

AN135

16-125548

Omron Copley Configuration Guide

Introduction

The following guide will demonstate how to use Sysmac Studio to setup and configure an Omron Ethercat Master (PLC) with a Copley Drive to edit PDO Mapping, view and edit cyclic data, and build and execute a POU Program to send an SDO.

The Sysmac Studio Version used:



Copley Hardware used was a BEL-090-30 with firmware version 4.20, and Omron Hardware used was an Omron NJ301-1200 version 1.10. The Operating System used was a Windows 10 Enterprise.

Setup

Click the "New Project" Button to create a new project in Sysmac Studio. Enter the Omron Master information and click "Create".

Offline	Project Pro	perties Copley_Tutorial	
Open Project	Author	Anthony	
grif ☐ Import	Comment		
Export	Туре	Standard Project 🔹	
A Online	Select D	evice	
Connect to Device	Category Device Version	Controller NJ301 - 1200 1.10 - Create	

Double click on the EtherCAT Icon under the "Configuration and Setup" Tab on the left shown below.



Next click on the Controller Tab in the toolbar at the top of the page and select "Communications Setup".



Check that the Omron Ethercat Master is powered on and connected to the PC through one of the following connection methods shown below under Connection type. The following example used "Direct connection via USB".

Communications Setup		- 🗆 ×
▼ Connection type		
Select a method to connect with the Controller to use every time you go of Direct connection via USB Ethernet connection via Ethernet Select one method from these options at every online connection. Direct connection via USB Direct connection via USB Direct connection via USB Direct connection via Ethernet	online.	A- *
 Remote connection via USB Ethernet connection via a hub 		
▼ Remote IP Address		
Select a method to connect with the Controller to use every time you go o	online. • Ethernet Communications Test	
▼ Options		
Confirm the serial ID when going online. Check forced refreshing when going offline.		
▼ Response Monitor Time		
Set the Response Monitor Time in the communications with the Controller 2 (s)	r.	
ОК	Cancel	

Right-click on the master icon and select "Display ESI Library". Click on the underlined and highlighted words <u>this folder</u> at the bottom of the library. Paste the ESI files of any downstream devices on the network in this folder. Be sure that the ESI files support MDP Protocol (from Slots folder). Save your project and restart Sysmac for these changes to the ESI Library to take effect.

📓 ESI	Library	—		Х
	II ESI files Omron 3G3AX-MX2-ECT Omron 3G3AX-RX-ECT Omron CJ1W-ECTxx Omron E3NW-ECT Omron E3X-ECT Omron FH-xxxx-xx Omron FQ-MS12x-x-ECT Omron FZM1-XXX-ECT Omron GRT1-ECT_Ver2_0 Omron GX-Analog IO Omron GX-Digital IO Omron GX-Digital IO Omron GX-Digital IO-T Omron GX-Digital IO-T Omron GX-JC06-H Omron NX_Coupler Omron R88D-KNxxx-ECT Omron R88D-KNxxx-ECT-L Omron ZW-CE1x			
To ad delet resta	d or delete an ESI file, exit from thi e the file to/from <mark>this folder.</mark> The cl ting this software. Close	is software, a hange will be	nd then a applied	add/ after

Open your saved project and right-click on the master icon. Select "Compare and Merge with Actual Network Configuration" followed by "Apply actual network configuration". Click "Apply".

Compare and Merge with Actual Network Configuration			— 🗆 🗙 t				
Node Address Network configuration on Sysmac Studio Master Master	Node address Actual network configuration	Netw Comparison result Mast Matched	Actua Lower Configuration				
	3 BEL Rev:0x00010004	Added	3 : B y				
			E				
S Apply actual netw	Apply actual network configuration						
Do you apply the actual network configuration to the network configuration on Sysmac Studio? Apply Cancel							
<	work configuration		e				
Some slaves such as Power Supply Units are not included in the actual network configuration.							
	Close		M				

To set the Node Address, while the drive is selected in the EtherCAT Tab, edit the Node Address Textbox shown below and power-cycle the drive.

Item name	Value
Device name	E001
Model name	BEL
Product name	BEL
Revision	0x00010004
Node Address	1
Enable/Disable Settings	Enabled 🔹
Serial Number	0x0000000
PDO Map Settings	Edit PDO Map Settings
Enable Distributed Clock	Enabled (DC Cyclic)
Reference Clock	Exist
Setting Parameters	
Backup Parameter Settings	
Module Configuration	Setting Edit Module Configuration

Error Log

To see any errors that may have occurred, click on the Troubleshooting Button to view the Controller Errors, Controller Event Log, User-defined Errors, or User-defined Event Log.





Assigning a Module to an Axis

E001					
BEL					
BEL					
0x00010004					
1					
Enabled 🔻					
0x0000000					
Edit PDO Map Settings					
Enabled (DC Cyclic)					
Exist					
Setting Edit Module Configurati					
Module Configuration Edits the module configuration					

To assign a module to each specific axis select the Copley Drive Icon under the Omron Master and then the "Edit Module Configuration" button shown in the picture on the left.

Click and drag the desired module from the Toolbox on the right to the desired axis module. Axis A of the BEL is mapped to CSP Mode shown in the Main Module Configuration Screen below.

Main Module Configuration Screen

ECAT EtherCAT	- No	ode1 : BE	L(E001) ×		
Posit	Slot	I	Module	I	I.
Node1 : BEL	. (E001)				
0 Aა	kis A	₩ Cy	clic position Mode (M	1)	

Click the Online Button followed by the Download To Controller Button both shown below.

Online Button



Download to Controller Button



After Downloading Select Execute and OK.

Transfer to Controller		
The following data will be transferre	ed.	
- Configurations and Setup EtherCAT, CPU/Expansion Racks Motion Control Setup, Cam Dat Task Settings	s, I/O Map, Controller Setup ta Settings, Event Settings	
	Transfer to Controller	
- Programming POUs, Data, Library	Successfully completed.	
Options Clear the present values of va	ОК	ן
 Do not transfer the program s Do not transfer the following. CJ-series Special Unit param Slave Terminal Unit operatio Do not transfer the EtherNet/ 	source. All data will be re-transferred when this option is changed. . (All items are not transferred.) neters and EtherCAT slave backup parameters. on settings and NX Unit application data. 'IP connection settings (built-in port and Unit).	
	Execute Close	2

Edit PDO Mapping

Double click on the EtherCAT tab under Configurations and Setup in the Multiview Explorer. Select the drive under the master and click the Edit Module Configuration Button.

Item name	Value
Device name	E001
Model name	BEL
Product name	BEL
Revision	0x00010004
Node Address	1
Enable/Disable Settings	Enabled 🔹
Serial Number	0x0000000
PDO Map Settings	Edit PDO Map Settings
Enable Distributed Clock	Enabled (DC Cyclic)
Reference Clock	Exist
Setting Parameters	
Backup Parameter Settings	
Module Configuration	Setting Edit Module Configuration

Select the Cyclic Position Mode (M1) Module.

🖨 I/O Map	ECAT Ethe	rCAT	- Node1 : BEL (E001)	×
Posit	Slot	I	Module	I
Node1 : BEL	(E001)			
0 Ax	is A	Cycl	ic position Mode (M1)	

Select Edit PDO Map Settings on the right to view, enable or disable the fixed PDO's associated with this axis.



The PDO map settings here are fixed, and therefore, cannot be edited.

EtherCAT Node1 : BEL (E001) ×							-
PDO Mapping Status: Process Data Size Input: 128/11472 [bit] Output: 96/11472 [bit]							
PDO Entry Mapping List	PDO Entry Mapping List Data included in Cyclic position Outputs						
	Input 128[bit]	Index	Size	Data Type	Name	Comment	1
	Output 96[bit]	0x6040:00	16[bit]	UINT	Control word		
Selection Input/Output Name	Flag I	0x607A:00	32[bit]	DINT	Profile target position		
No option		0x60B1:00	32[bit]	DINT	Velocity offset		
 Output Cyclic position Outputs 		0x60B2:00	16[bit]	INT	Torque offset		
No option							-
Input Cyclic position Inputs							

Click OK and return to the Main Module Configuration Screen. To edit the user mappable PDO's for the device, select the desired node and click the Edit PDO Map Settings Button on the right.

ECA	Ether	CAT 🔤 N	ode1 : BEL (E001) 🗙	
	Posit	l Slot	l Module	I
	Node	1 : BEL (E001)		
	0	Axis A	Cyclic position Mode	(M1)
			- ,	

The full list of editable RxPDO's and TxPDO's is displayed.

Selection	Input/Output	Name	Flag	
		No option		
	Output	Receive PDO 1	Editable	
۲		No option		
	Output	Receive PDO 2	Editable	
0		No option		
	Output	Receive PDO 3	Editable	
•		No option		
	Output	Receive PDO 4	Editable	
۲		No option		
	Input	Transmit PDO 1	Editable	
0		No option		
	Input	Transmit PDO 2	Editable	
•		No option		
	Input	Transmit PDO 3	Editable	
•		No option		
	Input	Transmit PDO 4	Editable	

Select Receive PDO 1.

				Output Upitj
Selection	Input/Output	Name	Flag	
		No option		
	Output	Receive PDO 1	Edi	

Select the Add PDO Entry Button on the bottom right.

Add PDO Entry	Delete PDO Entry				
OK	Cancel	Apply			

Select objects to map to the RxPDO and click OK.

Edit PDO Map Settings	—		\times
0x2010:00 PVT Buffer data			^
0x2183:00 Latching faults			_
0x2194:00 Output pin values			_
0x21E1:00 D/A converter output value			
0x2240:00 Actual motor position			- 10
0x2242:00 Position of load encoder			
0x2262:00 Phase Angle			
0x2325:00 Registration offset for step and direction mode			
0x23/1:00 Gain schedulong key parameter			- 1
0x2508:00 Trace start/stop control			
0x250A:00 Trace memory reserve size			_
0x250B:00 Trace memory address			
0x6040:00 Control word			
0x6060:00 Modes of operation			
0x606A:00 Velocity sensor selection			_
0x606D:00 Velocity window (16-bit version)			
0x606F:00 Velocity threshold			_ !
0x60/0:00 Velocity threshold time			
0x6071:00 Target Torque			$\overline{}$
0v607E-00 Factor group polarity	_	_	
Position of load encoder			
Data type : DINT			\sim
Size : 32[bit]			
Comment : Signed double integer			
			\sim
	ОК		ancel

Click the Apply Button on the bottom right to apply the changes to the PDO Map Settings then click OK.

Select the I/O Map tab in the Configurations and Setup Menu to view the changes to the PDO Mapping.

🥔 I/O Map	× 🛱 EtherCAT	🐼 MC_Axis000 (0)	🔄 Section0 - Program0		
Position		Port	Description	R/W	Data Type
	🔻 💐 EtherCAT Netv	vork Configuration			
EtherCA	Master				
Node1	🔻 🍧 BEL				
	Receive PDC	0 1_Position of load enco	d Signed double integer	W	DINT
Slot 0	🔻 🕴 Cyclic po	sition Mode			
	Cyclic po	sition Outputs_Control w	<i>i</i> o	W	UINT
	Cyclic po	sition Outputs_Profile ta	rg	W	DINT
	Cyclic po	sition Outputs_Velocity o	off	W	DINT
	Cyclic po	sition Outputs_Torque of	fs	W	INT
	Cyclic po	sition Inputs_Status word	i_	R	UINT
	Cyclic po	sition Inputs_Actual mot	01	R	DINT
	Cyclic po	sition Inputs_Position loc	р г	R	DINT
	Cyclic po	sition Inputs_Actual mot	01	R	DINT
	Cyclic po	sition Inputs_Torque actu	Ia	R	INT
	🔻 💐 CPU/Expansio	n Racks			
CPU Rac	CPU Rack 0				

View and Edit PDO Cyclic Data

Click the Online Button shown below.

lio	
Simulation	Tools Help
ធាង	.# # 9 ₹ <u>1</u> × 8 ∳ * * 0
×	Online
Network co	figuration I
	Master Master
	E001 BEL Rev:0x00010004

Navigate to the I/O Map under the Configurations and Setup Tab on the left.



A live feed of the cyclic data used by the selected module (CSP Mode) is displayed there. The data sent to the drive (RxPDO's) can be edited here for testing purposes. A live feed of the data sent by the drive to the master (TxPDO's) is also shown here.

Select a Monitor Type of Hex on the bottom left of the I/O Map.

- Monitor tuno -			
Monitor type			
Data type	🔵 Binary 💽 Hex 🔵	Signed decimal 🔵 Unsigi	ned decimal

🥔 I/O Map	×						
Position	Port	Description	R/W	Data Type	Value	Variable	
	EtherCAT Network Configuration						
EtherCA	Master						
Node1	🔻 🖀 BEL						
Slot 0	Cyclic position Mode						
	Cyclic position Outputs_Control word_6040_00		W	UINT	16#0		
	Cyclic position Outputs_Profile target position_607A_00		W	DINT	16#0		
	Cyclic position Outputs_Velocity offset_60B1_00		W	DINT	16#0		
	Cyclic position Outputs_Torque offset_60B2_00		W	INT	16#0		
	Cyclic position Inputs_Status word_6041_00		R	UINT	16#670		
	Cyclic position Inputs_Actual motor position_6064_00		R	DINT	16#0		
	Cyclic position Inputs_Position loop error_60F4_00		R	DINT	16#0		
	Cyclic position Inputs_Actual motor velocity_606C_00		R	DINT	16#0		
	Cyclic position Inputs_Torque actual value_6077_00		R	INT	16#0		
	▼ 🖣 CPU/Expansion Racks						
CPU Rac	CPU Rack 0						

If it is safe to do so and as a test, try enabling the drive by writing "16#F'' to the Control Word (CANopen Object 0x6040) and view the change in the Status Word.

Cyclic position Outputs_Control wo

If there are no faults present in the drive, the status light for the axis should be solid green (drive enabled). A change in the Status Word should also have occurred.

R

Cyclic position Inputs_Status word_

UINT 16#5237

W UINT

16#F

Send SDO's (Acyclic Data)

Click the "Offline" button.



Create a POU Program to send an SDO. Navigate to Programming > POUs > Programs.

Right click Programs > Add > Ladder.



Right click the rung and select "Insert Input (C)" and name the contact.





Right click to the right of the contact on the rung and select "Insert Function Block".

Type within the Function Block: "EC_CoESDOWrite" and press enter.



Fill in the data as shown below. The writeData variable type is UINT.

ECAT Ether	🛗 EtherCAT 🛛 🗂 Node1 : BEL (E001) 🛛 🖨			🖨 I/O Ma	Map 🔄 Section0 - Program0 🗙			
Varia	bles			_			-	
0	ena	ableWrite	1- sdoObjWrite Enter Variable- writeData-	writed EC_CoE Execute NodeAdr SdoObj TimeOut WriteDat	Gain_Cp SDOWrite Done Busy Error ErrorID AbortCode	busy error errorID abortCode		
			2.	- WriteSize				

Click on the Variables Menu shown below. Double click in the empty cell sdoObjWrite "Initial Value". Click on the box located on the left side of the cell.

EtherCAT Section0 - Program0 ×									
Variab	les								
Name	Namespace - Using								
Internals	Name	Data Type	Initial Value	I AT	Retain	Constant	Cor		
Externals	enableWrite	BOOL							
	writeData	UINT							
	sdoObjWrite	_sSDO_ACCESS							
	busy	BOOL							
	orror	POOL							

Enter the CANopen Object information and click OK. The Current Loop Proportional Gain is Object 0x2380 sub-index 1.



sdoObjWrite						
	Index	Subindex	IsCompleteAccess			
	(UINT)	(USINT)	(BOOL)			
	16#2380	1	False			

Enter the data to be sent to the CANopen Object in the writeData variable's Initial Value Column shown below.

Variab	Variables								
Name	Namespace - Using								
Internals	Name	Data Type	Initial Value	I AT	Retain	Constant	Con		
Externals	enableWrite	BOOL							
	writeGain_Cp	EC_CoESDOWrite							
	sdoObjWrite	_sSDO_ACCESS	(Index := 16#2						
	writeData	UINT	200						
	husy	BOOL							

Press the Online Button then the Download to Controller Button. Collapse the Variables Menu by clicking on it again.

ECAT Ether	rCAT	-🗖 Node1 : BEL (E001)	🖨 I/O Map	🖶 Sectio	on0 - Program0 🗙	
Varia	bles					
0	ena	ableWrite 	Writed EC_COE Execute 1— NodeAdr Write— SdoObj riable— TimeOut Data— WriteDat	Sain_Cp SDOWrite Done Busy Error ErrorID AbortCode	—busy (False) —error (False) —errorID (0000) —abortCode (0000 0000)	
			2-WriteSize			

The writeData variable should now have a default value of 200.

Click the RUN Mode Button shown below.

A	8	69	<mark>∳</mark> ∂	E.	e.	0	입	ů.	٦	Ð,	Q	¹⁰ 0]
Map		Sectio	on0 - I	Pro _l F	RUN M	lode							

The writeData variable can be edited while the program is running by double clicking it and entering a new value. The value of the writeData variable below was changed from 200 to 250.

ECAT Ether	rCAT	- Node1	: BEL (E001)	🖨 I/O Map	🖶 Sectio	n0 - Program0 ×	
Varia	bles						
0	en	ableWrite	sdoObj\ Enter Var 200 ▼ (:00) write 250	WriteG EC_CoES Execute 1— NodeAdr Nrite— SdoObj iable— TimeOut Data— WriteDat 2— WriteSize	iain_Cp iDOWrite Done - Busy - Error - ErrorID - AbortCode -	—busy (False) —error (False) —errorID (0000) —abortCode (0000 0000)	
							-

ECAT Ether	rCAT	-🗆 Node1 : B	EL (E001) 🛛 🖨	I/O Map	🗧 Sectio	on0 - Program0 🗙	
Varia	bles						
0	ena True	bleWrite	1 sdoObjWrite	Writed EC_CoE Execute NodeAdr	Sain_Cp SDOWrite Done Busy Error	busy (False) error (False)	
			Enter Variable (250) writeData 2	TimeOut WriteDat WriteSize	ErrorID AbortCode	errorID (0000) abortCode (0000 00	100)

To send the SDO, click on the gap of the enableWrite Input and click "True".

To check that the SDO was sent and that the Current Loop Proportional Gain was set to 250, connect the drive to CME. The drive can be connected to CME over serial for monitoring purposes while Sysmac is controlling the drive over EtherCAT. Do not use CME to command the drive because the drive can have only one master controlling it at one time. The Current Loop Proportional Gain was indeed set to 250 shown in the Current Loop Screen in CME.



Edit Watchdog Timer

Navigate to the Task Settings Menu under Configurations and Setup in the Multiview Explorer.

The Watchdog Timer is the same as the Task Timeout Detection Time and is calculated by multiplying the Period/Execution Time by the Task Timeout Detection Multiplier. The Watchdog Timer is displayed in the Task Timeout Detection Time along with the multiplier. Edit either the Period or the multiplier to change the Watchdog Timeout Value. For example, if the Period/Execution Rate is every 500us and the Task Timeout Detection Multiplier is set to "Period times 5", then the Watchdog Timeout Value is 2.50ms.



Revision History

Date	Version	Revision					
11/27/2019	Rev 00	Initial release					