

APPLICATION NOTE

IRC5 ROBOT CONTROLLER AND CI502 WITH SAFETY I/O MODULES

SETTING UP THE IRC5 WITH "PREPARED FOR ABB CI502"



Contents

| 1 | Introd | duction | | 3 |
|---|----------|------------|---------------------------------|------|
| | 1.1 | Scope | | 3 |
| | 1.2 | Terms ar | nd abbreviations | 3 |
| | 1.3 | Referenc | ces | 4 |
| 2 | Setup | overviev | N | 5 |
| _ | | | | |
| 3 | Instal | lation and | d configuration | 6 |
| | 3.1 | Prerequi | sites | 6 |
| | | 3.1.1 | Hardware | 6 |
| | | 3.1.2 | Software and firmware versions | 7 |
| | 3.2 | Hardwar | e setup | 7 |
| | 3.3 | PROFINE | ET setup | 8 |
| | | 3.3.1 | PROFINET configuration | 8 |
| | | 3.3.2 | CI502 PROFINET configuration | 12 |
| | 3.4 | CI502 m | odule configuration | 14 |
| | | 3.4.1 | CI502 standard I/O channels | 15 |
| | 3.5 | DX581-S | configuration | 18 |
| | | 3.5.2 | DX581-S signals | 23 |
| | 3.6 | DI581-S (| configuration | . 28 |
| | | 3.6.2 | DI581-S signals | . 33 |
| | 3.7 | Reintegr | ation of safety I/O channels | . 38 |
| | 3.8 | SafeMov | re2 configuration | . 39 |
| | 3.9 | Downloa | ading the configuration to IRC5 | 41 |
| | C | | | 40 |
| 4 | Sumn | nary | | 42 |

1 Introduction

1.1 Scope

This application note describes how to configure S500 safety I/O modules that are connected to an IRC5 controller with the "Prepared for ABB CI502" option (Product ID: 3HAC064043-001). It gives a detailed description of the I/O channel configuration of DX581-S and DI581-S safety I/O modules using ABB RobotStudio.

This documentation is intended for qualified personnel familiar with functional safety. You must read and understand the safety concepts and requirements presented in the referenced documentation before you operate an IRC5 system with safety I/O modules.

This application note is relevant for:

- Personnel responsible for the installation and configuration of the fieldbus hardware and software of IRC5 systems.
- Personnel that configure IRC5 I/O systems.
- System integrators who use IRC5 robot controllers.

1.2 Terms and abbreviations

| Description | | | | | | |
|---|--|--|--|--|--|--|
| ABB CI502-PNIO PROFINET IO Bus Module / Communication interface module, Product ID: 1SAP220700R0001. A PROFINET IO device module used to connect to a PROFINET IO controller. | | | | | | |
| Cyclic redundancy check. A number derived from and stored or transmitted with a block of data to detect data corruption. | | | | | | |
| Configurable digital input or output. It can be used as an input and/or an output. | | | | | | |
| Input/Output | | | | | | |
| Internet protocol | | | | | | |
| Output Signal Switching Device | | | | | | |
| A special state of safety I/O modules which leads to the delivery of safe substitute values, which are "0" values for S500 safety I/O modules. | | | | | | |
| Programmable logic controller | | | | | | |
| An industrial technical standard for data communication over Industrial Ethernet. | | | | | | |
| The process of switching from substitute values "0" to the process data. | | | | | | |
| RobotWare (Firmware of IRC5 controller) | | | | | | |
| ABB I/O modules which can be used with the ABB IRC5 robot controller | | | | | | |
| Terminal Unit | | | | | | |
| | | | | | | |

The table below explains the abbreviations used in the document.

1.3 References

The table below shows the related documents with the download links.

| Ref | Type, Title, Document-ID, Download-Link, Version |
|-----|---|
| [1] | AC500-S Unbundled S500 Safety I/Os, 3ADR024128K0201, http://search.abb.com/library/Download.aspx?DocumentID=3ADR024128K02 01&LanguageCode=en&DocumentPartId=&Action=Launch or newer version 3ADR024128K02** (** = sequential version number) |
| [2] | AC500-S Safety User Manual, 3ADR025091M0207, http://search.abb.com/library/Download.aspx?DocumentID=3ADR025091M0 207&Language-Code=en&DocumentPartId=&Action=Launch or newer version 3ADR025091M02** (** = sequential version number) |
| [3] | CI502-PNIO (-XC) Description, 3ADR024127K0201, http://search.abb.com/library/Download.aspx?DocumentID=3ADR024127K02 01&Language-Code=en&DocumentPartId=&Action=Launch, or newer version 3ADR024127K02** (** = sequential version number) |
| [4] | Functional Safety and SafeMove2, 3HAC052610-001 http://search.abb.com/library/Download.aspx?DocumentID=3HAC052610- 001&LanguageCode=en&DocumentPartId=&Action=Launch G (RW6.07) or newer |
| [5] | Usage of unbundled S500 safety I/Os and AC500-S F_iPar_CRC Calculator, 3ADR020122K0201 http://search.abb.com/library/Download.aspx?DocumentID=3ADR020122K02 01&LanguageCode=en&DocumentPartId=&Action=Launch |
| [6] | Operating manual of RobotStudio, 3HAC032104-001 http://search.abb.com/library/Download.aspx?DocumentID=3HAC032104- 001&LanguageCode=en&DocumentPartId=&Action=Launch Revision D or newer |
| [7] | PROFINET Controller/Device I/O Configurator, 3HAC065546-001, http://search.abb.com/library/Download.aspx?DocumentID=3HAC065546- 001&LanguageCode=en&DocumentPartId=&Action=Launch to be found in RobotStudio Help in "Additional Resources" section. Revision B or newer |
| [8] | User Documentation DVD for all IRBs, 3HAC032875-001 https://new.abb.com/products/3HAC032875-001/userdoc-dvd-for-all-irbs |

2 Setup overview

This manual focuses on the configuration of ABB S500 safety I/O modules connected to an IRC5 controller via PROFINET, using the IRC5 "Prepared for ABB CI502" option, as shown in Fig. 1.



Fig. 1: IRC5 controller with SafeMove2 and ABB safety I/Os configured using the "Prepared for ABB CI502" option

The solution with the "Prepared for ABB CI502" robot controller option described in this application note offers:

- Connection of safety sensors such as light curtains, laser scanners, safety mats, etc. directly to the SafeMove2 safety controller, for example, for installations without safety fieldbus equipped PLCs.
- Prepared in terms of software support (that is, no hardware, wiring, and so on) in ABB RobotStudio.
- Replacement of SafeMove1 functionality.
- "Prepared for ABB CI502" offers the same functionality as F-Host, but is limited to ABB safety I/O modules from ABB Automation Products.
- A CI502 PROFINET IO communication interface module with on-board standard I/Os is used to attach ABB safety I/O modules.

Key characteristics of the solution with the "Prepared for ABB CI502" robot controller option:

- No explicit need for the PROFIsafe F-Host robot controller option.
- Higher flexibility and productivity with SafeMove2 features and the "Prepared for ABB CI502" option.
- Smaller safety distances due to faster safety response times.

3 Installation and configuration

This chapter describes the prerequisites, hardware and PROFINET setup to connect ABB DI581-S and DX581-S safety I/O modules and the CI502 communication interface module. The configuration and special parameters of the DX581-S and DI581-S safety I/O modules are described in detail. This includes the description of how to use the diagnostic signals of the DX581-S and DI581-S safety I/O modules to reintegrate passivated safety channels, for example, in the case of detected cross-talk wiring errors, and so on.

3.1 Prerequisites

To complete the tasks described in this application note, the reader must have expertise of:

- Mechanical and electrical installation work with the IRC5 robot controller.
- The system and fieldbus parameter configuration of the IRC5 robot controller.
- The configuration of the SafeMove2 option in the IRC5 robot controller.

For more information, refer to [4], [6] and [7].

3.1.1 Hardware

The following hardware is needed:

| Hardware name | Comments Refer to the ABB Robotics catalog from 2018 (or newer) | | |
|---|---|--|--|
| IRC5 robot controller with options: 1241-1 "Prepared for ABB CI502" 888-2 "PROFINET Controller Device" 996-1 "Safety Module" | | | |
| CI502-PNIO | CI502-PNIO (V3): S500, PROFINET IO communication interface module with 8 DI, 8 DO and 8 DC channels, Order code: 1SAP220700R0001 | | |
| ТU508-ЕТН | TU508-ETH: S500, ETH terminal unit, spring terminals, Order code: 1SAP214000R0001 | | |
| DI581-S | DI581-S: S500, Safety digital input module 16SDI, Order code: 1SAP284000R0001 | | |
| DX581-S | DX581-S: S500, Safety digital I/O module 8SDI/SDO, Order code: 1SAP284100R0001 | | |
| TU582-S | TU582-S: S500, Safety I/O terminal unit, spring terminals, 24V DC, Order code: 1SAP281200R0001 | | |

3.1.2 Software and firmware versions

The functionality described in this application note was tested with the following component software versions:

| Component | Software/firmware | Comments | | | |
|--------------------------|-------------------|---|--|--|--|
| | version | | | | |
| | | Additional options are required: | | | |
| IRC5 Robot Controller | RW 6.08.01 | 1241-1 "Prepared for ABB CI502" 888-2 "PROFINET Controller/Device" 996-1 "Safety Module" These can be ordered from ABB Robotics. | | | |
| | | PROFINET IO communication interface module | | | |
| CI502-PNIO | 3.2.6 | It can be ordered from ABB Automation Products. | | | |
| | | Safety digital input/output module | | | |
| DX581-S | 1.0.0 | It can be ordered from ABB Automation Products. | | | |
| | | Safety digital input module | | | |
| DI581-S | 1.0.0 | It can be ordered from ABB Automation Products. | | | |
| RobotStudio | 6.08 | Download link: https://new.abb.com/products/robotics/de/rob otstudio/downloads | | | |
| | | This software tool is needed to calculate CRC for individual safety I/O module parameters. | | | |
| AC500-S F iPar CRC | 1000 | Download link: | | | |
| Calculator | | http://search.abb.com/library/Download.aspx?D ocumentID=9AKK106713A4484&LanguageCode=e n&DocumentPartId=&Action=Launch | | | |

3.2 Hardware setup

This section gives references to the hardware setup of IRC5 robot controller with S500 safety I/O modules using the "Prepared for ABB CI502" option.

The hardware setup of the IRC5 robot controller and related components is described in [8].

The installation instructions for S500 safety I/O modules are listed in the "References" section in [1]. A note on connections:

- Connect +24V DC to terminals 1.8 (UP) and 3.8 (UP3) on TU508-ETH.
- Connect 0V to terminal 1.9 (ZP) on TU508-ETH.
- Connect +24V DC and 0V separately to the attached DI581-S and/or DX581-S safety I/O modules, respectively, to 1.8 (UP) and 1.9 (ZP) on TU582-S.

Examples of possible sensor and actor connections to the DI581-S and DX581-S safety I/O modules are listed in the "Circuit examples" sections in [2].

3.3 **PROFINET** setup

The S500 safety I/O modules are attached to the CI502 PROFINET IO communication interface module, which is used as a communication interface for connectivity to the IRC5 robot controller. This section describes how to setup the PROFINET parameters of the CI502 module.

3.3.1 PROFINET configuration

- 1. Open RobotStudio and connect to the IRC5 controller.
- 2. Open the I/O Configurator: Select "Controller" \rightarrow "Configuration" \rightarrow "I/O Configurator".

| Controller RAPD Add-Ins Iticate Restart Backup Inputs/ Events File FilePendant Online Signal Analyzer Terminal Jobs Controller Installation | | | | RobotStudio 6.08 | | | | | |
|--|--------------|--------------------------------------|------------------|--|-------------|---|---|-------------------|--|
| Itate Imput:// Events File File/Fieldant Online - Signal Analyzer Terminal Jobs Imput:// Swe Parameters Imput:// Swe | Controller P | Add-Ins | | | | | | | |
| T Controller 100/s T Communication Image: Controller 100/s Controller Image: Controller 100/s Man-Machine Communication Man-Machine Communication Man-Machine Communication Main-Machine Communication Motion ABB RobotStudio 6.08 Image: Controller VO Configurator VO Configurator Vo Configurator Vo Confi | ticate | ickup Inputs/ Events ° Outputs Tr | File FlexPendant | Online Signal Analyzer Ter Monitor Online - | rminal Jobs | Configuration | Load Parameter | 5 • E | Conveyor Tracking Integrated Vision |
| ABB RobotStudio 6.08 IO on Controller RAPID Add-Ins L/O Configurator Close Zave Print Vindo Print V Signal Editor x Screenshot Screenshot Search Y Tags Customize Commands Window Layout Minimize the Ribbon Ctrl+F1 Default Layout Minimize the Ribbon Ctrl+F1 | ¥ ¥ | | Controller roots | | | Commur Controll I/O Syste Man-Ma Motion Add Sign | ication er m ichine Communication nals figurator | n Configurator | |
| on Controller RAPID Add-Ins <u>I/O Configurator</u> Close Customize Quick Access Toolbar Y Save Print Y V Undo Y Redo Search Y Tags Customize Commands Window Layout Minimize the Ribbon Christian Default Layout | ABB RobotSt | udio 6.08 | ю | | | | | | |
| Customize Quick Access Toolbar ✓ Save Print ✓ ✓ Undo ✓ Redo Search ✓ Tags ✓ Customize Commands ✓ Window Layout Minimize the Ribbon Ctrl+F1 Default Layout Default Layout | n Controller | RAPID Add-Ins | I/O Configurator | | | | | | |
| Save Print V Undo V Redo Search V Tags Customize Commands Window Layout Minimize the Ribbon Ctrl+F1 Default Layout | | | 0 | ustomize Quick Access Too | Ibar | | | | |
| Close Print V Undo Redo Redo Screenshot Screenshot Customize Commands Customize Commands Window Layout Minimize the Ribbon Ctrl+F1 Default Layout Default Layout | X | | | <u>S</u> ave | | | | | |
| ▼ Undo > ▼ × Signal Editor × Redo > Search ▼ Tags > Customize Commands Window Layout Minimize the Ribbon Ctrl+F1 Default Layout | Close | | | Print | | | | | |
| v Redo Search Screenshot Tags Customize Commands Window Layout Minimize the Ribbon Ctrl+F1 Default Layout Default Layout | | | ~ | Undo | + | | | | |
| Signal Editor X Screenshot Search Tags Window Layout Minimize the Ribbon Ctrl+F1 Default Layout | | | _ | Redo | | | | | |
| Search Tags Window Layout Minimize the Ribbon Ctrl+F1 Default Layout | ₹ × | Signal Editor X | | Screenshot | | | | | |
| Customize Commands | × | Search | ~ | Tags | | | | | × |
| Window Layout Minimize the Ribbon Ctrl+F1 Default Layout | | | | Customize Commands | | | | | |
| Minimize the Ribbon Ctrl+F1 Default Layout | | | W | Vindow Layout | | | | | |
| Default Lavout | | | | Minimize the Ribbon | Ctrl+E1 | | | | |
| Detault Lavout | | | | Default Levent | Cuitir | | | | |
| | | | | Default Layout | | | | | |
| Vvindows Output | | | | Windows | • | Output | | | |
| Properties | | | | | | Properti | es | | |
| Configuration | | | | | | Configu | ration | | |
| Properties | | | | | ļ | ✓ Propertie | 25 | | |
| Device Catalogue V Properties | | | | | | Device C | atalogue Prope | erties | |
| | | | | | | | | | |

Note that you may have to change the window settings to see the "Properties" view. To do so, right-click on "I/O Configurator" \rightarrow "Windows" and then select "Properties".

3. Configure the PROFINET properties.

Open the PROFINET controller properties in the "Configuration" tab using "Communication" \rightarrow "IP Setting" \rightarrow "PROFINET Network".



Enter the "IP-Address", "Subnet" and the LAN "Interface" in the "Properties" tab (refer to the example below).

| Properties | Device Catalogue | | | | | | | |
|------------|------------------|---------------|-----|--|--|--|--|--|
| € | Search | | | | | | | |
| 4 General | | | | | | | | |
| Label | | PROFINET Netw | ork | | | | | |
| Address | ; | 192.168.15.6 | | | | | | |
| Subnet | | 255.255.255.0 | | | | | | |
| Interface | e | LAN3 | | | | | | |

After this step, the warning sign on the "PROFINET Network" node in the tree disappears.

4. Enter a PROFINET Station Name.

Open the PROFINET properties in the "Configuration" tab using "I/O System" \rightarrow "PROFINET".

In the "Configuration" tab, enter a valid PROFINET name, for example, "irc5-pnio". PROFINET names can only consist of small letters and/or numbers and/or "-".

| ・ ・ | ABB RobotSt | udio 6.08 | IO | | |
|---|--|-----------------|------------------|---|--|
| File Home Modeling | Simulation Controller | RAPID Add-Ins | I/O Configurator | | |
| Request Release Write Access Write Access Access | Signal Editor | | | | |
| Configuration | ∓ x | Signal Editor × | – | Properties Device Catalogue | • |
| Search | × | Search | × | Search | |
| TR6_08_00 (IRC5 Testrack) Communication Ethernet Port IP Setting PROFINET Network* Public Network Private Network FlexPendant Network Axis computer 1 | | | | General Name Network Connection System PROFINET Station Name Nested Diagnosis | PROFINET PROFINET Network Activated Deactivated |
| ▷ Static VLAN ▲ I/O System □ <u>PROFINET</u> ▷ ▲ PROFINET_Anybus | | | | Simulated | ⊘ Yes⊚ No |
| Properties Device Catalogue | | | | | |
| Search | | _ | | | |
| ✓ General | | | | | |
| Name | PROFINET | | | | |
| Network | | | | | |
| Connection | PROFINET Network | | | | |
| PROFINET Station Name | irc5-pnio | | | | |
| Nested Diagnosis | Activated Deactivated | | | | |
| Simulated | ⊘ Yes No | | | | |

After this step, the warning sign on the "PROFINET" node in the tree below "I/O System" disappears.

5. Add the CI502 PROFINET IO communication interface module and the DX581-S and/or DI581-S safety I/O modules in the RobotStudio project.

In the "Configuration" tab, select "I/O System" \rightarrow "PROFINET" \rightarrow "Controller", open "Device Catalogue" and select the "CI502-PNIO (V3)" device.

| ک یا ۲ ۲ ۲ ۲ ۲ ۲ | Ŧ | _ | ABB Ro | botStu | idio 6.08 | | 10 | | | | |
|-----------------------------------|-----------------|------------------|--------|----------|-------------|---------|------------------|------------------------------|----------------------|----------------------|-----------------|
| File Home Model | ling ! | Simulation | Con | ntroller | RAPID | Add-Ins | I/O Configurator | | | | |
| Request Release Write Access | Write config | Signal Editor | Close | | | | | | | | |
| | | | | ∓x | Signal Edit | or X | Ŧ | Properties Device Catalogue | | | |
| Search | | | | X | Search | | × | Search | | | |
| TR6_08_00 (IRC5 Testr | rack) | | | | | | | Vendor | Family | Device | Order Number |
| Communication | | | | | | | | ABB Automation Products GmbH | CI502-PNIO (V3) | CI502-PNIO (V3) | 1SAP220700R0001 |
| Ethernet Port | | | | | | | | ABB Automation Products GmbH | CI502-PNIO-XC (V3) | CI502-PNIO-XC (V3) | 1SAP420700R0001 |
| ▲ IP Setting PROFINET N= | * | | | | | | | ABB Robotics | Internal BASIC V1.2 | Internal BASIC V1.2 | 0 |
| Public Network | WORK - | | | | | | | ABB Robotics | Internal ENERGY V1.2 | Internal ENERGY V1.2 | 0 |
| Private Network | | | | | | | | ABB Robotics IRC5 | IRC5 PNIO-Device | IRC5 PNIO-Device | 0 |
| FlexPendant N | etwork | | | | | | | ABB Robotics | BASIC V1.2 | BASIC V1.2 | 0 |
| Axis computer 1 | | | | | | | ABB Robotics | ENERGY V1.2 | ENERGY V1.2 | 0 | |
| Static VLAN | | | | | | | ABB Robotics | DSQC688 | DSQC688 | ABCC-PRT | |
| ⊿ 🚘I/O System | | | | | | | | | | | |
| PROFINET* | | | | | | | | | | | |
| ▷ Device Controller | | | | | | | | | | | |

Double-click on "CI502-PNIO (V3)" to add the CI502 module to the robot PROFINET Controller.

Select the "CI502_PNIO_V3" node in the "Configuration" tab and the "Device Catalogue" tab will show all S500 devices which can be attached to the CI502 module. Add "DX581-S Input/Output (Safety)" and/or "DI581-S Input (Safety)" devices from the device catalogue by double-clicking the devices.



The selected devices appear as nodes under the "CI502_PNIO_V3" node.



3.3.2 CI502 PROFINET configuration

To configure the CI502 PROFINET parameters, select the "CI502-PNIO_V3" device in the "Configuration" tab and activate the "Properties" tab as shown below.



Configure the parameters in the "Properties" tab as required.

| Properties | Device Catalogue | | | | | | | | | |
|-----------------------------|-------------------|--------------------------------------|--|--|--|--|--|--|--|--|
| € 2↓ Search | | | | | | | | | | |
| Profinet Configuration | | | | | | | | | | |
| PROFIN | IET Station Name | ci502-pn-08 | | | | | | | | |
| Reduction | on Ratio | 8 | | | | | | | | |
| Faulty T | elegrams | 24 | | | | | | | | |
| Fast De | vice Startup | Deactivated | | | | | | | | |
| Network | | | | | | | | | | |
| Connect | ted to Industrial | PROFINET | | | | | | | | |
| IP Adres | ss | 192.168.15.8 | | | | | | | | |
| Subnet | | 255.255.255.0 | | | | | | | | |
| Gatewa | у | 192.168.15.1 | | | | | | | | |
| System | | | | | | | | | | |
| Name | | CI502_IO_Cluster_01 | | | | | | | | |
| State w | hen System Start | Activated | | | | | | | | |
| Trust Le | vel | DefaultTrustLevel | | | | | | | | |
| Simulate | ed | ○ Yes○ No | | | | | | | | |
| Identific | ation Label | CI502_01 | | | | | | | | |
| Vendor | Name | | | | | | | | | |
| Product | Name | | | | | | | | | |

| The key parameters are explained in the table below. For more information on CI502 |
|--|
| parameters, refer to [3]. |

| Parameter | Description | | | | | | |
|---|--|--|--|--|--|--|--|
| PROFINET Station name | This parameter defines the PROFINET name for the PROFINET IO device. There are two options to set the PROFINET IO device name for CI502 modules: | | | | | | |
| | Option 1, "Allocation of the Device Name via DCP": | | | | | | |
| | The allocation of the device name via DCP is standard for PROFINET networks. For this method of allocation, you must set both rotary address switches to "0" on the CI502 module. | | | | | | |
| | ABB CI502 PWR/RUN 10 DC0 2.0 DI8 3.0 D08 STA1 ETH 11 DC1 2.1 DI9 3.1 D09 STA2 ETH 12 DC2 2.2 DI10 3.2D010 S-ERR 13 DC3 2.3 DI11 3.3D011 I/O-Bus 14 DC4 2.4 DI12 3.4D012 JOBB 2.4 DI12 3.4D014 3.6D014 JOBB 17 DC7 2.8 UP 3.8 UP3 JOIH 2.9 ZP 3.8 ZP UP 24VDC 200W PROFINET IO Device 6DC 8DI 8D0 Input 24VDC/Output 24VDC 0.5A | | | | | | |
| | Option 2, "Allocation of the Device Name via Address Switches": | | | | | | |
| | The CI502 has 2 rotary switches to set an explicit name to the PROFINET IO device before commissioning. No engineering tool is needed. The device gets its name (including the fixed part of the device name) directly from the switch settings (01hFFh). This name can be used directly within the device configuration: | | | | | | |
| | "ci502-pn-xx" | | | | | | |
| | Note: "ci502-pn-" is the fixed part of the device name and xx represents the position of the rotary switch (0FFh or 0255d). The rotary switches have hexadecimal values. For example, to set the name to "ci502-pn-08", set the upper rotary switch to "0" and the lower switch to "8". | | | | | | |
| | For the detailed descriptions of the options and how to set the "PROFINET Station name" for CI502, refer to "Allocation of the Device Name" in [3]. | | | | | | |
| Network parameters ("IP Address", "Subnet" and "Gateway") | Set the "IP Address" as required. It must be in the range of the PROFINET, which is configured under "Communications" \rightarrow "IP Settings" \rightarrow "PROFINET Network", for example: | | | | | | |
| | IP Address: 192.168.15.6 Subnet: 255.255.255.0 Gateway: 192.168.15.1 | | | | | | |

| Parameter | Description |
|----------------------|---|
| Name | Default value: CI502_PNIO_V3 |
| | The name can be set as required, for example, to reflect the function of the I/O cluster. |
| Identification Label | It can be set as required to identify the module. |

3.4 CI502 module configuration

You can configure the behavior of the inputs and outputs in the "Properties" tab of the CI502 module and its sub-element, respectively.

For the detailed descriptions of all CI502 parameters, refer to "Parameterization" of CI502 in [3].

To complete the configuration tasks described in this application note, you do not need to change the default values. The default configuration of CI502 module parameters is shown below.



| 🍋 🚽 → 🗠 → 🧹 → 🗧 🗸 ABB RobotStudio | 6.08 | IO | | |
|--|-----------------|------------------|--|--|
| File Home Modeling Simulation Controller F | RAPID Add-Ins | I/O Configurator | | |
| Request Release Write Access Write Access Access | | | | |
| Configuration = × | Signal Editor × | Ŧ | Properties Device Catalogue | : |
| Search 🗙 | Search | × | Search | |
| Image: TR6_08_00 (IRC5 Testrack) Communication Ethernet Port IP Setting PROFINET Network* Public Network* Private Network* FlexPendant Network* Avia computer 1* | Name Name | Assigned to Devi | System Name Information Description C1502 Parameter set Error LED / Failsafe funct Process cycle time Clack supply | CI502 Input/Output Input/Output module On I ms process cycle time |
| ► Static VLAN | | | Input delay | 8 ms |
| ▲ | | | Fast counter | No counter |
| ▷ Device | | | Detect short circuit at out | On |
| ▲ Controller ▲ I I Cloue Cluster 01* | | | Behaviour DO at comm | Off |
| ▲ II 00: CI502 DIM1 | | | Substitute value at output | 0 |
| ▶ 01: CI502 DIM1 | | | Preventive voltage feedb | Off |
| 32768: cl502-pn-01 ≥ 32769: port-001 | | | Detect voltage overflow o | Off |
| ▶ 32770: port-002 | | | IO-BUS Reset after PRO | On |
| 01: CI502_InputOutput* 01: CI502_InputOutput 01: CI502_InputOutput 02: DX581_S_InputOutput_Safety* 01: DX581_S_InputOutput (Safety) 03: DI581_S_Input_Safety* 03: DI581_S_Input_Safety* | | | | |

3.4.1 CI502 standard I/O channels

In addition to PROFINET IO device functionality, the CI502 has 8 reserved configurable digital input/outputs, 8 digital inputs and 8 digital outputs, which can be used, for example, for error acknowledgement on the IRC5 robot controller and/or CI502 with its I/O modules.

For example, to add standard signals in the IRC5 robot controller and map them to the CI502 I/O channels, select "CI502_InputOutput" in the "Configuration" tab and change the "Type of Signal" to Digital Input in "Signal Editor" tab:



Enter a signal name in the "Name" field and configure the "Device Mapping" according to the tables in Sections 3.4.1.1 and 3.4.1.2. Press "Enter" to insert a new line for the next signal.

| Si | gnal Ed | itor 🗙 | | | | | | | | | Ŧ |
|----|---------|--------|-----------|--------------------|----------------|----------------|-----------------------------|----------|--------------|---------------|--------------------------|
| S | earch | | | | | | | | | | × |
| | | Name | | Assigned to Device | Type of Signal | Device Mapping | Signal Identification Label | Category | Access Level | Default Value | Filter Time Passive (ms) |
| +* | | Л | di_1O0_00 | CI502_InputOutput | Digital Input | 0 | | | Default | 0 | 0 |
| +* | | Л | di_IO0_01 | CI502_InputOutput | Digital Input | 1 | | | Default | 0 | 0 |
| +* | | Л | di_IO0_02 | CI502_InputOutput | Digital Input | 2 | | | Default | 0 | 0 |
| +* | | Л | do_IO0_00 | CI502_InputOutput | Digital Output | 8 | | | Default | 0 | |
| +* | | Л | do_IO0_01 | CI502_InputOutput | Digital Output | 9 | | | Default | 0 | |
| +* | | Л | do_IO0_02 | CI502_InputOutput | Digital Output | 10 | | | Default | 0 | |
| | | Л | | CI502_InputOutput | Digital Output | | | | Default | 0 | |

3.4.1.1 CI502 input channels

The following table shows the offset values for signal mapping CI502 input channels in the RobotStudio "Signal Editor".

| Channel/Signal | Offset (Mapping) | Remark/Description |
|-------------------------------|---------------------|---|
| Digital inputs DC0-DC7 | 0-7 | Group input (Byte) – Digital inputs DC0-DC7 |
| Digital input DC0 | 0 | |
| Digital input DC1 | 1 | |
| Digital input DC2 | 2 | |
| Digital input DC3 | 3 | |
| Digital input DC4 | 4 | |
| Digital input DC5 | 5 | |
| Digital input DC6 | 6 | |
| Digital input DC7 | 7 | |
| Digital inputs DI8-DI15 | 8-15 | Group input (Byte) – Digital inputs DI8-DI15 |
| Digital input DI8 | 8 | |
| Digital input DI9 | 9 | |
| Digital input DI10 | 10 | |
| Digital input DI11 | 11 | |
| Digital input DI12 | 12 | |
| Digital input DI13 | 13 | |
| Digital input DI14 | 14 | |
| Digital input DI15 | 15 | |
| Fast counter : Actual value 1 | 32-63 | Group input (DWord) – reserved for fast counter |
| Fast counter : Actual value 2 | 64-95 | Group input (DWord) – reserved for fast counter |
| Fast counter : State Byte 1 | 96-103 | Group input (DWord) – reserved for fast counter |
| Fast counter : State Byte 2 | 104-111 | Group input (DWord) – reserved for fast counter |

3.4.1.2 CI502 output channels

The offset values for signal mapping the CI502 output channels in the RobotStudio "Signal Editor":

| Channel/Signal | Offset | Remark/Description |
|-------------------------------|-----------|---|
| | (Mapping) | |
| Digital outputs DC0-DC7 | 0-7 | Group output (Byte) – Digital outputs DC0-DC7 |
| Digital output DC0 | 0 | |
| Digital output DC1 | 1 | |
| Digital output DC2 | 2 | |
| Digital output DC3 | 3 | |
| Digital output DC4 | 4 | |
| Digital output DC5 | 5 | |
| Digital output DC6 | 6 | |
| Digital output DC7 | 7 | |
| Digital outputs DO8-DO15 | 8-15 | Group output (Byte) – Digital outputs DO8-DO15 |
| Digital output DO8 | 8 | |
| Digital output DO9 | 9 | |
| Digital output DO10 | 10 | |
| Digital output DO11 | 11 | |
| Digital output DO12 | 12 | |
| Digital output DO13 | 13 | |
| Digital output DO14 | 14 | |
| Digital output DO15 | 15 | |
| Fast counter : Start value 1 | 32-63 | Group output (DWord) – reserved for fast counter |
| Fast counter : End value 1 | 64-95 | Group output (DWord) – reserved for fast counter |
| Fast counter : Start value 2 | 96-127 | Group output (DWord) – reserved for fast counter |
| Fast counter : End value 2 | 128-159 | Group output (DWord) – reserved for fast counter |
| Fast counter : Control Byte 1 | 160-167 | Group output (Byte) – reserved for fast counter |
| Fast counter : Control Byte 2 | 168-175 | Group output (Byte) – reserved for fast counter |

3.5 DX581-S configuration

The DX581-S safety I/O module has 8 safety digital inputs, which can be configured as 1-channel or 2-channel safety digital inputs, 8 safety digital outputs and 4 test pulse outputs. For a detailed description of all DX581-S parameters, refer to the "Parameterization" section of DX581-S in [2].

You can configure the behavior of the inputs and outputs of the DX581-S safety I/O module in the "Properties" tab:

1. Configure the generic properties of the module.

Select the "DX581_S_InputOutput_Safety" node and activate its "Properties" tab.



| Parameter | Description |
|----------------------|--|
| Name | The "Name" can be set as required, for example, to reflect the function of the DX581-S safety I/O module. Default value: "DX581_S_InputOutput_Safety" |
| Identification Label | It can be set as required to identify the module. |

| Parameter | Description |
|---------------------|--|
| Destination address | The destination address is the so-called F_Dest_Add, which is used for PROFIsafe F-Device identification. |
| | Set the F_Dest_Add destination address according to the value set with the two rotary hardware switches on the DX581-S safety I/O module. |
| | Note that the F_Dest_Add destination address in the configuration must be set as a decimal value, but the rotary switches are set as hexadecimal values. The default setting of the DX581-S rotary switches is 02h (hexadecimal). |

For information on the other parameters listed in the "Properties" tab, refer to [2].

2. Configure the safety I/O channels.

Select the "DX581-S Input/Output (Safety)" node and its "Properties" tab:

| File Home Modeling Simulation Controller RAPID Add-Ins L/O Configurator Image: Configurator Ima | 🏷 📓 🔊 - 🟱 - 🍠 - 🗢 🛛 ABB RobotSt | udio 6.08 IO | | |
|--|---|--------------------------------|---|---|
| Request Release Write Access Config Editor Signal Editor X Properties Device Catalogue Image: Configuration image: Configu | File Home Modeling Simulation Controller | RAPID Add-Ins I/O Configurator | | ۵ 🕜 |
| Search X Sea | Request Release Write Signal Configuration Editor | X Sional Editor X | Properties Device Catalogue | ÷ x |
| ETTRE_08_00 (IRCS Testrack) Communication Communication Communication Controller Controller Controller | Search | Search | | ~ |
| Idea Gage Mill Idea Close DMM Idea Close DMM Discrepancy time Idea Close DMM Discrepancy time Discrepan | | Name Type o | A System Name Information Name Information Description Double Statement Description Description Double Statement Description Descrip | DX581-S Input/Dutput (Safety) Input/Dutput module On Q 2 channel equivalent 0 5 ms 2 channel equivalent 0 5 ms 2 channel equivalent 0 2 channel equivalent 9 2 channel equivalent 9 5 ms 100 ms 2 channel equivalent 9 100 ms 9 9 9 9 9 9 9 |

| Parameter | Description | | | | |
|---------------------------------|---|--|--|--|--|
| Check supply | "On", "Off" | | | | |
| | Default value: "On" | | | | |
| | The parameter setting defines whether diagnosis messages are generated for this device in case of a missing power supply on "UP" terminals. | | | | |
| Input, Channel configuration | "Not used", "1 channel", "2 channel equivalent", "2 channel antivalent" | | | | |
| | Default value: "Not used" | | | | |
| | Note that if channels are used as "2 channel equivalent" or "2 channel antivalent" inputs, the following possible channel combinations are supported: | | | | |
| | • Channels 0 and 4 | | | | |
| | • Channels 1 and 5 | | | | |
| | • Channels 2 and 6 | | | | |
| | Channels 3 and 7 | | | | |
| | Note that in "2 channel equivalent" or "2 channel antivalent" configurations you must configure the higher channel in the same way as the lower one. In addition, only the lower channel reflects the result of both channels and must be used in the controller program. The higher channel always delivers fail-safe "0" values in the controller program. | | | | |
| Input, Test pulse | "Disabled", "Enabled" | | | | |
| | Default value: "Disabled" | | | | |
| | If "Enabled" is selected, the safety input channel must be powered by the dedicated test pulse output of the DX581-S safety I/O module: | | | | |
| | Input channels 0 and 1 shall use test pulse output T0 | | | | |
| | Input channels 2 and 3 shall use test pulse output T1 | | | | |
| | Input channels 4 and 5 shall use test pulse output T2 | | | | |
| | Input channels 6 and 7 shall use test pulse output T3 | | | | |

The key parameters are explained in the table below. For a detailed description of all parameters, refer to "Parameterization" in [2].

| Parameter | Description |
|--|---|
| Input Delay | "1 ms", "2 ms", "5 ms", "10 ms", "15 ms", "30 ms", "50 ms", "100 ms", "200 ms", "500 ms" |
| | Default value: 5 ms |
| | Signals with a duration shorter than the input delay value are not captured by the safety module. |
| | For more information, refer to the "Functionality" section of DX581-S safety I/O module in [2]. |
| 2 channel configuration, Discrepancy time | "10 ms", "20 ms", "30 ms", "40 ms", "50 ms", "60 ms", "70 ms", "80 ms", "90 ms", "100 ms", "150 ms", "200 ms", "250 ms", "300 ms", "400 ms", "500 ms", "750 ms", "1 s", "2 s", "3 s", "4 s", "5 s", "10 s", "20 s", "30 s" |
| | Default value: 50 ms |
| | It is used in a 2-channel configuration to detect if both input channels have changed to the same state after the discrepancy time. |
| | Note that for OSSD devices such as laser scanners, light curtains, etc. it is highly recommended to set the discrepancy time to 10 ms to avoid the reintegration procedure using dedicated acknowledge reintegration signals. |
| | In case of mechanical position switches, mode selectors, E-Stop buttons, etc. discrepancy time values of 100 ms and above must be used depending on their properties. |
| | For more information, refer to "Functionality" section of the DX581-S safety I/O module in [2]. |
| Output channel | "Not used", "Used" |
| | Default value: "Not used" |
| Output, Detection | "Off", "On" |
| | Default value: "On" |
| | The "Detection" parameter defines whether the internal output channel test is active. |
| | Note that the reachable SILCL (IEC 62061), SIL (IEC 61508) and PL (ISO 13849-1) levels for the safety outputs of the DX581-S safety I/O module are only valid if the parameter Detection = "On". If the parameter detection = "Off" then contact ABB technical support to obtain proper reachable SILCL, SIL and PL levels. |

3. Calculate I Par CRC (F_iPar_CRC) for the DX581-S parameters.

The I Par CRC (F_iPar_CRC according to PROFIsafe definition) parameter is a special parameter which defines a checksum and is used for the safe transfer of DX581-S safety I/O parameters to physical DX581-S safety I/O modules.

The checksum I Par CRC must be calculated and entered after the parameter configuration of the DX581-S safety I/O module (for example, "Destination address" parameter) and its I/O channels (for example, "Input delay" parameter) is complete. If DX581-S parameters are changed later, the I Par CRC calculation must be done again.

Note that to configure I Par CRC, you have to install the vendor tool "AC500-S F_iPar_CRC Calculator" beforehand using this link:

http://search.abb.com/library/Download.aspx?DocumentID=9AKK106713A4484&Language Code=en&DocumentPartId=&Action=Launch



Select the "DX581_S_InputOutput_Safety" node and its "Properties" tab:

Call the "Vendor Tool" by clicking on the button right to the "I Par CRC" value.

| PROFIsafe F-Parameters | | |
|------------------------|------------|-------------|
| Source address | 1 | |
| Destination address | 17 | |
| Timeout | 100 | |
| SIL | SIL3 | |
| Version | 1 | |
| CRC Length | 3-Byte-CRC | |
| Block Id | 1 | |
| I Par CRC (hex) | 4B93421A | Vendor Tool |

The "AC500-S F_iPar_CRC Calculator" is launched. Verify all entries, which are DX581-S parameters, in the "AC500-S F_iPar_CRC Calculator" tool and acknowledge them using the checkbox.

| AC500-S F_iPar_CRC Calculator | | x |
|--|---|----------|
| File About AC500-S F_iPar_CRC Calculator | | |
| Device Type: DX581-S:S500,Safety Dig. Description: Input/Output module Slot: 2 Import file: - | .I/O Mod.8SDI/SDO | |
| Parameter | vaiue | <u>^</u> |
| F_Parameter | | |
| F_Check_iPar | NoCheck | |
| F_SIL | SIL3 | |
| F_CRC_Length | 3-Byte-CRC | Ē |
| DX581-S Parameter set | | |
| Check supply | On | |
| Input channel configuration 0 | | |
| Input 0, Channel configuration | 2 channel equivalent | |
| Input 0, Test puise | Disabled | |
| Input 0, Input Delay | 5 ms | |
| Input channel configuration 4 | 2 shared servicelest | |
| Input 4, Channel configuration | 2 channel equivalent | |
| Input 4, Test pulse | Disabled 6 ma | |
| 2 channel configuration 0/4. Discrepancy time | 5 IIIS 10 me | |
| Input channel configuration 4 | 10 115 | |
| Input 1 Channel configuration | 2 channel equivalent | |
| Input 1 Test pulse | Enabled | |
| Input 1, Input Delay | 5 ms | |
| Input channel configuration 5 | 0.00 | |
| Input 5. Channel configuration | 2 channel equivalent | |
| Input 5. Test pulse | Enabled | ÷ |
| PLEASE CHECK ALL DEVICE PARAMETER ENT | RIES OF THIS DEVICE! re correctly set! | |
| F_iPar_CRC | | |
| Dec: 427665404 | Copy to clipboard | |
| Hex: 197DA7FC | Copy to clipboard | |
| | | |

Copy the hexadecimal value of the I Par CRC (F_iPar_CRC) from "AC500-S F_iPar_CRC Calculator" to the clipboard and paste it to the I Par CRC parameter field of the DX581-S safety I/O module in RobotStudio.

| PROFIsafe F-Parameters | |
|------------------------|----------------------|
| Source address | 1 |
| Destination address | 17 |
| Timeout | 100 |
| SIL | SIL3 • |
| Version | 1 * |
| CRC Length | 3-Byte-CRC 👻 |
| Block Id | 1 * |
| l Par CRC (hex) | 197DA7FC Vendor Tool |

3.5.2 DX581-S signals

To add signals to the IRC5 robot controller using the I/O configurator in RobotStudio, you must enter the offset values for signal mapping of the DX581-S safety I/O channels. The tables in sections 3.5.2.1 and 3.5.2.2 show the offset values for the signal mappings of the DX581-S safety I/O channels.

3.5.2.1 DX581-S input signal mapping

| Channel/Signal | Offset (Mapping) | Remark/Description |
|-----------------------------|---------------------|---|
| Safety digital inputs 10-17 | 0-7 | Group input (Byte) – Safety digital inputs 10-17 |
| Safety digital input IO | 0 | Safety DIO. If used as a 2-channel configuration: value of the 2-channel evaluation (IO and I4) |
| Safety digital input I1 | 1 | Safety DI1. If used as a 2-channel configuration: value of the 2-channel evaluation (I1 and I5) |
| Safety digital input I2 | 2 | Safety DI2. If used as a 2-channel configuration: value of the 2-channel evaluation (I2 and I6) |
| Safety digital input I3 | 3 | Safety DI3. If used as a 2-channel configuration: value of the 2-channel evaluation (I3 and I7) |
| Safety digital input I4 | 4 | Safety DI4. If used as a 2-channel configuration: value is always FALSE. See Safety DI0. |
| Safety digital input I5 | 5 | Safety DI5. If used as a 2-channel configuration: value is always FALSE. See Safety DI1. |
| Safety digital input I6 | 6 | Safety DI6. If used as a 2-channel configuration: value is always FALSE. See Safety DI2. |
| Safety digital input I7 | 7 | Safety DI7. If used as a 2-channel configuration: value is always FALSE. See Safety DI3. |
| Safe diagnostic IO-I7 | 8-15 | Group input (Byte) – Safety input signals to indicate the use of fail-safe values on safety DI channels |
| Safe_Diag - Input IO | 8 | Indication of fail-safe value used on Safety DIO |
| Safe_Diag - Input I1 | 9 | Indication of fail-safe value used on Safety DI1 |
| Safe_Diag - Input I2 | 10 | Indication of fail-safe value used on Safety DI2 |
| Safe_Diag – Input I3 | 11 | Indication of fail-safe value used on Safety DI3 |
| Safe_Diag - Input I4 | 12 | Indication of fail-safe value used on Safety DI4 |
| Safe_Diag – Input I5 | 13 | Indication of fail-safe value used on Safety DI5 |
| Safe_Diag - Input I6 | 14 | Indication of fail-safe value used on Safety DI6 |
| Safe_Diag - Input I7 | 15 | Indication of fail-safe value used on Safety DI7 |
| Safe diagnostic O0-O7 | 16-23 | Group input (Byte) – Safety input signals to indicate the use of fail-safe values on Safety DO channels |
| Safe_Diag – Output O0 | 16 | Indication of fail-safe value used on Safety DO0 |
| Safe_Diag – Output O1 | 17 | Indication of fail-safe value used on Safety DO1 |
| Safe_Diag – Output O2 | 18 | Indication of fail-safe value used on Safety DO2 |
| Safe_Diag – Output O3 | 19 | Indication of fail-safe value used on Safety DO3 |
| Safe_Diag - Output O4 | 20 | Indication of fail-safe value used on Safety DO4 |

The offset values for input signal mapping of the DX581-S safety I/O module:

| Channel/Signal | Offset | Remark/Description |
|------------------------------------|----------|---|
| | (Mapping | |
| Safe_Diag – Output O5 | 21 | Indication of fail-safe value used on Safety DO5 |
| Safe_Diag – Output O6 | 22 | Indication of fail-safe value used on Safety DO6 |
| Safe_Diag – Output O7 | 23 | Indication of fail-safe value used on Safety DO7 |
| Reintegration request IO-I7 | 24-31 | Group input (Byte) – Indication that safety input channels can be reintegrated to deliver safety process values instead of fail-safe "0" values |
| Rei_Req – Input IO | 24 | Safety DIO channel can be reintegrated |
| Rei_Req – Input I1 | 25 | Safety DI1 channel can be reintegrated |
| Rei_Req – Input I2 | 26 | Safety DI2 channel can be reintegrated |
| Rei_Req – Input I3 | 27 | Safety DI3 channel can be reintegrated |
| Rei_Req – Input I4 | 28 | Safety DI4 channel can be reintegrated |
| Rei_Req – Input I5 | 29 | Safety DI5 channel can be reintegrated |
| Rei_Req – Input I6 | 30 | Safety DI6channel can be reintegrated |
| Rei_Req – Input I7 | 31 | Safety DI7 channel can be reintegrated |
| Reintegration request 00-07 | 32-39 | Group input (Byte) – Indication that safety output channels can be reintegrated to deliver safety process values instead of fail-safe "0" values |
| Rei_Req – Output O0 | 32 | Safety DO0 channel can be reintegrated |
| Rei_Req – Output O1 | 33 | Safety DO1 channel can be reintegrated |
| Rei_Req – Output O2 | 34 | Safety DO2 channel can be reintegrated |
| Rei_Req – Output O3 | 35 | Safety DO3 channel can be reintegrated |
| Rei_Req – Output O4 | 36 | Safety DO4 channel can be reintegrated |
| Rei_Req – Output O5 | 37 | Safety DO5 channel can be reintegrated |
| Rei_Req – Output O6 | 38 | Safety DO6 channel can be reintegrated |
| Rei_Req – Output O7 | 39 | Safety DO7 channel can be reintegrated |
| PROFIsafe Protocol inputs – Byte 0 | 40-47 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 1 | 48-55 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 2 | 56-63 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 3 | 64-71 | Group input – only for internal use |

3.5.2.2 DX581-S output signal mapping

| Channel/Signal | Offset (Mapping) | Remark/Description |
|-------------------------------------|---------------------|---|
| Safety digital outputs 00-07 | | Group output (Byte) – Safety digital outputs O0- |
| | • | 07 |
| Safety digital output O0 | 0 | Safety DO0 |
| Safety digital output O1 | 1 | Safety DO1 |
| Safety digital output O2 | 2 | Safety DO2 |
| Safety digital output O3 | 3 | Safety DO3 |
| Safety digital output O4 | 4 | Safety DO4 |
| Safety digital output O5 | 5 | Safety DO5 |
| Safety digital output O6 | 6 | Safety DO6 |
| Safety digital output O7 | 7 | Safety DO7 |
| Acknowledge reintegration I0-I7 | 8-15 | Group output (Byte) – Safety outputs to reintegrate safety digital inputs IO-I7 |
| Ack_Rei – Input I0 | 8 | Output to reintegrate safety DIO |
| Ack_Rei – Input I1 | 9 | Output to reintegrate safety DI1 |
| Ack_Rei – Input I2 | 10 | Output to reintegrate safety DI2 |
| Ack_Rei – Input I3 | 11 | Output to reintegrate safety DI3 |
| Ack_Rei – Input I4 | 12 | Output to reintegrate safety DI4 |
| Ack_Rei – Input I5 | 13 | Output to reintegrate safety DI5 |
| Ack_Rei – Input I6 | 14 | Output to reintegrate safety DI6 |
| Ack_Rei – Input I7 | 15 | Output to reintegrate safety DI7 |
| Acknowledge reintegration 00-07 | 16-23 | Group output (Byte) – Safety outputs to reintegrate safety digital outputs O0-O7 |
| Ack_Rei – Output O0 | 16 | Output to reintegrate safety DO0 |
| Ack_Rei – Output O1 | 17 | Output to reintegrate safety DO1 |
| Ack_Rei – Output O2 | 18 | Output to reintegrate safety DO2 |
| Ack_Rei – Output O3 | 19 | Output to reintegrate safety DO3 |
| Ack_Rei – Output O4 | 20 | Output to reintegrate safety DO4 |
| Ack_Rei – Output O5 | 21 | Output to reintegrate safety DO5 |
| Ack_Rei – Output O6 | 22 | Output to reintegrate safety DO6 |
| Ack_Rei – Output O7 | 23 | Output to reintegrate safety DO7 |
| PROFIsafe Protocol outputs – Byte 0 | 24-31 | Group output – only for internal use |
| PROFIsafe Protocol outputs – Byte 1 | 32-39 | Group output – only for internal use |
| PROFIsafe Protocol outputs – Byte 2 | 40-47 | Group output – only for internal use |

The offset values for output signal mapping of the DX581-S safety I/O module:

| Channel/Signal | Offset (Mapping) | Remark/Description | |
|-------------------------------------|---------------------|--------------------------------------|--|
| PROFIsafe Protocol outputs – Byte 3 | 48-55 | Group output - only for internal use | |

To use the safety signals of the DX581-S safety I/O module in the IRC5 safety control program, assign symbolic names to them. Select "DX581_S_InputOutput_Safety" in the "Configuration" tab and add new signals by changing the "Type of Signal", for example, to "Digital Input" in the "Signal Editor" tab.



Enter a signal name in the "Name" field and adapt the "Device Mapping" using the offset values listed in tables from Sections 3.5.2.1 and 3.5.2.2.

Press "Enter" to insert a new line for the next signal to fill the list of safety signals for the DX581-S safety I/O module. For example, you can create a list of signals as shown below.

| Sig | Signal Editor × | | | | | | | |
|-----|-----------------|-----------------------|----------------|----------------|---------------|-------------------------------|-----------------|--|
| Sei | arch | | | | | | | |
| | Nam | e | Type of Signal | Device Mapping | Default Value | Input Offset on Source Device | Output Offset 0 | |
| +* | Л | fdi_IO1_00 | Digital Input | 0 | 0 | -1 | -1 | |
| +* | Л | fdi_IO1_01 | Digital Input | 1 | 0 | -1 | -1 | |
| +* | ⊿ _1 | fgi_IO1_Rei_Req_I0_I7 | Group Input | 24-31 | 0 | -1 | -1 | |
| +* | | fdi_IO1_Rei_Req_I0 | Digital Input | 24 | 0 | -1 | -1 | |
| +* | | fdi_IO1_Rei_Req_I1 | Digital Input | 25 | 0 | -1 | -1 | |
| +* | Л | fdo_IO1_00 | Digital Output | 0 | 0 | -1 | -1 | |
| +* | Л | fdo_IO1_01 | Digital Output | 1 | 0 | -1 | -1 | |
| +* | ⊿ ∏(| fgo_IO1_Ack_Rei_I0_I7 | Group Output | 8-15 | 0 | -1 | -1 | |
| +* | | fdo_IO1_Ack_Rei_I0 | Digital Output | 8 | 0 | -1 | -1 | |
| +* | | fdo_IO1_Ack_Rei_I1 | Digital Output | 9 | 0 | -1 | -1 | |
| | Л | [| Digital Output | | 0 | -1 | -1 | |

The created safety signals for DX581-S safety I/O module can be later used (refer to Section 3.8) in the IRC5 safety controller to realize the required safety functions, as described in [4].

3.6 DI581-S configuration

DI581-S safety I/O module has 16 safety digital inputs, which can be configured as 16 1-channel or as 8 2-channel safety digital inputs, and 8 test pulse outputs. For a detailed description of all DI581-S parameters, refer to the "Parameterization" section of DI581-S in [2].

You can configure the behavior of the inputs of the DI581-S safety I/O module in the "Properties" tab:

1. Configure the generic properties of the module.

Select the "DI581_S_Input_Safety" node and activate its "Properties" tab:

| 飞 🚽 🕣 - 🟱 - 🖊 - 🗢 🛛 ABB RobotStudi | o 6.08 | 10 | | |
|--|-----------------|----------------------|--|--|
| File Home Modeling Simulation Controller | RAPID Add-Ins | I/O Configurator | | ۵ 📀 |
| Request Release Write Access Access Access | | | | |
| Configuration = X | Signal Editor X | - | Properties Device Catalogue | ∓ × |
| Search X | Search | × | E AL Search | × |
| ▲ □ TR6_08_00 (IRC5 Testrack) ▷ Communication ▲ □ PROFINET** Device ▲ Controller ▲ □ Collog_PNIO_V3* ▲ □ Collog_PNIO_V0+ □ Dir: CISO2 DIM1 □ Dir: CISO2 InputOutput □ Dir: CISO2 InputOutput □ Dir: CISO2 InputOutput □ Dir: CISO2 InputOutput □ Dir: CISO2 InputOutput (Safety)* □ Dir: CISO3 InputOutput (Safety)* ■ □ Dir: CISO3 Input Safety* □ Dir: CISO3 Input Coutput □ Dir: CISO3 Input Coutput □ Dir: CISO3 Input Safety* □ Dir: CISO3 Input Safety □ = CISO3 □ = CISO3 □ = CISO3 □ = CISO4 □ = CISO4 | Name J | Type of Digital O | System Name Trust Level Simulated Identification Label Vendor Name Product Name EIO_SafetyEnabled Information Input Size Output Size Vendor Name Product Name Order number Description Vendor Id PROFISate F-Parameters Source address Timeout SIL Version CRC Length Block Id I Par CRC (hex) | DI581_S_Input_Safety InternalDeviceTrustLevel Ves No DI581-S_01 True 6 2 ABB Automation Products GmbH DI581-S Input (Safety) Input module 26 1 1 18 100 SIL3 1 |

| Parameter | Description | | |
|----------------------|---|--|--|
| Name | The "Name" can be set as required, for example, to reflect the function of the DI581-S safety I/O module. | | |
| | Default value: "DI581_S_Input_Safety" | | |
| Identification Label | It can be set as required to identify the module. | | |

| Parameter | Description |
|---------------------|---|
| Destination address | The destination address is the so-called F_Dest_Add, which is used for PROFIsafe F-Device identification. |
| | Set the F_Dest_Add destination address according to the value set with the two rotary hardware switches on the DI581-S safety I/O module. |
| | Note that the F_Dest_Add destination address in the configuration must be set as a decimal value, but the rotary switches are set as hexadecimal values. The default setting of the DI581-S rotary switches is 02h (hexadecimal). |
| | For more information on F_Dest_Add, refer to [2]. |

Refer to [6] for information on all other parameters listed in the "Properties" tab.

2. Configure the safety I/O channels.

ABB RobotStudio 6.08 - • × 3 Home Modeling Simulation Controller RAPID Add-Ins I/O Configurator ۵ 🕜 開社 X Request Release Write Signal Write Access Write Access config Editor Close Access Configuration ∓ × Signal Editor × ∓ x Search × × × TR6_08_00 (IRC5 Testrack) Name System Туре о Communication
 ▲ ≥I/O System
 ▲ →PROFINET* DI581-S Input (Safety) Name Informatio
 Description Input module Device A Controller DI581-S Parameter set Check supply On • ▲ CI502_PNIO_V3* ▲ [] 00: CI502 DIM1 ▶ 01: CI502 DIM1 ▶ 32768: ci502-pn-01 Input 0, Channel configuration 2 channel equivalent • Input 0, Test pulse Disabled • Input 0, Input Delay 5 ms • Input 8, Channel configuration 2 channel equivalent • Input 8, Test pulse Disabled Input 8, Input Delay 5 ms • 2 channel configuration 0/8, Discr 10 ms • Input 1, Channel configuration 2 channel equivalent • Input 1, Test pulse Enabled Input 1, Input Delay 5 ms • ▷ ----Local*
▷ ----EtherNetIP* Input 9, Channel configuration 2 channel equivalent • b __SC Feedback Net* Input 9, Test pulse Disabled • Input 9, Input Delay 5 ms • 2 channel configuration 1/9, Discrepancy time 100 ms • Input 2, Channel configuration Not used • Input 2, Test pulse Disabled • Input 2, Input Delay 5 ms • Input 10, Channel configuration Not used • Disabled Input 10, Test pulse • Input 10, Input Delay 5 ms • 2 channel configuration 2/10, Discrepancy time 50 ms • Input 3, Channel configuration Not used • Input 3 Test pulse Disabled • Input 3, Input Delay 5 ms • 2 channel configuration 2 channel configuration 0/8, Discrepancy time Notin .

Select the "DI581-S Input (Safety)" node and its "Properties" tab:

The key parameters are explained in the table below. For information on all parameters, refer to the "Parameterization" section in [2].

| Parameter | Description | | |
|---------------------------------|---|--|--|
| Check supply | "On", "Off" | | |
| | Default value: "On" | | |
| | The parameter setting defines whether diagnosis messages are generated for this device in case of a missing power supply on the "UP" terminals. | | |
| Input, Channel configuration | "Not used", "1 channel", "2 channel equivalent", "2 channel antivalent" | | |
| | Default value: "Not used" | | |
| | Note that if the channels are used as "2 channel equivalent" or "2 channel antivalent" inputs, the following possible channel combinations are supported: | | |
| | Channels 0 and 8 | | |
| | Channels 1 and 9 | | |
| | Channels 2 and 10 | | |
| | Channels 3 and 11 | | |
| | Channels 4 and 12 | | |
| | Channels 5 and 13 | | |
| | Channels 6 and 14 | | |
| | Channels 7 and 15 | | |
| | Note that in "2 channel equivalent" or "2 channel antivalent" configurations you must configure the higher channel in the same way as the lower one. In addition, only the lower channel reflects the result of both channels and must be used in the controller program. The higher channel always delivers fail-safe "0" values in the controller program. | | |

| Parameter | Description | | | |
|--|--|--|--|--|
| Input, Test pulse | "Disabled", "Enabled" | | | |
| | Default value: "Disabled" | | | |
| | If "Enabled" is selected, the safety input channel must be powered by the dedicated test pulse output of the DI581-S safety I/O module: | | | |
| | Input channels 0 and 1 shall use test pulse output T0 | | | |
| | Input channels 2 and 3 shall use test pulse output T1 | | | |
| | Input channels 4 and 5 shall use test pulse output T2 | | | |
| | • Input channels 6 and 7 shall use test pulse output T3 | | | |
| | • Input channels 8 and 9 shall use test pulse output T4 | | | |
| | Input channels 10 and 11 shall use test pulse output T5 | | | |
| | • Input channels 12 and 13 shall use test pulse output T6 | | | |
| | • Input channels 14 and 15 shall use test pulse output T7 | | | |
| Input Delay | "1 ms", "2 ms", "5 ms", "10 ms", "15 ms", "30 ms", "50 ms", "100 ms", "200 ms", "500 ms" | | | |
| | Default value: 5 ms | | | |
| | Signals with a duration shorter than the input delay value are not captured by the safety module. | | | |
| | For more information, refer to the "Functionality" section of the DI581-S safety I/O module in [2]. | | | |
| 2 channel configuration, Discrepancy time | "10 ms", "20 ms", "30 ms", "40 ms", "50 ms", "60 ms", "70 ms", "80 ms", "90 ms", "100 ms", "150 ms", "200 ms", "250 ms", "300 ms", "400 ms", "500 ms", "750 ms", "1 s", "2 s", "3 s", "4 s", "5 s", "10 s", "20 s", "30 s" | | | |
| | Default value: 50 ms | | | |
| | It is used in 2-channel configuration to detect whether both input channels have changed to the same state after the discrepancy time. | | | |
| | Note that for OSSD devices such as laser scanners, light curtains, etc. it is highly recommended to set the discrepancy time to 10 ms to avoid the reintegration procedure using dedicated acknowledge reintegration signals. | | | |
| | In case of mechanical position switches, mode selectors, E-Stop buttons, etc. Discrepancy time values of 100 ms and above must be used depending on their properties. | | | |
| | For more information, refer to the "Functionality" section of the DI581-S safety I/O module in [2]. | | | |

3. Calculate the I Par CRC (F_iPar_CRC) for DI581-S parameters.

The I Par CRC (F_iPar_CRC according to the PROFIsafe definition) parameter is a special parameter which defines a checksum and is used for a safe transfer of the DI581-S safety I/O parameters to physical DI581-S safety I/O modules.

The checksum I Par CRC must be calculated and entered after the parameter configuration of the DI581-S safety I/O module (for example, "Destination address" parameter) and its I/O channels (for example, "Input delay" parameter) is complete. If DI581-S parameters are changed later, the I Par CRC calculation must be done again.

Note that to configure I Par CRC, you have to install the vendor tool "AC500-S F_iPar_CRC Calculator" beforehand using this link:

http://search.abb.com/library/Download.aspx?DocumentID=9AKK106713A4484&Language Code=en&DocumentPartId=&Action=Launch

| 🍾 📙 🧐 - 🕅 - 🖉 - 🗢 🛛 ABB RobotStud | lio 6.08 | ю | | | |
|--|-----------------|------------------|---------------------|------------------|------------------------------------|
| File Home Modeling Simulation Controller | RAPID Add-Ins | I/O Configurator | | | ۵ () |
| Request Release Write Access Write Signal Access Configuration Search V | Signal Editor X | | Properties | Device Catalogue | ÷ x |
| | | ^ | □ Z + | | ~ |
| Communication | Name DC | Digital C | A System | | DI581 S Input Safety |
| ⊿ 🚘 I/O System | 10 | | Trust Le | evel | InternalDeviceTrustLevel |
| Device | | | Simulate | ed | Yes● No |
| ▲ CI502_PNIO_V3* | | | Identifica | ation Label | DI581-S_01 |
| ■ 00. CI502 DIM1 ■ 01: CI502 DIM1 | | | Vendor I | Name | |
| 32768: ci502-pn-01 | | | Product | Name | |
| | | | EIO_Sat | fetyEnabled | True |
| ▲ | | | Informate | 10N 7A | 6 |
| 01: CI502 Input/Output | | | Output S | Size | 2 |
| A I 02: DX581_S_InputOutput_Safety* N 01: DX581_S_InputOutputSafety* N 01: DX581_S_InputOutputSafety* N 01: DX581_S_InputOutputSafety* N 01: DX581_S_InputO | | | Vendor I | Name | ABB Automation Products GmbH |
| O3: DI581 S Input Safety* | | | Product | Name | DI581-S Input (Safety) |
| ≥ 01: DI581-S Input (Safety)* | | | Order nu | umber | |
| PROFINET_Anybus* | | | Descript | tion | Input module |
| ▷ 📥Local* | | | Vendor I | ld | 26 |
| ▷ → EtherNetIP* | | | PROFISA Source : | ate F-Parameters | 1 |
| > | | | Destinat | tion address | 18 |
| | | | Timeout | t | 100 |
| | | | SIL | | SIL3 |
| | | | Version | | 1 |
| | | | CRC Lei | ngth | 3-Byte-CRC + |
| | | | Block Id | l | 1 |
| | | | I Par CR | RC (hex) | 881E1293 Vendor Tool |
| | | | | | |

Select the "DI581_S_Input_Safety" node and its "Properties" tab:

Call the "Vendor Tool" by clicking on the button right to the "I Par CRC" value.

| 1 | |
|------------|--|
| 18 | |
| 100 | |
| SIL3 | • |
| 1 | T |
| 3-Byte-CRC | Ŧ |
| 1 | v |
| 881E1293 | Vendor Tool |
| | 1 18 100 SIL3 1 3-Byte-CRC 1 881E1293 |

"AC500-S F_iPar_CRC Calculator" tool is launched. Verify all entries, which are DI581-S parameters, in the "AC500-S F_iPar_CRC Calculator" tool and acknowledge them using the checkbox.

| AC500-S F_iPar_CRC Calculator | | x | | |
|---|--|----------|--|--|
| File About AC500-S F_iPar_CRC Calculator | | | | |
| Device Type: DI581-S:S500,Safety Dig. Description: Input module Slot: 3 Import file: - | Input Mod.16SDI | | | |
| rarameter | value | | | |
| F_Parameter | | | | |
| F_Check_iPar | NoCheck | | | |
| F_SIL | SIL3 | = | | |
| F_CRC_Length | 3-Byte-CRC | | | |
| DI581-S Parameter set | | | | |
| Check supply | On | | | |
| Input channel configuration 0 | | _ | | |
| Input 0, Channel configuration | 2 channel equivalent | | | |
| Input 0, Test pulse | Disabled | | | |
| Input 0, Input Delay | 5 ms | _ | | |
| Input channel configuration 8 | | | | |
| Input 8, Channel configuration | 2 channel equivalent | _ | | |
| Input 8, Test pulse Disabled | | _ | | |
| Input 8, Input Delay 5 ms | | _ | | |
| 2 channel configuration 0/8, Discrepancy time | 10 ms | _ | | |
| Input channel configuration 1 | | - | | |
| Input 1, Channel configuration 2 channel equivalent | | _ | | |
| Input 1, Test pulse Enabled | | - | | |
| Input 1, Input Delay 5 ms | | | | |
| Input channel configuration 9 | 2 shared assistant | | | |
| Input 9, Channel configuration | 2 channel equivalent | - | | |
| Input 9, Test puise | Disabled | - | | |
| PLEASE CHECK ALL DEVICE PARAMETER ENT | RIES OF THIS DEVICE! e correctly set! | | | |
| F_iPar_CRC | | | | |
| Dec: 526479154 | Copy to clipboard | | | |
| Hex: 1F616F32 Copy to clipboard | | | | |
| | | | | |

Copy the hexadecimal value of the I Par CRC (F_iPar_CRC) from the "AC500-S F_iPar_CRC Calculator" to the clipboard and paste it to the I Par CRC parameter field of the DI581-S safety I/O module in RobotStudio.

| PROFIsafe F-Parameters | |
|------------------------|----------------------|
| Source address | 1 |
| Destination address | 18 |
| Timeout | 100 |
| SIL | SIL3 🔹 |
| Version | 1 • |
| CRC Length | 3-Byte-CRC 👻 |
| Block Id | 1 |
| I Par CRC (hex) | 1F616F32 Vendor Tool |
| | |

3.6.2 DI581-S signals

To add signals to the IRC5 robot controller using the safety I/O configurator in RobotStudio, enter the offset values for signal mapping of the DI581-S safety I/O channels. The tables in sections 3.6.2.1 and 3.6.2.2 show the offset values for the signal mappings of DI581-S safety I/O channels.

3.6.2.1 DI581-S input signal mapping

| Channel/Signal | Offset (Mapping) | Remark/Description |
|------------------------------|---------------------|---|
| Safety digital inputs 10-115 | 0-15 | Group input (Word) – Safety digital inputs 10-115 |
| Safety digital input IO | 0 | Safety DIO. If used as a 2-channel configuration: value of the 2-channel evaluation (IO and I8) |
| Safety digital input I1 | 1 | Safety DI1. If used as a 2-channel configuration: value of the 2-channel evaluation (I1 and I9) |
| Safety digital input I2 | 2 | Safety DI2. If used as a 2-channel configuration: value of the 2-channel evaluation (I2 and I10) |
| Safety digital input I3 | 3 | Safety DI3. If used as a 2-channel configuration: value of the 2-channel evaluation (I3 and I11) |
| Safety digital input I4 | 4 | Safety DI4. If used as a 2-channel configuration: value of the 2-channel evaluation (I4 and I12) |
| Safety digital input I5 | 5 | Safety DI5. If used as a 2-channel configuration: value of the 2-channel evaluation (I5 and I13) |
| Safety digital input I6 | 6 | Safety DI6. If used as a 2-channel configuration: value of the 2-channel evaluation (I6 and I14) |
| Safety digital input I7 | 7 | Safety DI7. If used as a 2-channel configuration: value of the 2-channel evaluation (I7 and I15) |
| Safety digital input I8 | 8 | Safety DI8. If used as a 2-channel configuration: value is always FALSE. See Safety DI0. |
| Safety digital input 19 | 9 | Safety DI9. If used as a 2-channel configuration: value is always FALSE. See Safety DI1. |
| Safety digital input I10 | 10 | Safety DI10. If used as a 2-channel configuration: value is always FALSE. See Safety DI2. |
| Safety digital input I11 | 11 | Safety DI11. If used as a 2-channel configuration: value is always FALSE. See Safety DI3. |
| Safety digital input I12 | 12 | Safety DI12. If used as a 2-channel configuration: value is always FALSE. See Safety DI4. |
| Safety digital input I13 | 13 | Safety DI13. If used as a 2-channel configuration: value is always FALSE. See Safety DI5. |
| Safety digital input I14 | 14 | Safety DI14. If used as a 2-channel configuration: value is always FALSE. See Safety DI6. |
| Safety digital input I15 | 15 | Safety DI15. If used as a 2-channel configuration: value is always FALSE. See Safety DI7. |
| Safe diagnostic 10-115 | 16-31 | Group input (Word) – Safety input signals to indicate the usage of fail-safe values on safety DI channels |
| | 16 | Indication of fail-safe value used on Safety DIO |
| | 17 | Indication of fail-safe value used on Safety DI1 |

The offset values for the input signal mapping of the DI581-S safety I/O module:

| Channel/Signal | Offset | Remark/Description |
|------------------------------|-----------|---|
| | (Mapping) | |
| Safe_Diag – Input I2 | 18 | Indication of fail-safe value used on Safety DI2 |
| Safe_Diag – Input I3 | 19 | Indication of fail-safe value used on Safety DI3 |
| Safe_Diag – Input I4 | 20 | Indication of fail-safe value used on Safety DI4 |
| Safe_Diag – Input I5 | 21 | Indication of fail-safe value used on Safety DI5 |
| Safe_Diag – Input I6 | 22 | Indication of fail-safe value used on Safety DI6 |
| Safe_Diag – Input I7 | 23 | Indication of fail-safe value used on Safety DI7 |
| Safe_Diag – Input I8 | 24 | Indication of fail-safe value used on Safety DI8 |
| Safe_Diag – Input I9 | 25 | Indication of fail-safe value used on Safety DI9 |
| Safe_Diag – Input I10 | 26 | Indication of fail-safe value used on Safety DI10 |
| Safe_Diag – Input I11 | 27 | Indication of fail-safe value used on Safety DI11 |
| Safe_Diag – Input I12 | 28 | Indication of fail-safe value used on Safety DI12 |
| Safe_Diag – Input I13 | 29 | Indication of fail-safe value used on Safety DI13 |
| Safe_Diag – Input I14 | 30 | Indication of fail-safe value used on Safety DI14 |
| Safe_Diag – Input I15 | 31 | Indication of fail-safe value used on Safety DI15 |
| Reintegration request IO-I15 | 32-47 | Group input (Word) – Indication that safety |
| | | input channels can be reintegrated to deliver |
| | | safety process values instead of fail-safe "0" |
| | | values |
| Rei_Req – Input IO | 32 | Safety DIO channel can be reintegrated |
| Rei_Req – Input I1 | 33 | Safety DI1 channel can be reintegrated |
| Rei_Req – Input I2 | 34 | Safety DI2 channel can be reintegrated |
| Rei_Req – Input I3 | 35 | Safety DI3 channel can be reintegrated |
| Rei_Req – Input I4 | 36 | Safety DI4 channel can be reintegrated |
| Rei_Req – Input I5 | 37 | Safety DI5 channel can be reintegrated |
| Rei_Req – Input I6 | 38 | Safety DI6 channel can be reintegrated |
| Rei_Req – Input I7 | 39 | Safety DI7 channel can be reintegrated |
| Rei_Req – Input I8 | 40 | Safety DI8 channel can be reintegrated |
| Rei_Req – Input I9 | 41 | Safety DI9 channel can be reintegrated |
| Rei_Req – Input I10 | 42 | Safety DI10 channel can be reintegrated |
| Rei_Req – Input I11 | 43 | Safety DI11 channel can be reintegrated |
| Rei_Req – Input I12 | 44 | Safety DI12 channel can be reintegrated |
| Rei_Req – Input I13 | 45 | Safety DI13 channel can be reintegrated |
| Rei_Req – Input I14 | 46 | Safety DI14 channel can be reintegrated |
| Rei_Req – Input I15 | 47 | Safety DI15 channel can be reintegrated |

| Channel/Signal | Offset (Mapping) | Remark/Description |
|------------------------------------|---------------------|-------------------------------------|
| PROFIsafe Protocol inputs – Byte 0 | 48-55 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 1 | 56-63 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 2 | 64-71 | Group input – only for internal use |
| PROFIsafe Protocol inputs – Byte 3 | 72-79 | Group input – only for internal use |

3.6.2.2 DI581-S output signal mapping

The offset values for the output signal mapping of the DI581-S safety I/O module:

| Channel/Signal | Offset | Remark/Description |
|-------------------------------------|-----------|--|
| | (Mapping) | |
| Acknowledge reintegration I0-I15 | 0-15 | Group output (Word) – Safety outputs to |
| | | reintegrate safety digital inputs IO-I17 |
| Ack_Rei – Input IO | 0 | Output to reintegrate safety DIO |
| Ack_Rei – Input I1 | 1 | Output to reintegrate safety DI1 |
| Ack_Rei – Input I2 | 2 | Output to reintegrate safety DI2 |
| Ack_Rei – Input I3 | 3 | Output to reintegrate safety DI3 |
| Ack_Rei – Input I4 | 4 | Output to reintegrate safety DI4 |
| Ack_Rei – Input I5 | 5 | Output to reintegrate safety DI5 |
| Ack_Rei – Input I6 | 6 | Output to reintegrate safety DI6 |
| Ack_Rei – Input I7 | 7 | Output to reintegrate safety DI7 |
| Ack_Rei – Input I8 | 8 | Output to reintegrate safety DI8 |
| Ack_Rei – Input I9 | 9 | Output to reintegrate safety DI9 |
| Ack_Rei – Input I10 | 10 | Output to reintegrate safety DI10 |
| Ack_Rei – Input I11 | 11 | Output to reintegrate safety DI11 |
| Ack_Rei – Input I12 | 12 | Output to reintegrate safety DI12 |
| Ack_Rei – Input I13 | 13 | Output to reintegrate safety DI13 |
| Ack_Rei – Input I14 | 14 | Output to reintegrate safety DI14 |
| Ack_Rei – Input I15 | 15 | Output to reintegrate safety DI15 |
| PROFIsafe Protocol outputs – Byte 0 | 16-23 | Group output – only for internal use |
| PROFIsafe Protocol outputs – Byte 1 | 24-31 | Group output – only for internal use |
| PROFIsafe Protocol outputs – Byte 2 | 32-39 | Group output - only for internal use |
| PROFIsafe Protocol outputs – Byte 3 | 40-47 | Group output - only for internal use |

To use the safety signals of the DI581-S safety I/O module in the IRC5 safety control program, assign symbolic names to them.

Select the "DI581_S_Input_Safety" in the "Configuration" tab and add new signals by changing the "Type of Signal", for example, to "Digital Input" in the "Signal Editor" tab.



Enter a signal name in the "Name" field and configure the "Device Mapping" using the offset values listed in Sections 3.6.2.1 and 3.6.2.2.

| Signal E | ditor × | (| | | | | |
|----------|---------|--------------------------------------|----------------|----------------|---------------|-------------------------------|--------|
| Search | | | | | | | |
| | Nam | e | Type of Signal | Device Mapping | Default Value | Input Offset on Source Device | Output |
| +* | Л | fdi_IO2_00 | Digital Input | 0 | 0 | -1 | -1 |
| +* | Л | fdi_IO2_01 | Digital Input | 1 | 0 | -1 | -1 |
| +* | ⊿ ∭ | fgi_IO2_Rei_Rreq_I0_I15 | Group Input | 32-47 | 0 | -1 | -1 |
| +* | | <mark>_</mark> ∏_ fdi_IO2_Rei_Req_I0 | Digital Input | 32 | 0 | -1 | -1 |
| +* | | <mark>_</mark> ∏_ fdi_IO2_Rei_Req_I1 | Digital Input | 33 | 0 | -1 | -1 |
| +* | ⊿ ∭ | fgo_IO2_Ack_Rei_I0_I15 | Group Output | 0-15 | 0 | -1 | -1 |
| +* | | <mark>_</mark> ∏_ fdo_IO2_Ack_Rei_I0 | Digital Output | 0 | 0 | -1 | -1 |
| +* | | | Digital Output | 1 | 0 | -1 | -1 |
| | Л | [| Digital Output | | 0 | -1 | -1 |

Press "Enter" to insert a new line for the next signal to fill the list of safety signals for the DI581-S safety I/O module. For example, you can create a list of signals as shown below.

3.7 Reintegration of safety I/O channels

If the safety channels of DX581-S and/or DI581-S safety I/O modules get passivated, for example, due to wiring errors such as a short circuit to +24V DC, a discrepancy time error, and so on, there are two ways to reintegrate safety channels after the causes of the errors are remedied (that is, the cause of the passivation is no longer present):

1. Power cycle the CI502 module off and then on with the DX581-S and/or DI581-S safety I/O modules (refer to the UP terminals on the modules).

After power off/on cycle safety I/O modules are passivated and have to be reintegrated using either restart of IRC5 robot controller or use the "F-Host Op. Ack" button (Login as "Safety User" on FlexPendant and select "Control Panel" \rightarrow "Safety Controller" \rightarrow "Configuration") on the FlexPendant.

2. Use safety "Post-Logic" procedures, which have to be programmed for the IRC5 safety controller, and the "Acknowledge reintegration" signals from DI581-S and/or DX581-S, respectively, to reintegrate the module channels. This avoids unnecessary downtime due to power cycling.

The channel passivation of DI581-S and DX581-S safety I/O modules can be detected by monitoring "Safe diagnostic" input signals in the IRC5 safety controller program. If the cause for the channel passivation is no longer present, the "Reintegration request" input signal of the given channel is set to TRUE. The acknowledgement can be performed in the IRC5 robot controller application by setting the "Acknowledge reintegration" output signal of the given channel to TRUE and later to FALSE (using the rising edge scenario). If "Group inputs" (Bytes/Words) and "Group outputs" (Bytes/Words) are used for the DI581-S and DX581-S safety I/O module channels, all channels of the given safety I/O module can be simultaneously reintegrated.

For more information on DI581-S and DX581-S safety I/O module passivation and reintegration, refer to [2].

3.8 SafeMove2 configuration

After the configuration of the CI502 module and S500 safety I/O modules as well as signals in the RobotStudio "IO configurator", you can use the safety signals in the "Visual SafeMove" editor of the RobotStudio.

For a detailed description of how to use the "SafeMove" editor, refer to [4], which can be called, for example, from RobotStudio, as shown below.



To use the CI502 and safety I/O signals, you have to open the "Visual SafeMove" editor, navigate to "Controller" tab and login as a "Safety User" first:



After this, open the "Visual SafeMove" editor using "Safety" \rightarrow "Visual SafeMove":

| 🕥 📓 47 - 🔍 - 🔍 - 🗧 ABB Rc | botStudio 6.08 | | active and active activ |
|--|--|---------------|--|
| File Home Modeling Simulation Cor | troller RAPID Add-Ins I/O Configurator | | |
| Add Controller + Witte Access Access | Control Tools Retart Backup Inputs/ Events Outputs Control Tools Control Tool | Configuration | Safety Control Operator Panel Window Wiscol Safetow |
| Controller | x | | Visual SafeMove |
| HOME | | | Electronic Position Switches V EPS Wizard Visual SafeMove |
| If Configuration Event Lon | | | configuration tool to visualize and configure safety zones. |
| B UO System RAPID | | | Press F1 for more help. |

The defined safety signals from the DX581-S and DI581-S safety I/O modules on the CI502 module become available and you can use them to configure the safety functions of the robot application, as shown below.



At least one robot tool must be configured in Visual SafeMove, to be able to download the configuration.



3.9 Downloading the configuration to IRC5

The configuration created in RobotStudio has to be downloaded to the IRC5 controller.

To download the configuration:

- 1. Set the IRC5 controller to the "Manual mode".
- 2. Log in as a "Safety User".
- 3. Request Write Access.



The request needs to be granted on the FlexPendant.

4. Write the configuration to the IRC5 robot controller.



5. Answer "Yes" to the following question:



6. Answer "Yes" to the following question:



The IRC5 robot controller starts again.

7. Make a backup of the changed system for later use, if required.

4 Summary

This application note provided details on the configuration of ABB S500 safety I/O modules connected to an IRC5 controller via PROFINET using the IRC5 "Prepared for ABB CI502" option. For related information, such as checklists for the ABB S500 safety I/O module and IRC5 safety controller commissioning, safety function response time calculation, safety values, and so on, refer to [2] and [4].



REVISION HISTORY

| Rev. | Description of version / Changes | Date / Who |
|------|----------------------------------|------------------|
| A | First release | 2019-02-22 / ABB |

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