



Application Note

EMPD Europe
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PAC Controllers

PAC320 to PAC120



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PAC Controllers

PAC320 To PAC120

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PAC Controllers PAC320 To PAC120

1. Abstract

This application note describes how a CODESYS-project which has been originally developed for the PAC320 can be transferred to a PAC120 project.

2. Hardware comparison

The main differences between PAC320 and PAC120 are shown in the following table:

	PAC320	PAC120
CPU	1.6 GHz Dual Core	1 GHz Single Core
RAM	1 GB	256 MB
Flash	2 GB	256 MB
RJ-45 Ports	3 x Ethernet ^{*1)}	1 x Ethernet
E-Bus	1 x EtherCAT	1 x EtherCAT ^{*2)}
USB	2 x USB 2.0	1 x USB 2.0
SD Card	1	1
Retain memory	256 kByte	128kByte

Table 1: Comparison PAC320 vs. PAC120

*1): One for EtherCAT, two for Ethernet

*2): For the EtherCAT communication the additional module PACIO-400-02 (Bus Extender) is required.

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3. Real Time Behavior

Due to the reduced clock frequency of the PAC120 the real time here behavior is different.

The following summary helps to select the correct cycle time for the EtherCAT master task.

NumberOfAxes	PAC120				PAC320			
	Average ExeTime	Max. ExeTime	SynchOffset	EtherCAT CycleTime	Average ExeTime	Max. ExeTime	SynchOffset	EtherCAT CycleTime
1	353	529	5	1000	164	336	20	1000
5	549	810	5	2000	294	450	20	1000
10	855	1141	5	2000	452	690	20	1000
15	1129	1436	5	2000	614	988	20	2000

Table 2: Comparison of Task cycle times

ExeTime[μs]:

The required time for the execution of the functions for the communication to the NumberOfAxes on the EtherCAT.

The execution times of the functions (ExeTimeAppli), which are also called via the EtherCAT task, are added to this execution time. These are generally all functions that are linked to an EtherCAT node (Application).

The EtherCAT Task Cycle Time therefore must always be set greater than the Max.ExeTime to provide execution time for these functions.

EtherCAT TaskCycleTime = Max.ExeTime + ExeTimeAppli + Jitter (caused by different execution times of the application per cycle)

EtherCAT Task Cycle Time[μs]:

Cycle time of the EtherCAT task.

The required time for the execution of the functions for the communication at the EtherCAT determines the task cycle time, which must be set for the EtherCAT - task.

SynchOffset[%]:

Determines the time behavior between PAC and the axes.

EtherCAT Task Cycle Time and SynchOffset are parameters of the EtherCAT master settings in the CODESYS project.

Example:

The EtherCAT Task Cycle Time of a project with PAC120 and 15 axes must be set at least to 2000μs. Then (2000-1436) = 564 μs would be left for the application.

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4. Task Configuration

The most important task for the real time behavior of the motion is the EtherCAT master task.

The timer for generating the cycle time must be accurate and have low jitter.

With the PAC320 a separate timer generates an external event which then starts the task. This means that in the CODESYS project the task is of the type 'External Event'.

In the PAC120 the EtherCAT task is mapped with a task of type 'Cyclic'.

As with the PAC320, there are also the task priorities 0 (highest) to 31 (lowest). However, it should be noted that these priorities must be divided into two groups.

Group 1 contains the priorities 0 - 15 and is intended for functions that must be executed in real time. This includes the EtherCAT task with priority 0 (!) and further tasks, which e.g. execute the Profinet communication.

Group 2 contains the priorities 16 to 31. In contrast to group 1, these task priorities do not influence the real-time behavior of the overall system and are therefore to be selected for visualizations or file operations. Possibly also a communication via Ethernet.

5. Periphery

the following differences must be considered here.

5.1. Access to the SD-Card, USB-Slot

Syntax:

Controller	SD-Card	Example	USB-Slot	Example
PAC120	/media/sd	'/media/sd/CSVstate.bin'	/media/usb1	'/media/usb1/CSVstate.bin'
PAC320	/Hard Disk	'/Hard Disk/CSVstate.bin'	/Hard Disk1	'/Hard Disk1/CSVstate.bin'
			/Hard Disk2	'/Hard Disk2/CSVstate.bin'

Table 3: Access to Memory Periphery

Note: if a recipe manager is used the name of the file path must be also modified!

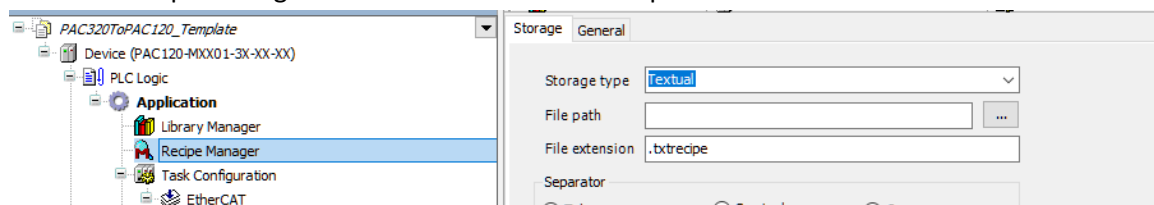


Figure 1: File Path for Recipes

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5.2. Profinet Configuration

This is described in the application note AN_0053_PAC120_Profinet.

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6. PAC320 Source Conversion to PAC120 Source

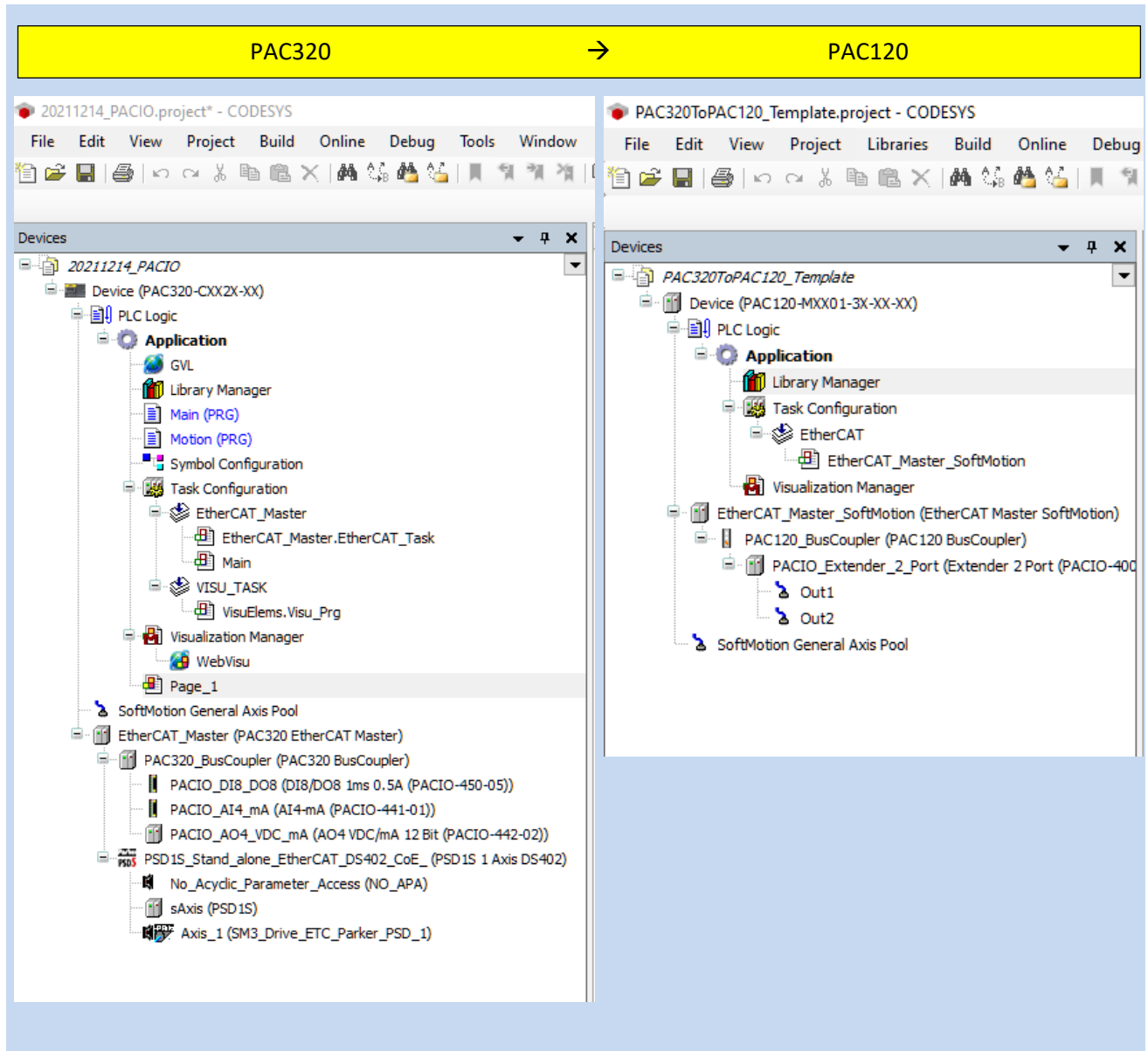


Figure 2: Setup the PAC120 Project by Copy-Paste

Due to the different hardware, the program functions should be copied and pasted into the PAC120 project. The template of a PAC120 project is used for this purpose Project (*PAC320ToPAC120_Template.project*). The relevant hardware components are already available in this project.

The following areas are copied separately:

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6.2. Step 2: Devices at the BusCoupler

PAC320
→
PAC120

PAC320 project: Select all hardware modules which are connected to the **BusCoupler** by CTRL left mouse click and copy it.

PAC120 project: Make a right click onto the **BusCoupler** and execute paste.

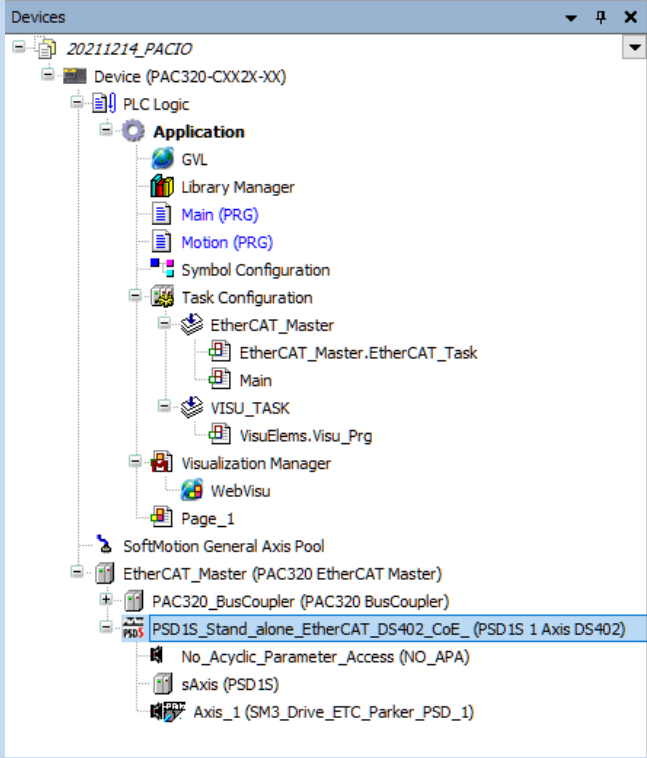
Now all selected elements are copied to the **BusCoupler**.

Figure 4: Step2 BusCoupler

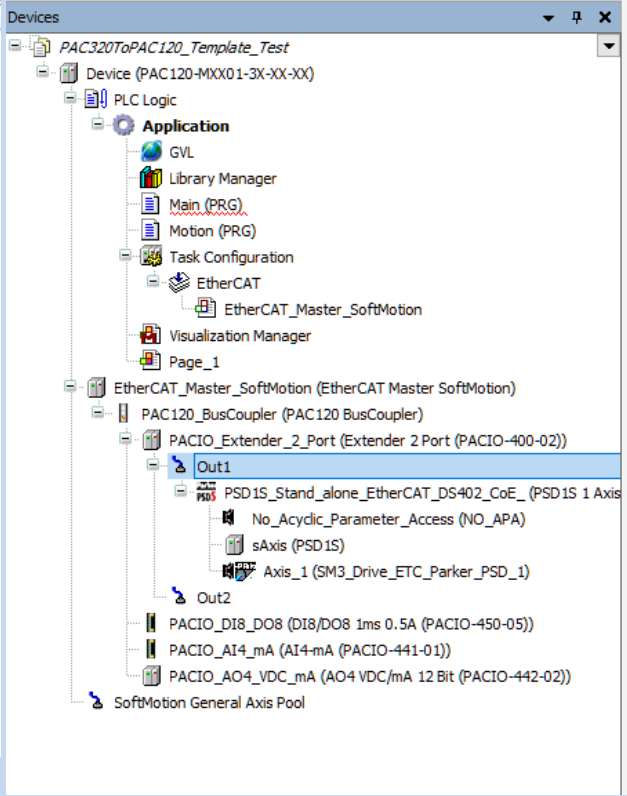
PAC Controllers PAC320 To PAC120

6.3. Step 3: Devices at the EtherCAT Port

PAC320
→
PAC120



The screenshot shows the 'Devices' tree for a PAC320 project. Under 'EtherCAT_Master', several hardware modules are listed, including 'PAC320_BusCoupler', 'PSD1S_Stand_alone_EtherCAT_DS402_CoE', 'No_Acydic_Parameter_Access', 'sAxis', and 'Axis_1'. The 'PSD1S_Stand_alone_EtherCAT_DS402_CoE' module is highlighted with a blue selection bar.



The screenshot shows the 'Devices' tree for a PAC120 project. The hardware modules from the PAC320 project have been copied to the 'EtherCAT_Master_SoftMotion' folder. The 'Out1' folder is expanded, showing the copied modules: 'PSD1S_Stand_alone_EtherCAT_DS402_CoE', 'No_Acydic_Parameter_Access', 'sAxis', and 'Axis_1'. The 'PSD1S_Stand_alone_EtherCAT_DS402_CoE' module is highlighted with a blue selection bar.

PAC320 project: Select all hardware modules which are connected to the **EtherCAT_Master** by CTRL left mouse click and copy it.

PAC120 project: Make a right click onto the **EtherCAT_Master_SoftMotion** and execute paste.

Now all selected elements are copied to the **EtherCAT_Master_SoftMotion**.

Figure 5: Step3 EtherCAT_Master

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6.4. EtherCAT_Master Settings

6.4.1. Rename the EtherCAT_Master entry

```
1 PROGRAM Main
2 VAR
3   xInit:BOOL;
4 END_VAR
5
6 IF NOT xinit THEN
7   EtherCAT_Master.StartConfigWithLessDevice:=TRUE;
8   xInit:=TRUE;
9 END_IF
10
11 IF EtherCAT_Master.xConfigFinished AND EtherCAT_Master.xDistributedClockInSync THEN
12   Motion();
13 END_IF
```

The name of the EtherCAT_Master must be changed to
EtherCAT_Master_SoftMotion

Figure 6: Rename the EtherCAT Master

6.4.2. Setup the EtherCAT Master Port

General Autoconfig master/slaves **EtherCAT**

EtherCAT NIC Settings

Destination address (MAC) FF-FF-FF-FF-FF-FF Broadcast Redundancy

Source address (MAC) 40-ED-98-40-08-DD

Network name eth1

Select network by MAC Select network by name

Distributed Clock Options

Cycle time 1000 μs

Sync offset 20 %

Sync window monitoring

Sync window 1 μs

After a connection between the CODESYS and the PAC120 is established
browse the eth1 port of the PAC120 to get the correct MAC-ID.
Eth1 represents the Out1 port of the PACIO Extender.

Figure 7: Browse the eht1 port

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7. More Tips

The following parts should not be copied but added directly to the PAC120 project:

- Additional tasks
- Web Visualization
- Libraries

8. Related documents

The set up of the PAC120 IP -address is described in the attached manual from page 32.

The default IP-address is the same as this of the PAC320: 192.168.10.50.

Parker Automation Controller Series PAC120

Operation

5.2 Configuration

A web interface is used to configure PAC120. After logging in, you can check and change various system settings and/or display system information.



5.2.1 IP Address

The PAC120 is delivered with a fixed IP address and a fixed subnet mask.

	PAC120 -Pxx01-3X-00-01 (IEC)	PAC120 -Mxx01-3X-00-01 (IEC, PLCopen Motion)
IP address	169.254.116.116	192.168.10.50
Subnet mask	255.255.0.0	255.255.0.0

To connect to the PAC120 for the first time, your PC must be in the same IP address range as the PAC120.

If necessary, change the IP address of your PC accordingly.

	CAUTION Duplicate IP addresses Assigning the same IP address to two different devices may cause serious network problems. → Check your network for duplicate IP addresses. → To put PAC120 into operation for the first time, we recommend using a direct network connection between and set IP addresses for PAC120 and the programming PC. You may have to use a cross-over network cable.
	CAUTION Unknown IP address → When the connection to the PAC120 fails, because the IP address is not known, you can start the PAC120 in service mode (section 5.5.2).

From page 33 of the manual the access to the web interface is described.

Manual: PAC120 5715-719UK V2.pdf.

Home Page: www.parker.com/PAC120.