Application Note





Title	How to connect CMMT to a BECKHOFF IPC in TwinCAT V3 NC
Version	
Document no	
Original	en
Author	
Last saved	

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1 Components/Software used

Type/Name	Version Software/Firmware	Date of manufacture
CMMT-AS-C4-3A-EC-S1		
CMMT Plug In	1.0.1.10	
Festo Automation Suite	1.0.3.6	
TwinCAT V3	Version 12.0.21005.1 REL	
TwinCAT V3 - IPC	Build 4022.22	

Table 1.1:1Components/Software used

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Information

This AppNote describes the procedure with the CMMT-AS motor controller. The CMMT-AS servo drive controller and CMMT-ST servo drive controller for extra-low voltage are based on the same software platform. Therefore, the described settings can also be used as a reference for its parameterization. It is hereby expressly pointed out, that this has not been explicitly tested and therefore the function cannot be guaranteed!

2 Starting with TwinCAT V3

Start and name a new TwinCAT Project

New Project					?	×
▷ Recent		.NET Framework 4.5	Sort by: Default	- # III	Search Installed Templates (Ctrl+E)	ρ-
 Installed Templates Other Project T TwinCAT Meas TwinCAT PLC TwinCAT Project Samples Online 	iypes urement cts	TwinCAT XAE	Project (XML format)	TwinCAT Projects	Type: TwinCAT Projects TwinCAT XAE System Manager Configuration	
		2	lick here to go online and find	templates.		
Name:	CMMT_NC_TEST		20420 0 1 .			
Location:	C:\Users\gbqz\D	ocuments\Visual Studio	2013\Projects	•	Krowse	
Solution name:	CMM1_NC_TEST				Create Pectory for solution	ancel

Make a connection to the IPC (Industrial PC) by double clicking on SYSTEM -> Choose Target... -> Search (Ethernet).

→

Note

Make sure that the laptop and the IPC are within the same network through the IP settings.



Choose Target System	×
	OK Cancel
	Search (Ethernet)
	Search (Fieldbus)
	☐ Set as Default
Connection Timeout (s): 5	

Execute a Broadcast Search and select the Laptop Ethernet Adapter where the IPC is connected to narrow down the search.

Add Route Dialog		×
Enter Host Name / IP:	Refresh Status	Broadcast Search
Host Name Connected Address AMS NetId	version Comment	
Select Adapter(s) TwinCAT-Intel PCI Ethernet Adapter (Gioabit) 10.101.65 ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter 192. VirtualBox Host-Only Ethernet Adapter 192.168.56.1 2 Route N	5.124 255.255.254.0 168.0.77 255.255.0.0 55.255.255.0	
AmsNel Transport Type: TCP_IP ~	ОК	Cancel
Address Info:	 Static Temporary 	 Static Temporary
Max Fragment Size (kByte): 0	Add Route	Close



Note

If the IPC doesn't appear with the broadcast search, and the network settings have been forgotten, a monitor can be connected to it with the DVI connector, as well as a mouse and keyboard through USB. Running in the IPC is a Windows operating system will be visible in the monitor and the network settings of the IPC can be changed accordingly.



Click on the IPC, change the Address Info to IP Address -> Add Route.

Add Route Dialog × Enter Host Name / IP: Refresh Status Broadcast Search Host Name AMS NetId TwinCAT OS Version Connected Address Comment CX-2A57CE 192.168.0.17 5.42.87.206.1.1 3.1.4020 Windows 7 < CX-2A57CE CDE64375 Route Name (Remote): Route Name (Targe 5.42.87.206.1.1 AmsNetId: Target Route Remote Route O Project 🔘 None Transport Type: TCP_IP Static Static Address Info: 192.168.0.17 Temporary Temporary Host Name
 IP Address Connection Timeout (s): 5 Max Fragment Size (kByte): 0 + Add Route Close Logon Information at is valid for the * Enter a user name and password t remote system. Administrator User name: Password: • Encrypt Password (TwinCAT 3 only) ОК Cancel

The default Password for any IPC is by default 1.

To confirm a successful connection, an "X" will appear under the Connected column

Add Route Dialog						×
Enter Host Name / IP:			F	lefresh Status	Bro	adcast Search
Host Name	Connected	Address	AMS NetId	TwinCAT	OS Version	Comment
CX-2A57CE	Х	192.168.0.17	5.42.87.206.1.1	3.1.4020	Windows 7	
<	CX-2A570		Route	Name (Remot	re): CDE64	375
AmeNetId	5 42 87 2	00.1.1	_	_		010
Amaneuu.	TCD ID		– Large	et Route	Remo	ite Route
Transport Tupe:	TCP IP	U6.1.1	− l arge ○ P	et Route roject	Remo N	ite Route
Transport Type: Address Info:	TCP_IP	~	P S	et Route roject tatic	Remo N SI	nte Route one tatic
Transport Type: Address Info: O Host Name ()	TCP_IP 192.168.0	0.17	Parge ○ P ● S ○ T	et Route roject tatic emporary	Remo ON © SI OT	one one tatic emporary
Transport Type: Address Info: O Host Name I Connection Timeout (s):	TCP_IP 192.168.0 IP Address 5	0.17	□ arge ○ P ● S ○ T	et Route roject tatic emporary	Remo N SI To	ite Route one tatic emporary

Close the Add Route Dialog window, select the IPC and click OK

Choose Target System	×
□	OK Cancel
	Search (Ethernet) Search (Fieldbus)
	Set as Default
Connection Timeout (s): 5	

Install the CMMT ESI File

3 Install the CMMT ESI File

Download the EtherCAT ESI file from the support portal for CMMT.

"Install" it in TwinCAT V3 by copying the file into the following folder

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



Note

This procedure is recommended before TwinCAT has been started, If TwinCAT is already running, the Device Repository can be refreshed/updated by clicking on TwinCAT -> EtherCAT Devices -> Reload Device Descriptions.

TV	INCAT TWINSAFE PLC TOOLS SCOPE	WIND	OW HELP
1	Activate Configuration	i	
1	Restart TwinCAT System		
1	Restart TwinCAT (Config Mode)		
2	Reload Devices		
1	Scan		
10	Toggle Free Run State		
۲	Show Online Data		Choose Target
6.0	Show Sub Items		
	Security Management		
RE6	Access Bus Coupler/IP Link Register		
	Update Firmware/EEPROM	•	ocal v3.1 (Build 4022.22)
	Show Realtime Ethernet Compatible Devices		/ersion
	File Handling	- •	
	Selected Item	- •	
	EtherCAT Devices	•	Update Device Descriptions (via ETG Website)
	Target Browser	•	Reload Device Descriptions
	Filter Designer	•	Manage User Defined Whitelist
	About TwinCAT		Manage User Defined Blacklist

4 Scanning the EtherCAT Network

Once chapters 1 & 2 have been done, go to I/O, right click on Devices and execute a SCAN.



From the available interfaces, select the EtherCAT one and click on OK

5 new I/O devices found	×
Device 1 (Profinet Controller CCAT (RT)) Device 2 (EtherCAT) Device 3 [EtherCAT Automation Protocol) [Local Area Connection 2 (TwinCAT-Intel I Device 4 [EtherCAT Automation Protocol) [Local Area Connection (TwinCAT-Intel P(Device 6 (COM Port) [Bus 0 Slot 126 UART 0 (0xD0B1A000)]	OK Cancel Select All Unselect All

Select Yes on Scan for Boxes.



If CMMT is successfully detected, select to Append linked axis to: NC - Configuration -> OK





Note

Free Run can be activated to test communication between BECKHOFF IPC and CMMT.

After a successful SCAN of the network, CMMT should appear under the I/O'S EtherCAT Master and Axis 1 under the MOTION -> NC Task.



Click on the scanned CMMT Driver and enable DC for synchronization.

Solution Explorer 🔹 म 🗙	CMMT_NC_TEST ⇒ ×
© ⊃ ☆ ™ ≠ <mark>-</mark>	General EtherCAT DC Process Data Startup CoE - Online Diag History Online
Search Solution Explorer (Ctrl+ü)	
Solution 'CMMT_NC_TEST' (1 project)	
	Advanced Settings
PLC	
SAFETY	
96 C++	
▲ 🔄 I/O	
▲ ➡ Devices	
tmage	
🛟 Image-Info	
SyncUnits	
P inputs	
Term 1 (EK1200)	
🔺 🐚 Drive 3 (CMMT-AS)	

5 PLC Project setup

5.1 Adding the PLC Project

Right click on PLC and select Add New Item...



Choose the Standard PLC Project and select Add

Add New Item - CMMT_NC_TEST			? >	(
▲ Installed	Sort by: Default	• # 듣	Search Installed Templates (Ctrl+E)	+
Plc Templates	Standard PLC Project	Plc Templates	Type: Plc Templates	
	Empty-LC Project	Pic Templates	containing a task and a program.	
Name: CMMT_MC				
Location: C:\Users\gbqz\	Documents\Visual Studio 2013\Proje	CONCIMINATING T +	Browse	
			Add Cancel	

5.2 Adding PLC I/O Variables

Add a Global Variable List (GVL) and declare 1 USINT Output with initial value 8 and 1 USINT Input.



1	{attribute 'qualified only'}		
2	VAR_GLOBAL		
3	I_usiModesOfOperationDisplay	AT %I*	:USINT;
4	Q_usiModesOfOperation	AT %Q*	:USINT := 8;
5	END_VAR		

→

Modes of Operation 8 means that the Axis will be in "Cyclic Synchronous Position" Mode. In this mode, the CMMT doesn't control the movement to the Target Position by himself. The IPC's NC element is responsible for defining and controlling the trajectory. This is done by sending the in-between positions of the Target Position to the CMMT.

Build the PLC Project.

Note



If the compilation has been done without any error, the variables should be visible at the very bottom of the PLC Project within the PLC Task Inputs/Outputs.



Link the created variables to the **Modes of Operation Display** Input and **Modes of Operation** Output of the CMMT.



<

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□ / □ lar □ / □ Tar

Cancel

>

Attach Variable Modes of operation (Output)	×
Search: MOTION PLC CMMT_MC CMMT_MC Instance CMMT_MC Instance	
Cancel OK	



Note

If the variables are not visible in the Variable List, it could be that the PLC project compilation has not been done or there is an error on the PLC program.

5.3 Adding the PLC Open Library

Go to PLC -> References (Double Click) -> Add Library -> Tc2_MC2

Here are	the	PLC	Open	FBs
----------	-----	-----	------	-----





Create in the GVL a variable of Type AXIS_REF, which will be linked to the NC Axis element.



Build/Compile the PLC project without errors



6 MOTION NC Axis configuration

Open the Axis 1 encoder settings by opening the following path:

MOTION -> NC Task -1 1 SVB -> Axes -> Axes 1 -> Enc

Modify the **Scaling Factor Numerator** according to the Fieldbus Settings in the CMMT.

=	AUTOMATION SU New Project*	ITE	# Q	0	Axis1	×		
	PARAMETERISATI	лс	DIAGNOSIS	CONTRO	L B			
Ф	Axis1 CMMT-AS-C4-3A Path: 192.168.1.20 Disconnected	-EC-S	1 Connect				a () c	
Param	eter pages	<	Fieldbus					
Driv	e configuration							
Devi	ce settings				F			
Field	bus				Factor group			
Digit	al I/O				Current user unit		Rev [rev, rpm,] (3)	
Ana	ogue I/O			1	Position	0	-6	-
Enco	der interface							
▼ Axis	1				Speed	0	-3	
	Motor				Acceleration	0	-3	-
	Gears				Jerk	0	-3	_
	Δvis]

Solution Explorer 👻 👎 🗙	CMMT_NC_T	EST 🔁 🗙			
○ ○ ☆ [•] o - 司 ₽ <mark></mark>	General N	C-Encoder Parameter Time Compensation Online			
Search Solution Explorer (Ctrl+ü)					_
Solution 'CMMT_NC_TEST' (1 project)		Parimeter	Offline Value	0	nl
CMMT_NC_TEST	-	Incoder Evaluation:			
SYSTEM		Invert Encoder Counting Direction	FALSE	-	
License		Scaling Factor Numerator	0.000001		
Real-Time		Scaling Factor Denominator (default: 1.0)	1.0		
▲ I lasks		Position Bias	0.0		
E Routes		Modulo Factor (e.g. 360.0°)	360.0		
🚛 Type System		Tolerance Window for Modulo Start	0.0		
TcCOM Objects		Encoder Mask (maximum encoder value)	0xFFFFFFF		
		Encoder Sub Mask (absolute range maximum value)	0x000FFFFF		
NC-Task T SAF		Reference System	'INCREMENTAL'	-	
tage linage	-	Limit Switches:			
Tables		Soft Position Limit Minimum Monitoring	FALSE	-	
Objects		Minimum Position	0.0		
▲ ⊒⊶ Axes		Soft Position Limit Maximum Monitoring	FALSE	-	
▷ 👯 Enc		Maximum Position	0.0		
Þ ≇∐ Drive	+	Filter:			
ta, Ctrl	+	Homing:			
Inputs	+	Other Settings:			
Outputs		3		_	-

 $10^{-6} \ = \ 0.\ 000001$

The Axis settings, CMMT, Motor and Actuator, must also be checked for compatibility between the Festo Automation Suite Settings and the NC Axis settings.

For example: Velocity, Acceleration, Quick stop ramp, maximum velocity, etc.

Solution Explorer 👻 👎 🗙	CMMT.	NC_TEST 😤 🗶 PLC_OPEN_FBs Library	v Manager GVL	MAIN		
○ ○ ☆ `o - @ ≠ <u>-</u>	Gene	aral Settings Parameter Dynamics Online Function	ons Coupling Compensation			
Search Solution Explorer (Ctrl+ü)			0///	0	-	11-1
CMMT_NC_TEST SYSTEM		Parapoter Maximum Dynamics:	Offline Value	Online Value	Iy	Unit
MOTION		Reference Velocity	2200.0		F	mm/s
 MC-Task 1 SAF 	1	Maximum Velocity	2000.0		F	mm/s
Image		Maximum Acceleration	15000.0		F	mm/s2
Tables		Maximum Deceleration	15000.0		F	mm/s2
Dbjects	+	Default Dynamics:				
Axes	+	Manual Motion and Homing:				
Axis 1	+	Fast Axis Stop:				
Þ ➡∐ Drive	+	Limit Switches:				
tia Ctri	+	Monitoring:				
P Inputs	+	Setpoint Generator:				
🔺 🛏 Axis 2	+	NCI Parameter:				
🕨 👯 Enc	+	Other Settings:				
Drive						
La Ctrl						
Inputs						
Outputs						

These settings are located under the MOTION -> NC -> Axes -> Axis 1 -> Parameters

Double click on Axis one and link the AXIS_REF object by following this path:

Solution Explorer	• ¶ ×	Library Manager 🛱	GVL	MAIN	CMMT_N	IC_TEST ⊕ ×
් ට රු ්o - ම ළ <u>-</u>		General Settings	Parameter [Dynamics Online	Functions Co	upling Compensation
Search Solution Explorer (Ctrl+ü)	<u>ہ</u> م	T-1/0		Drive E (CMMT /	(C)	
Solution 'CMMT_NC_TEST' (1 project)		dink To 1/0		Drive 5 (CMMT-7	45)	
		Link To PLC				
SYSTEM		Avia Turaci C (Nerra DC 02	/D61- MDD 742 /		- E Dava)
		Axis Type: CA	INOPEN DS UZ	(Profile MDP 742 (e.g. EtherCAT C	oE Drive) V
NCHask 1 SAF C_Tack 1 SVR			-	- Disolay (Ophy) -		
t C+lask + 3Vb		Select Axis Pl	.C Referen e	('Axis 1')		×
T bles						
🛅 Objects		GVL.CMMT_Axis	1_Ref (CMMT_	MC Instance)		ок
⊿ ≩a⊢Aves						Cancel
Axis 1						
P ♦ Enc						Unused
						⊖ All
Inputs						
Outputs						
PLC						
SAFETY						
₩ C++						
P 🔁 1/0						
1						

General	Settings	Parameter	Dynamics	Online	Functions	Coupling	Compensation			
Link To I/O			Drive 5	(CMMT-/	AS)					
Link To	PLC		GVL.CI	GVL.CMMT_Axis1_Ref (CMMT_MC Instance)						

Click on **Activate Configuration** to download the scanned network + Settings to the IPC.





Note

If the IPC is missing some licenses required for the NC application, a window will pop up, mentioning that the licenses are missing. For testing purposes, TwinCAT V3 allows to generate Trial Licenses, which will expire after a certain period. The license can be bought from BECKHOFF at any time once the tests have been successful.



License codes can be viewed at the SYSTEM -> License -> Online Licenses Tab.

Solution Explorer	• 4 ×	CMMT_NC_TES	T⇔×							
0 0 🕼 '0 - 🗊 👂 🗕		Order Information (Runtime) Manage Licenses Project Licenses Online Licenses								
Search Solution Explorer (Ctrl+ü)	ب م		11		DL IC T	<u>.</u>				
Solution 'CMMT_NC_TEST' (1 project)		Order No	License	Instances	Platform Type	Status				
CMMT_NC_TEST			TC3 NC PTP Axis	10 instances (0 in use)	Runtime	expires on Oct 3, 2018 (trial license)				
SYSTEM		TC1000	TC3 ADS	cpu license	Runtime	expires on Oct 3, 2018 (trial license)				
📑 License		TC1100	TC3 IO	cpu license	Runtime	expires on Oct 3, 2018 (trial license)				
Real-Time		TC1200	TC3 PLC	cpu license	Runtime	expires on Oct 3, 2018 (trial license)				
asks Ben Routes		TF5000	TC3 NC PTP	cpu license	Runtime	expires on Oct 3, 2018 (trial license)				
Type System										

After the configuration has been done, click on the RUN Mode symbol to bring the IPC into Run Mode.

CMMT_NC_TEST - Microsoft Visual Studio												
FILE EDIT VIEW PROJECT	BUILD DEBUG	TWINCAT	TWINSAFE	PLC	TOOLS	SCO						
G - O 🖥 - 🛅 - 😩 🗎	🖆 🛣 🗗 ដា 📔	9-9-	Attach •	•								
Build 4022.22 (Loaded) 🔹 💂	i 🖈 🔳 🗷 🌮	K 🌀 🔁 🖏	CX-2A57C	E	•	.						
Solution Explorer												
© ⊃ ☆ ĭo - i / ≁ <mark>-</mark>		Order	Information (Ru	ntime) I	Manage Lic	enses						

Note

HW changes or Network changes must be done with the system in Configuration mode, which is triggered by clicking on the Blue Icon. Once configurations have been done, the PLC code can only be downloaded once the IPC is in RUN Mode.

7 PLC Programming

Now the that the complete configuration has been done, the PLC Open Function Blocks for Softmotion can be integrated as done in CODESYS.



They must be linked to the AXIS_REF element that we have created for the Axis.