击 (Click): The 'POU...' option in the 'Add' submenu is selected.
- ④ 名称输入 (Name input): The 'Name' field in the 'Add POU' dialog is set to 'POU'.
- ⑤ 选择“Ladder Logic Diagram(LD)” (Select “Ladder Logic Diagram(LD)”): The 'Implementation language' dropdown in the 'Add POU' dialog is set to 'Ladder Logic Diagram (LD)'.
- ⑥ 点击 (Click): The 'Open' button in the 'Add POU' dialog is clicked.

The 'Add POU' dialog box contains the following fields and options:

- Create a new POU (Program Organization Unit)**
- Name:** POU
- Type:**
 - ☒ **Program**
 - ☐ **Function Block**
 - ☐ Extends: [] ...
 - ☐ Implements: [] ...
 - ☐ **Function**
- Access specifier:** []
- Method implementation language:** Ladder Logic Diagram (LD)
- Implementation language:** Ladder Logic Diagram (LD)
- Buttons:** Open, Cancel

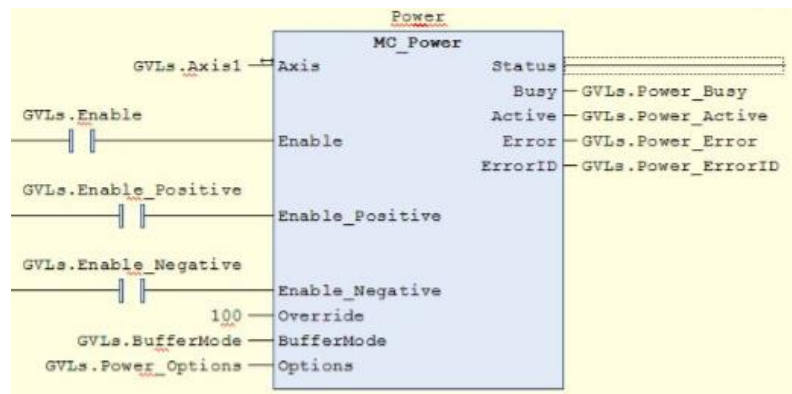
程序制作

追加的LD用POU如下所示。



程序制作

MC运行,利用MC_Power的FB进行电动机的当前ON/OFF。
同时,本书中,使用MC_MoveAbsolute的FB进行绝对定位运行。



MC_Power的功能块

【FB说明】：用Axis设定轴，使Enable、Enable_Positive、Enable_Negative为TRUE(ON)时，电动机当前ON。



MC_MoveAbsolute的功能块

【FB说明】：用Axis设定轴，设定运行参数(Position、Velocity···)，使Execute为True(ON)时,开始运行。

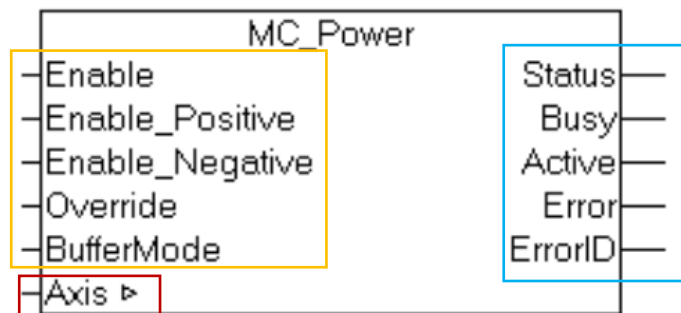
※ 有关FB的详情,请参阅 Beckhoff Information System。
https://infosys.beckhoff.com/index_en.htm

MC_POWER的详细说明

MC_Power activates software enable for an axis. Enable can be activated for both directions of travel or only one direction. At Status output operational readiness of the axis is indicated.

Inputs

(本资料称之为“输入参数”。)



```

VAR_INPUT
    Enable          : BOOL; (* B *)
    Enable_Positive : BOOL; (* E *)
    Enable_Negative : BOOL; (* E *)
    Override        : LREAL (* V *) := 100.0; (* in percent - Beckhoff proprietary input *)
    BufferMode       : MC_BufferMode; (* V *)
END_VAR

```

Enable	General software enable for the axis.
Enable_Positive	Advance movement enable in positive direction. Only takes effect if Enable=TRUE.
Enable_Negative	Advance movement enable in negative direction. Only takes effect if Enable=TRUE.
Override	Velocity override in % for all movement commands. (0 ≤ Override ≤ 100.0)
BufferMode	The BufferMode is evaluated if Enable is reset. MC_Aborting mode leads to immediate deactivation of the axis enable. Otherwise, e.g. in MC_Buffered mode, the block waits until the axis no longer executes a command.

Outputs

(本资料称之为“输出参数”。)

```

VAR_OUTPUT
    Status : BOOL; (* B *)
    Busy   : BOOL; (* V *)
    Active  : BOOL; (* V *)
    Error   : BOOL; (* B *)
    ErrorID : UDINT; (* E *)
END_VAR

```

Status	Status=TRUE indicates that the axis is ready for operation.
Busy	The Busy output is TRUE, as long as the function block is called up with Enable
Active	Active indicates that the command is executed
Error	Becomes TRUE if an error occurs.
ErrorID	If the error output is set, this parameter supplies the error number

Inputs/outputs

```

VAR_IN_OUT
    Axis : AXIS_REF;
END_VAR

```

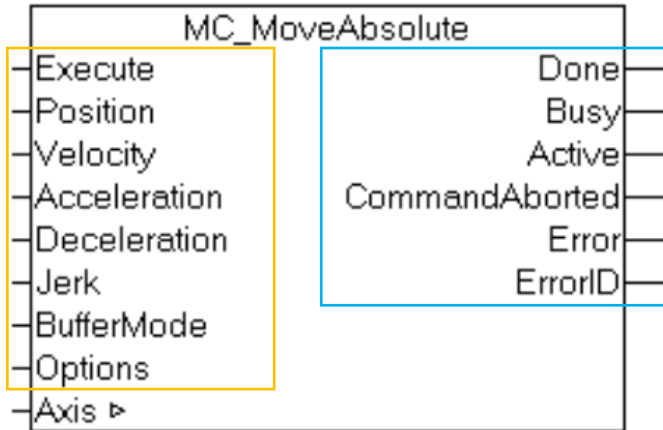
The axis data structure of type AXIS_REF addresses an axis uniquely within the system. Among other parameters it contains the current axis status, including position, velocity or error status.

Notes:

In addition to software enable it may be necessary to activate a hardware enable signal in order to enable a drive. This signal is not influenced by MC_Power and must be activated separately by the PLC.

MC_MoveAbsolute的详细说明

MC_MoveAbsolute starts positioning to an absolute target position and monitors the axis movement over the whole travel path. The Done output is set once the target position has been reached. Otherwise the CommandAborted or, on error, the Error output is set.



Inputs

```
VAR_INPUT
    Execute          : BOOL;
    Position         : LREAL;
    Velocity         : LREAL;
    Acceleration     : LREAL;
    Deceleration     : LREAL;
    Jerk            : LREAL;
    BufferMode       : MC_BufferMode;
    Options          : ST_MoveOptions;
END_VAR
```

Execute	The command is executed with a rising edge at input <i>Execute</i> .
Position	Absolute target position to be used for positioning.
Velocity	Maximum travel velocity (>0).
Acceleration	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
BufferMode	The BufferMode is analysed, if the axis is already executing another command. The running command can be aborted, or the new command becomes active after the running command. The BufferMode also determines the transition condition from the current to the next command. If the command is passed to a slave axis just Buffermode Aborting can be used. A second instance of a Move function block is required to use the BufferMode. It is not possible to trigger the same function block with different parameters as long as it is busy.
Options	The data structure <i>Option</i> includes additional, rarely required parameters. The input can normally remain open.

Outputs

```
VAR_OUTPUT
    Done          : BOOL;
    Busy          : BOOL;
    Active        : BOOL;
    CommandAborted : BOOL;
    Error         : BOOL;
    ErrorID       : UDINT;
END_VAR
```

Done	The <i>Done</i> output becomes TRUE once the target position was reached.
Busy	The <i>Busy</i> output becomes TRUE when the command is started with <i>Execute</i> and remains TRUE as long as the motion command is processed. When <i>Busy</i> becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs, <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> , is set.
Active	Active indicates that the command is executed. If the command was queued, it becomes active once a running command is completed.
CommandAborted	Becomes TRUE, if the command could not be fully executed. The axis may have been stopped, or the running command may have been followed by a further Move command.
Error	Becomes TRUE if an error occurs.
ErrorID	If the error output is set, this parameter supplies the error number.

将空FB插入POU中。

The screenshot illustrates the process of inserting an empty function block (FB) into a Program Organization Unit (POU) within the TwinCAT environment. The interface includes a Solution Explorer on the left, a main editor window in the center, and a context menu on the right.

① 选择要插入FB的行(line): The user selects the line where the FB will be inserted in the POU editor.

② 展开: The user expands the 'FBD/LD/IL' menu item in the top toolbar.

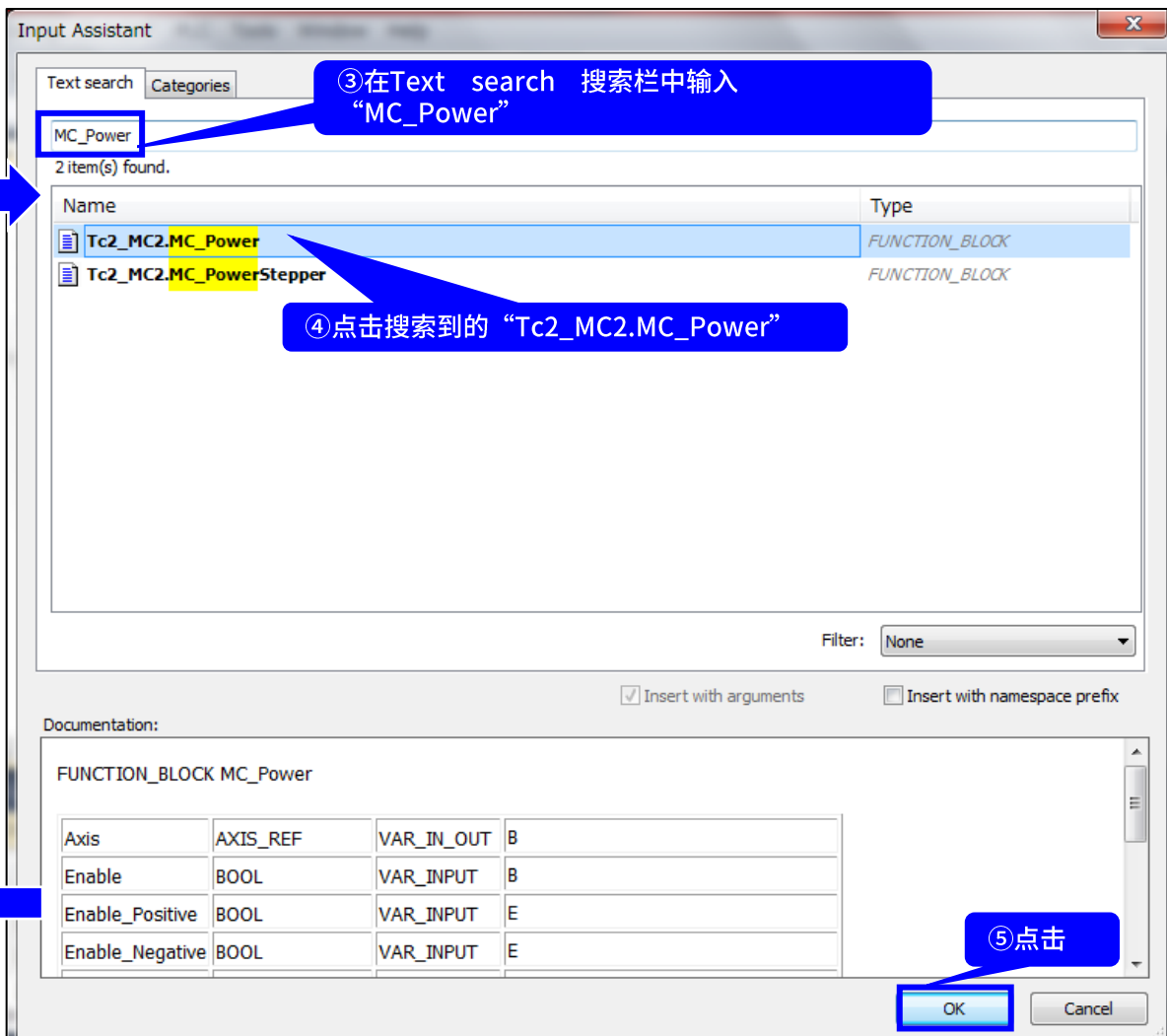
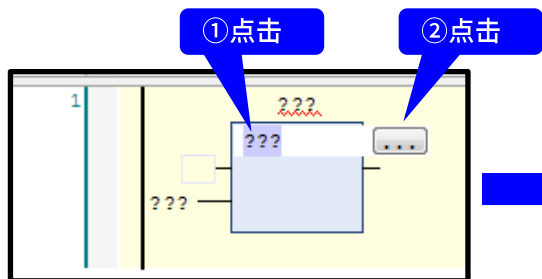
③ 点击: The user clicks on the 'Insert Empty Box' option in the context menu.

④ 在所选行(line)上制成空FB: The user creates an empty FB in the selected line, as shown in the bottom right inset.

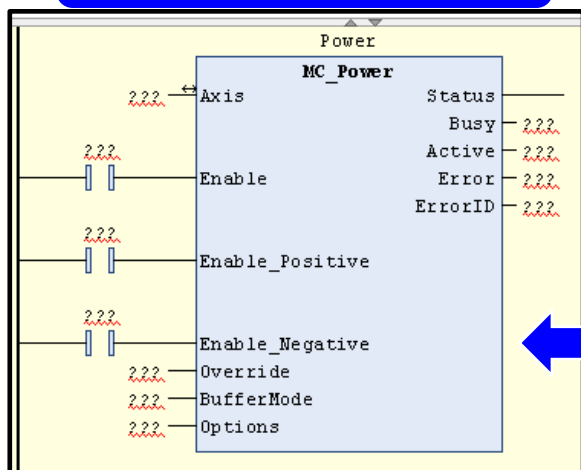
The context menu options include: Paste below, Paste above, Paste right (after), View as function block diagram, View as ladder logic (checked), View as instruction list, Insert Network, Insert Network (below), Insert Box, Insert Empty Box, Insert Assignment, Insert Coil, Insert Set coil, and Insert Reset coil.

程序制作

在空FB中设定MC_Power。

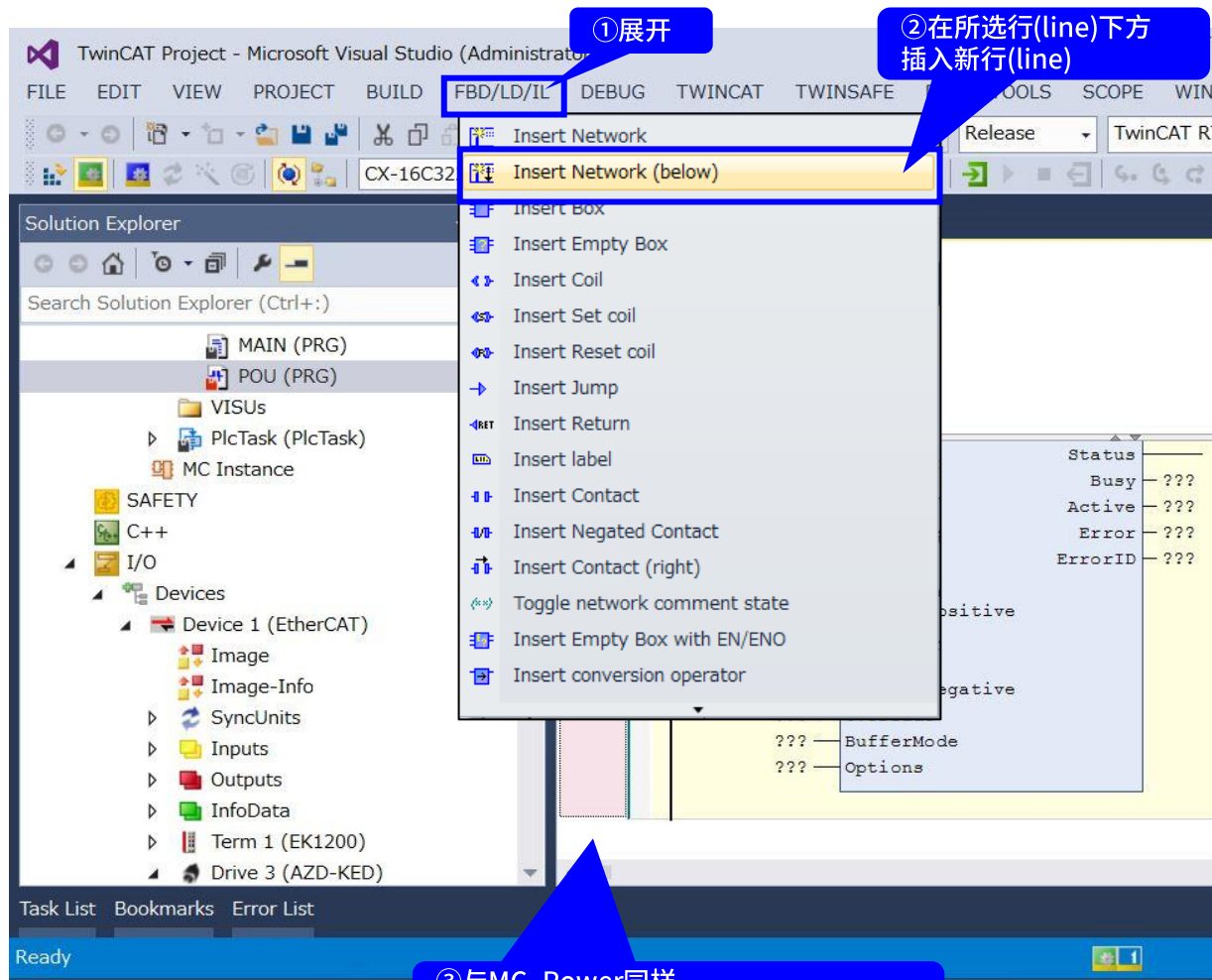


⑥MC_Power的功能块制成了。

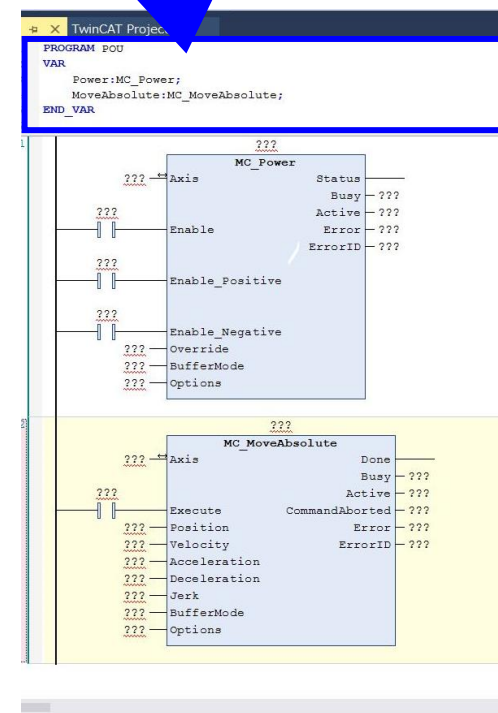


程序制作

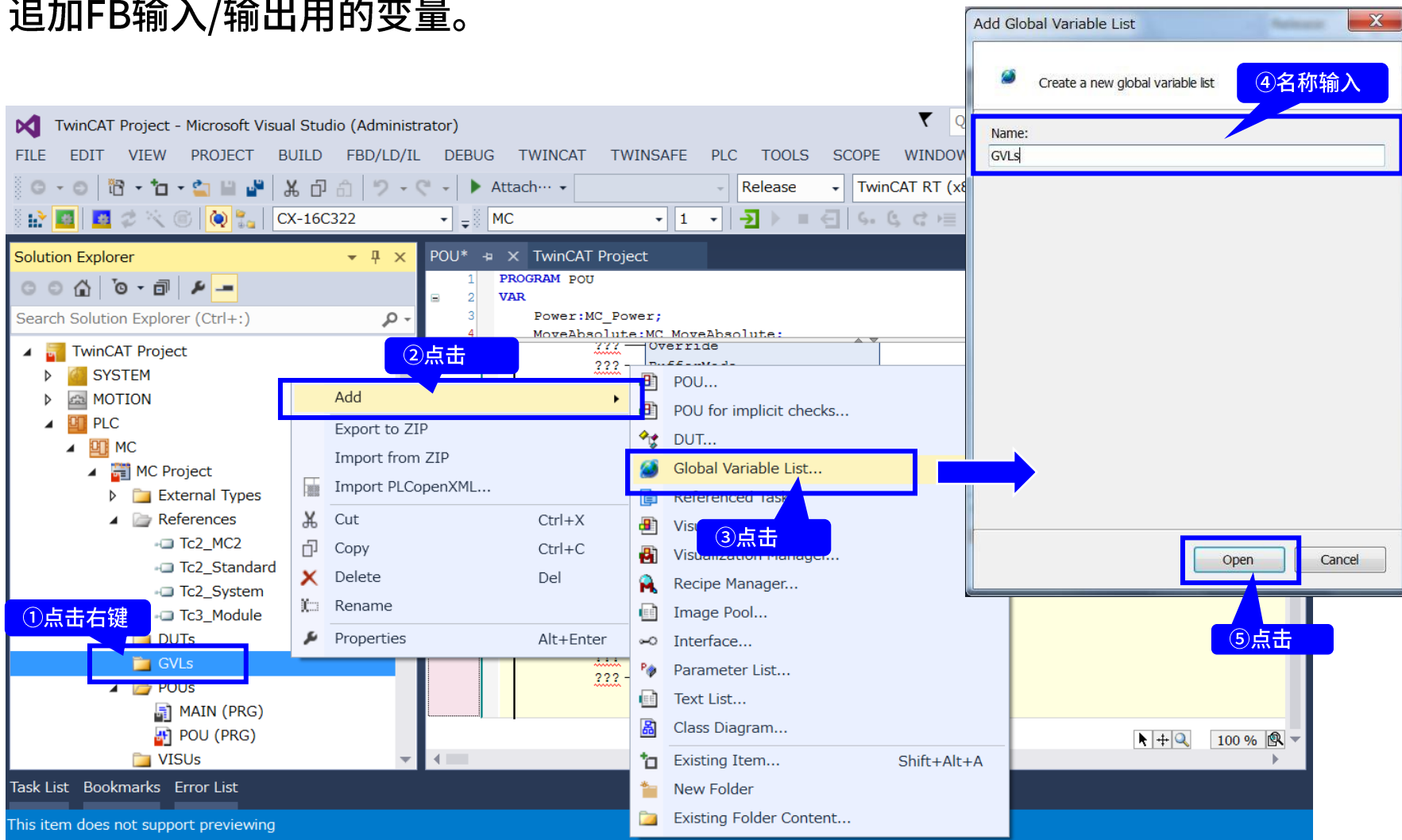
将新FB插入下一行。追加了两个FB后,定义各自的输入/输出参数。



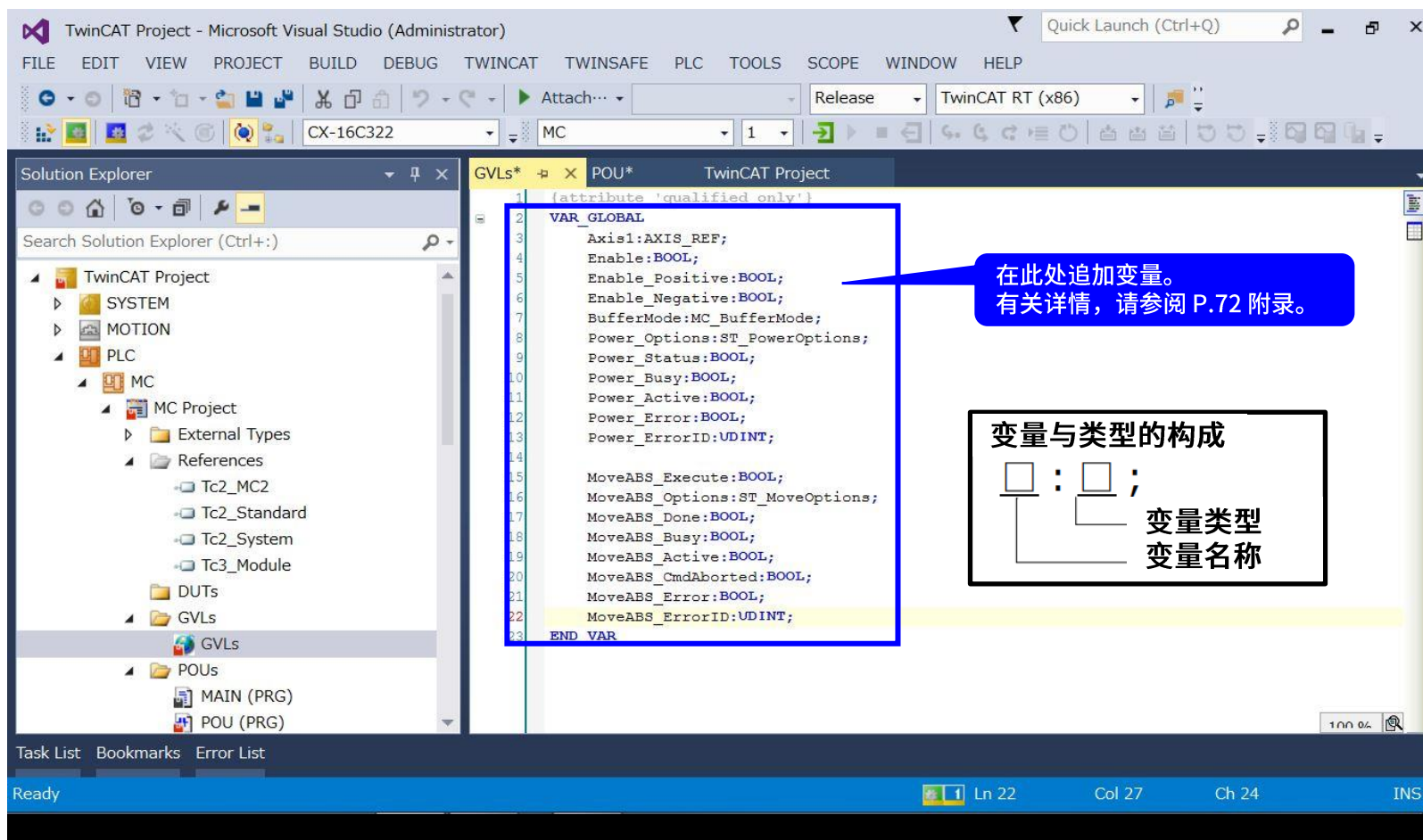
④FB定义如下。
Power:MC_Power;
MoveAbsolute:MC_MoveAbsolute;



追加FB输入/输出用的变量。



追加全局变量。有关类型，请参阅每个 FB 的详细说明页面。



设定FB输入/输出参数刚刚追加的全局变量。

The screenshot shows the TwinCAT Project environment in Microsoft Visual Studio. The Solution Explorer on the left displays the project structure, with the **POU (PRG)** folder selected. A blue arrow labeled "① 点击" points to this folder. The main editor shows the **POU*** file, where the **MoveAbsolute** function block is being configured. A blue arrow labeled "② 点击" points to the **Axis** input parameter. The **Input Assistant** dialog box is open, showing the **Variables** tab. A blue arrow labeled "③ 点击" points to the **Axis1** variable in the list. The **OK** button is highlighted with a blue arrow labeled "④ 点击".

Input Assistant dialog box content:

Name	Type	Address	Origin
MC	Application		
GVLS	VAR_GLOBAL		
Axis1	AXIS_REF		
BufferMode	MC_BufferMode		
Enable	BOOL		
Enable_Negative	BOOL		
Enable_Positive	BOOL		
MoveABS_Active	BOOL		
MoveABS_Busy	BOOL		
MoveABS_CmdAborted	BOOL		
MoveABS_Done	BOOL		
MoveABS_Error	BOOL		
MoveABS_ErrorID	UDINT		
MoveABS_Execute	BOOL		

Documentation:
Axis1: AXIS_REF;
(VAR_GLOBAL)

追加所有输入/输出参数后,将显示以下画面。

Solution Explorer

- DUTs
- GVLs
- POUs
- MAIN (PRG)
- POU (PRG)
- VISUs
- PlcTask (PlcTask)
- MC Instance
- SAFETY
- C++
- I/O
- Devices
 - Device 1 (EtherCAT)
 - Image
 - Image-Info
 - SyncUnits
 - Inputs
 - Outputs
 - InfoData
 - Term 1 (EK1200)
 - Drive 3 (AZD-KED)
 - Transmit PDO mapping 1
 - Receive PDO mapping 1
 - WcState
 - InfoData
 - Device 4 (USB)
 - Image
 - Inputs
 - Outputs

POU* POU

```
1 PROGRAM POU
2 VAR
3   Power:MC_Power;
4   MoveAbsolute:MC_MoveAbsolute;
5 END_VAR
```

Power

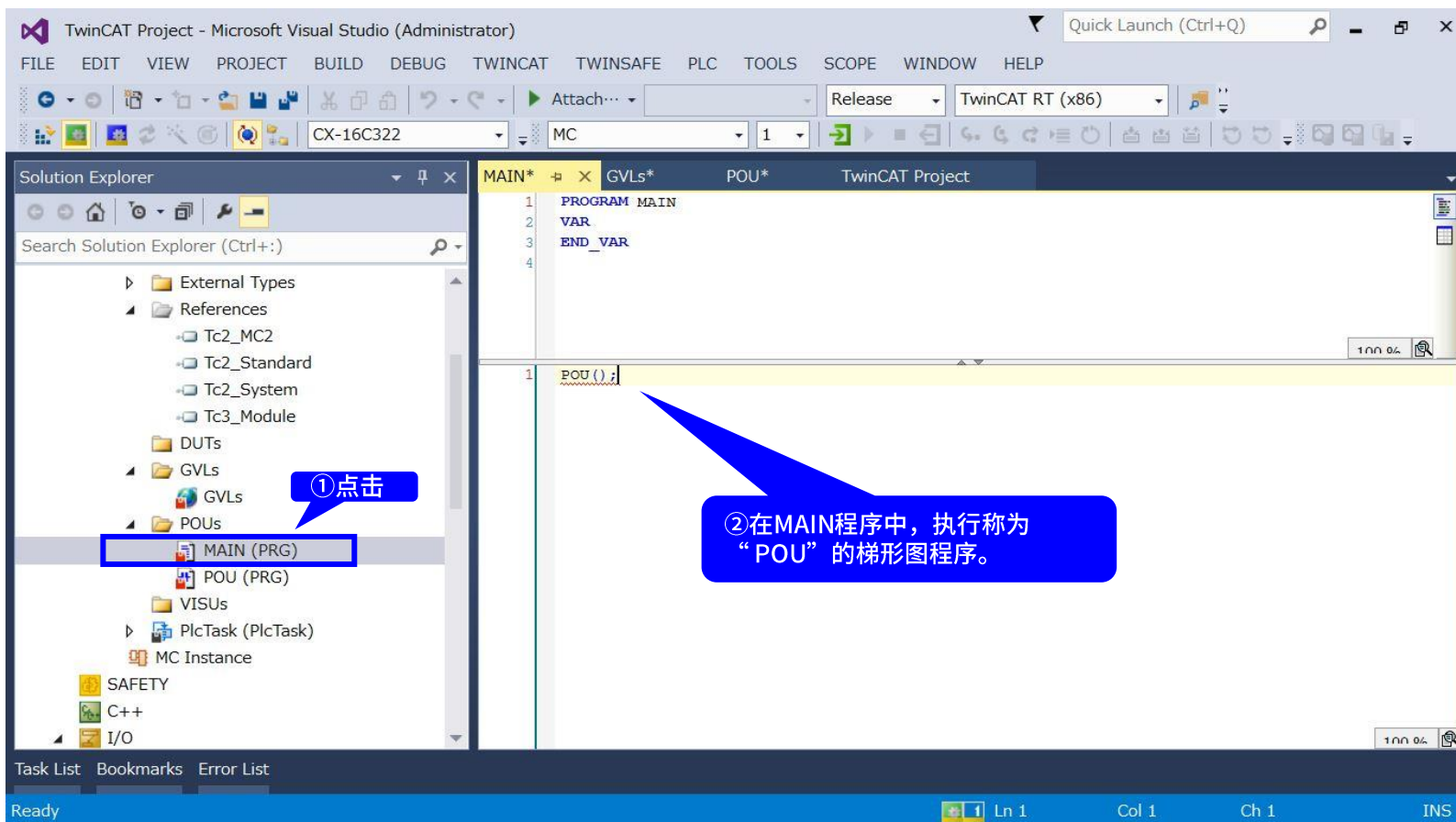
Input	Output
GVLs.Axis1	Axis
GVLs.Enable	Enable
GVLs.Enable_Positive	Enable_Positive
GVLs.Enable_Negative	Enable_Negative
100	Override
GVLs.BufferMode	BufferMode
GVLs.Power_Options	Options
	Status
	Busy - GVLs.Power_Busy
	Active - GVLs.Power_Active
	Error - GVLs.Power_Error
	ErrorID - GVLs.Power_ErrorID

MoveAbsolute

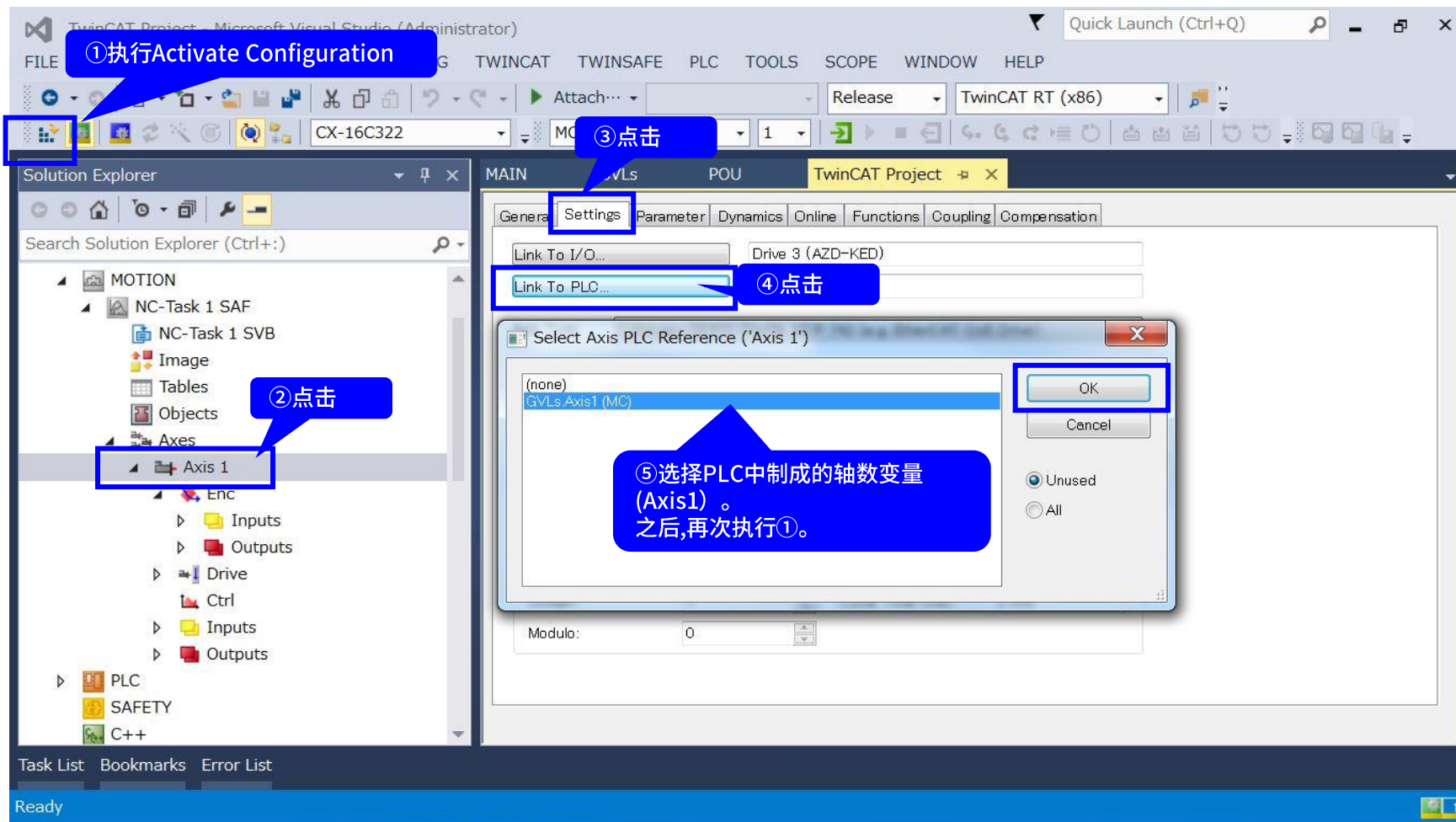
Input	Output
GVLs.Axis1	Axis
GVLs.MoveABS_Execute	Execute
800	Position
10	Velocity
1500	Acceleration
1500	Deceleration
0	Jerk
GVLs.BufferMode	BufferMode
GVLs.MoveABS_Options	Options
	Done
	Busy - GVLs.MoveABS_Busy
	Active - GVLs.MoveABS_Active
	CommandAborted - GVLs.MoveABS_CmdAborted
	Error - GVLs.MoveABS_Error
	ErrorID - GVLs.MoveABS_ErrorID

Task List Bookmarks Error List

完成MAIN的范例程序(取样程序)。MAIN程序是ST语言,POU程序是LD语言,因此需要在MAIN内调用POU。



链接在MOTION中进行了轴登录的Axis1与PLC中定义了变量的Axis1。
现在I/O与PLC通过MOTION连接起来了。



① 点击

② 点击

④ Login

③ 确保没有错误。

如果build成功,轴变量 (Axis1) 便会追加到PLC的MC Instance。

由CSP进行定位运行

Target

用CSP运行电动机。

首先,将FB的MC_Power的输入参数强制ON。

①全部点击,使之成为TRUE。

②点击「Force values to all on line application」

TwinCAT Project - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD FBD/LD/IL DEBUG TWINCAT TWINSAFE PLC TOOLS SCOPE WINDOW HELP

Attach... Release TwinCAT RT (x86)

CX-16C322 MC 1

Solution Explorer

Search Solution Explorer (Ctrl+):

POU (PRO)

VISUs

MC.tmc

PlcTask (PlcTask)

MC Instance

PlcTask Inputs

GVLs.Axis1.NcToPlc

PlcTask Outputs

GVLs.Axis1.PlcToNc

SAFETY

C++

I/O

Devices

Device 1 (EtherCAT)

Image

Image-Info

SyncUnits

Inputs

MAIN [Online] GVLs [Online] POU [Online] TwinCAT Project

TwinCAT_Project.MC.POU

Expression	Type	Value	Prepared val...	Address	Comment
Power	MC_Power				

1

Power

MC_Power

Status FALSE

Busy GVLs.Power_Busy FALSE

Active GVLs.Power_Active TRUE

Error GVLs.Power_Error FALSE

ErrorID GVLs.Power_ErrorID 0

100

Override

BufferMode MC Abortin

Options

2

MoveAbsolute

MC_MoveAbsolute

Done FALSE

Task List Bookmarks Error List

Ready

由CSP进行定位运行

The screenshot shows the TwinCAT Project environment. The main workspace displays a ladder logic diagram for the MC_Power function block. The variable declaration table on the right lists the following parameters and their values:

Expression	Type	Value	Prepared val...	Address
Power	MC_Power			
Axis				
Status		TRUE		
Busy		GVLS.Power_Busy	TRUE	
Active		GVLS.Power_Active	TRUE	
Error		GVLS.Power_Error	FALSE	
ErrorID		GVLS.Power_ErrorID	0	

Annotations in the image:

- ③ 确认输入参数为TRUE。 (Confirm input parameters are TRUE.)
- ④ 确认输出参数无错误, Status为TRUE。 (Confirm output parameters are correct, Status is TRUE.)

如果成功,电动机励磁。

由CSP进行定位运行

接下来,使MoveABS_Execute的Execute输入为ON。

The screenshot shows the TwinCAT Project - Microsoft Visual Studio (Administrator) interface. The Solution Explorer on the left shows the project structure, including the 'POU (PRG)' folder. The main editor displays the 'TwinCAT_Project.MC.POU' file, showing a function block call for 'MoveAbsolute'. The function block is configured with the following parameters:

Expression	Type	Value	Prepared val...	Address	Comment
Power	MC_Power				

The function block call is as follows:

```
MoveAbsolute
MC_MoveAbsolute
Axis: GVLs.Axis1
Done: TRUE
Busy: GVLs.MoveABS_Busy
Active: GVLs.MoveABS_Active
CommandAborted: GVLs.MoveABS_CmdAborted
Error: GVLs.MoveABS_Error
ErrorID: GVLs.MoveABS_ErrorID
Execute: GVLs.MoveABS_Execute
Position: 800
Velocity: 10
Acceleration: 1500
Deceleration: 1500
Jerk: 0
BufferMode: MC_Abortin
Options: GVLs.MoveABS_Options
```

Two blue callouts provide additional information:

- ①强制ON (Forced ON) - points to the 'Execute' input.
- ②电动机启动。不起动时,请确认输出无错误且Done为TRUE。 (Motor start. When not starting, please confirm that there are no output errors and Done is TRUE.) - points to the 'Done' output.

由CSP进行定位运行

在Online画面上确认电动机是否按程序运行。

① 点击

② 点击

③ 确认为设定速度。

④ 定位运行结束后,将处于设定的目标位置。

Online Tab Data:

Parameter	Value
Setpoint Position: [mm]	731.8698
Actual Velocity: [mm/s]	9.9967
Setpoint Velocity: [mm/s]	10.0000
Override: [%]	100.0000
Total / Control Output: [%]	0.46 / 0.00
Error: [mm]	0 (0x0)

Online Tab Data (Bottom):

Parameter	Value
Setpoint Position: [mm]	800.0000
Actual Velocity: [mm/s]	0.0000
Setpoint Velocity: [mm/s]	0.0000
Override: [%]	100.0000
Total / Control Output: [%]	0.00 / 0.00
Error: [mm]	0 (0x0)

1. BECKHOFF TwinCAT 3 的通信设定
2. Cyclic同步位置模式（CSP）的运行方法
- 3. 通过SDO通信读写参数**

通过SDO通信读写参数

■驱动器的参数设定有以下3种方法。

- ① SDO通信的FB(功能块)
- ② BECKHOFF的TwinCAT
- ③ 支援软件MEXE02 (可从敝公司的网站免费下载)

■关于参数的保存

写入的参数保存在驱动器的RAM或NV存储器中。
切断驱动器的控制电源后,写入RAM的参数将被删除。
即使切断控制电源也会保存写入NV存储器的参数。

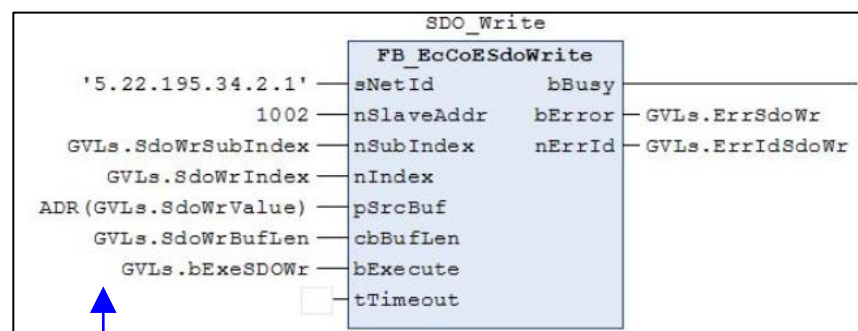
①②保存在RAM中。要将写入RAM的参数保存到NV存储器,请进行“NV存储器批量写入 (40C9h) ”。
NV存储器的可写入次数约为10万次。

③保存在NV存储器中。

通过SDO通信读写参数

下面介绍如何使用SDO通信的FB写入参数。

编程例



参数写入，
当使bExecute由FALSE(0)→为TRUE(1)时，执行写入。

例：将运行电流设定为80.0%时，
输入运行电流的Index、Sub-Index、
类型(数据长度 (Data length)),然后执行写入。

Index	Sub	名称	型
4120h	00h	Operating current [1=0.1%]	INT16

FB的输入参数

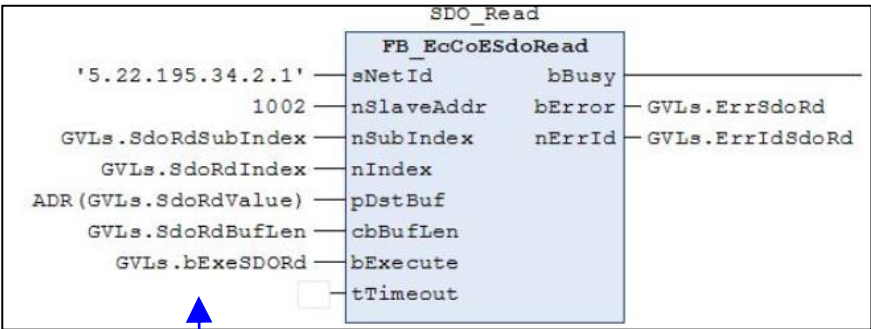
```

SdoWrIndex    := 4120h;
SdoWrSubIndex := 0;           //固定
SdoWrBufLen   := 2; //2byte
SdoWrValue    := 800; //0.1%单位
    
```


通过SDO通信读写参数

下面介绍如何使用SDO通信的FB读取参数。

编程例



例：读取运行电流时
输入运行电流的Index、Sub-Index、
类型(数据长度 (Data length)),然后执行读取。

Index	Sub	名称	型
4120h	00h	Operating current [1=0.1%]	INT16

FB的输入参数

```
SdoRdIndex      := 4120h;  
SdoRdSubIndex  := 0; //固定  
SdoRdBufLen    := 2;           //2byte
```

输入要读取对象(object)的Index、Sub-Index、字节长度，
当使bExecute由FALSE(0)→为TRUE(1)时,执行读取。
读取的结果存储在SdoRdValue中。

通过SDO通信读写参数

Target

用SDO通信读写参数。

要使用SDO读写参数,需要追加以下的FB。

- 写入参数: FB_EcCoESdoWrite
- 读取参数: FB_EcCoESdoRead

请按以下步骤追加Tc2_EtherCAT的library(程序库)。

The image illustrates the process of adding a library in TwinCAT. On the left, the 'Solution Explorer' shows the project structure. The 'References' folder is selected, and a right-click context menu is displayed with 'Add library...' chosen. On the right, the 'Add Library' dialog is shown with 'Tc2_EtherCAT' selected in the library list.

① 点击右键

② 点击

③ 选择并追加

通过SDO通信读写参数

定义全局变量。

将SDO用的参数追加到GVLs变量。用作FB的输入变量。

TwinCAT Project - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD DEBUG TWINCAT TWINSAFE PLC TOOLS SCOPE WINDOW HELP

Quick Launch (Ctrl+Q)

Attach... Release TwinCAT RT (x86)

CX-16C322 MC 1

Solution Explorer

Search Solution Explorer (Ctrl+:)

PLC

MC

MC Project

External Types

References

Tc2_EtherCAT

Tc2_MC2

Tc2_Standard

Tc2_System

Tc3_Module

DUTs

GVLs

POUs

MAIN (PRG)

POU (PRG)

VISUs

MC.tmc

TwinCAT Project MAIN GVLs* POU

```

18 MoveABS_Busy:BOOL;
19 MoveABS_Active:BOOL;
20 MoveABS_CmdAborted:BOOL;
21 MoveABS_Error:BOOL;
22 MoveABS_ErrorID:UDINT;
23
24 //SDO Write
25 bExeSDOWr AT%I+:BOOL; //SDO Write execution
26 SdoWrValue AT%I+:DINT; //Buffer Data for writing
27 SdoWrIndex AT%I+:WORD; //Index
28 SdoWrSubIndex AT%I+:BYTE; //Sub-Index
29 SdoWrSrcBuf AT%I+:PVOID; //Reference address of buffer data
30 SdoWrBufLen AT%I+:UDINT; //Byte length
31 ErrSdoWr AT%Q+:BOOL; //Error bit
32 ErrIdSdoWr AT%Q+:UDINT; //Error ID
33
34 //SDO Read
35 bExeSDORd AT%I+:BOOL; //SDO Read execution
36 SdoRdValue AT%Q+:DINT; //Buffer Data for reading
37 SdoRdIndex AT%I+:WORD; //Index
38 SdoRdSubIndex AT%I+:BYTE; //Sub-Index
39 SdoRdSrcBuf AT%I+:PVOID; //Reference address of buffer data
40 SdoRdBufLen AT%I+:UDINT; //Byte Length
41 ErrSdoRd AT%Q+:BOOL; //Error bit
42 ErrIdSdoRd AT%Q+:UDINT; //Error ID
43 END_VAR

```

追加。
有关详细信息，请参阅 P.73 附录。

通过SDO通信读写参数

将SDO程序追加到POU,制作SDO通信用程序。

① 点击

② 输入程序名称

③ 选择FBD

④ 点击

TwinCAT Project - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD DEBUG TWINCAT TWIN

Quick Launch (Ctrl+Q)

Solution Explorer

Search Solution Explorer (Ctrl+:)

TwinCAT Project

POUs

Add

Export to ZIP

Import from ZIP

Export PLCOpenXML...

Import PLCOpenXML...

Cut Ctrl+X

Copy Ctrl+C

Delete Del

Rename

Properties Alt+Enter

POU...

POU for implicit checks...

DUT...

Global Variable List...

Referenced Task...

Visualization...

Visualization Manager...

Recipe Manager...

Image Pool...

Interface...

Parameter List...

Text List...

Class Diagram...

Existing Item... Shift+Alt+A

New Folder

Existing Folder Content...

SDORD AT%I*:BOOL; //SDO Read execution

dValue AT%Q*:DINT; //Buffer Data for read

dIndex AT%I*:WORD; //Index

dSubIndex AT%I*:BYTE; //Sub-Index

dSrcBuf AT%I*:PVOID; //Reference address of

dBufLen AT%I*:UDINT; //Byte Length

doRd AT%Q*:BOOL; //Error bit

dSdoRd AT%Q*:UDINT; //Error ID

Add POU

Create a new POU (Program Organization Unit)

Name:

POU_SDO

Type:

☒ Program

☐ Function Block

☐ Extends:

☐ Implements:

Access specifier:

Method implementation language:

Function Block Diagram (FBD)

☒ Function

Return type:

Implementation language:

Function Block Diagram (FBD)

Open Cancel

Task List Bookmarks Error List

This item does not support previewing

Ln 24

通过SDO通信读写参数

调用SDO读写用的功能块。

The image shows the TwinCAT Project - Microsoft Visual Studio (Administrator) interface. The steps are as follows:

- ① 点击** (Click): In the Solution Explorer, click on the **POU_SOD (PRG)** project.
- ② 点击** (Click): In the **FBD/LD/IL** menu, click on **Insert Empty Box**.
- ③ 点击** (Click): Click on the newly inserted empty box in the ladder logic network.
- ④ 用EcCoE搜索。** (Search with EcCoE): In the **Input Assistant** dialog, search for **EcCoE**.
- ⑤ 选择 "Tc2_EtherCAT_FB_EcCoESdoWrite"。** (Select "Tc2_EtherCAT_FB_EcCoESdoWrite"): Select the **Tc2_EtherCAT_FB_EcCoESdoWrite** function block from the search results.
- ⑥ 点击** (Click): Click the **OK** button in the **Input Assistant** dialog.

通过SDO通信读写参数

按照相同的步骤,制作 “Tc2_EtherCAT_FB_EcCoESdoRead”。

TwinCAT Project - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD **FBD/LD/IL** DEBUG TWINCAT TWINSAFE

Insert Network
Insert Network (below)
Insert Box
Insert Empty Box
Insert Coil
Insert Set coil
Insert Reset coil
Insert Jump
Insert Return
Insert label
Insert Contact
Insert Negated Contact
Insert Contact (right)
Toggle network comment state
Insert Empty Box with EN/ENO
Insert conversion operator

Solution Explorer

Search Solution Explorer (Ctrl+:)

- Tc3_Module
 - DUTs
 - GVLS
 - GVLS
 - POUs
 - MAIN (PRG)
 - POU_SDO (PRG)
 - VISUs
 - PlcTask (PlcTask)
 - PPHM.tmc
 - PPHM Instance
 - PlcTask Inputs

POU_SDO* **MAIN** **GVLS***

FB_EcCoESdoWrite

??? — sNetId bBusy —
 ??? — nSlaveAddr bError — ???
 ??? — nSubIndex nErrId — ???
 ??? — nIndex
 ??? — pSrcBuf
 ??? — cbBufLen
 ??? — bExecute
 ??? — tTimeout

FB_EcCoESdoRead

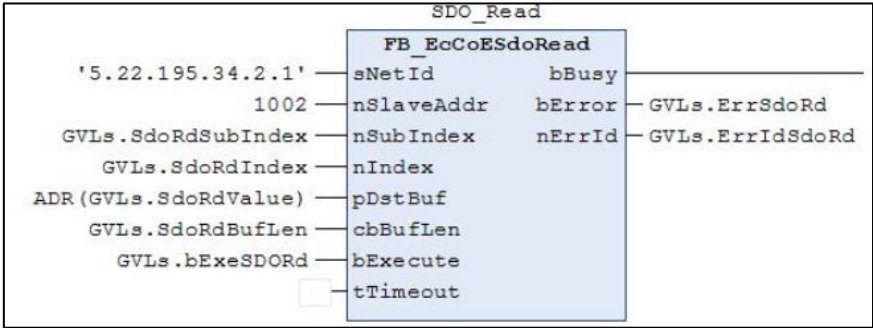
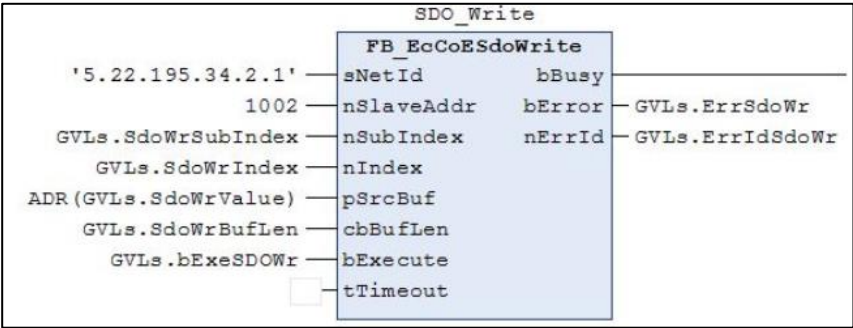
??? — sNetId bBusy —
 ??? — nSlaveAddr bError — ???
 ??? — nSubIndex nErrId — ???
 ??? — nIndex
 ??? — pDstBuf
 ??? — cbBufLen
 ??? — bExecute
 ??? — tTimeout

插入新行

按与前页相同的步骤追加 “FB_EcCoESdoRead”。

通过SDO通信读写参数

下面介绍FB_EcCoESdoWrite与FB_EcCoESdoRead的输入参数。



输入参数	输入的内容
sNetId	EtherCAT主站的AMS networkID
nSlaveAddr	EtherCAT从站地址
nSubIndex	读写对象的Sub-Index
nIndex	输入要读写对象的Index
pSrcBuf	指定读写用的数据缓冲器的地址。 制作数据缓冲器用的变量，用ADR()进行地址转换
cbBufLen	读写对象的最大字节长度

通过SDO通信读写参数

在调用的功能块中设定输入与输出变量。

①定义变量。

```

1 PROGRAM POU_SOD
2 VAR
3   SDO_Write:FB_EcCoESdoWrite;
4   SDO_Read:FB_EcCoESdoRead;
5 END_VAR

```

②请这样设定。

SDO_Write

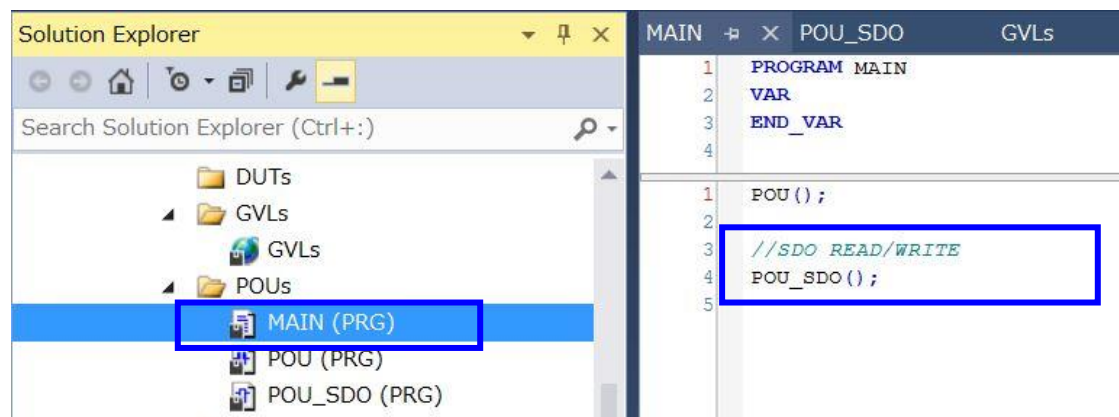
Variable	Value	Property
sNetId	'5.22.195.34.2.1'	
nSlaveAddr	1002	
nSubIndex	GVLs.SdoWrSubIndex	GVLs.ErrSdoWr
nIndex	GVLs.SdoWrIndex	GVLs.ErrIdSdoWr
pSrcBuf	ADR (GVLs.SdoWrValue)	
cbBufLen	GVLs.SdoWrBufLen	
bExecute	GVLs.bExeSDOWr	
tTimeout	☐	

SDO_Read

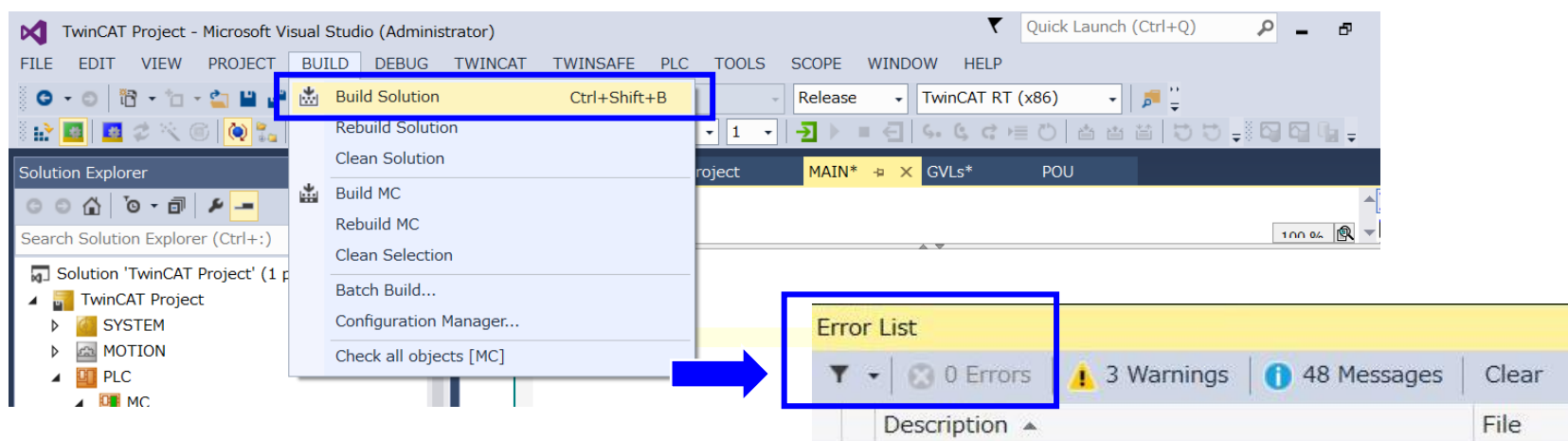
Variable	Value	Property
sNetId	'5.22.195.34.2.1'	
nSlaveAddr	1002	
nSubIndex	GVLs.SdoRdSubIndex	GVLs.ErrSdoRd
nIndex	GVLs.SdoRdIndex	GVLs.ErrIdSdoRd
pDstBuf	ADR (GVLs.SdoRdValue)	
cbBufLen	GVLs.SdoRdBufLen	
bExecute	GVLs.bExeSDORD	
tTimeout	☐	

通过SDO通信读写参数

将POU_SDO追加到MAIN程序。

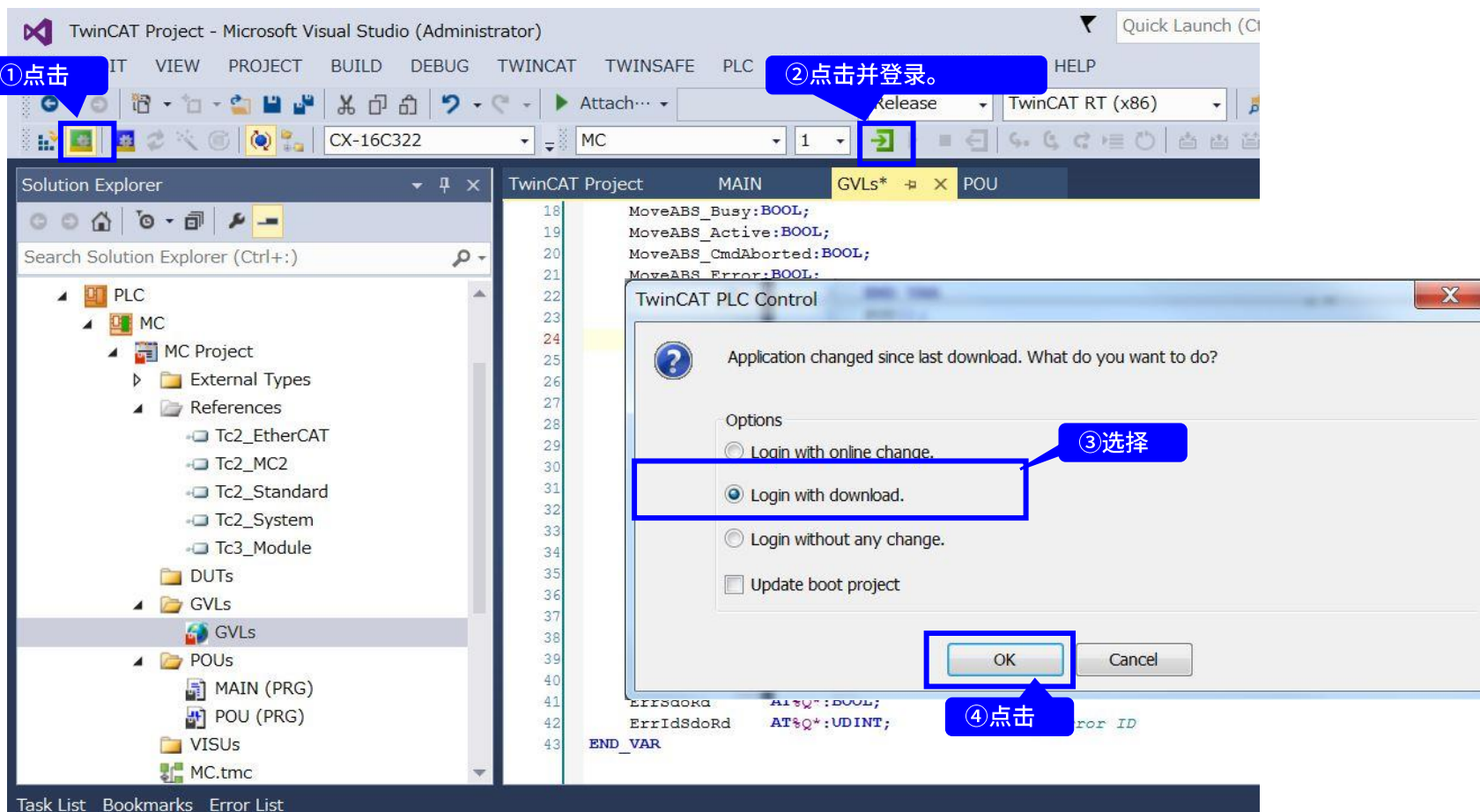


在BUILD下运行程序,确认没有错误。



通过SDO通信读写参数

如果没有错误，请下载到EPC并登录。



通过SDO通信读写参数

登录后,从GVLs [Online]重写变量值,将运行电流变更为80%。

①点击

③点击。使反映所设定的值。

②输入每个变量的值。

Expression	Type	Value	Prepared val...	Address	Comment
bExeSDOWr	BOOL	FALSE	TRUE	%I*	SDO Write execution
SdoWrValue	DINT	0	800	%I*	Buffer Data for writing
SdoWrIndex	WORD	0	16672	%I*	Index
SdoWrSubIndex	BYTE	0	0	%I*	Sub-Index
SdoWrSrcBuf	PVOID	16#00000000		%I*	Reference address of buffer data
SdoWrBufLen	UDINT	0	2	%I*	
ErrSdoWr	BOOL	FALSE		%Q*	
ErrIdSdoWr	UDINT	0		%Q*	Error ID

※将Sub-Index固定为「0」。

bExeSDOWr	BOOL	TRUE		%I*	SDO Write execution
SdoWrValue	DINT	800		%I*	Buffer Data for writing
SdoWrIndex	WORD	16672		%I*	Index
SdoWrSubIndex	BYTE	0		%I*	Sub-Index
SdoWrSrcBuf	PVOID	16#00000000		%I*	Reference address of buffer data
SdoWrBufLen	UDINT	2		%I*	Byte length
ErrSdoWr	BOOL	FALSE		%Q*	Error bit
ErrIdSdoWr	UDINT	0		%Q*	Error ID

通过SDO通信读写参数

写入的“运行电流[%]”值可从SDO读取用FB中确认。

The screenshot shows the TwinCAT Project Manager interface with the 'GVLs [Online]' tab selected. The main table displays SDO parameters for 'TwinCAT_Project.MC.GVLs'. Annotations indicate the steps for writing and reading values:

- ① 输入每个变量的值。** (Input the value for each variable.) - Points to the 'Value' column in the main table.
- ② 点击。使反映所设定的值。** (Click. To reflect the set value.) - Points to the 'SdoWrValue' row in the main table.
- ③ 确认值是否正确。** (Confirm if the value is correct.) - Points to the 'SdoRdValue' row in the 'Ref' table.

Expression	Type	Value	Prepared val...	Address	Comment
SdoWrValue	DINT	800		%I*	Buffer Data for writing
SdoWrIndex	WORD	16672		%I*	Index
SdoWrSubIndex	BYTE	0		%I*	Sub-Index
SdoWrSrcBuf	PVOID	16#00000000		%I*	Reference address of buffer data
SdoWrBufLen	UDINT	2		%I*	Byte length
ErrSdoWr	BOOL	FALSE		%Q*	Error bit
ErrIdSdoWr	UDINT	0		%Q*	Error ID
bExeSDORd	BOOL	FALSE	TRUE	%I*	SDO Read execution
SdoRdValue	DINT	0		%Q*	
SdoRdIndex	WORD	0	16672	%I*	Buf
SdoRdSubIndex	BYTE	0	0	%I*	Sub
SdoRdSrcBuf	PVOID	16#00000000		%I*	Ref
SdoRdBufLen	UDINT	0	2	%I*	Byt
ErrSdoRd	BOOL	FALSE		%Q*	Err
ErrIdSdoRd	UDINT	0		%Q*	Err

Expression	Type	Value
ErrSdoWr	BOOL	FALSE
ErrIdSdoWr	UDINT	0
bExeSDORd	BOOL	TRUE
SdoRdValue	DINT	800
SdoRdIndex	WORD	16672
SdoRdSubIndex	BYTE	0
SdoRdSrcBuf	PVOID	16#00000000
SdoRdBufLen	UDINT	2
ErrSdoRd	BOOL	FALSE
ErrIdSdoRd	UDINT	0

通过SDO通信读写参数

还可使用支援软件MEXE02 Ver.4进行确认。

New1* | AZ EtherCAT compatible : Motor/Actuator 10000P/R - MEXE02

File Edit View Communication Tool Support Help

ORIENTAL MOTOR/Common Virtual COM Port (COM3)
AZ EtherCAT compatible - Motor/Actuator 10000P/R

(a5) Navigation

Currently open window

Parameter

Parameter

(p1) Objects of profile area

Objects of manufacturer-specific area

(p2) Base settings

(p3) Motor & Mechanism(Coordinates)

(p4) ETO & Alarm & Info

(p5) I/O action and function

(p6) Direct-IN function

(p7) Direct-OUT function

(p8) Remote-I/O function(R-I/O)

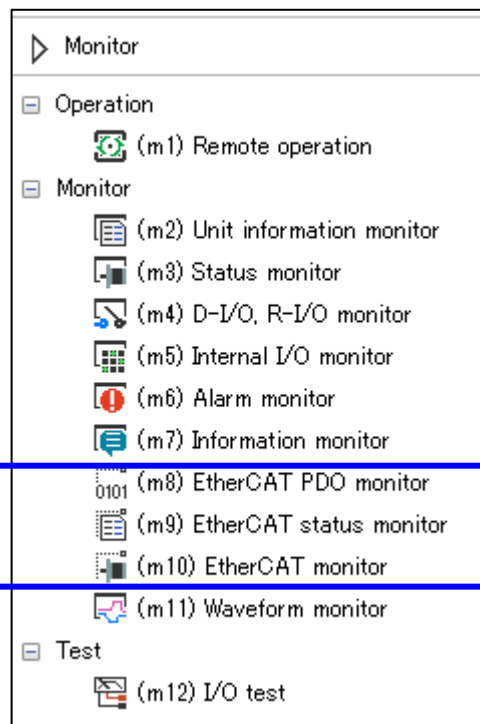
Monitor

(p2) Base settings

1	Motor user name	
2	Driver user name	
3	Driver simulation mode	Use real motor
4	Main power mode	Automatic discrimination
5	Base current[%]	100.0
6	Operating current[%]	80.0
7	Stop current[%]	50.0
8	Push current[%]	20.0
9	Command filter setting	LPF (speed filter)
10	Command filter time constant[ms]	1
11	Smooth drive function	Enable
12	Current control mode	Follow the CCM input
13	Servo emulation (SVE) ratio[%]	100.0
14	SVE position loop gain	10
15	SVE speed loop gain	180
16	SVE speed loop integral time constant[ms]	100.0
17	Automatic current cutback function	Enable
18	Automatic current cutback switching time[ms]	100

关于MEXE02的监控功能

MEXE02具有与EtherCAT相关的各种监控功能。
请活用于设备测试阶段的动作确认、异常时的状态确认。



■EtherCAT PDO监控

- 可确认发送/接收的PDO映射的对象(object)
- 可直接确认对象(object)的数据内容

■EtherCAT 状态监控(监视)

- 可确认整个驱动器的状态
- 可确认CoE通信区域的对象(object)SM2,SM3

■EtherCAT监视

在不登录PDO映射的情况下,可看到以下常见对象(object)。

- 目标位置、反馈位置、目标速度、反馈速度等
- 可利用Touch probe功能示教
- statusword (状态字) 显示驱动器状态机的转换状态
- 可通过controlword (控制字) 确认是否按设计写入

P.45 运行用全局变量

```
Axis1:AXIS_REF;  
Enable:BOOL;  
Enable_Positive:BOOL;  
Enable_Negative:BOOL;  
BufferMode:MC_BufferMode;  
Power_Options:ST_PowerOptions;  
Power_Status:BOOL;  
Power_Busy:BOOL;  
Power_Active:BOOL;  
Power_Error:BOOL;  
Power_ErrorID:UDINT;  
  
MoveABS_Execute:BOOL;  
MoveABS_Options:ST_MoveOptions;  
MoveABS_Done:BOOL;  
MoveABS_Busy:BOOL;  
MoveABS_Active:BOOL;  
MoveABS_CmdAborted:BOOL;  
MoveABS_Error:BOOL;  
MoveABS_ErrorID:UDINT;
```

P.60 参数读写用全局变量

```
//SDO Write
bExeSDOWr  AT%I*:BOOL; //SDO Write execution
SdoWrValue  AT%I*:DINT;           //Buffer Data for Writing

SdoWrIndex  AT%I*:WORD;           //Index
SdoWrSubIndex AT%I*:BYTE;         //Sub-Index
SdoWrSrcBuf  AT%I*:PVOID;         //Reference address of buffer data
SdoWrBufLen  AT%I*:UDINT;         //Byte length
ErrSdoWr     AT%Q*:BOOL;         //Error bit
ErrIdSdoWr   AT%Q*:UDINT;         //Error ID

//SDO Read
bExeSDORd   AT%I*:BOOL;           //SDO Read execution
SdoRdValue  AT%Q*:DINT;           //Buffer Data for Reading
SdoRdIndex  AT%I*:WORD; //Index
SdoRdSubIndex AT%I*:BYTE;         //Sub-Index
SdoRdSrcBuf  AT%I*:PVOID;         //Reference address of buffer data
SdoRdBufLen  AT%I*:UDINT;         //Byte Length
ErrSdoRd     AT%Q*:BOOL;         //Error bit
ErrIDSdoRd   AT%Q*:UDINT;         //Error ID
```