Application manual

PROFIBUS Anybus Device

Application manual

PROFIBUS Anybus Device

RobotWare 6.14

Document ID: 3HAC050965-001

Revision: D

Table of contents

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Overview of this manual

About this manual

This manual describes the option PROFIBUS Anybus Device and contains instructions for the configuration.

Usage

This manual should be used during installation and configuration of the PROFIBUS anybus device.

Who should read this manual?

This manual is intended for

- Personnel that are responsible for installations and configurations of industrial network hardware/software
- Personnel that make the configurations of the I/O system
- System integrators

Prerequisites

The reader should have the required knowledge of

- Mechanical installation work
- Electrical installation work

References

ABB documents

Reference	Document ID
Operating manual - RobotStudio	*3HAC032104-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Product manual - IRC5	*3HAC047136-001*
Technical reference manual - System parameters	*3HAC050948-001*
Product specification - Controller IRC5	*3HAC047400-001*
Application manual - PROFIBUS Controller	*3HAC050966-001*

Other references

Reference	Description
International standard IEC 61158 Type 3 International standard IEC 61784	The PROFIBUS industrial network standard is described in the international standards.
PROFIBUS Technical Guideline	Installation Guideline for PROFIBUS-DP/FMS (Version 1.0, September 1998).
www.profibus.com	The web site of PROFIBUS International.

Revisions

Revision	Description
-	Released with RobotWare 6.0.

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Revision	Description
A	Released with RobotWare 6.01. • Minor corrections. • System parameter *Connection* removed from *Industrial Network*.
B	Released with RobotWare 6.02. • Updated the path to the template files, see *Template I/O configuration file on page 26*.
C	Released with RobotWare 6.10.01. • Cfg name removed from entire manual.
D	Released with RobotWare 6.14. • Path to GSD file corrected in *Information about the anybus device on page 25*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

> 💡 **Tip**
>
> All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.
- Examples of how to use the application.

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Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

Safety

Safety regulations

Before beginning mechanical and/or electrical installations, ensure you are familiar with the safety information in the product manuals for the robot.

The integrator of the robot system is responsible for the safety of the robot system.

Network security

Network security

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to provide, and continuously ensure, a secure connection between the product and to your network or any other network (as the case may be).

You shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its entities are not liable for damage and/or loss related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Terminology

Terms

Term	Explanation
Controller	The *PROFIBUS master* is referred to as *PROFIBUS controller*.
Device	In this manual the term *device* is used to describe a physical I/O unit.
External device or controller	The term *external* is used to describe a master or slave on the PROFIBUS industrial network connected to the IRC5 controller.
GSD file	A GSD file contains information about a PROFIBUS device.
Internal device	The term *internal* is used to describe when the IRC5 controller acts as slave on the PROFIBUS industrial network.
Internal Anybus Device	A built-in device in the robot controller.
LAN	Port/connector for Local Area Network.
Master	See term *Controller*
Slave	See term *Device*
WAN	Port/connector for Wide Area Network.

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1 Introduction

1.1 What is PROFIBUS?

General

PROFIBUS is a vendor independent open industrial network standard for a wide range of applications, particularly in the fields of factory and process automation. It is maintained, updated and marketed by PROFIBUS International.

PROFIBUS is suitable for high-speed time critical applications as well as for complex communication tasks.

Standardization

The PROFIBUS communication is specified in the international standard *IEC 61158 Type 3*, which includes the entire range of PROFIBUS versions. All PROFIBUS devices should be certified by the PROFIBUS User Organization (PNO) to ensure interoperability and conformance.

Communication protocols

DP (Decentralized Periphery) is the simple, fast, cyclic and deterministic communication protocol between a network controller and the assigned devices. The forerunner of DP was FMS (Fieldbus Message Specification), which is obsolete today.

The original version of DP, DP-V0, provides cyclic data exchange and diagnostics. DP-V1 extends DP-V0 with acyclic data exchange and DP-V2 offers direct device-to-device data exchange and clock synchronization. These versions are all backward compatible.

The following table specifies a number of PROFIBUS-DP data.

Network type	Multi-Controller/Device communication system
Installation	Linear network, terminated at both ends. Shielded twisted pair cables. 9-pin D-sub or M12 connectors.
Speed	9.6 Kbps - 12 Mbps

Electronic device data sheet

The configuration process is based on electronic device data sheet (GSD files), which are required for each PROFIBUS device. GSD files are provided by the device manufacturers and contain electronic descriptions of all relevant communication parameters of the PROFIBUS device.

1.2 The PROFIBUS anybus device for IRC5

General

The PROFIBUS anybus device for IRC5 is inserted into an expansion board on top of the main computer unit in the robot controller.

The PROFIBUS anybus device, DSQC 667, requires the main computer DSQC1000.

Options

With option *PROFIBUS Anybus Device*, the IRC5 controller can act as a device on the PROFIBUS network.

> ℹ️ **Note**
>
> If PROFIBUS master functionality is required, then the option *PROFIBUS Controller* must be used.
>
> For more information see *Application manual - PROFIBUS Controller*.

Illustration, example

The following figure illustrates an overview of the hardware.
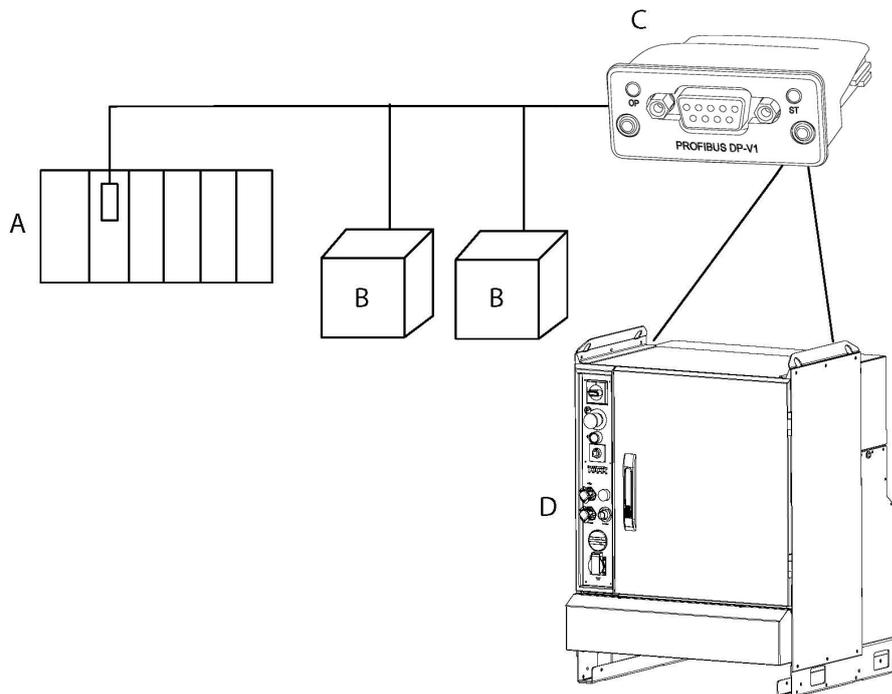
xx1300000695

A	PROFIBUS Controller
B	General PROFIBUS device, DP-Slave
C	PROFIBUS Anybus Device, DSQC 667. Placed in the computer module.
D	IRC5 controller

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Specification overview

| Item	Specification
Industrial Network	PROFIBUS DP-V1
Data rate	9.6 Kbps - 12 Mbps
Connection size	Maximum 64 input bytes and 64 output bytes

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2 Hardware overview

2.1 Main computer DSQC1000

Connections

The I/O network is connected to the PROFIBUS anybus device, DSQC 667, on the main computer.

The following figure illustrates the location of the anybus device in the main computer unit.
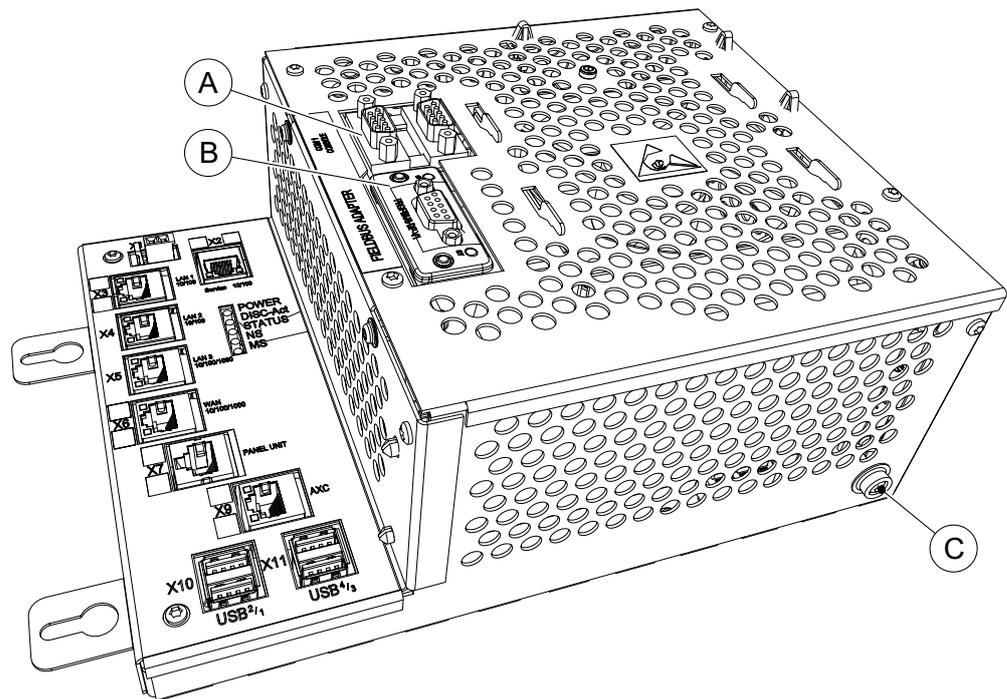
xx1300000694

	Description	Designation	Article number
A	Anybus device / RS232 expansion board	DSQC1003	3HAC046408-001
B	PROFIBUS anybus device	DSQC 667	3HAC026840-001
C	Ground connection for ESD bracelet		

Installation of the anybus device

For information on how to install and replace the anybus device, see *Product manual - IRC5*.
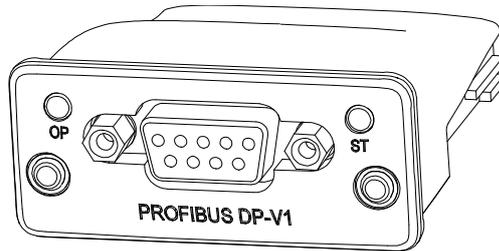
Illustration, PROFIBUS anybus device DSQC 667

xx0700000396

OP	Operation mode LED
ST	Status LED
PROFIBUS DP-V1	PROFIBUS connector

LEDs

This section describes the LEDs of the PROFIBUS anybus device.

Operation mode LED

LED state	Description
OFF	Not online/No power
GREEN	Online, data exchange
GREEN, flashing	Online, clear
RED, flashing (1 flash)	Parametrization error
RED, flashing (2 flashes)	PROFIBUS configuration error

Status LED

LED state	Description
OFF	No power or not initialized
GREEN	Initialized
GREEN, flashing	Initialized, diagnostic event(s) present
RED	Exception error

PROFIBUS Anybus Device connector
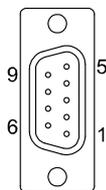
xx0700000507

The following table describes the connections to the PROFIBUS Anybus Device connector.

Pin	Signal	Description
1	Not used	

Continues on next page

Pin	Signal	Description
2	Not used	
3	RxD/TxD-P	Receive/Transmit data; line B (red)
4	CNTR-P	Control of repeater direction
5	DGND	Data ground (reference voltage to VP)
6	VP	Power supply +5V (for example bus termination)
7	Not used	
8	RxD/TxD-N	Receive/Transmit data; line A (green)
9	Not used	
Housing	Cable shield	Internally connected to the protective earth via cable shield filters according to the PROFIBUS standard.

2.2 Cables and connections

2.2.1 Connections

General

All devices are connected in a network structure. Each network segment can have a maximum of 32 active devices. In order to connect a larger number of stations (controllers and devices), the network must be segmented. The segments are then interconnected with repeaters that amplify and refresh the data signals. Each repeater allows the PROFIBUS system to be extended by an additonal network segment.

The start and end of each segment is fitted with an active network terminator, see illustration in section *Termination on page 23*.

Cables and connectors

Cables used for connecting the PROFIBUS network must be according to the PROFIBUS specification, *IEC 61158 Type 3*. See also the *Installation Guideline for PROFIBUS-DP/FMS* published by the user organization of PROFIBUS (PNO).
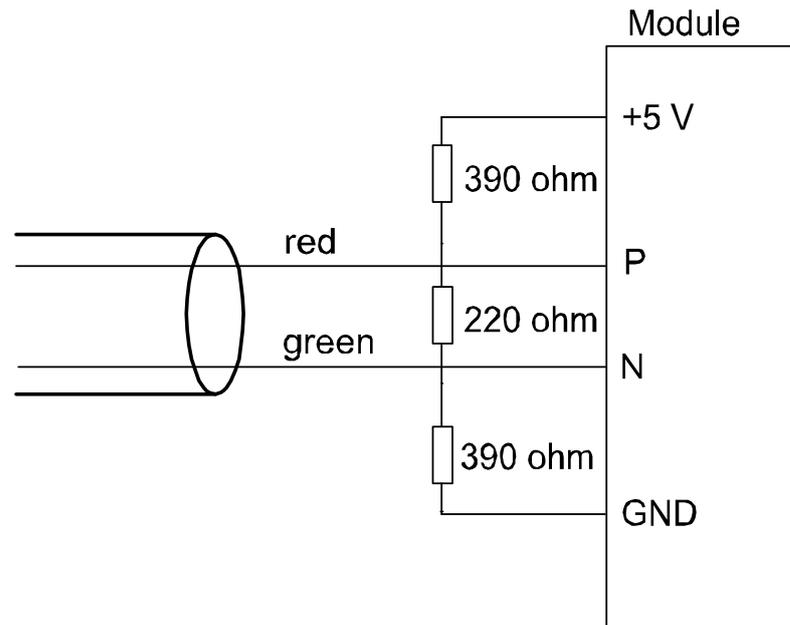
Drop cables are not allowed for PROFIBUS, so special D-subs must be used when the PROFIBUS device is not the last in line. The connector must have the possibility to insert two PROFIBUS cables in the same D-sub.

2.2.2 Termination

General

To reduce the reflections on the data lines, it is very important that both ends of the PROFIBUS network are terminated.

The termination used by PROFIBUS is an active termination as showed in the following figure.

```
                                          Module
                                    ┌──────────────
                              ┌──────┤ +5 V
                            ┌─┴─┐
                            │   │ 390 ohm
                            └─┬─┘
          red               │
    ┌─────────────────────────┤ P
    │                        ┌─┴─┐
    │                        │   │ 220 ohm
    │                        └─┬─┘
          green              │
    └─────────────────────────┤ N
                            ┌─┴─┐
                            │   │ 390 ohm
                            └─┬─┘
                              └──────┤ GND
                                    └──────────────
```

en0400001144

After connecting the PROFIBUS network always check that the termination is in place on both ends of the network, and that there are no other terminations on the network. If a termination is missing or an extra termination is added somewhere in the PROFIBUS network the communication will probably fail.

2.2.3 Selecting cables

Cable parameters, PROFIBUS-DP

The cable parameters for the standard network cables result in the maximum length of each network segment for the respective data transfer rate. See details for cable type A in the following tables.

Segment lengths and data rates, cable type A

Data rate in kbit/s	Maximum segment length in m
9.6	1200
19.2	1200
45.45	1200
93.75	1200
187.5	1000
500	400
1500	200
3000	100
6000	100
12 000	100

Other parameters, cable type A

Parameter	Value
Impedance	135 to 165 Ω
Capacity	≤ 30 pF/m
Loop resistance	≤ 110 Ω/km
Conductor cross-sectional area	≥ 0.34 mm^2 (AWG 22)

3 Software overview

3.1 Information about the anybus device

General

To use the PROFIBUS anybus device, the IRC5 controller must be installed with the option *840-2 PROFIBUS Anybus Device*.

The PROFIBUS anybus device can be used to:

- connect the IRC5 controller to a PLC.
- connect the IRC5 controller to another IRC5 controller which acts as a master.

Predefined network

When the robot system is installed with the PROFIBUS anybus device option, a predefined industrial network with the name *PROFIBUS_Anybus* is created at system startup.

Predefined internal anybus device

When the robot system is installed with the PROFIBUS anybus device option, a predefined PROFIBUS internal anybus device with the name *PB_Internal_Anybus* is created with the size of 8 input bytes and 8 output bytes.

If another input or output size is required, the predefined device *PB_Internal_Anybus* must be changed.

GSD files

In order to configure a PROFIBUS network with an external PROFIBUS configuration tool, a GSD file for each I/O device needs to be imported into the tool. These files contains vital information about the PROFIBUS I/O devices and they shall be supplied by the vendor/manufacturer of the specific PROFIBUS module.

The GSD files for the IRC5 controller are available at the following locations:

- **In the RobotWare installation folder in RobotStudio:**
  ...\RobotPackages\RobotWare_RPK_<version>\utility\service\GSD
- **On the IRC5 Controller:**
  <SystemName>\PRODUCTS\<RobotWare_xx.xx.xxxx>\utility\service\GSD

> **ℹ Note**
>
> Navigate to the RobotWare installation folder from the RobotStudio **Add-Ins** tab, by right-clicking on the installed RobotWare version in the **Add-Ins** browser and selecting **Open Package Folder**.

The directory contains the following files:

GSD-file	Description
soft0baa.gsd	Softing DP-Master PBpro (DSQC1005)

Continues on next page

GSD-file	Description
HMS_1811.gsd	PROFIBUS Anybus Device (DSQC 667)
	The name of the PROFIBUS anybus device in the GSD file is *Anybus-CC PROFIBUS DP-V1*. This name will be shown in the PROFIBUS configuration tool.

Template I/O configuration file

A template I/O configuration file is available for the PROFIBUS internal anybus device, *PB_Internal_Anybus*. This file contain preconfigured names for all available inputs and outputs. This file can be loaded to the controller, using RobotStudio or the FlexPendant, to facilitate and speed up the configuration.

The I/O template configuration file, *PB_Internal_Anybus.cfg*, can be obtained from the RobotStudio or the IRC5 controller.

- **In the RobotWare installation folder in RobotStudio**: *...\RobotPackages\ RobotWare_RPK_<version>\utility\service\ioconfig\PROFIBUS*

- **On the IRC5 Controller**: *<SystemName>\PRODUCTS\ <RobotWare_xx.xx.xxxx>\utility\service\ioconfig\PROFIBUS*

Note

Navigate to the RobotWare installation folder from the RobotStudio **Add-Ins** tab, by right-clicking on the installed RobotWare version in the **Add-Ins** browser and selecting **Open Package Folder**.

Limitations

The predefined internal anybus device, *PB_Internal_Anybus* has the following limitations:

- 8 digital input bytes and 8 digital output bytes but can be increased to the maximum value, which is 64 digital input bytes and 64 digital output bytes.

- Both the input and output map starts at bit 0 and ends at bit 63.

Note

If the PROFIBUS anybus device loses connection with the controller, the configured input signals are cleared (reset to zero).

When the connection is re-established, the controller updates the input signals.

---

4 Configuring the Anybus device

4.1 Recommended working procedure

General

This section describes the recommended working procedure when installing and configuring the PROFIBUS anybus device. The working procedure helps to understand the dependencies between the different steps.

When the IRC5 controller with the PROFIBUS anybus device is connected to an external controller, the IRC5 controller acts as an ordinary device on the PROFIBUS network.

Basic steps

Use this procedure to install and configure the PROFIBUS anybus device.

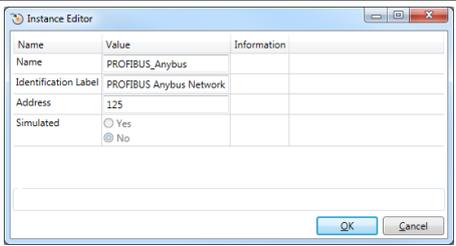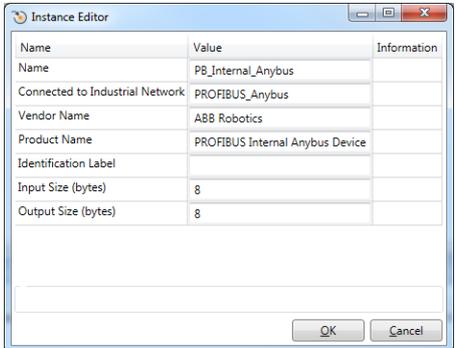|	Action	See
1	Create and configure the anybus device in the IRC5 controller using RobotStudio or the FlexPendant.	*Configuring the anybus device on page 28*
2	Configure the external controller using the vendor specific configuration tool.	*Configuring the external controller on page 30*

4.2 Configuring the anybus device

General

The anybus device is pre-installed at the system startup. However, the address, the input and output size of the device can be changed.

The size of the anybus device determines how many I/O signals that can be attached.

Anybus device configuration

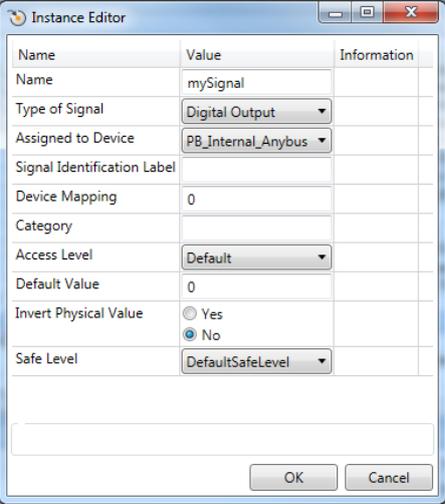Use this procedure to install and configure the PROFIBUS anybus device in the IRC5 controller, using RobotStudio.

	Action	Note
1	Start RobotStudio and connect to the IRC5 controller. Request write access.	
2	Open the **Configuration Editor** and select **I/O System**.	For more information about the parameters, see *System parameters on page 31*.
3	If the address needs to be changed: In the **Type** list click **Industrial Network** and edit the network *PROFIBUS_Anybus*. Edit the parameter values for the industrial network. • **Address**, change the default value to the desired address. Click **OK**.	 xx1400002386
4	If the size needs to be changed: In the **Type** list click **PROFIBUS Internal Anybus Device** and edit the I/O device, *PB_Internal_Anybus*. Edit the parameter values, if applicable. • **Input Size** and **Output Size**, change the values to the desired size. This step is optional, for more information see *Information about the anybus device on page 25*. Click **OK**.	 xx1400002116

Continues on next page

	Action	Note
5	In the **Type** list click **Signal**. Add I/O signals for the anybus device.	xx1400002117
6	Restart the controller.	

4.3 Configuring the external controller

General

The external controller is configured using the vendor specific configuration tool that is delivered, or bought, together with the controller.

The tool is used in order to specify all the devices in the PROFIBUS network. One of the devices is the anybus device of the IRC5 controller. To create such a device, the GSD file describing the internal device has to be imported into the vendor specific configuration tool, see *GSD files on page 25*.

GSD files must be imported for all I/O devices used in the network.

External controller configuration

This procedure describes the general steps that needs to be performed when configuring an external controller, independent of which tool is used.

	Action
1	Use the external controller configuration tool to: • Specify the address of the external PROFIBUS controller. • Import the GSD files for the IRC5 anybus device and all other types of I/O devices in the network. • Add the IRC5 controller anybus device and set the same PROFIBUS address as in the IRC5 controller. • Check the size of the input and output area of the IRC5 anybus device. • Add any other I/O devices into the industrial network structure. • Add signals for all I/O devices including the anybus device.

5 System parameters

5.1 Introduction

About the system parameters

There are both PROFIBUS specific parameters and more general parameters. This chapter describes all PROFIBUS specific system parameters. The parameters are divided into the type they belong to.

For information about other system parameters, see *Technical reference manual - System parameters*.

5 System parameters

5.1.1 PROFIBUS system parameters

Industrial Network

These parameters belong to the type *Industrial Network* in the topic *I/O System*.

Parameter	For more information, see ...
Name	*Technical reference manual - System parameters*
Identification Label	*Technical reference manual - System parameters*
Address	*Address on page 33*
Simulated	*Technical reference manual - System parameters*

PROFIBUS Internal Anybus Device

These parameters belong to the type *PROFIBUS Internal Anybus Device* in the topic *I/O System*.

Parameter	For more information, see ...
Name	*Technical reference manual - System parameters*
Connected to Industrial Network	*Technical reference manual - System parameters*
Identification Label	*Technical reference manual - System parameters*
Vendor Name	*Technical reference manual - System parameters*
Product Name	*Technical reference manual - System parameters*
Input Size	*Input Size on page 34*
Output Size	*Output Size on page 35*

5.2 Type Industrial Network

5.2.1 Address

Parent

Address belongs to the type *Industrial Network*, in the topic *I/O System*.

Description

The parameter *Address* specifies the address of the predefined industrial network *PROFIBUS_Anybus* and the PROFIBUS anybus device. This address is used by an external controller to set up a connection to the anybus device.

Usage

This is the address that the PROFIBUS anybus device uses to communicate.

Prerequisites

The *PROFIBUS Anybus Device* option must be installed.

Default value

The default value is 125.

Allowed values

Allowed values between 0-125.

5.3 Type PROFIBUS Internal Anybus Device

5.3.1 Input Size

Parent

> *Input Size* belongs to the type *PROFIBUS Internal Anybus Device*, in the topic *I/O System*.

Description

> The parameter *Input Size* defines the data size in bytes for the input area received from the connected PROFIBUS Controller

Usage

> *Input Size* is a PROFIBUS specific parameter

Prerequisites

> The *PROFIBUS Anybus Device* option must be installed.

Default value

> The default value is 8 bytes (64 signal bits).

Allowed values

> Allowed values are the integers 1-64 (8-512 signal bits), specifying the input data size in bytes.

5.3.2 Output Size

Parent

Output Size belongs to the type *PROFIBUS Internal Anybus Device*, in the topic *I/O System*.

Description

The *Output Size* defines the data size in bytes for the output area transmitted to the connected PROFIBUS controller.

Usage

The parameter *Output Size* is a PROFIBUS specific parameter.

Prerequisites

The *PROFIBUS Anybus Device* option must be installed.

Default value

The default value is 8 bytes (64 signal bits).

Allowed values

Allowed values are the integers 1-64 (8-512 signal bits), specifying the output data size in bytes.

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