QuickStart Instructions

SPS-Kit

phyCORE-MPC5200B tiny

Using CoDeSys from 3S

Note: The PHYTEC SPS-Kit-Disc includes the electronic version of the English phyCORE®-MPC5200Tiny Hardware Manual

Edition: November 2006

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1 Introduction

5 min

This QuickStart provides general information on the PHYTEC phyCORE-MPC5200B tiny Single Board Computer. It gives an overview of CoDeSys software development tool chain and instructions on how to run example programs on the phyCORE-MPC5200B tiny in conjunction with the CoDeSys development environment.

Please refer to the phyCORE-MPC5200B tiny Hardware Manual for specific information on such board-level features as jumper configuration, memory mapping and pin layout. Selecting the links on the electronic version of this document links to the applicable section of the phyCORE-MPC5200B tiny Hardware Manual.

1.1 Rapid Development Kit Documentation

This "Rapid Development Kit" includes the following electronic documentation on the enclosed "PHYTEC SPS Kit disc":

- PHYTEC phyCORE-MPC5200B tiny Hardware Manual and Development Board Hardware Manual
- PHYTEC phyCORE-MPC5200B tiny QuickStart Instructions
- MPC5200B tiny controller User's Manuals and Data Sheets

1.2 Professional Support Packages available

This Kit comes with free installation support. If you do have any questions concerning installation and setup, you are welcome to contact our support department.

For more in-depth questions, we offer a variety of custom tailored packages with different support options (e-mail, phone, direct contact to the developer) and different reaction times.

Please contact our sales team to discuss the appropriate support option if professional support beyond installation and setup is important to you.

1.3 Overview of this QuickStart Instruction

This QuickStart Instruction gives a general "Rapid Development Kit" description, as well as software installation hints and example programs enabling quick out-of-the box start-up of the phyCORE®-MPC5200B in conjunction with the CoDeSys IDE. It is structured as follows:

1) The *“Getting Started"* section uses a demo application to demonstrate the download of an embedded application to the MPC5200 using CoDeSys.
2) The *“Getting more involved"* section provides step-by-step instructions on how to modify the example, create and build new projects and generate and download output files to the phyCORE®-MPC5200 using CoDeSys.
3) The *“Debugging*” section provides information on how to debug an application with the CoDeSys debugging features.

In addition to dedicated data for this Rapid Development Kit, the PHYTEC Spectrum CD-ROM contains supplemental information on embedded microcontroller design and development.

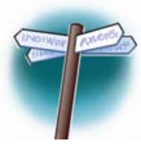
1.4 Conventions used in this QuickStart

The following is a list of the typographical conventions used in this book:

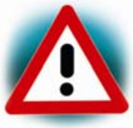
Italic Used for file and directory names, program and command names, command-line options, menu items, URLs, and other terms that corresponds the terms on your desktop.

Bold Used in examples to show commands or other text that should be typed literally by the user.

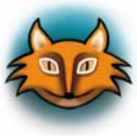
Pay special attention to notes set apart from the text with the following icons:



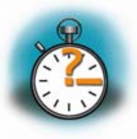
At this part you might leave be path of this QuickStart.



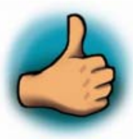
This is a warning. It helps you to avoid annoying problems.



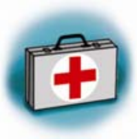
You can find useful supplementary information about the topic.



At the beginning of each chapter you can find information of the time to pass the following chapter.



You have successfully passed an important part of this QuickStart.



You can find information to solve problems.

1.5 System Requirements

Use of this "Rapid Development Kit" requires:

- the PHYTEC phyCORE-MPC5200B tiny,
- the PHYTEC Development Board with the included DB-9 serial cable and AC-to-DC adapter supplying 5 V DC/min. 1.5 A,
- the SPS Kit disc,
- PHYTEC Linux distribution based on OSELAS from Pengutronix
- an IBM-compatible host-PC (586 or higher) with Windows2000/XP

For more information and example updates, please refer to the following sources:

PHYTEC

http://www.phytec.de
support@phytec.de

Launched by Motorola freescale semiconductor

http://www.freescale.com/

1.6 The PHYTEC phyCORE-MPC5200B tiny

The phyCORE-MPC5200B tiny represents an affordable yet highly functional Single Board Computer (SBC) solution in the size
53 x 57 mm. The standard board is populated with a Freescale PowerPC Microcontroller MPC5200B featuring a 32-bit processor architecture with Double precision FPU, 462 MHz processor speed, Peripheral component interconnect (PCI) controller, ATA controller, BestComm DMA subsystem, 6 programmable serial controllers (PSC) configurable for the following functions:
Fast Ethernet controller (FEC), Universal serial bus controller (USB revision 1.1 host), Two inter-integrated circuit interfaces (I2C), Serial peripheral interface (SPI), Dual CAN 2.0 A/B controller (MSCAN), J1850 byte data link controller (BDLC)

All applicable LocalPlus data/address lines and applicable signals extend to two high-density 100-pin Molex SMT pin header connectors (pin width is 0.635 mm./25mil) lining the circuit board edges. This enables the phyCORE-MPC5200B tiny to be plugged like a “big chip” into target hardware.

The standard memory configurations of the phyCORE-MPC5200B tiny features 64MByte DDR-SDRAM and 16MByte external Flash. The external Flash supports direct on-board programming without additional programming voltages.

phyCORE-MPC5200B tiny Technical Highlights

- phyCORE dimensions 53 x 57 mm with two high-density 100-pin Molex SMT pin header connectors
- Processor: Freescale Embedded PowerPC MPC5200B, 396 MHz clock

Internal Features of the MPC5200B:

- e300 core
- 760 MIPS at 400 MHz (-40 to +85 °C)
- 32 k instruction cache, 32 k data cache
- Double precision FPU
- Instruction and data MMU
- SDRAM / DDR SDRAM memory Interface
- up to 132 MHz operation
- SDRAM and DDR SDRAM support
- 256 MByte addressing range per CS, two CS available
- Flexible multi-function external bus interface
- Peripheral component interconnect (PCI) controller
- ATA controller
- BestComm DMA subsystem
- 6 programmable serial controllers (PSC), configurable for the following functions:
- Fast Ethernet controller (FEC)
- Supports 100Mbps IEEE 802.3 MII, 10 Mbps IEEE 802.3 MII
- Universal serial bus controller (USB)
- USB revision 1.1 host
- Two inter-integrated circuit interfaces (I2C)
- Serial peripheral interface (SPI)
- Dual CAN 2.0 A/B controller (MSCAN)
- J1850 byte data link controller (BDLC)
- Test/debug features
- JTAG (IEEE 1149.1 test access port)
- Common on-chip processor (COP) debug port

The PHYTEC Development Board, in EURO-card dimensions (160 x 100 mm/6.25 x 4 in.), is fully equipped with all mechanical and electrical components necessary for the speedy and secure insertion of PHYTEC phyCORE-MPC5200B tiny Single Board Computer.

Development Board Technical Highlights

- reset push button, configurable via jumper for different reset signals
- one software programmable LED
- LEDs for supply voltage monitoring
- power supply for regulated input voltage of +5V. It supplies regulated +3.3 V for the phyCORE-MPC5200B tiny.
- two DB-9 sockets for the RS-232 interface
- two DB-9 plugs for two separate CAN interfaces

1.7 Software Development Tool Chain

1.7.1 CoDeSys

CoDeSys is one of the most powerful IEC61131-3 programming tools for PLCs and industrial controllers under Windows. It supports all 5 standard IEC61131-3 programming languages that includes

- Instruction List
- Sequential Function Chart
- Function Block Diagram
- Structured Text
- Ladder Diagram
- Continuous Function Chart

With CoDeSys it is possible to debug your application (breakpoints, stepping, monitoring of variables) while running on the target hardware.

2 Getting Started

35 min

In this section, you will install all necessary software for the SPS-Kit, including CodeSys and example programs. You will learn how to configure CodeSys and the target hardware so you can access the MPC5200Tiny from within CodeSys.

2.1 Installing SPS Kit Software

When you insert the SPS Kit disc into the CD-ROM drive of your host-PC, the setup program that installs the software required for the SPS Kit should start automatically. Otherwise the setup program **setup.exe** can be manually executed from the root directory of the SPS Kit disc.

2.1.1 Requirements of the Host Platform

The used host platform is a PC with Windows2000/XP.

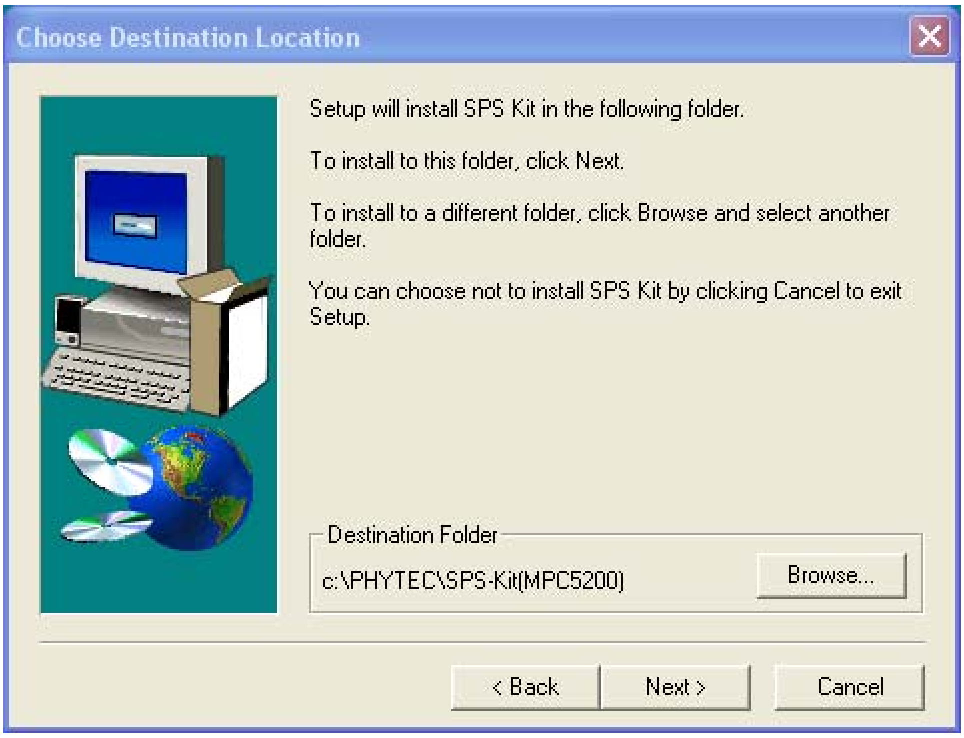
2.1.2 SPS Kit Setup

The setup for the SPS kit will install all necessary files for this quickstart. It will install CoDeSys, example programs written with CoDeSys and copy the configuration files and the run-time system for use with the MPC5200 Tiny on your hard drive.

- Insert your SPS Kit CD-ROM in you CD-ROM drive.

The setup should be started automatically. If not, open an file explorer, navigate to your CDDROM/DVD drive and launch **setup.exe** manually

- Click ***Next*** to proceed



Setup will install SPS Kit in the following folder.

To install to this folder, click Next.

To install to a different folder, click Browse and select another folder.

You can choose not to install SPS Kit by clicking Cancel to exit Setup.

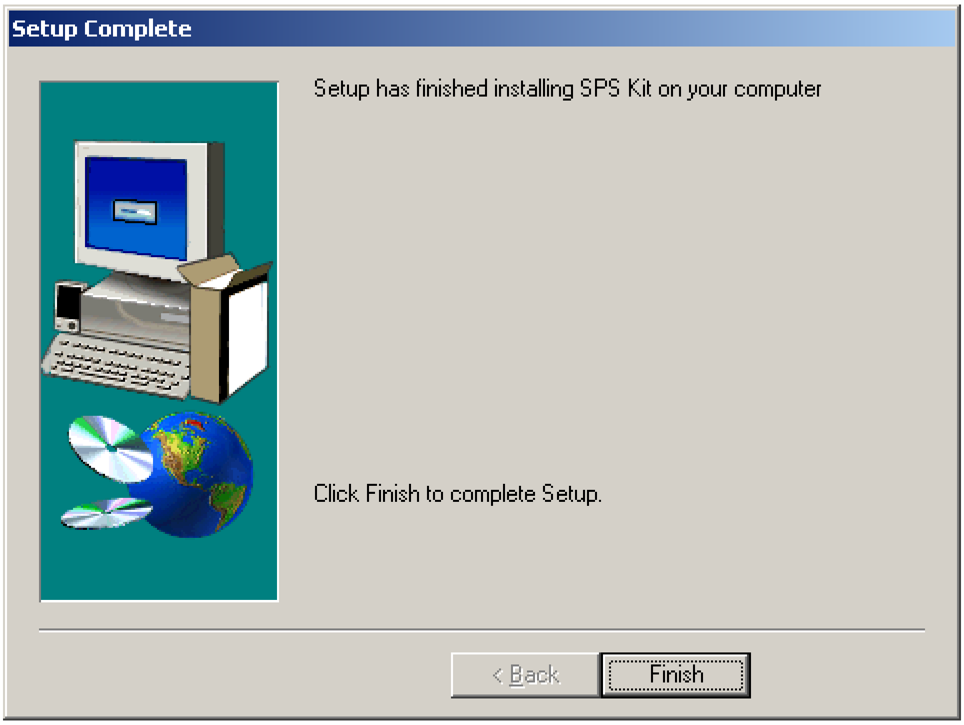
Destination Folder

c:\PHYTEC\SPS-Kit(MPC5200)

- After accepting the Welcome window you are asked for the destination location for the installation of the SPS Kit software.

The default destination location is ***C:\PHYTEC\SPS-Kit(MPC5200)***. All path and file statements within this QuickStart Instruction are based on the assumption that you accept the default install paths and drives. If you decide to individually choose different paths you must consider this for all further file and path statements.

We recommend that you accept the default destination location.



Setup Complete

Setup has finished installing SPS Kit on your computer

Click Finish to complete Setup.

After copying all necessary files for the SPS Kit, the setup for CoDeSys starts automatically. If not, you can start it manually by running setup.exe in the folder *Software/CoDeSys* on the SPS Kit disc.
Please follow the installation guide for CoDeSys to install it.

During the installation of CoDeSys you are asked for the language CoDeSys will be installed for. Please choose *English* for this quickstart. If you want CoDeSys in another language, you can change the language after working with this quickstart in CoDeSys in the menu *Project\Options\Desktop*.

At the end you have to install the MPC5200 target files in CoDeSys.

Click on

- *Start/Program Files/3S Software/CoDeSys V2.3/InstallTarget*.

Press **Open**, change to the directory

C:\PHYTEC\SPS-Kit(MPC5200)\Target\Install and open the file **3S-OSADL-PLCLinux.tnf**

Choose the **3S CoDeSys SP OSADL-Linux on PPC** entry and click on **Install**.
Press **Close**.

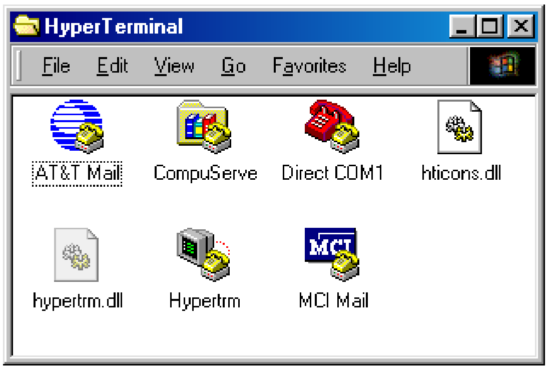
The setup of the SPS Kit is now complete. The demo applications were copied, CoDeSys is installed and configured to run with the MPC5200 tiny.

2.2 Downloading and starting the CoDeSys run-time system on the Target

For interfacing the MPC5200 Tiny from your host PC you need a serial connection via the enclosed serial cable. After configuring the serial connection in this chapter, you can start a Linux shell on the board from the host PC. From this shell you can start the run-time system.

Start the HyperTerminal program within the *Programs|Accessories* bar.

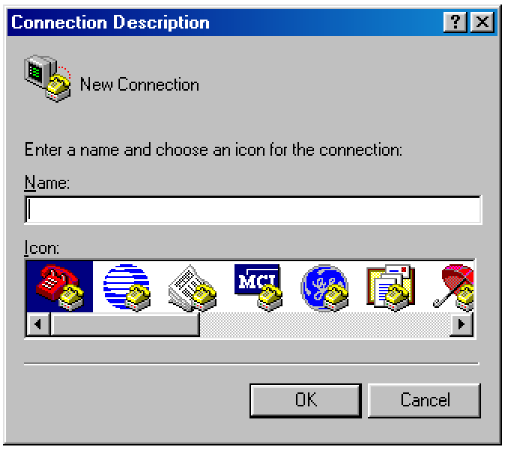
The HyperTerminal main window will now appear[1]:



[1] : The HyperTerminal window has a different appearance for different versions of Windows.

Double-click on the HyperTerminal icon “*Hypertrm*” to create a new HyperTerminal session.

The Connection Description window will now appear. Enter “COM Direct” in the *Name* text field.



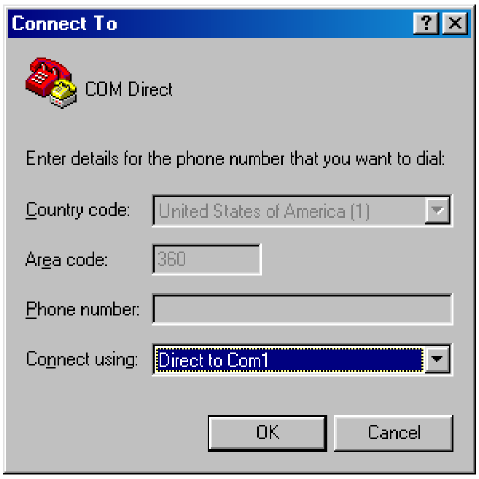
New Connection

Enter a name and choose an icon for the connection:

Name:

Icon:

Next click on *OK*. This creates a new HyperTerminal session named “COM Direct” and advances you to the next HyperTerminal window.



COM Direct

Enter details for the phone number that you want to dial:

Country code: United States of America (1)

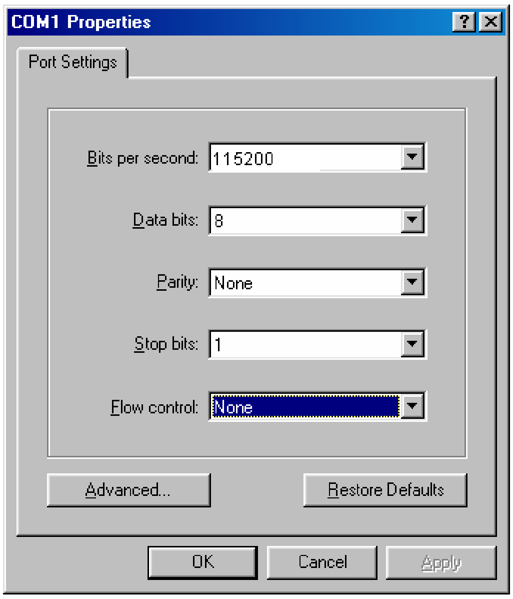
Area code: 360

Phone number:

Connect using: Direct to Com1

The *COM Direct Properties* window will now appear. Specify *Direct to COM1/COM2* under the *Connect Using* pull-down menu (be sure to indicate the correct COM setting for your system).

Click the *Configure* button in the *COM Direct Properties* window to advance to the next window (*COM1/COM2 Properties*).



Bits per second: 115200

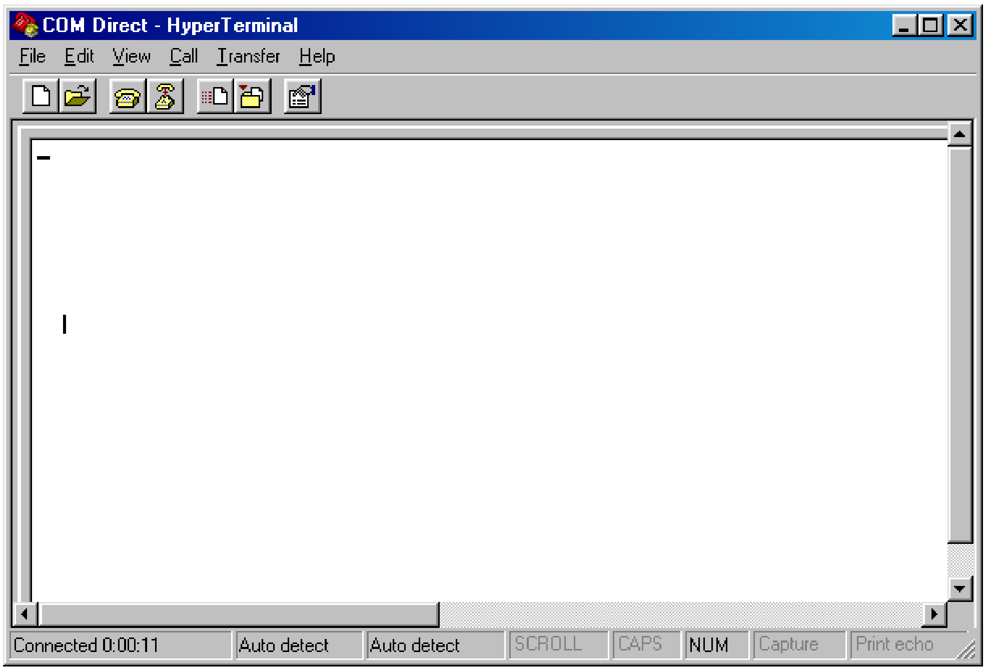
Data bits: 8

Parity: None

Stop bits: 1

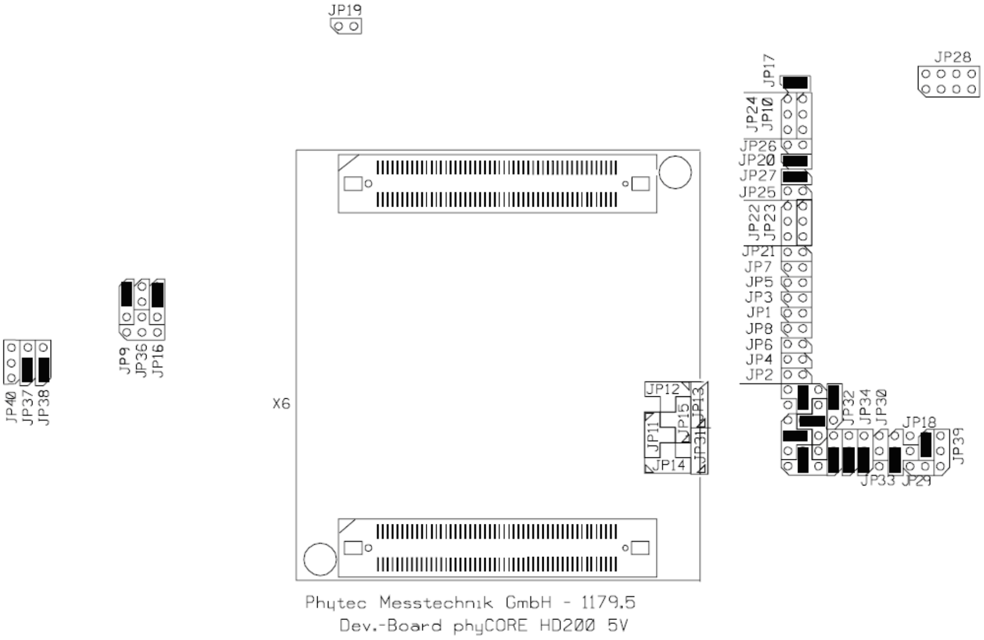
Flow control: None

- Set the following COM parameters: Bits per second = 115200; Data bits = *8*; Parity = *None*; Stop Bits = *1*; Flow Control = *None*.
- Selecting *OK* advances you to the *COM Direct–HyperTerminal* monitoring window. Notice the connection status report in the lower left corner of the window.



2.2.1 Setting the jumpers on the Development Board

Going through this QuickStart you have to setup some Jumper settings. You can see the right jumper settings on the following screenshot. If you don't have these settings on your board set the jumper like shown in the screenshot.



2.2.2 Connecting the host to the target

In this section you will learn how to connect your host pc with the target. The connection will be done with a cross-over Ethernet cable and a serial null modem cable. You will start Linux from flash on the target and you will be able to login in Linux over the serial connection with HyperTerminal.

- Connect the serial cable with the lower connector P1 on the target and the serial interface COM1 on your host.

Ensure to use the cable included in this RDK.

.

- Connect the cross-over Ethernet cable with the RJ45 connector of the target and the right network card of your host.

- Be sure that HyperTerminal is still open.

- Connect the AC adapter with the power supply connector X1 (5V) on your board.

The power connector should have 5 VDC inside and outside should be ground.

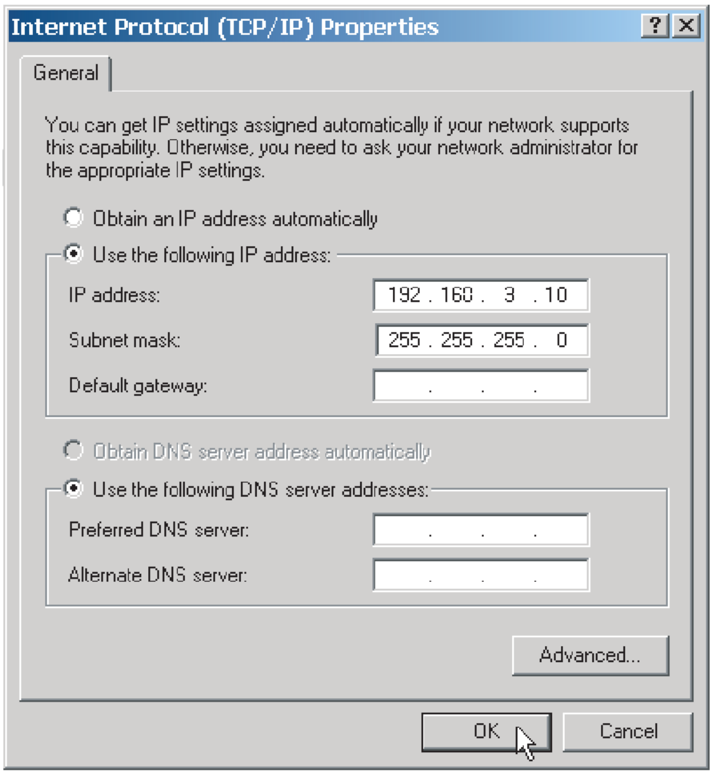
.

After connecting the board with the power supply the target starts booting. You should see the Linux boot messages in HyperTerminal When the target finished loading a login prompt should appear. Type *root* and enter.

2.2.3 Configuring the host

In the following step you will have to configure the IP address of your host. We recommend disconnecting your host from any other network. If you change the host IP, problems may occur with existing hosts.

- On the Windows desktop right-click on **Network Neighbourhood** and click **Properties**.
- Right-click on **Local Area Connection** and click **Properties**.
- Select **Internet Protocol (TCP/IP)** and click **Properties**.



Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 192 . 168 . 3 . 10

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

- In the Internet Protocol (TCP/IP) Properties window, select **Use the following IP address** if not already selected and specify the new IP address you wish to use. Enter **192.168.3.10**.

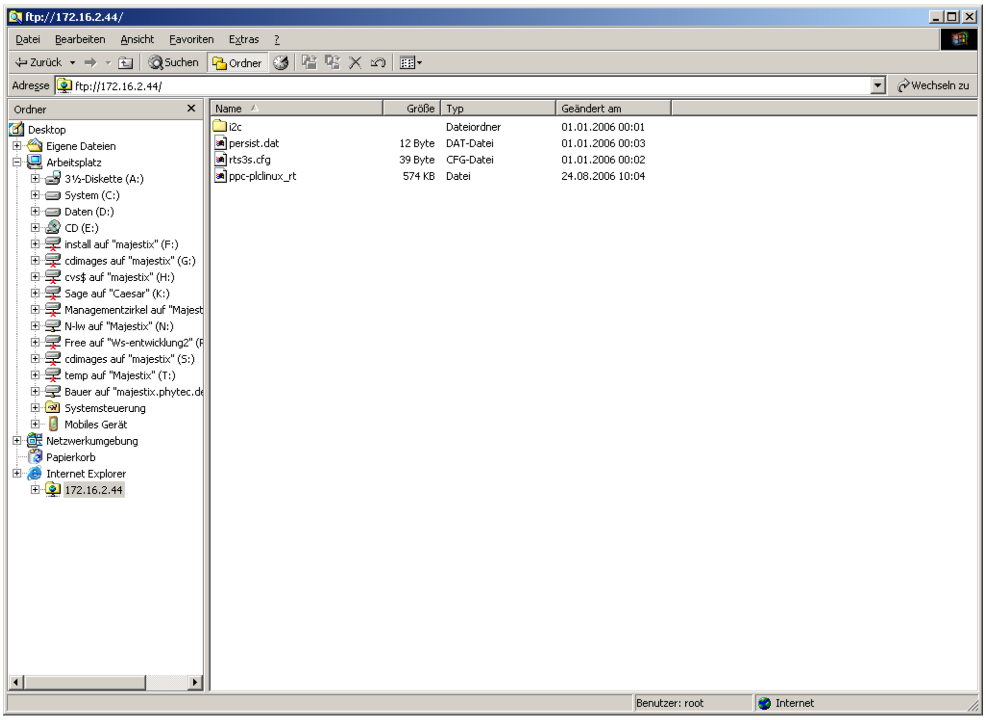
- Enter 255.255.255.0 in the **Network mask** field.
- Close the dialogs.

Your host is now configured so you can access the target via Ethernet.

2.2.4 Configuring the target

In this section you will learn how to transfer files from your host PC to the target using windows file explorer and the ftp protocol.

- Open the windows file explorer.



Adresse ftp://172.16.2.44/

Name	Größe	Typ	Geändert am
i2c		Dateiordner	01.01.2006 00:01
persist.dat	12 Byte	DAT-Datei	01.01.2006 00:03
rts3s.cfg	39 Byte	CFG-Datei	01.01.2006 00:02
ppc-plclinux_rt	574 KB	Datei	24.08.2006 10:04

Benutzer: root

- Enter in the address field:

  ftp://root@192.168.3.11/

When asked for a username type in **root.** A password is not required.

- Open another windows file explorer
- Change to the directory *C:\PHYTEC\SPS-Kit(MPC5200)\RTS*
- Click on the file **ppc-plclinux_rt** and drag it to the explorer window with the ftp connection
- Click on the file **libIODrvTemplate.so** and drag it to the explorer window with the ftp connection.
- Click on the file **rts3s.cfg** and drag it to the explorer window with the ftp connection

Starting the run-time system

- Copy the IO driver library in the user/lib directory on the host

  In HyperTerminal type

  cp libIODrvTemplate.so /usr/lib
- Type **./ppc-plclinux_rt.** The run-time system should start now.

This is only a demo version. The run run-time system will shutdown after 1 hour.

2.3 Running the demo application

In this chapter you will learn how to setup your project so it is automatically downloaded to the target and CodeSys can communicate with the target application.

- Start CoDeSys

  Click on *Start/Programs/3S Software/CodeSysV2.3/ CodeSysV2.3*

- Open the demo application

  Click on *File/Open*

  Navigate to the demo directory

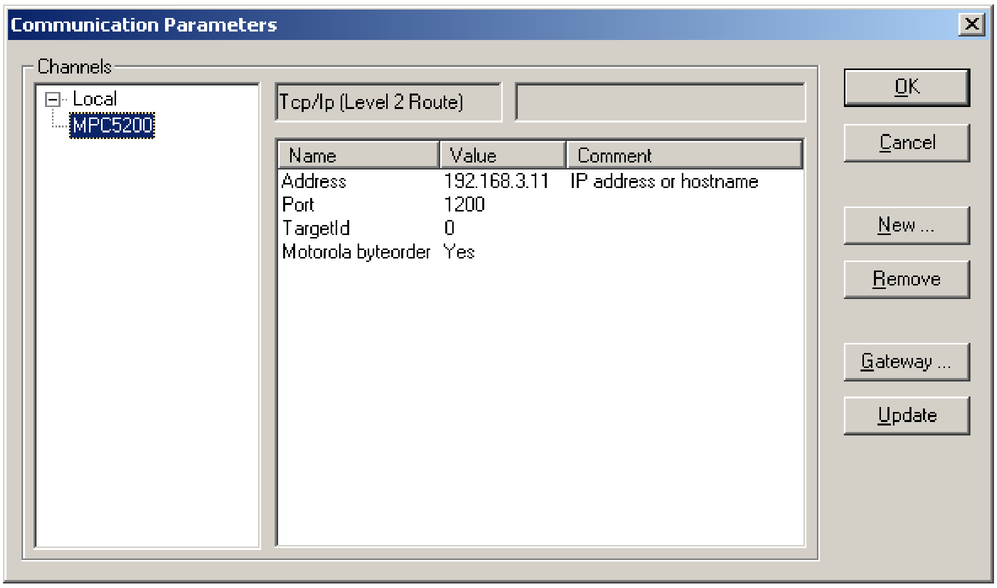
  C:\Phytec\SPS-Kit(MPC5200)\Demos\Blinky

  Click on the project file *Led.pro*

- Change the communication parameters

  Click on *Online/Communication parameters*

There is an entry *MPC5200* with the setting TCP/IP and the IP address of the MPC5200. If you use another IP address on the MPC5200 tiny change the entry so it fits your settings.



Name	Value	Comment
Address	192.168.3.11	IP address or hostname
Port	1200	
TargetId	0	
Motorola byteorder	Yes	

- Press *OK* to close the **Communication Parameters** dialog

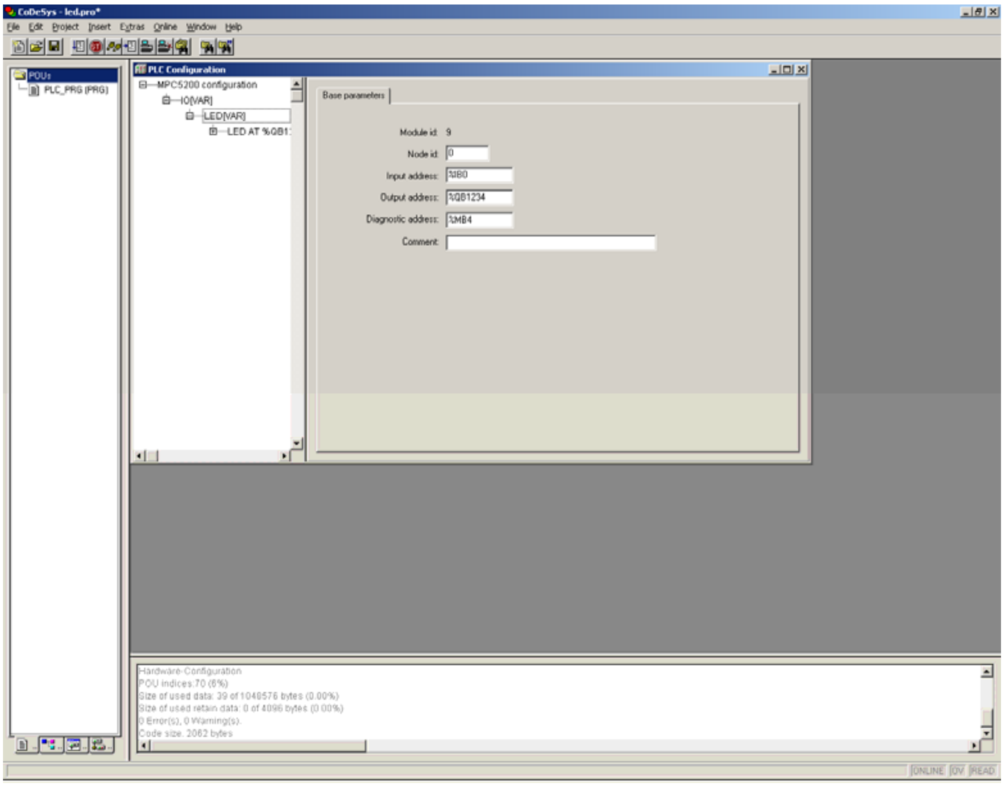
- Load the PLC configuration

In the project browser, click on the tab sheet **Resources**. In **Resources** click on **PLC Configuration.**

In the **PLC Configuration** dialog should appear a root entry **MPC5200 configuration.** To view the configuration for the I/Os, right click on the root entry, select **Append sub element** and click on **IO**. Now right click on **IO**, select **Append LED**.

In the **Base parameters** dialog enter %**QB1234** in the field **Output address.**

The **PLC Configuration** dialog will now look like this



Module id: 9
Node id: 0
Input address: %IB0
Output address: %QB1234
Diagnostic address: %MB4
Comment:

```
Hardware-Configuration
POU indices:70 (6%)
Size of used data: 39 of 1048576 bytes (0.00%)
Size of used retain data: 0 of 4096 bytes (0.00%)
0 Error(s), 0 Warning(s).
Code size: 2062 bytes
```

There is a variable called LED with the output address %QB1234 that can be used to toggle the LED on the board.

Open the source code by pressing **POUs** in the project browser. Double-click on **PLC_PRG.** Here you can see how the LED is toggled by referencing the variable **%QB1234**.

counter:=counter+1;

%QB1234:=counter MOD 2;

- Login in

  Online/Login

A dialog appears that not program is on the controller. Press **Yes** to download the program.

- Starting the demo

  Online/Run

The red led on the MPC5200 carrier board is flashing.

If the LED is not flashing please be sure that J17 on the carrier board is closed.

Press *Online/Logout* to stop the demo.

You now have successfully run your first demo application with CodeSys.

3 Getting More Involved

25 min

This chapter shows you how to connect a CAN device to the MPC5200 and program the CAN device using CoDeSys and CANOpen.

This CAN demo assumes a Beckhoff BK5150 CANOpen device connected to CAN0 of the MPC5200. You can also connect other CANOpen devices. Refer to the hardware manual of your CANOpen device for proper settings.

3.1 Configuring the demo application

Start CoDeSys if not already open.

Click on *File/Open*

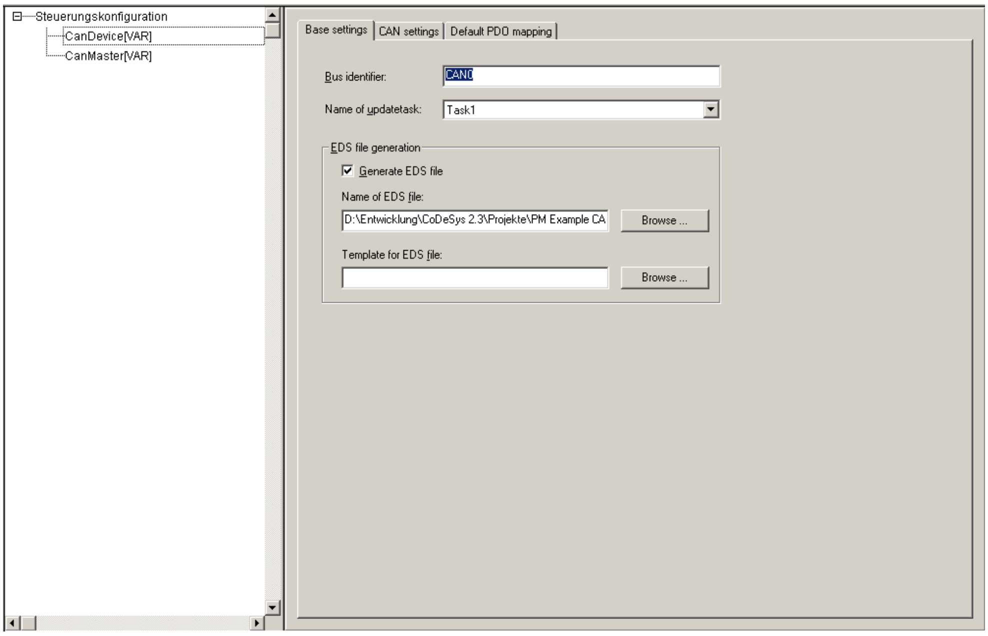
Navigate to the demo directory

C:\Phytec\SPS-Kit(MPC5200)\Demos\CAN

Click on the project file *CanDemo.pro*

Change to the tab sheet **Resources** and click on **PLC Configuration.**

Click on the entry **Can Device.**



Bus identifier: CAN0

Name of updatetask: Task1

EDS file generation

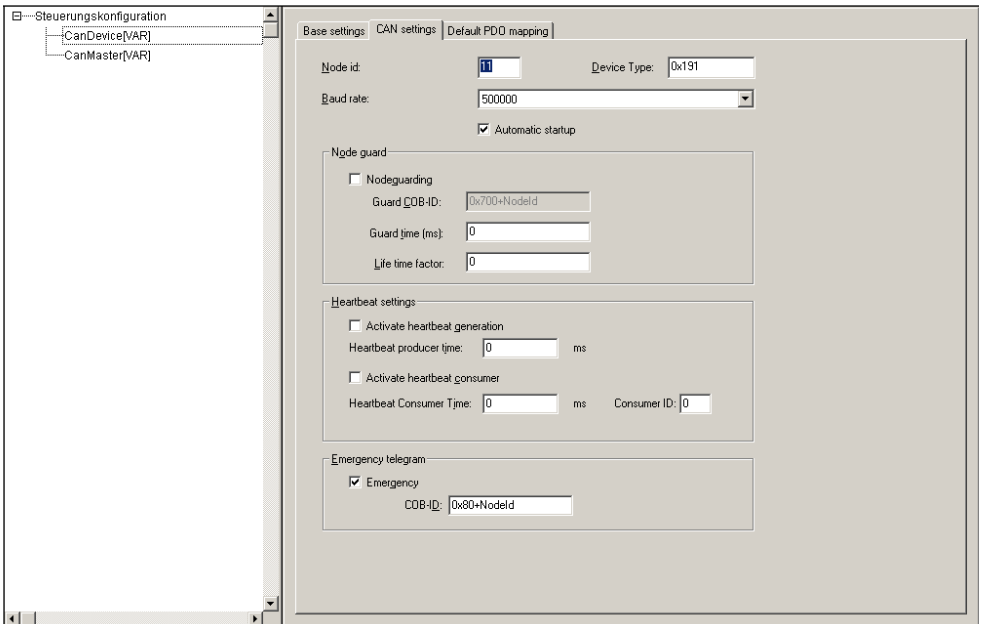
☑ Generate EDS file

Name of EDS file: D:\Entwicklung\CoDeSys 2.3\Projekte\PM Example CA

Template for EDS file:

Bus identifier is the CAN interface on the MPC5200. **CAN0** is the first interface.

Select the tab sheet **CAN settings.**



Node id: 11 Device Type: 0x191

Baud rate: 500000

☑ Automatic startup

Node guard

☐ Nodeguarding

Guard COB-ID: 0x700+NodeId

Guard time (ms): 0

Life time factor: 0

Heartbeat settings

☐ Activate heartbeat generation

Heartbeat producer time: 0 ms

☐ Activate heartbeat consumer

Heartbeat Consumer Time: 0 ms Consumer ID: 0

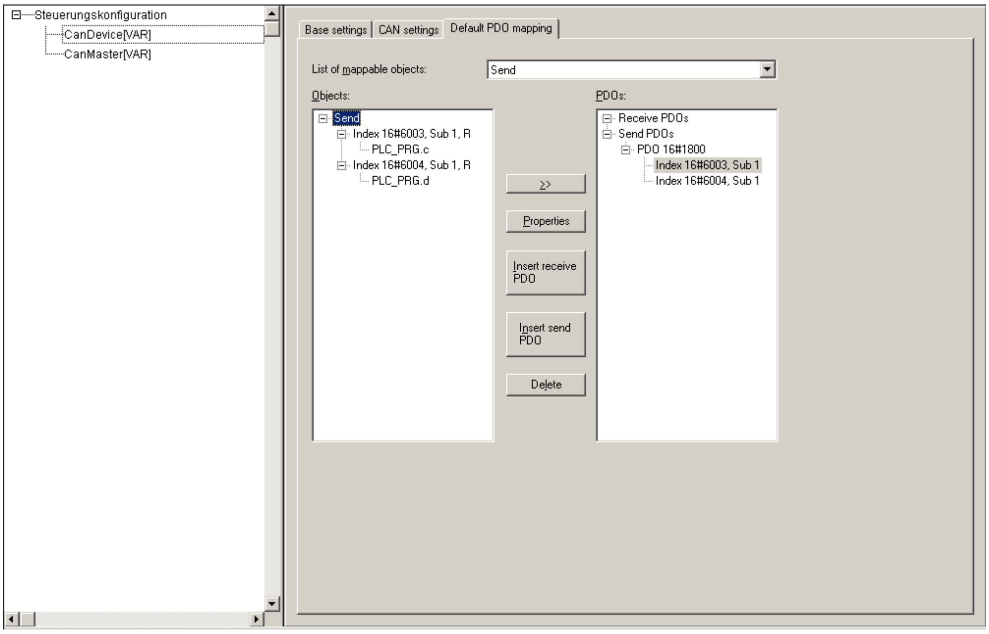
Emergency telegram

☑ Emergency

COB-ID: 0x80+NodeId

Node id is the id of the CAN device connected to the MPC5200. **Baud rate** is the baud rate with which the connection runs, here it is set to 500kb/s. You can also select **Nodeguarding** and **Emergency telegram** if it is supported.

Select the tab sheet **Default PDO mapping.**



Steuerungskonfiguration
- CanDevice[VAR]
- CanMaster[VAR]

List of mappable objects: Send

Objects:

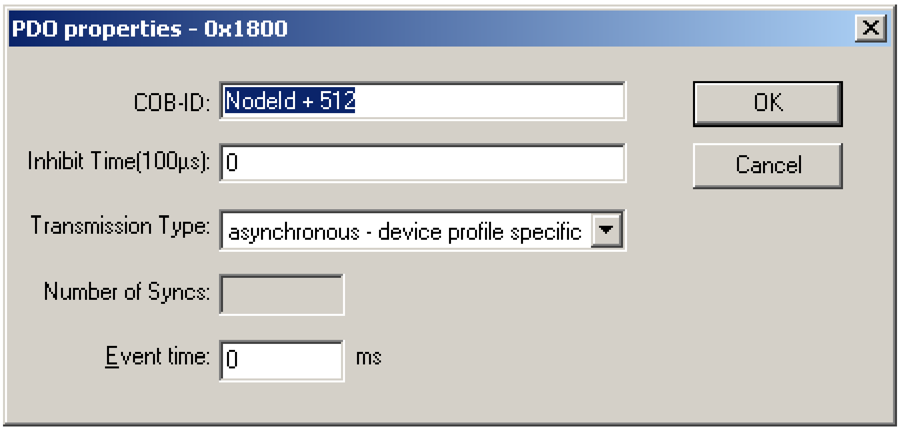
- Send
  - Index 16#6003, Sub 1, R
    - PLC_PRG.c
  - Index 16#6004, Sub 1, R
    - PLC_PRG.d

PDOs:

- Receive PDOs
- Send PDOs
  - PDO 16#1800
    - Index 16#6003, Sub 1
    - Index 16#6004, Sub 1

On the right side you can see a predefined Send PDO with two **Index** entries. These entries refer to the two Index entries in the **Objects** list on the left. Both entries are connected to a local variable in the program *PCL_PRG*. This means, that every time the variables *c* and *d* are updated a PDO is sent with the value of the two variables as data.

Click on the **PDO 16#1800** entry on the right and press **Properties.**



PDO properties - 0x1800

COB-ID: NodeId + 512

Inhibit Time(100µs): 0

Transmission Type: asynchronous - device profile specific

Number of Syncs:

Event time: 0 ms

The COB-ID is the COB that is used for sending the PDO. It consists of an offset and the NodeID configured in the CAN settings tab sheet. Change this value when working with different CAN devices that expects different COB Id´s.

- Change to the tab sheet **POUs** in the project browser. Double-click on **PCL_PRG**. The source code window for this project appears.

The program starts with a call to

```
CanOpenWriteMSG(
        wDrvNr:= 0,
        dwCanID:= 16#70B,
        ucLen:= 2,
        bRtrFrame:= TRUE,
        pPointer8byte:= 0,
        ucByte1:= 0,
        ucByte2:= 0 );
```

Note that you can also send CAN packets directly via a library call.

The parameters are:

wDrvNR: CAN interface
dwCanID: COB Id of the packet
ucLen: number of data bytes to send
bRtr: Remote frame
pPointer8byte: ???
ucByte1: first data byte
ucByte2: second data byte
…

This is used in this example to initialize the CAN device.

The program counts up the two variables *c* and *d*. So with every update cycle there will be a packet transmitted with these values.

Click on *Project\Build* to generate the program.

3.2 Starting the demo application

If the run-time system on the target isn't running type in the HyperTerminal

./ppc-plclinux_rt

to start the run-time system.

To start the CAN demo, press *Online/Login* and *Online/Run.* If the settings match your hardware devices, the CAN device will process the CAN messages.
Press *Online\Logout* to stop the demo.

You have successfully passed the Getting More Involved part of this QuickStart

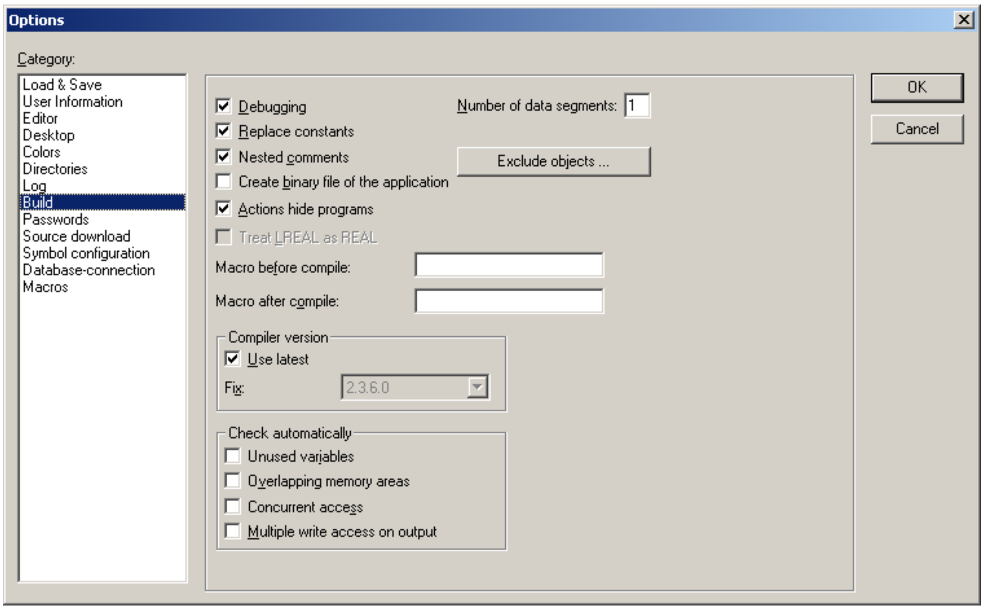
4 Debugging

30 min

In this chapter you will get a short overview over the debugging features of CoDeSys. You will learn how to start the debugger, and set breakpoint. Also we give you a short example for the CoDeSys visualization.

4.1 Starting the debugger

The demo is already configured running in debug mode. If not, you can activate the debug mode by clicking on *Project/Options*.



Options

Category:

- Load & Save
- User Information
- Editor
- Desktop
- Colors
- Directories
- Log
- Build
- Passwords
- Source download
- Symbol configuration
- Database-connection
- Macros

☑ Debugging

☑ Replace constants

☑ Nested comments

☐ Create binary file of the application

☑ Actions hide programs

☐ Treat LREAL as REAL

Number of data segments: 1

Exclude objects ...

Macro before compile:

Macro after compile:

Compiler version

☑ Use latest

Fix: 2.3.6.0

Check automatically

☐ Unused variables

☐ Overlapping memory areas

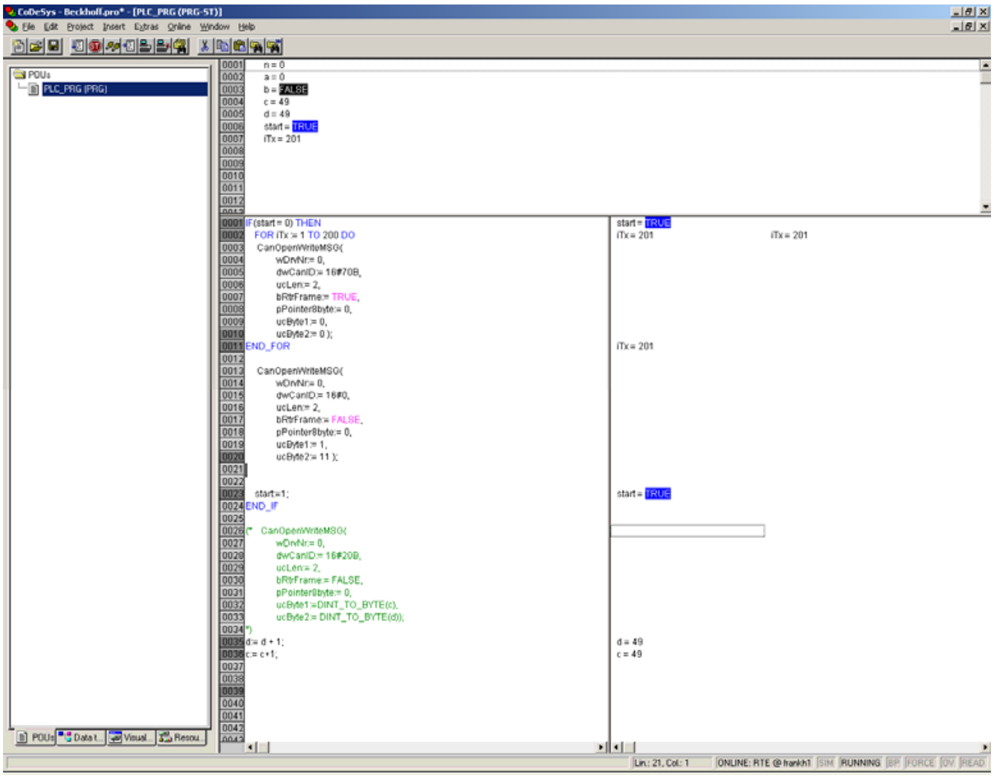
☐ Concurrent access

☐ Multiple write access on output

In the **Options** dialog click on build and check **Debugging**.

Start the run-time system on the MPC5200 if not already running.
Start HyperTerminal, login to the MPC5200 and type **./ppc-plclinux_rt.** The run-time system should start now.
Press *Online/Login*

Press *Online/Run* to start the example. You will see the variable changes on the right window while the program is running.



```
n = 0
a = 0
b = FALSE
c = 49
d = 49
start = TRUE
iTx = 201
```

```
IF (start = 0) THEN
  FOR iTx := 1 TO 200 DO
   CanOpenWriteMSG(
        wDrvNr:= 0,
        dwCanID:= 16#70B,
        ucLen:= 2,
        bRtrFrame:= TRUE,
        pPointer8byte:= 0,
        ucByte1:= 0,
        ucByte2:= 0 );
END_FOR

   CanOpenWriteMSG(
        wDrvNr:= 0,
        dwCanID:= 16#0,
        ucLen:= 2,
        bRtrFrame:= FALSE,
        pPointer8byte:= 0,
        ucByte1:= 1,
        ucByte2:= 11 );


  start:=1;
END_IF

(*  CanOpenWriteMSG(
        wDrvNr:= 0,
        dwCanID:= 16#20B,
        ucLen:= 2,
        bRtrFrame:= FALSE,
        pPointer8byte:= 0,
        ucByte1:=DINT_TO_BYTE(c),
        ucByte2:= DINT_TO_BYTE(d));
*)
d:= d + 1;
c:= c+1;
```

```
start = TRUE
iTx = 201                       iTx = 201









iTx = 201











start = TRUE











d = 49
c = 49
```

4.2 Setting a breakpoint

Set a breakpoint by clicking left of a source code line, for example in the line with the code

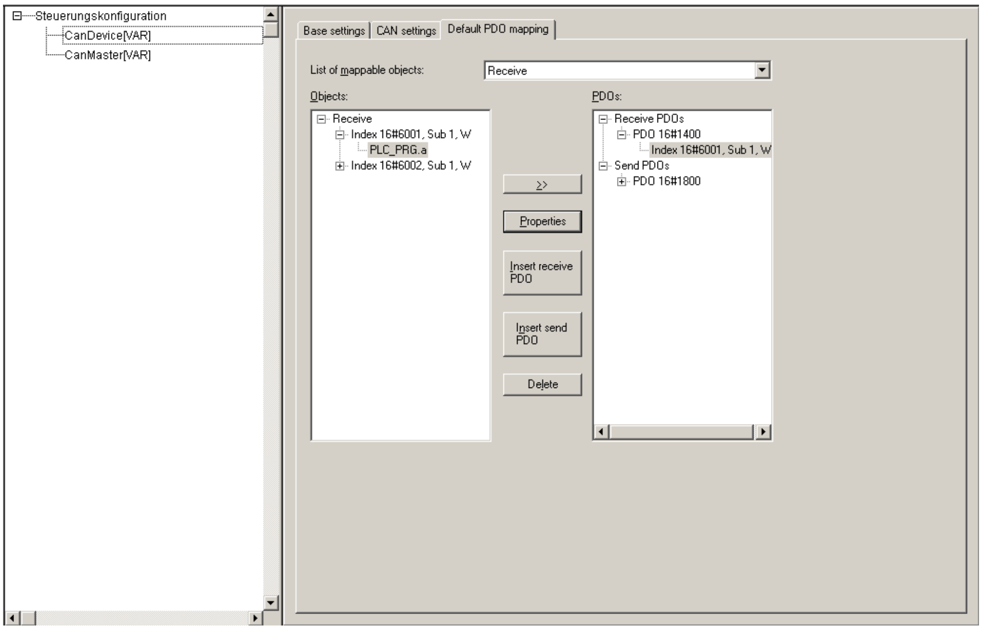
d:=d+1

The program stops. You can now execute a single command by pressing *F8.*

4.3 Visualization

With the CodeSys integrated visualization tool you can draw graphical elements and connect them with your program variables. So the changing of a variable during run-time on the target will change the graphical look of these elements.
In this chapter you will learn how to draw a graphical element and to connect it with a variable.

First we will define a Receive PDO that will trigger our visualization object.

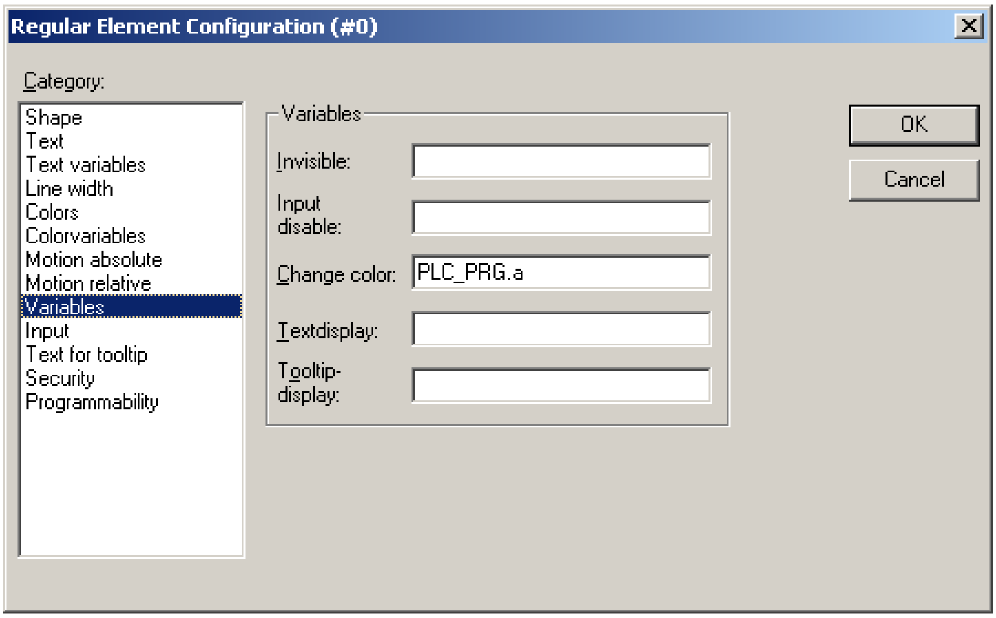


List of mappable objects: Receive

Open the **PLC Configuration** dialog. Click on **CANDevice** and then on the tab sheet **Default PDO mapping.**
In the drop down box **List of mappable objects** select **Receive**.
Click on the button **Insert Receive PDO**. In the **Objects** list open the first index. Select **PLC_PRG.a** and click on the **>>** symbol. The entry is added to the new inserted **Receive PDO**. Select the newly created index under the **Receive PDO** and click on **Properties.**

In the field **COB-ID** enter *NodeID + 512* or any other COB Id your device uses for sending.
You have now configured a receive PDO and connected it to the local variable *a* of the **PLC_PRG.**

Now we have to draw the visualization screen.
Click on the tab sheet **Visualization** in the project browser.
Select **Visualizations** with the right mouse button. In the popup select **Add Object**. In the following dialog enter a name for this visualization object, e.g. *CanVisu*.
We now draw a LED on the visualization screen. Click on the symbol for the circle ○ and draw a circle on the screen.
Click on the circle with the right mouse button and select **Configure**.
Select **Colors** and click on the button **Inside** in **Alarm Color**. Select red as the fill color.
Select **Variables** and enter PLC_PRG.a in the field **Change color**.



Category: Variables

Change color: PLC_PRG.a

Close the dialog and save the changes. Click on *Project/Rebuild all* to compile the project.

Start the run-time system on the target if not already running. Press *Online/Login* and then *Online/Start*. When you now force your device to send a POD with the specified COB-ID the program copies the data in this packet in variable *a*. If the variable is greater than zero, the LED should become red.

Please refer to the CoDeSys manual for further information about visualization.

5 Further Information

15 min

This chapter gives you some more informations on how to build your application for running stand-alone and how to write your own drivers and integrate them in the run-time system.

5.1 Running your application without the CoDeSys IDE

When your application is ready for production processes, you can run it as a stand-alone application without the need to have a PC with CoDeSys running.
For this to work, you have to create a boot project.

Open CoDeSys and the LED.pro demo if not already open.

If the run-time system on the target isn't running type in the HyperTerminal

./ppc-plclinux_rt

to start the run-time system.

Press *Online/Login*
Press *Online/Run* to start the example.

Now you have to create the bootproject.

Press *Online/Create Bootproject*.

This will automatically copy all necessary files to the target.

Press *Online/Logout.*

Press *File/Exit* to close CoDeSys.

Stop the run-time system by pressing **CTRL+C** in HyperTerminal.
Now you can start the run-time system again by typing

./ppc-plclinux_rt

The run-time sytem will now use the boot project files copied from CoDeSys at startup an run the application. The red led on the MPC5200 carrier board is flashing.

5.2 Starting the program when booting the target

In this passage you will integrate the created boot project into the start process of the target. When you have finished this part, the run-time sytem will be started automatically each time you are starting the target. With the configurations done in the previous chapter, the run-time system will load and execute the boot project

.

The run-time system is startet via the autologin tool that is part of the PHYTEC Linux distribution. You just have to configure the config file for the autologin tool and start the tool via an additional entry in the file *inittab*

The inittab file describes which processes are started at bootup and during normal operation (e.g. /etc/init.d/boot, /etc/init.d/rc, gettys...). Init distinguishes multiple runlevels, each of which can have its own set of processes that are started.

First you will have to create a start script for the autlogin tool in /etc/sysconfig.

Change the directory to /etc/sysconfig

cd /etc/sysconfig

Create and open a new file named autologin.

vi autologin

This will start the vi texteditor with an empty document named autologin.
Start the insert mode in vi by pressing *i*. Now you can insert text in the new document.

Enter the following lines:

```
USER=root
EXEC=/home/ ppc-plclinux_rt
AUTOLOGIN=yes
```

Press *ESC* to leave the insert mode. To save the file and exit vi press

:x

No you will have to add an entry in inittab
Change to the directory */etc*. Type the following command:

cd /etc

Open the file *inittab* with vi.

vi inittab

In the file, you´ll see the following line:
console::respawn:/sbin/getty –L 11520 /dev/ttyPSC2 vt100

Place the cursor at the end of this line, press i to enter insert mode of vi and press return.
In the new line enter

console::once:/sbin/autologin

This will start the autologin at system boot time.

Press *ESC* to leave the insert mode. To save the file and exit vi press

:x

Now you can reboot your system to see if the changes are working. Push the RESET button (S2) on the MPC5200 to restart the system. After rebooting, the run-time system should start and the LED starts flashing.

5.3 Writing I/O drivers

It is also possible to write your own drivers and dynamically include them in the run-time system. You can find the necessary driver templates and makefile installed on your hard disk in the folder *C:\Phytec\SPS-Kit(MPC5200)\RTS\IODrivers*. For this to work you'll need a Linux development system. Please refer to the *MPC5200 Linux Kit disc* that comes with the SPS Kit. On the disc you'll find a quickstart instructions that describes how to setup the development system.

For more information on writing own drivers in CoDeSys please refer to the CoDeSys manual.

You have successfully finished this QuickStart.

6 Summary

This QuickStart Instruction gave a general "Rapid Development Kit" description, as well as software installation advice and an example program enabling quick out-of-the box start-up of the phyCORE®-MPC5200 in conjunction with CoDeSys.

In the Getting started section you learned how to configure your host to provide a basis for working with your target platform. You installed the Rapid Development Kit software and you learned to copy and run a program on the target.

In the Getting More Involved section you got a step-by-step instruction on how to modify the example and copy output files to the phyCORE –MPC5200 using CoDeSys.

The Debugging part of this QuickStart gave you information on setting up and using the debugger with CoDeSys. You learned how to set breakpoints, watching and changing variables content and use the Visualization feature.

Document: **SPS Kit with phyCORE-MPC5200B tiny, QuickStart Instructions**
Document number: **L-688_2, November 2006**

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