Manual:

Smart RIOs PCD3.T66x

Controls Division

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0.1 Document-History

Version	Published	Changed	Remarks
pEN01	2010-11-05		Initial edition

0

0.2 Trademarks

Saia® is a registered trademark of Saia-Burgess Controls AG.
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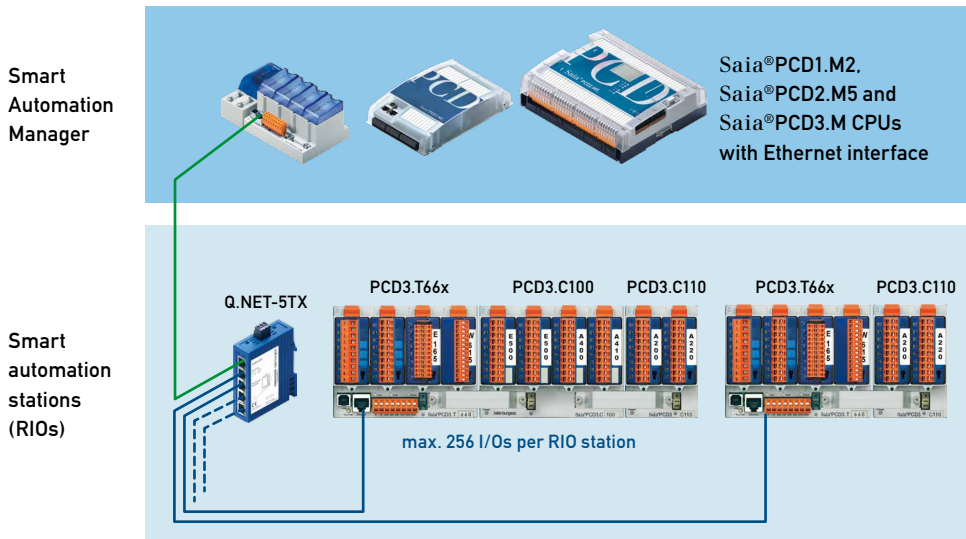
Published in Switzerland

1 Introduction

This quick start guide describes how to configure, program and commission Smart RIOs (PCD3.T665 and PCD3.T666) with PCDx.Mxxxx Smart Automation Managers.

For more details, refer to the online help in the PG5 "RIO Network Configurator"

1.1 System overview

Distributed Automation Net (DAN) system overview

Smart RIOs can be used either as simple remote I/O stations or as intelligent, distributed Smart Automation Stations capable of executing PG5 user programs.

In the latter case, central management of user programs in the Smart Automation Manager (PCDx.Mxxxx CPU) greatly simplifies the use of Smart RIOs and saves costs during engineering, commissioning and service.

1
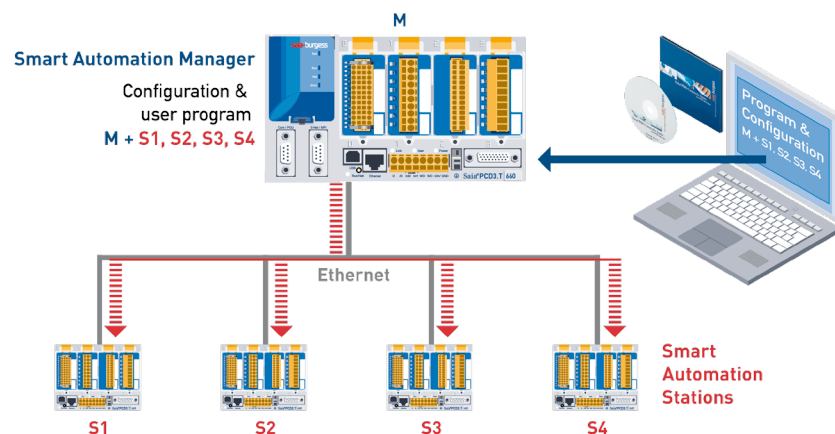
The efficient Ether-S-IO protocol is used to exchange data between Smart RIOs and the Smart Automation Manager.
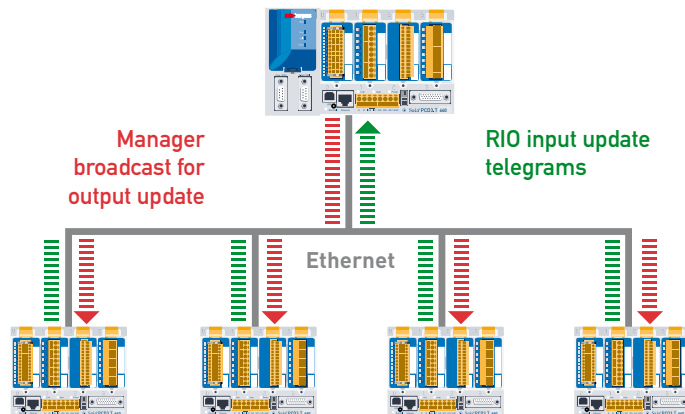
Data exchange between Manager and RIO can be configured in the PG5 "RIO Network Configurator" with just a few mouse clicks (simple steps). Once the configuration has been loaded into the Manager station, the operating system deals with data exchange autonomously, executing it as a background function. No further user programming is necessary.

1.2   System requirements

Smart RIOs:

PCD3.T665, HW version A1 or higher, FW version 1.16.01 or higher
PCD3.T666, HW version G or higher, FW version 1.16.01 or higher

Smart Automation Manager:

FW version 1.16.01 or higher for systems:

PCD1.M2120, PCD2.M5540, PCD3.M2130, PCD3.M2330, PCD3.M3330
PCD3.M5340, PCD3.M5540, PCD3.M6x40, PCD3.M5560, PCD3.M6x60

PG5 engineering tool:

PG5 $2.0.158 or higher

Technical data for the above systems can be found in annex A of this document.

1.3 Steps to configure, program and commission a Distributed Automation Network (DAN)

The following is a brief list of the necessary steps. For details, refer to subsequent chapters.

1

1. Create a new project in PG5 2.0 Project Manager

2. Create a CPU which will be used as Smart Automation Manager

3. Activate and configure the Ethernet interface of the Manager in the Device Configurator

4. Add RIO stations in the Project Manager

5. Configure RIO stations (I/O modules, media mapping, IP address, etc.) in the Device Configurator

6. Configure data exchange and any media mapping between Manager and RIO in the RIO Network Configurator

7. Create the user program in the Manager and the RIOs (if required)

8. Build and download the program in the Smart Automation Manager

9. Before the RIO station can be used, configure the IP settings with the help of the built-in Configuration web page. This can be accessed using a PC browser via USB (in this case Web-Connect is required) or Ethernet interface (default IP address: 192.168.10.100)

# 2　How to create a Distributed Automation Network (DAN)

2.1　Create a Smart RIO Network

1. Using Project Manager, add the Manager (Master) PCD to your project (Device / New).

2. Open the Manager PCD's Device Configurator. and select the device type for the manager. It must be a PCD which supports Ethernet and the Ethernet RIO (also requires latest FW version).

3. Select the Device properties and ensure S-Bus Support is Yes.

4. Select the Onboard Communications : Ethernet properties and set TCP/IP Enabled to Yes, then set the Ethernet RIO Network property to Smart RIO (PCD3.T665/ T666) as shown below.
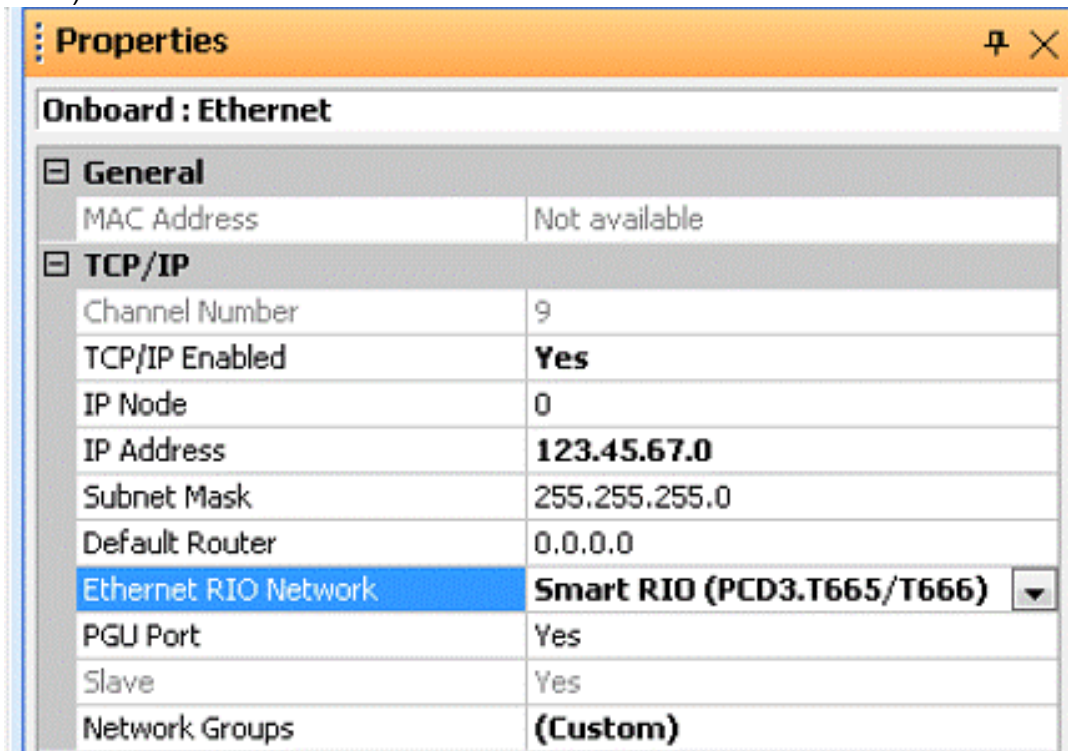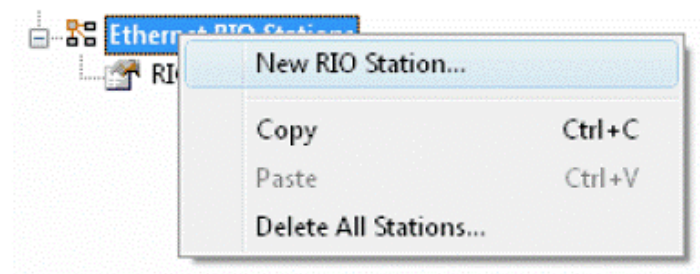

5. Close the Device Configurator and save the file.
   In Project Manager, you should now see a new Ethernet RIO Network branch in the Manager's Project Tree:
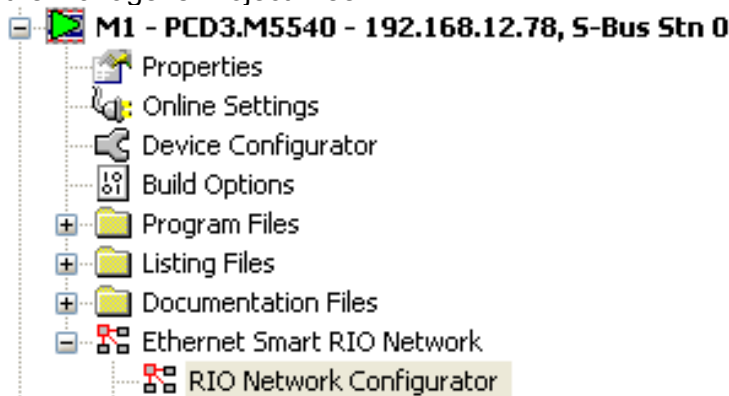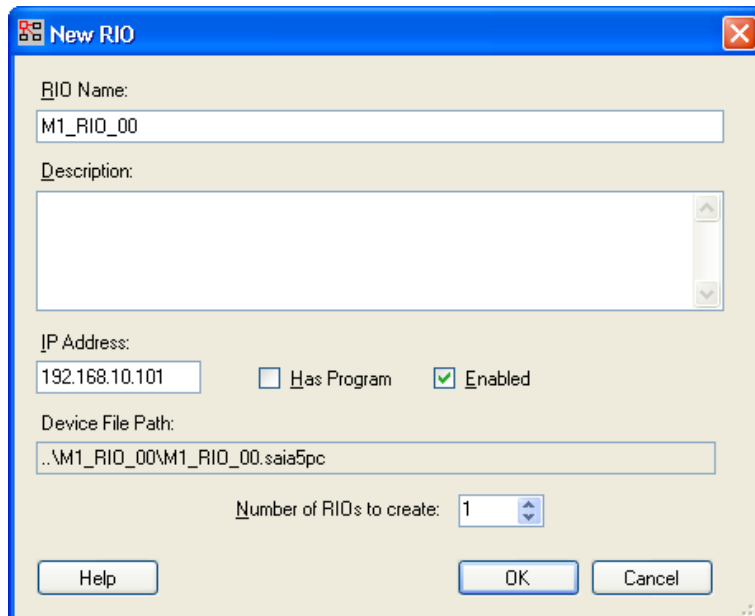
6. Now you can start adding RIOs to your network

RIOs can be created from Project Manager: Right-click on the Ethernet RIO's branch in the Project Tree and select New RIO...

2

Each RIO must have a unique name, i.e. it cannot have the same name as any other device in the project. (Copy/Paste of an existing RIO is also supported.)
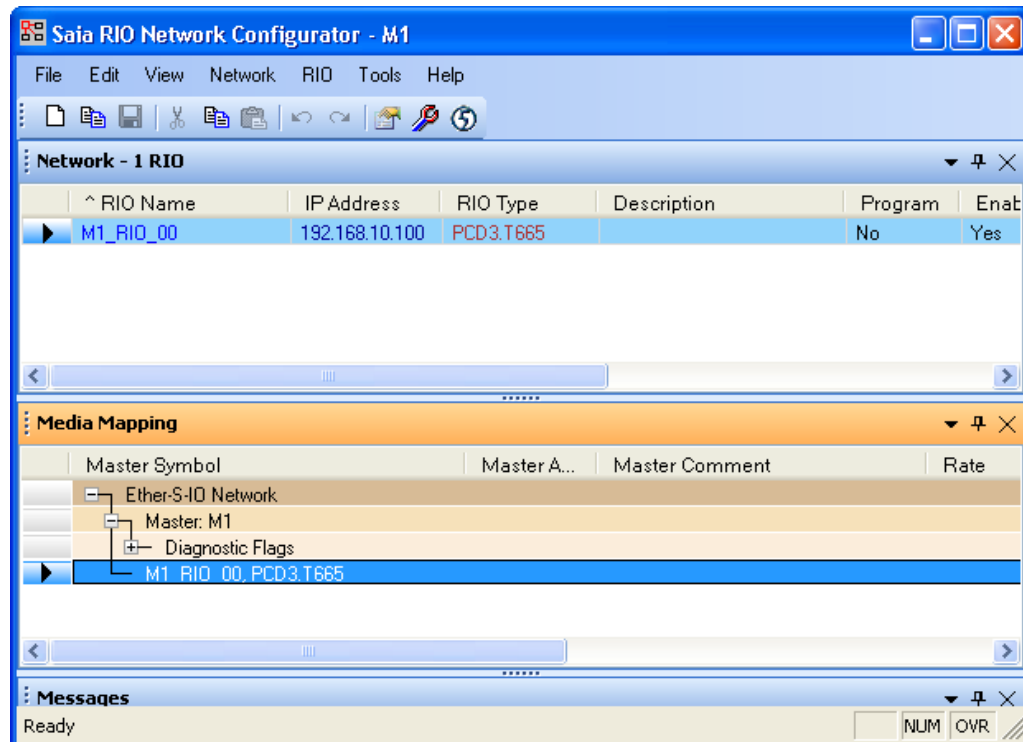
The above screen can be used to set a RIO's IP address. If the RIO has a program, the check box "Has Program" must be selected. Chapter 4 explains how to use RIOs that have a program.

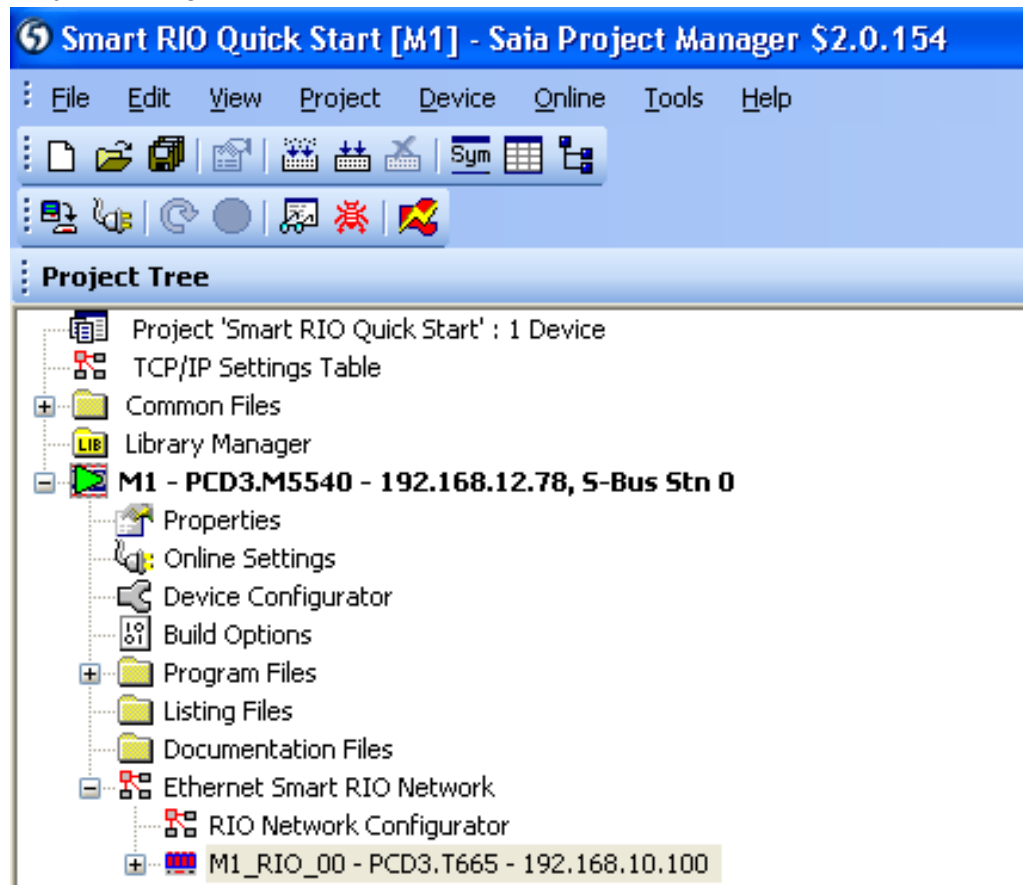Close the window by pressing the OK button.

2

The RIO that has just been added should now appear as follows in the RIO Network Configurator and the Project Manager.
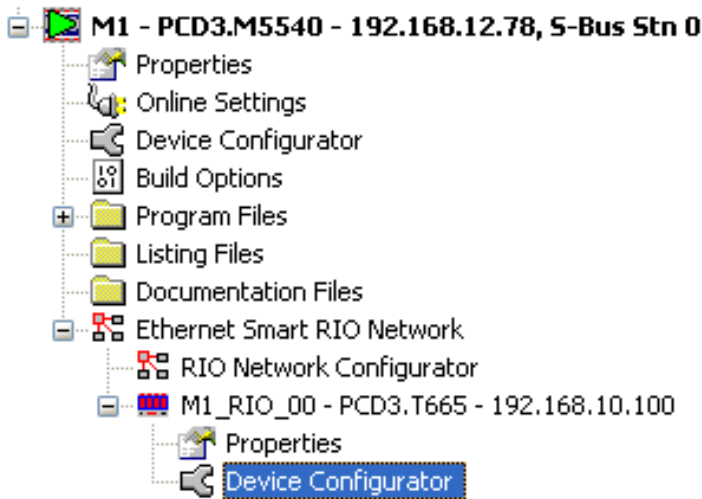
RIO Network Configurator:

Project Manager:

3 Configuration and Build of Smart RIO stations without program

3.1 Configuration in the Device Configurator

The RIO's Device Configurator can be opened either by double clicking on the RIO in the RIO Network Configurator or by opening the Device Configurator from the Project Manager.

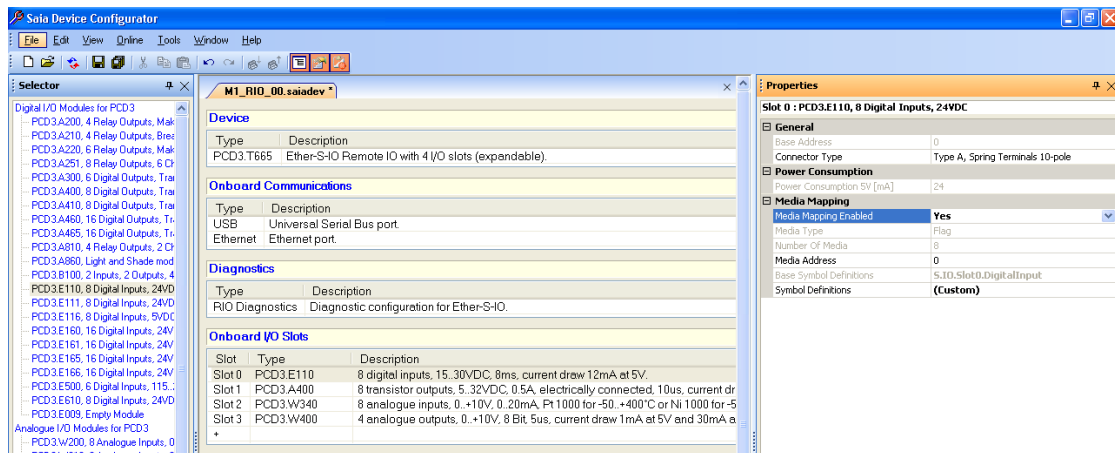
In the Device Configurator the RIO type and IP address can be changed if necessary.

The "reset output enable" option can be activated if required. For non-programmable RIOs, it is not necessary to change the other property settings.
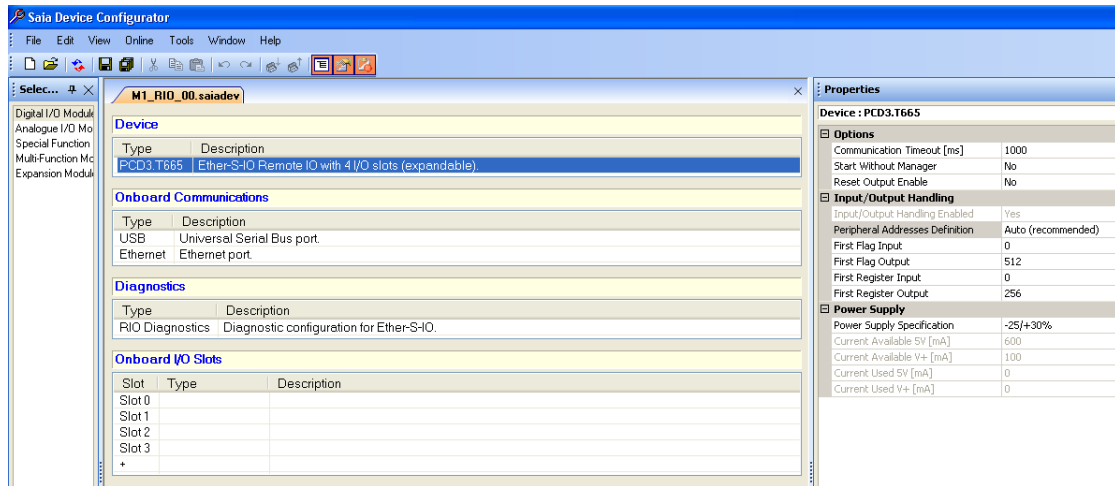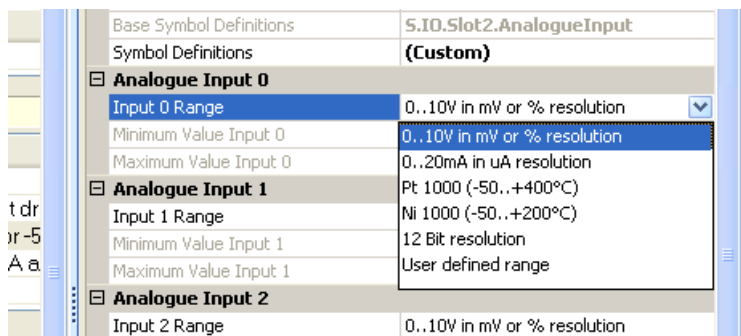
Configuring the RIO's I/O modules

I/O modules are now added from the module selector:

Ensure Media Mapping is enabled. It is not necessary to modify addresses or symbol definitions for RIOs that have no program.

The inputs/outputs of analogue modules and other special modules should be configured in the same way as for a standard PCD.

! The RIO configuration must never be downloaded from the Device Configurator into the Smart RIO station.
The I/O configuration is downloaded with the user program in the Manager Station. The Manager automatically sends the configuration to the RIOs after startup. For details refer to chapter 3.3.
A RIO's IP address can be set using the PC browser via a built-in web page in the RIO station. For details refer to chapter 5.

3.2   Media Mapping in the RIO Network Configurator

After saving the RIO's I/O module configuration from the Device Configurator, the RIO's I/O symbols used in the Manager are listed in the Media Mapping view as shown below.
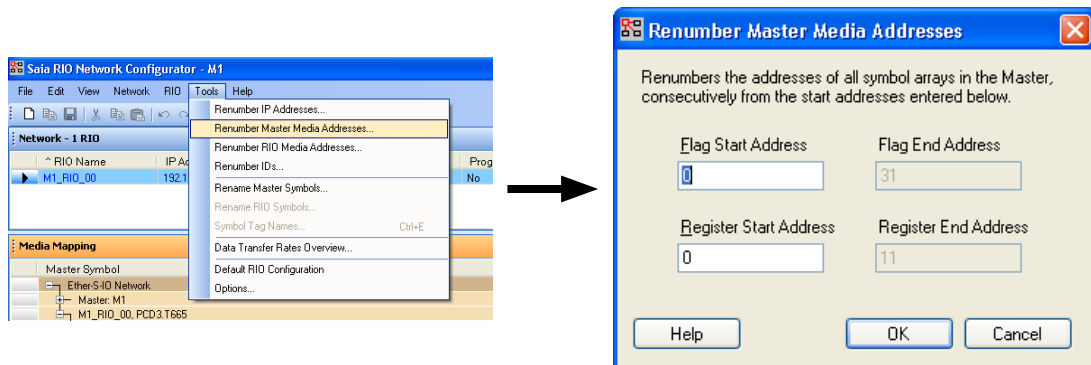
3
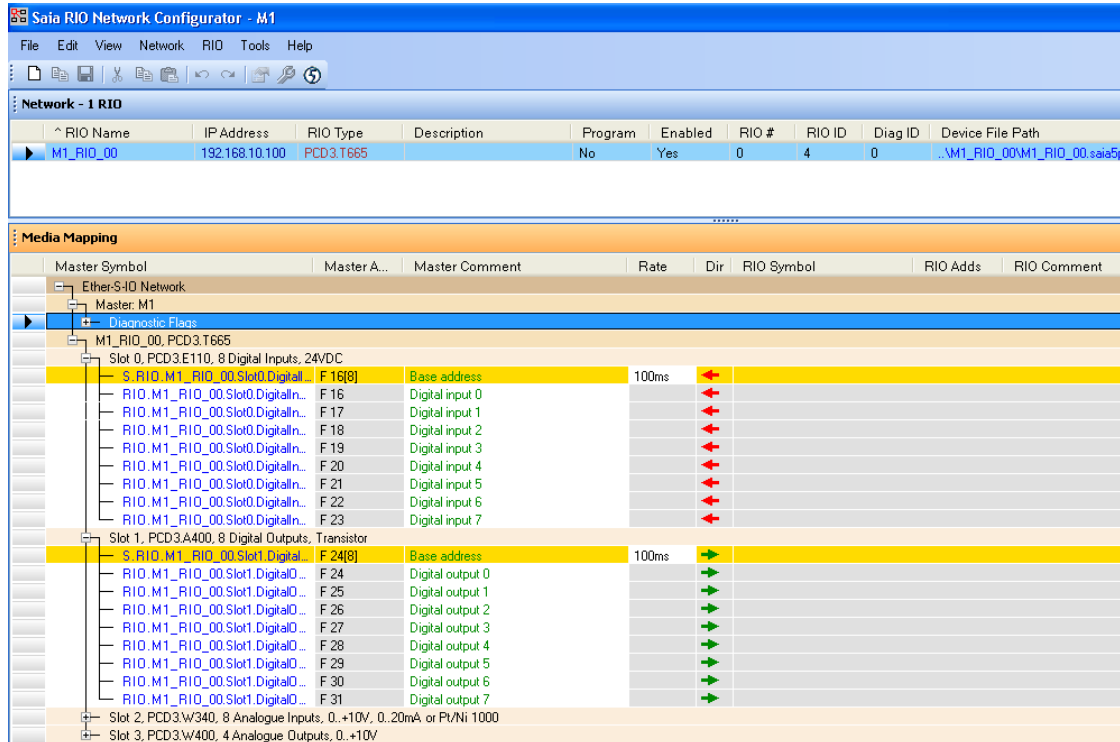
Symbols used on the Manager

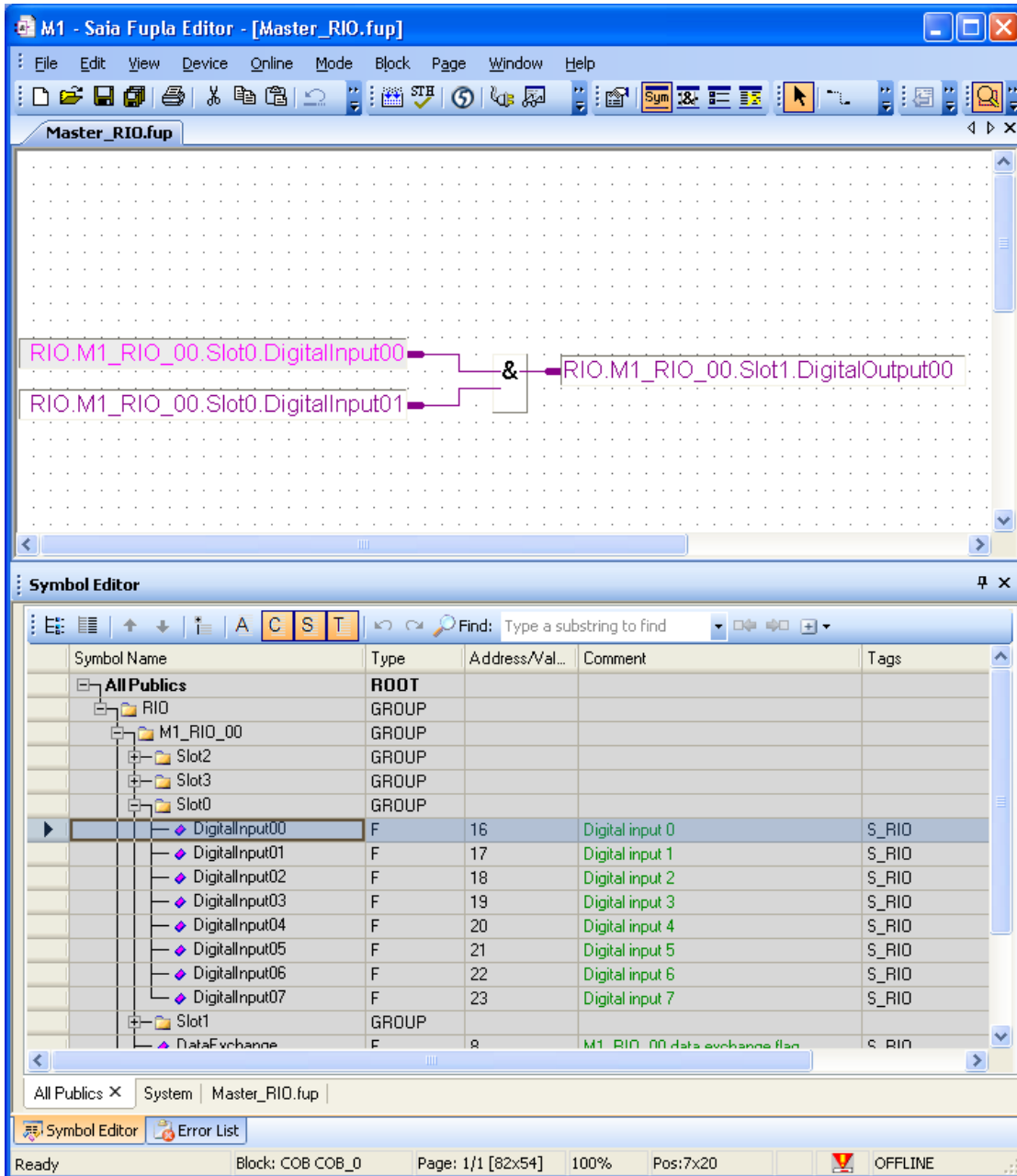Symbols used on the RIO are not present for a RIO without programm

!   The absolute addresses of Manager media are allocated by the RIO Network Configurator. Only the base address can be changed.

The symbol name can be modified if required. Allocated symbols are shown in the Symbol Editor under the "All Publics" Tab and can be used in user programs.

3.3 Build and Download of the Smart RIO project

The complete Smart RIO application is built and downloaded from the Manager station. Building and downloading the Manager station program also builds and downloads the RIO configurations and programs. It is not necessary to deal with individual RIOs.
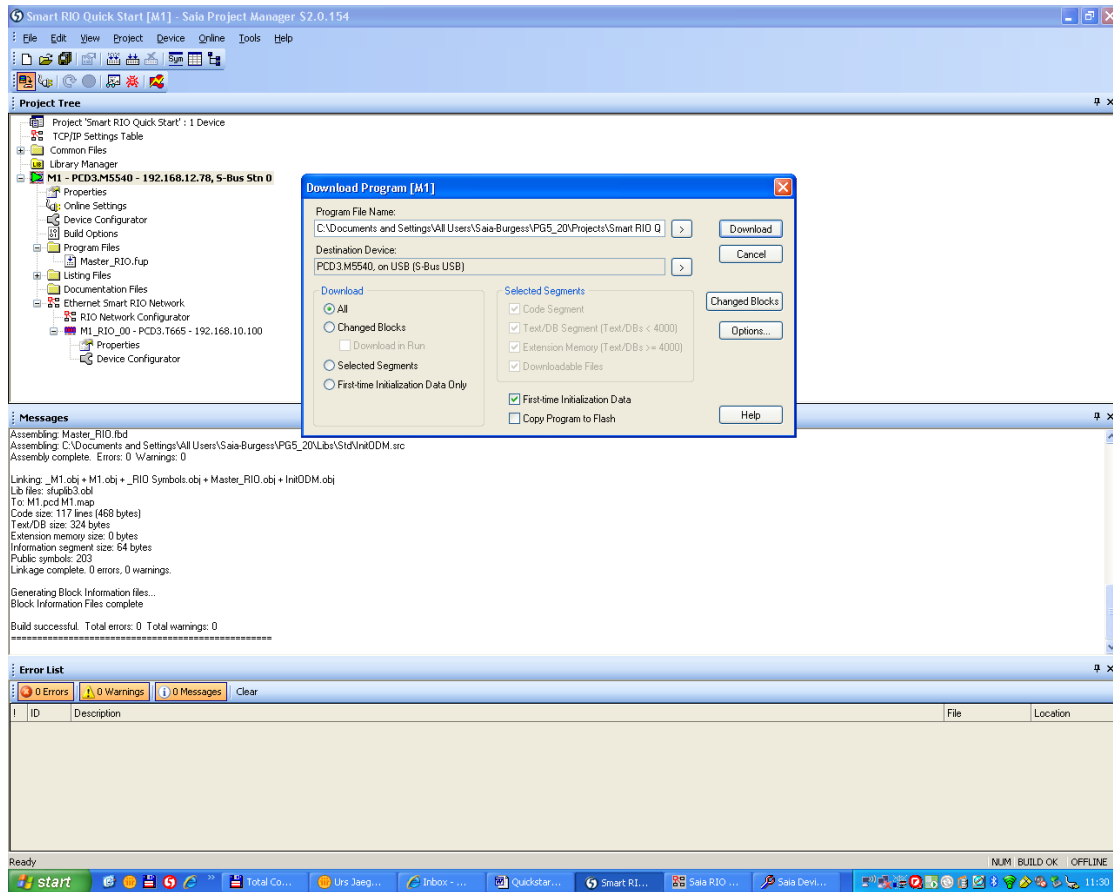
After start-up, the Manager sends the configuration to all RIOs automatically. If a RIO is disconnected or powered off and then reconnected, it will automatically receive its configuration from the Manager.

4   Configuration and Build of Smart RIOs station with a program

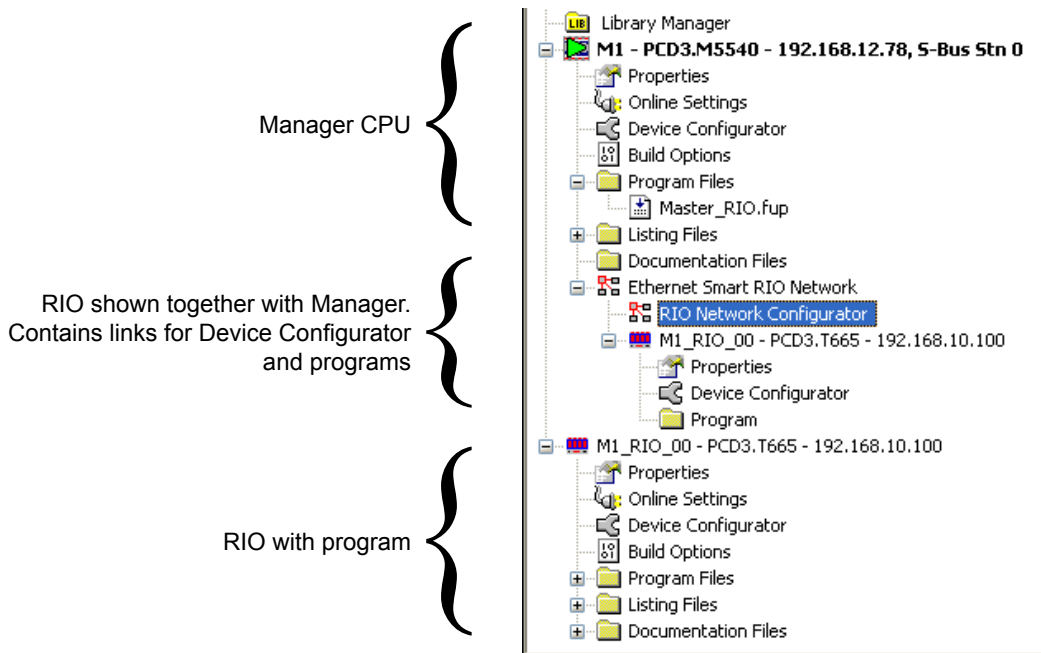To add a RIO which has a program, the check box "Has Program" must be selected as shown below.

> **!** this setting can be changed at any time by opening the RIO properties from the RIO Network Configurator.
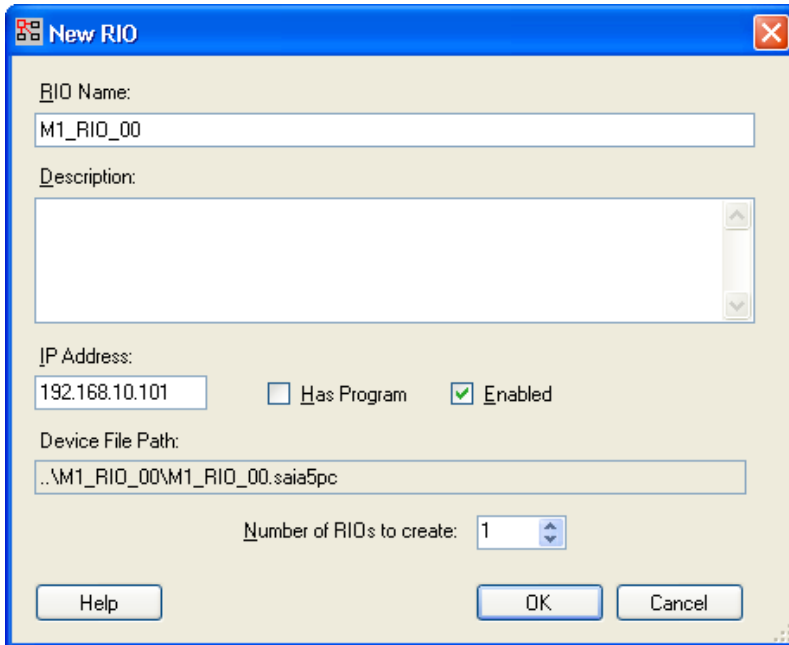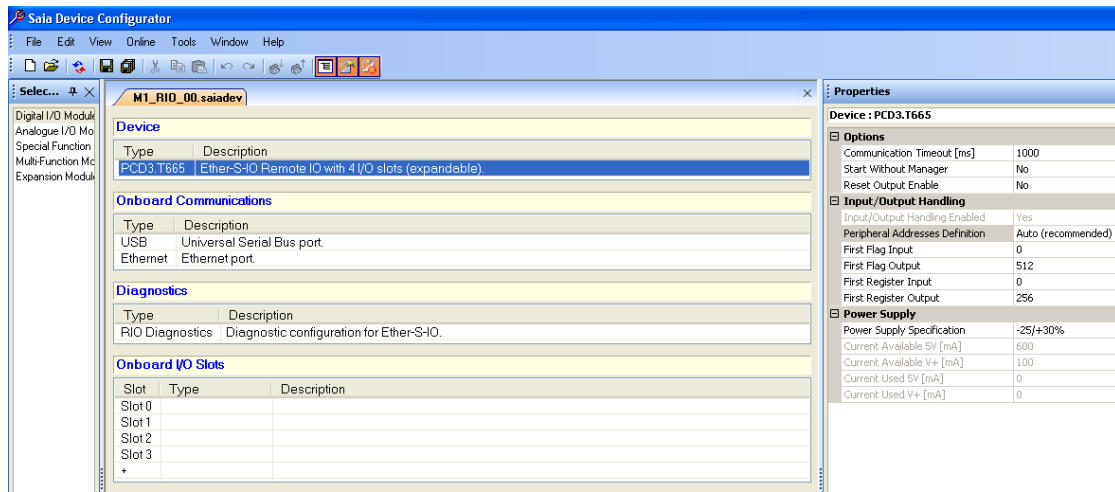

After confirming with the OK button, the RIO should appear as follows in the Project Manager:

Please note that a RIO which has a program is presented in the Project Manager as a standard CPU (the icon is different) with its related files.

4.1 Configuration in the Device Configurator

Presentation of RIO station which has a program in the Device Configurator:


4

In addition to the configuration for a RIO without program, the following settings can/ should be modified if necessary.

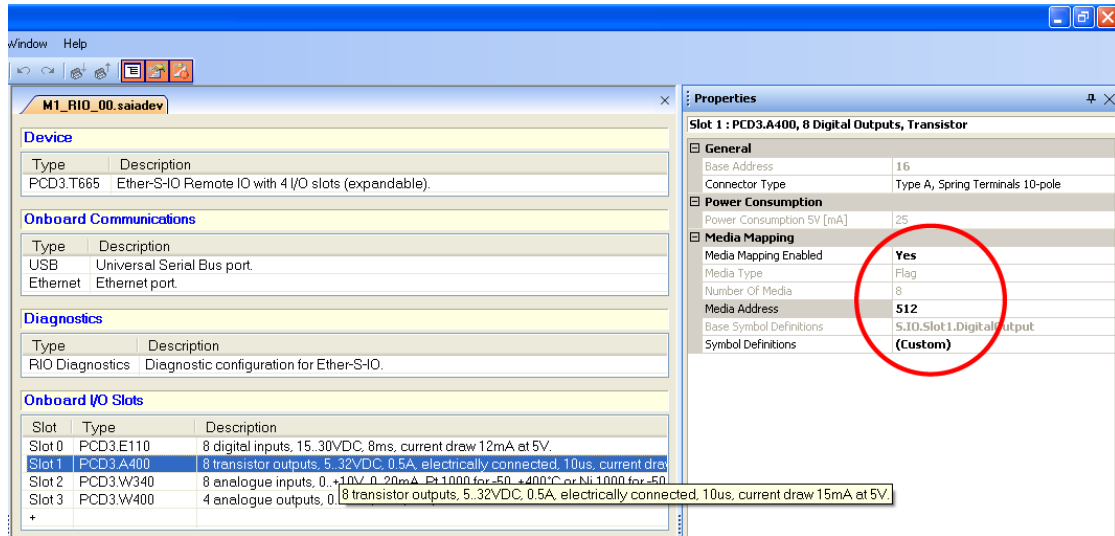Set the startup behaviour of the RIO when powering up without the Manager.
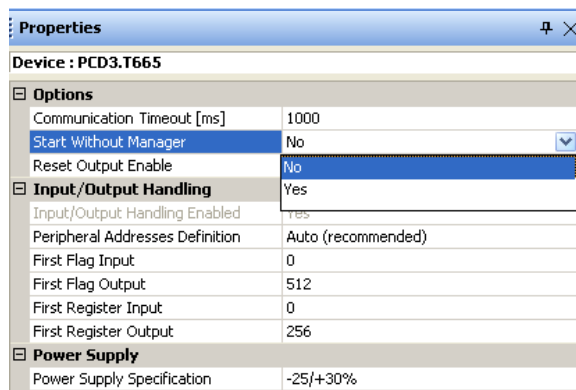
The base addresses for I/O handling must be checked and set. Make sure there are no conflicts with the RIO user program

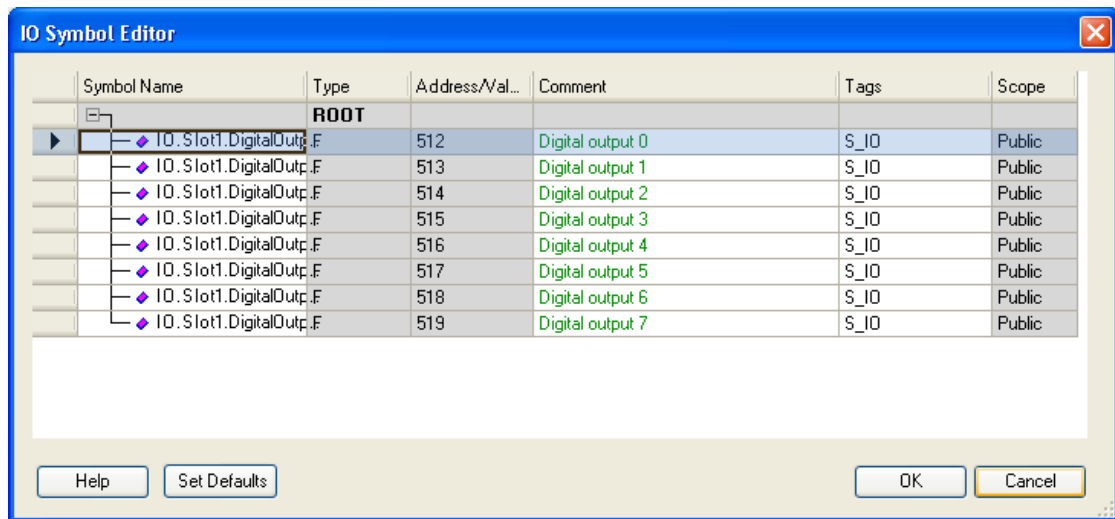The base address of RIO diagnostic elements must also be checked and set.
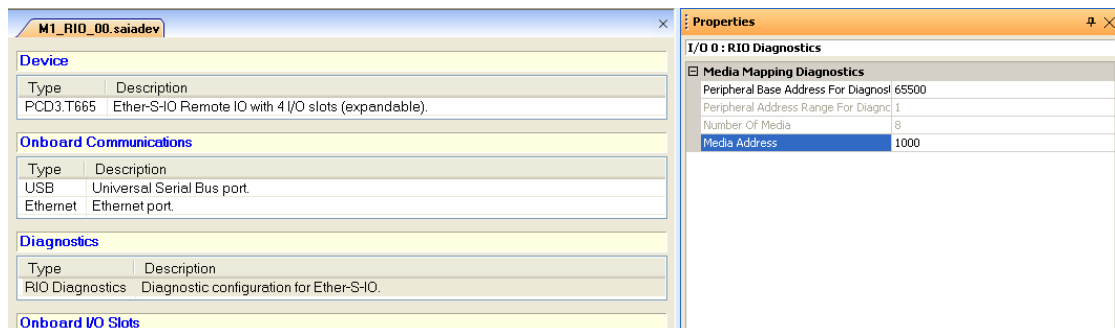
Media Mapping and addresses for I/O modules.

Automatically generated symbol names for I/Os can be used or customized here.

4

4.2 Media Mapping in the RIO Network Configurator

Presentation of a RIO with program:

Symbols used in the Manager

Symbols used in the RIO

Transfer Cycle Time

Transfer Direction

In addition to Manager symbols, those used in the RIO station are also listed.

All symbols listed will be exchanged between Manager and RIO. This means that, for example, if a RIO's outputs are controlled by a user program in the RIO, they need to be disabled from data transfer. Otherwise, they will be overwritten by the Manager.

Cycle time can be set individually for every data transfer array. In this way, time-critical signals (e.g. alarms) can be exchanged faster than non time-critical signals (e.g. temperature values).

> **!** Select appropriate cycle times. Do not set times that are unnecessarily short, since this will increase network traffic and add to the load on the Manager station. In the worst case, telegrams may even be lost. For more information refer to chapter 6. "Troubleshooting and Diagnostics"

4

How to disable data transfer

Right-click on the slot to be disabled and select "Disable Transfer".
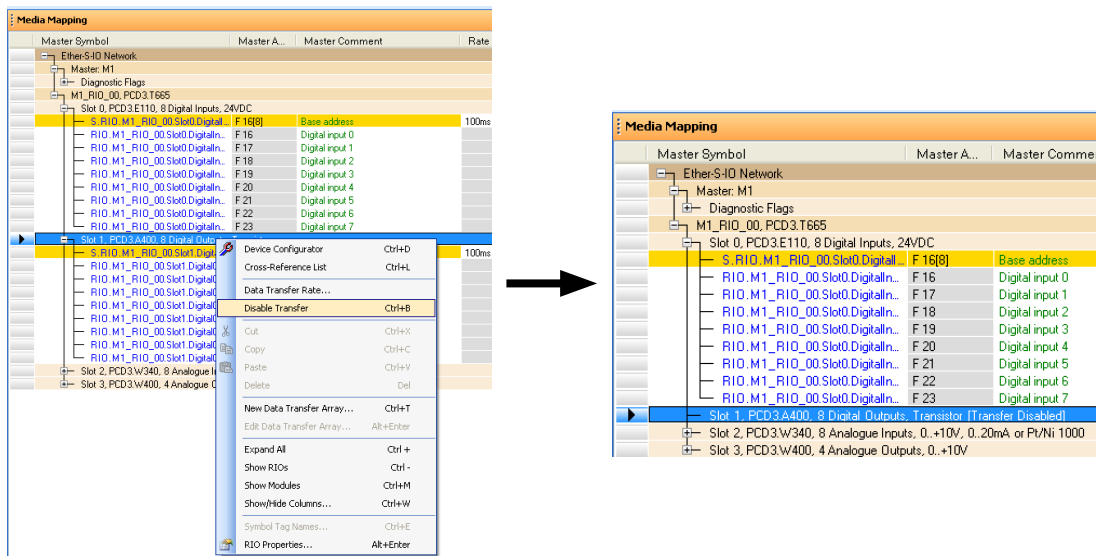
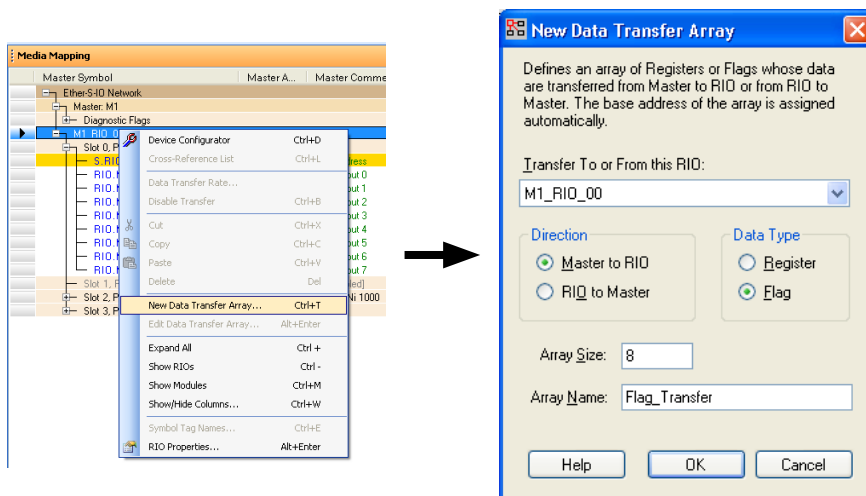After this, symbols for the slot will no longer be shown in Media Mapping.

! Only the whole I/O slot can be disabled!

How to insert Data Transfer arrays

If you wish to exchange data other than I/O signals, it is possible to insert additional Data Transfer Arrays.

Right-click on the RIO station where the data array is to be inserted and select "New Data Transfer Array".

Select the direction of transfer and the data type concerned. Then enter a name for the transfer array.

After insertion, the new array should appear as follows in the media mapping.

For Flags, only arrays with multiples of 8 flags can be transferred.

For Registers, arrays with a single Register are possible.

For every Data Transfer Array an individual transfer telegram will be generated.
It is therefore advisable to structure Data Transfer Arrays in a useful way.

4.3 Creating user programs for Smart RIOs

In the Project Manager, a user program can be created with any standard editor (Fupla, IL or Graftec)
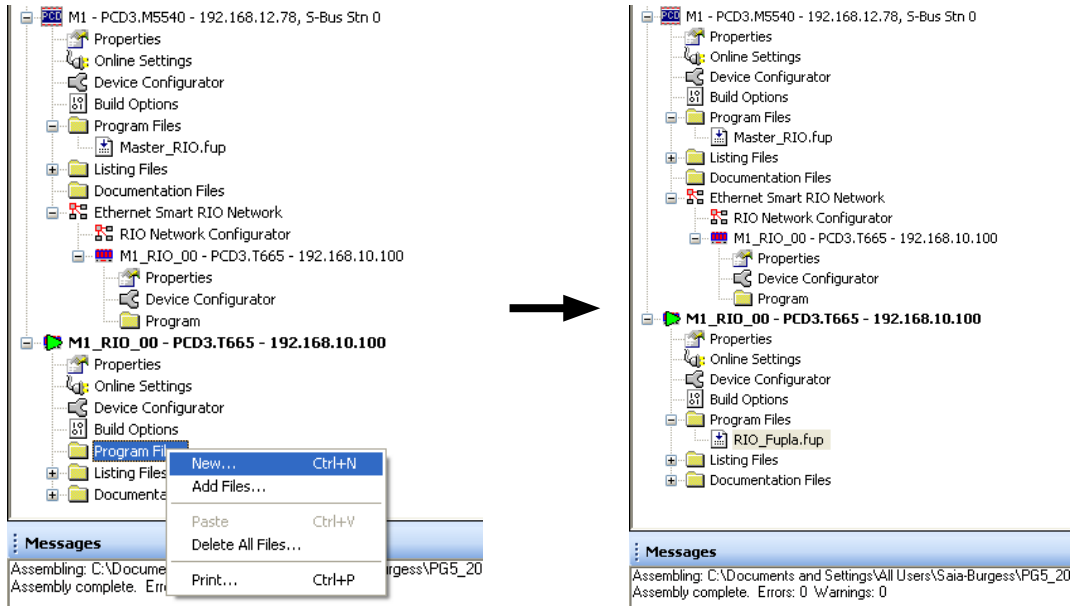
For RIOs the usable media (R, F, C, X, DB) are the same as with a standard CPU. The only limitation is in the space available for the user program (32 KB for PCD3.T665 and 128 KB for PCD3.T666).
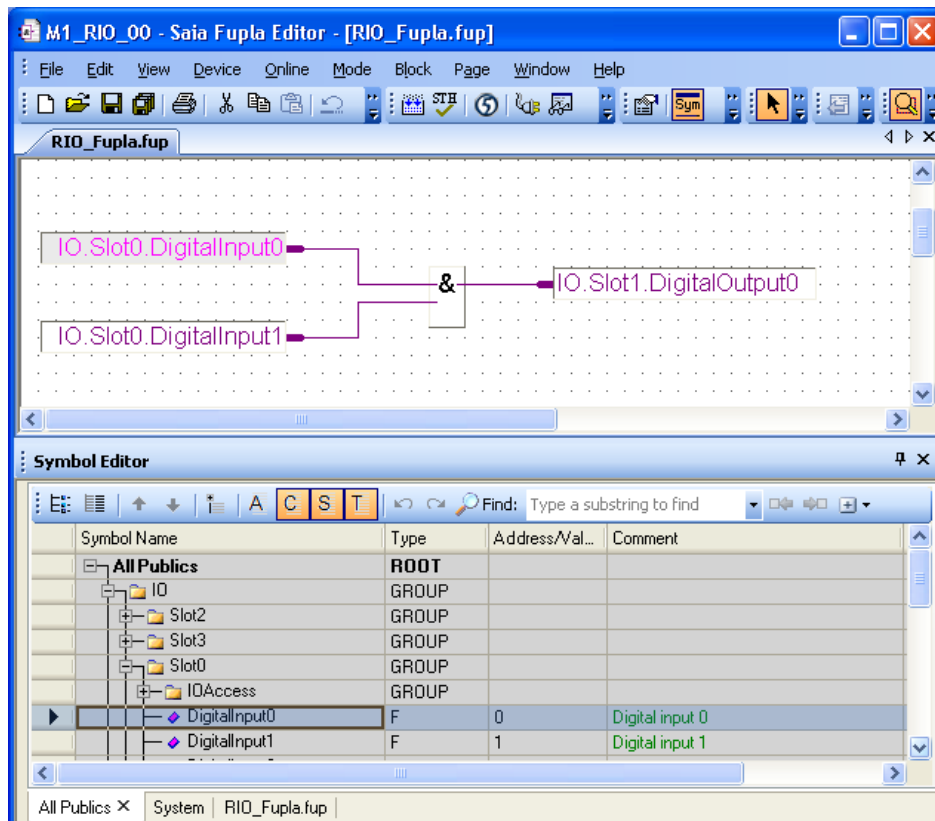
> **!** There is no battery on the RIOs → registers, flags, DBs and RAM texts are volatile!
> There is no hardware clock → date and time must be transmitted from the Manager to the RIO using a data transfer array

4.4 Build and Download of Smart RIO project with user program

The complete Smart RIO application is built and downloaded from the Manager station. Building and downloading the Manager station program also builds and downloads the RIO configurations and programs. It is not necessary to deal with individual RIOs.

For a quick check the RIO application can be built individually without the Manager project.

Select the RIO in the Project Manager:
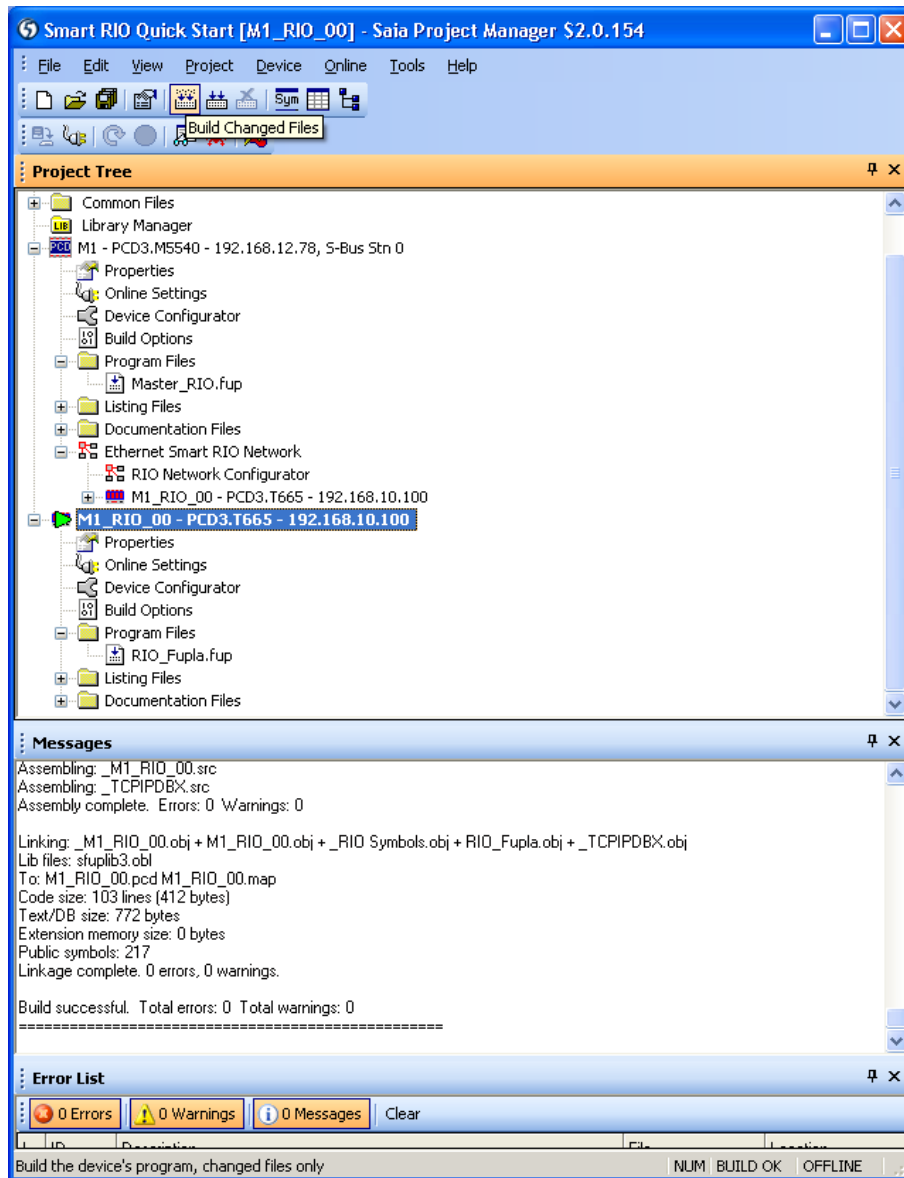
The user program cannot (must not) be downloaded in the RIO station with the PG5 downloader.

To build the complete Smart RIO Network project, the Manager station must be selected in the Project Manager and then the Build started.
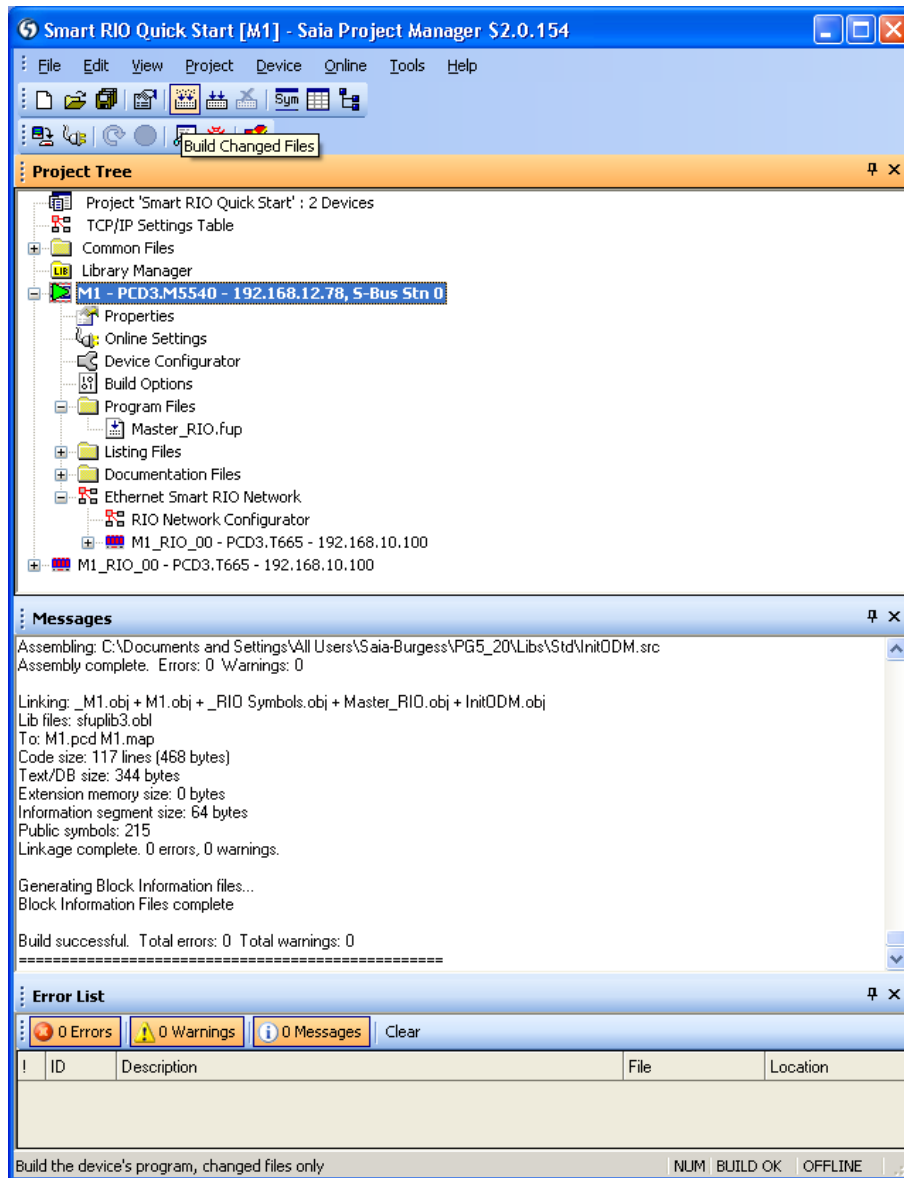
4

If there are many RIO stations, a "Rebuild All Files" may take quite a long time.

To save time, "Build Changed Files" can be used. This will also include the RIO stations.

The Smart RIO Network application is downloaded with the Manager's user program.

After start-up, the Manager sends the configuration and user programs to all RIOs automatically. If a RIO is disconnected or powered off and then reconnected, it will automatically receive its configuration and program from the Manager.

4.5 Online functions and program debugging

A RIO station supports the online connection with PG5 via USB or Ethernet.

It does not support the online functions for program download and program debugging (Run, Stop, Restart, Single Step, Breakpoints etc.).

Other online functions are supported, such as Fupla Online Mode and Watch Window. These are useful for debugging the RIO user program.
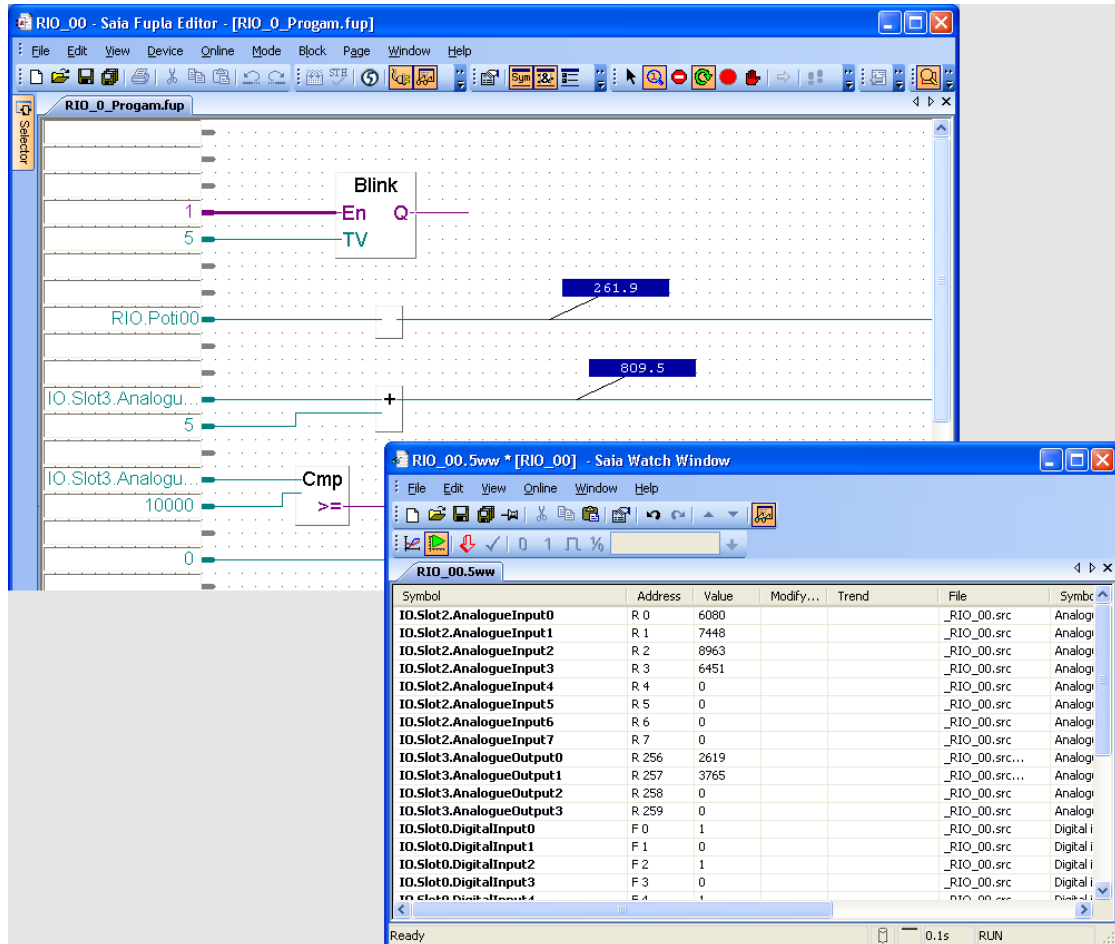
4.6 Using the RIO's built-in Web-Server

The RIO includes the standard PCD Web-Server, which supports user web pages.

These web pages can either be stored in user program memory (using Web-Builder) or on the onboard file system.

The Web-Server supports standard HTML pages or web pages created with our Web-Editor.
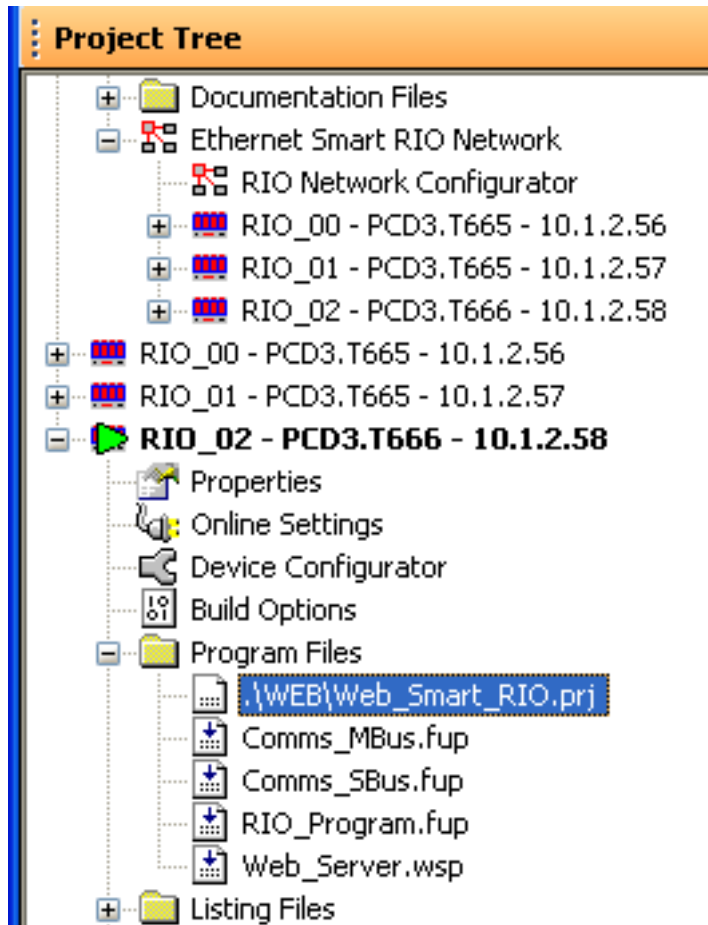
Since user program memory is limited, the IMaster.jar applet should be copied to the onboard flash file system or a Web-Connect PC.

The flash file system can be accessed via the FTP server as with a standard PCD CPU.

5   Configuration of IP settings in a RIO station

Before a RIO station can be used its IP settings must be configured.

Connect the RIO to your Ethernet network and use the factory-default IP address 192.168.10.100 (or other IP address if you have changed it). Alternatively, you can use Saia.Net Web-Connect to connect to the RIO via the S-Bus USB port.

When using the USB interface, configure a connection for USB S-Bus in Saia.Net Web-Connect.

5
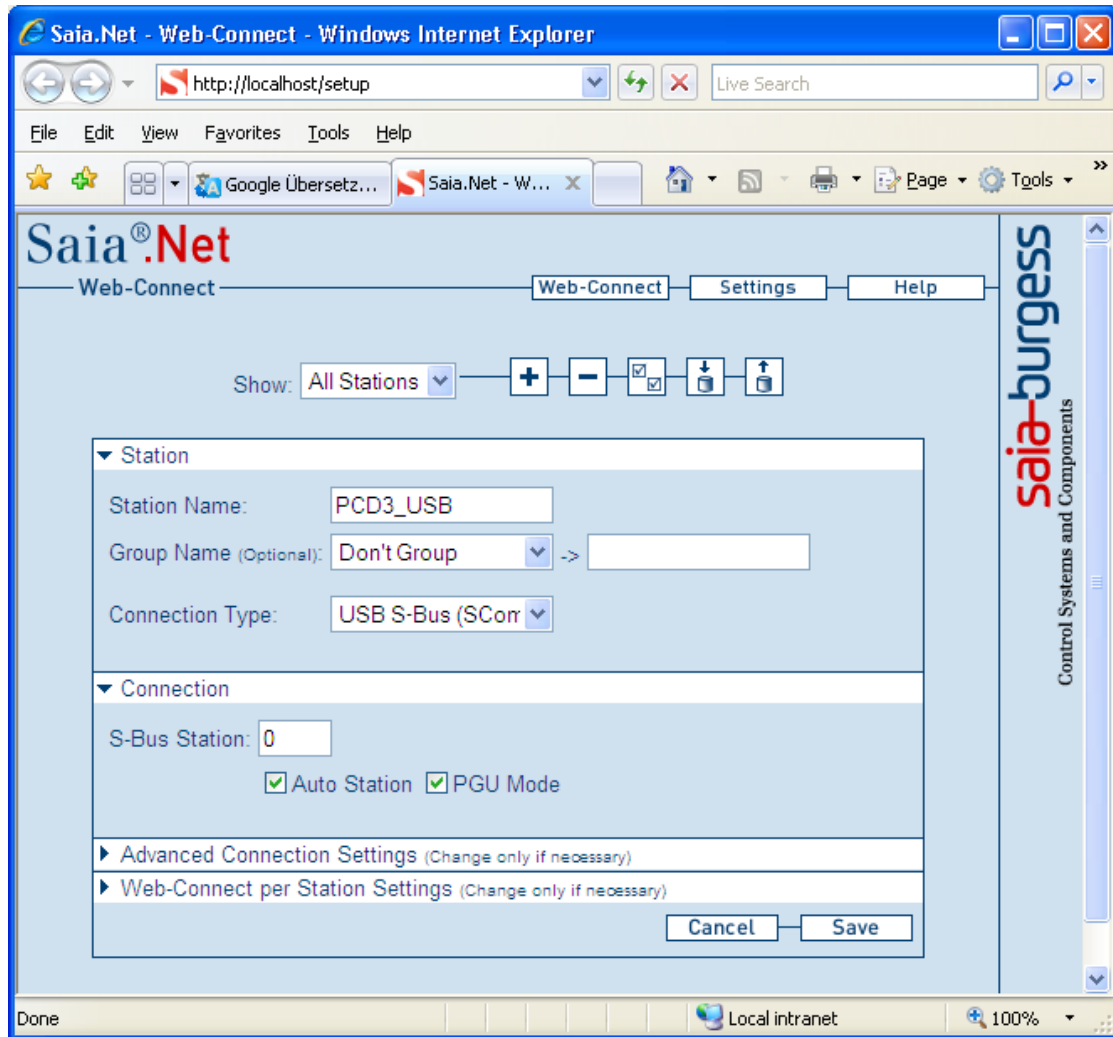
Connect to RIO station using the link to its web page:

Enter the Ethernet / S-Bus Configuration settings. For the standard Smart RIO Ether-S-IO protocol the S-Bus address is not used. It is only important if the Ether-S-Bus protocol is used (data exchange between RIOs).

> **!** If you change anything in the RIO using the web page then must make the same changes to the RIO with the Device Configurator or the RIO Network Configurator, so that the master will use the correct addresses.

6 Troubleshooting and diagnostics

6.1 Diagnostic Flags

The RIO Manager PCD contains Diagnostic Flags for the RIO network and for each individual RIO. It also contains a telegram lost counter for each RIO. RIOs with programs also contains Diagnostic Flags and a telegram lost counter which indicates the Manager's status.

Manager's Diagnostic Flags

The first 8 flags are for the Manager (but only the first three are currently used). Flags from 8 onwards are for each RIO. When adding RIOs with the RIO Configurator, it will increase the array size in multiples of 8 if it needs more Flags. This may cause an overlap with Flag addresses used by the RIO's I/Os, which can be corrected by using the Renumber Master Media Addresses command.

6

The first two Flags are for the Manager, and have these symbol names:

RIO.GlobalDiagnostic	1=The diagnostic flag of one or more RIOs is set
RIO.TelegramLost	1=One or more telegrams have been lost
RIO.SendError	1=Transmission failed

From offset 8, there are two Flags for each RIO, which have symbol names like this:

RIO.<rio_name>.DataExchange	1=Data exchange failed, 0=OK
RIO.<rio_name>.Diagnostic	1=RIO has error, 0=OK

	Master Symbol	Master A...	Master Comment
	Media Mapping		
	Ether-S-IO Network		
	Master: Device1		
▶	Diagnostic Flags		
	S.RIO.DiagFlagBase	F 100 [16]	Base address of RIO Diagnostic Flags
	S.RIO.GlobalDiagnostic	F 100	Another RIO Diagnostic Flag is set
	S.RIO.TelegramLost	F 101	One or more telegrams lost
	S.RIO.SendError	F 102	Transmit failed
		F 103	(not used)
		F 104	(not used)
		F 105	(not used)
		F 106	(not used)
		F 107	(not used)
	S.RIO.RIO_00.DataExchange	F 108	RIO_00 data exchange Flag
	S.RIO.RIO_00.Diagnostic	F 109	RIO_00 Diagnostic Flag
	S.RIO.RIO_01.DataExchange	F 110	RIO_01 data exchange Flag
	S.RIO.RIO_01.Diagnostic	F 111	RIO_01 Diagnostic Flag
	S.RIO.RIO_02.DataExchange	F 112	RIO_02 data exchange Flag
	S.RIO.RIO_02.Diagnostic	F 113	RIO_02 Diagnostic Flag
		F 114	(not used)
		F 115	(not used)
	RIO_00, PCD3.T665		

RIO Diagnostic Flags and Telegram Lost Counter

For each programmed RIO, 8 diagnostic flags have also been reserved, but only the first two are currently used.
They have been assigned the following system symbols, which can be used in the RIO program:

RIO.GlobalDiagnostic   1 = The Manager is not responding

RIO.TelegramLost   1 = One or more telegrams have been lost

6.2   Built-in web page

If problems occur, the system and status information provided on the built-in web pages can be used for trouble-shooting.

6.3   LED display

The LED on the front indicates the status of the RIO.
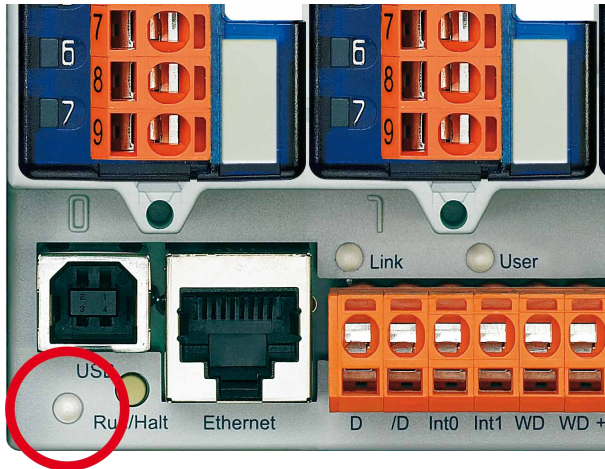
RIO status	LED status/colour
WAIT FOR FIRST CONFIG	RED
CONFIG AND PROG RECEIVED	
(no data exchange)	RED blinking if no Program RUN
GREEN blinking if Program RUN	
DATA EXCHANGE	GREEN
INVALIDE CONFIG	RED/GREEN blinking

A Appendix

A.1 Icons

i	In manuals, this symbol refers the reader to further information in this manual or other manuals or technical information documents. As a rule there is no direct link to such documents.
	This symbol warns the reader of the risk to components from electrostatic discharges caused by touch. Recommendation : at least touch the Minus of the system (cabinet of PGU connector) before coming in contact with the electronic parts. Better is to use a grounding wrist strap with its cable attached to the Minus of the system.
!	This sign accompanies instructions that must always be followed.
Classic	Explanations beside this sign are valid only for the Saia-Burgess PCD Classic series
xx7	Explanations beside this sign are valid only for the Saia-Burgess PCD xx7 series.

A

A.2   Technical Data

Characteristic	PCD3.T660	PCD3.T665	PCD3.T666
Number of In/Outputs	64 in base unit, expandable up to 256 1)		
I/O module slots	4 in base unit, expandable up to 16 1)		
Supported I/O modules	PCD3.Exxx, .Axxx, .Bxxx, .Wxxx		
Max. number of RIO stations	254	128	
Protocol for data exchange	Ether-S-Bus	Ether-S-IO	
Ethernet interface	10/100MBit/s		
Factory default IP configuration	IP address Subnet mask Default gateway	192.168.10.100 255.255.255.0 0.0.0.0	
USB interface for configuration and diagnostics	Yes		
User program memory size	-	32kB	128kB
Web-Server for configuration and diagnostics	Yes		
Web-Server for user web pages	-	Yes	
Onboard file system for web pages and data	No	256kB	512kB
Onboard interrupt inputs	No	Yes	
Onboard RS485 interface	No	Yes	
Special I/O modules	No	PCD3.H1xx	PCD3.F1xx M-Bus PCD3.H1xx
Watchdog	No		
Real-time clock	No		
Software clock (not battery protected)	No	Yes	
Battery onboard	No		
Automation Manager (Master Station)			
Max. 16 RIO stations	PCD3.M2130, PCD3.M2330		
Max. 32 RIO stations	PCD1.M2120, PCD3.M3330		
Max. 64 RIO stations	PCD2.M5540, PCD3.M5340, PCD3.M5540, PCD3.M6x40		
Max. 128 RIO stations	PCD3.M5560, PCD3.M6360, PCD3.M6560		

1)   with PCD3.Cxxx I/O extension modules

A

Ordering information

Type	Description
PCD3.T660	RIO, Ether-S-Bus data exchange, not programmable
PCD3.T665	Smart-RIO, Ether-S-IO data exchange, programmable 32 kB
PCD3.T666	Smart-RIO, Ether-S-IO data exchange, programmable 128 kB, serial interfaces

A.3   Address of Saia-Burgess Controls AG

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