Connecting JVL ethercat moter to Twincat3

This is a guide to connect a Mac motor as a NC axis to a Beckhoff Twincat3 PLC.

This allows the PLC to control the motor as a synchronized axis, and bypasses most of the intelligence of the motor firmware.

Contents

Setup Mac motor for DSP402 profile	2
Create empty Twincat project	2
Connect to PLC in Config mode	
Scan for IO	
Change the Ethercat cycle time	6
Change the NC Task cycle time	7
Apply the timing	9
Change gearing units	10
Change the parameter limits	
# Max acceleration	12
Change the following error parameters	13
Test motor	

Setup Mac motor for DSP402 profile

Before connecting the motor to the PLC, wee need to enable the can profile that allows the PLC to control it as a syncrnized NC axis.

This is done by enabling the DSP402 profile with the Mactalk software.

Connect Mactalk to the motor.

🝌 MacTalk® - Noname	
Files Motor ePLC Setup Updates Window Help	
Open Save Save in Motor Reset	et Position Clear Errors Reset Motor Filter Setup STOP Motor What's New
Serial port Comport:	t: 5 V Baud: 19.200 V Motor Address: All V Scan
Main Registers Advanced EventLog Tests Scope	ePLC MAC00-EC -EtherCAT Hojning Units (Disabled)
Setup	
Ethernet settings	Cyclic data setup (32bit)
IP address 169.254.3.233 169.254, 3.233	Read Word1 2 - Operating mode Entry '35 - Errors'
Subnet mask 255.255.0.0 255.255.0.0	Read Word2 10 - Actual position
Default gateway 169 254 30 87 169 254, 30, 87	Read Word3 12 - Actual velocity
	Read Word4 170 - Analogue input
	Read Word5 35 - Error status
EtherCAT error handling	Read Word6 169 - Actual torque
Motor set "Passive mode"	Read Word7 20 - Follow error
O Motor set velocity = 0	Read Word8 29 - Actual temperature
Protocol settinas	Write Word1 2 - Operating mode
Station alias 0	Write Word2 3 - Requested position
	Write Word3 5 - Velocity
	Write Word4 6 - Acceleration V
ModbusTCP timeout 0	Write Word5 7 - Torque
	Write Word6 170 - Analogue input 🔨 Add To Watch
	Write Word7 0 - No Selection
Enable DSP402 drive profile	Write Word8 0 - No Selection V Help
Use I/O in ePLC Default DSP402 homing method	Set module factory defaults Apply and save 🕢 Refresh Tab

Select the MAC00-EC Ethercat tab

Check the "Enable DSP402 drive profile " box

Press "Apply and save" button to store the configuration in the Ethercat module

Create empty Twincat project.

Open Visual studio 2017 with TwinCAT3 integration. If TwinCAT is not installed on the computer, the TwinCAT project will not be available.

The rest of this sample is done in Visual Studio.

Click File->New project.

Start Page - Microsoft Visual	Studio					
File Edit View Project I	Debug TwinCAT TwinSAFE PLC T	eam Scope Nsight Tools	Test Analyze Windo	w Help	and the Advance Provide	
		T i ul l			onNewMessageReady	
Suiid 4024.7 (Loaded) ▼ =:	en min s void s xií	Iwincativi • CX-:	eodaec≜ ≈			
Solution Explorer	← 4 × Start Page ↔ ×		Cot Sta	ortad		_
	New Project				?	×
	▶ Recent	Sort-by: Default	• # E		Search (Ctrl+E)	ρ-
¢	 Installed Visual C# Other Languages Other Project Types TwinCAT Measurement NVIDIA TwinCAT Projects TwinCAT PLC Online 	TwinCAT XAE Project	(XML format)	TwinCAT Projects	Type: TwinCAT Projects TwinCAT XAE System Manager configuration	
	Open Visual Studio Installer					_
	Name: JVLproject Location: CAUsers/Yournam Solution name: JVLproject	ne\Source\Repos			Browse Create directory for solution	
					Create new Git repository	
					ОК	Cancel
			тыз тюнат Місідуррм с	In		

#In the new project window, select TwinCAT project.

Select the twinCAT XAE project

Give your project a name and click "ok" button.

Connect to PLC in Config mode

2	JVLpro	oject - M	icrosoft Vis	ual Studio	þ										
File	Edit	View	Project	Build	Debug	TwinCAT	TwinSAFE	PLC	Team	Scope	Nsight	Tools	Test	Analyze	Window
ě (0 - 0	間 -	*a - 當	🗳 📲	¥ 🗇 8	1 9 -	🖓 👻 Relea	ise	• Twin	nCAT RT (x	64)		Attach	···· •	
Š E	uild 4024	4.7 (Load	led) 🔹	•		1 × 6	🍳 🛼 %	JVLpr	oject		- CX-50	DD9EC		- ,)	
Server E	Solution	Explore	er • [•] © •	50	- 4	ŢХ									
cplore	Search S	Solution	Explorer (C	Ctrl+")		<i>۹</i> -									
- 4	👦 So	lution 'J' JVLproj	VLproject' (ect	(1 project))										
	⊳	SYS MO	tem Tion												
			FTY												
		%. C++	-												
	Þ	AN/	ALYTICS												
	r	., .													

#Select the ADS connection for your PLC.

#Click the Restart TwinCAT in config mode

Microsoft Visual Studio	×
Restart TwinCAT System in Config Mode	
OK Cancel	

Click OK to allow TwinCAT to restart.

You should be connected to your PLC.

Scan for IO

Make sure your motor is connected to the Ethercat bus, and powered up.



Right click IO->Devices in your solution tree.

Select Scan

4 new I/O devices found	×
Device 1 (EtherCAT) Device 2 (EtherCAT Automation Protocol) Device 5 (EtherCAT) Device 3 (COM Port) [Bus 0 Slot 126 UART 0 (0xD0B1A000)]	OK Cancel
	Select All Unselect All

Make sure to select the Ethercat port where the motor is conneted. If you are not sure which one the motor is connected to, select all Ethercat ports.



Click yes to scan for boxes

When the motor is found, the PLC will recognize it as a NC axis compatible motor. You will be prompted to select an axis type.

EtherCAT drive(s) added		×
Append linked axis to:	 NC - Configuration CNC - Configuration 	OK Cancel

Select NC and click OK.

You will be prompted to activate free run after scan



Click Yes.

Change the Ethercat cycle time

The default cycle timing of the PLC and the motor is different, so the cycle time of the PLC need to be adjustet. This needs to be done in two places.

Change Ethercat cycle time



Double click on the Ethercat bus where the motor is connected. Too locate the right ethercat bus, look for the JVL logo in the Drive box

Select the adapter tab

Change the Freerun Cycle to 1 ms

Change the NC Task cycle time.



Double click on the NC Task

Select the task tab

Change the Cycle ticks to 1 ms

Apply the timing

N	JVLpro	ject - M	licrosoft Vis	ual Studi	D									
File	Edit	View	Project	Build	Debug	TwinCAT	TwinSAFE	PLC	Team	Scope	Nsight	Tools	Test	Analy
) G	- 0	間 -	*1 - 當		¥ 🗗 á	1 9 - I		ise	• Twir	nCAT RT (x	:64)	-)	Attach	n •
i Bu	ild 4024	4.7 (Loa	ded) 🔹)= 🔤 ;	2 🔨 😰	🍳 🐛 🔏	JVLp	roject		▼ CX-5	0D9EC		•

You can apply the new timing setting by clicking the activate configuration button.

Activate Con	figuration X
Project:	JVLproject
Target:	CX-50D9EC
	OK Cancel

Click OK to activate the new settings.

Microsof	t Visual Studio	×
	Device 'Device 1 (EtherCAT)' needs sync master (at least one variable linked to a task variable)	
	ОК	

You will get a warning when no plc program is linked to the IO's.

Ignore this warning.

Microsoft Visual Studio	×
Restart TwinCAT System in Run Mode	
OK Cancel	

Click OK to start PLC in run mode.

The motor is now configured as a NC axis, and can be controlled from a PLC program.

Change gearing units

The default unit is in mm with a factor 0.0001 counts pr mm

In this sample we will change the unit to Degrees.



- # Select the axis
- # Select the settings tab
- # Change the units to Degrees.

Change the Gear factor

JVLproject - Microsoft Visual Studio				
File Edit View Project Build Debug TwinCA	AT Twi	nSAFE PLC Team Scope Nsight Tools	Test Analyze Windov	
◎ G • O 籀 • 恤 • 🖕 🗎 📲 👗 正 白 ク	- 0 -	Release - TwinCAT RT (x64) - A	Attach 👻	
Build 4024 7 (Loaded) 🔹 🚽 🕪 🖪 🖪 🛃 🛠 🖄	216	K IVI project CX-50D9EC	• _ 8	
Solution Explorer 🔹 두 🗸 🗙	JVLproje	ect 🕫 X		
👮 🗢 🖓 🗂 र 💿 र 🕾 🗗 🏓 💻	Gener	al NC-Encoder Parameter Time Compensation Online		
Search Solution Explorer (Ctrl+ ")			(
Solution 'JVLproject' (1 project)		Parameter	Offline Value	
⊿ JVLproject	-	Encoder Evaluation:		
SYSTEM		Invert Encoder Counting Direction	FALSE	
MOTION		Scaling Factor Numerator	0.0439453125	
NC-Task 1 SVR		Scaling Factor Denominator (default: 1.0)	1.0	
		Position Bias	0.0	
Tables		Modulo Factor (e.g. 360.0°)	360.0	
Objects		Tolerance Window for Modulo Start	0.0	
◢ ≓골 Axes		Encoder Mask (maximum encoder value)	0xFFFFFFFF	
Axis		Encoder Sub Mask (absolute range maximum value)	0x000FFFFF	
b Inputs		Reference System	'INCREMENTAL'	
Outputs	-	Limit Switches:		
Þ ≃-∐ Drive		Soft Position Limit Minimum Monitoring	FALSE 💌	
t <u>k</u> Ctrl		Minimum Position	0.0	
P Inputs		Soft Position Limit Maximum Monitoring	FALSE 💌	
		Maximum Position	0.0	
🚯 SAFETY	+	Filter:		
‱ C++	+	Homing:		
	+	Other Settings:		

Select the encoder for the NC axis

Select the parameter tab

Enter the calculated unit for the motor. See sample calculation below.

Sample calculation:

Count pr. Revolution for MAC400 = 8192

Degrees pr. revolution = 360

Scaling Factor Numerator:

Degrees pr. count = Degrees pr. revolution / Count pr. revolution = 360/8192= 0, 0439453125

Change the parameter limits

The velocity is limited cautiously by default.

Its is recommended to adjust the Max Velocity, Max Acceleration and the Following error.



Select the axis for the motor

Select the parameter tab

Enter the calculated values from the calculations below

Max velocity

Enter the calculated values. Sample calculation below.

Sample calculation:

Max revolution pr minute for MAC 400 = 3500

Seconds pr. minute = 60

Degrees pr. revolution = 360

Degrees pr. second = Max rpm * degrees pr. revolution / Seconds pr. Minute = 3000 * 360/ 60 = 21000

Max acceleration

Enter the calculated values. Sample calculation below.

Sample calculation:

Max acceleration RPM/s= 500000

Seconds pr. minute = 60

Degrees pr. revolution = 360

Degrees in seconds² Max acceleration rpm * degrees pr. revolution / Seconds pr. Minute = 500000 * 360 / 60= 3000000

Click the activate configuration button to download data to the PLC

Change the following error parameters

The NC axis monitors the following error. This is how far behind the motor is at any given time. The motor will always be behind at least the time it takes to move between two sync cycles. With full speed that is significant.

Its recemented to adjust the following error limit to your suit the application.

TwinCAT call following error "Position lag Value" monitoring.

In this sample it is set to 120 degrees.



Select the axis for the motor

Select the parameter tab

enter the parameter.

Click the activate configuration button to download data to the PLC

Test motor

The motor can be tested on the Online Tab.



Select the axis for the motor

Select the parameter tab

Enable the motor with the set button.

Set Enabling	×
 ✓ Controller ✓ Feed Fw ✓ Feed Bw 	OK Cancel
Override (%): 100	All

Check Controller, Feed FW and Feed BW checkbox.

Enter 100% over override. Click ok. The motor has power and read to turn. Test the motor on the F1 to F4 buttons.