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Extension of BI/BO for busbar protection SIPROTEC 7SS85

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SIPROTEC 5 Application

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Content

1 Extension of BI/BO for busbar protection SIPROTEC 7SS85

1.1 Introduction

A SIPROTEC 5 device consists of a base module, up to 9 expansion modules and a power supply module for the optitional second row. In some applications for busbar protection SIPROTEC 7SS85 one device is not sufficient due to the required amount of binary inputs and outputs.

The hardware extension of the SIPROTEC 7SS85 with binary inputs and outputs can be realized by the connection of additional SIPROTEC 5 devices, e.g. bay controller SIPROTEC 6MD8x by using the protection data interface , a SIPROTEC 5 wide system feature. Alternatively also the data transmission via IEC 61850 GOOSE messaging on the IEC 61850 system interface is possible.

This application describes the recommended extensions of binary inputs and outputs by using the protection data interface PDI.

1.2 SIPROTEC 5 communication modules

SIPROTEC 5 devices are equipped with high-performance communication interfaces. The SIPROTEC 5 can be ordered with configured communication modules as well exchangeable and upgradable during the complete life cycle. The pluggable communication modules can be installed in the base module or the 1/3 module and in the expansion module CB202. The base module can be extended via module slots E and F. The expansion module CB202 is designed for 3 additional plug-in modules, if the two in the based module are not sufficient. The communication modules can be installed in slots N and P. Slot M is restricted to analog expansion modules. SIPROTEC 5 devices can only be equipped with one CB202.

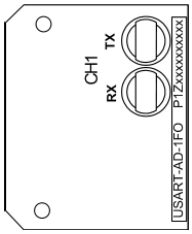


Fig 1: USART-AD-1FO

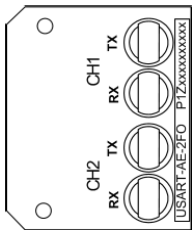


Fig 2: USART-AE-2FO

Serial for asynchronous or synchronous communication module with 1 independent optical interface (USART-AD-1FO) or 2 independent optical interfaces (USART-AE-2FO) are required and need to be installed in each of the connected devices, max. distance of 2 km.

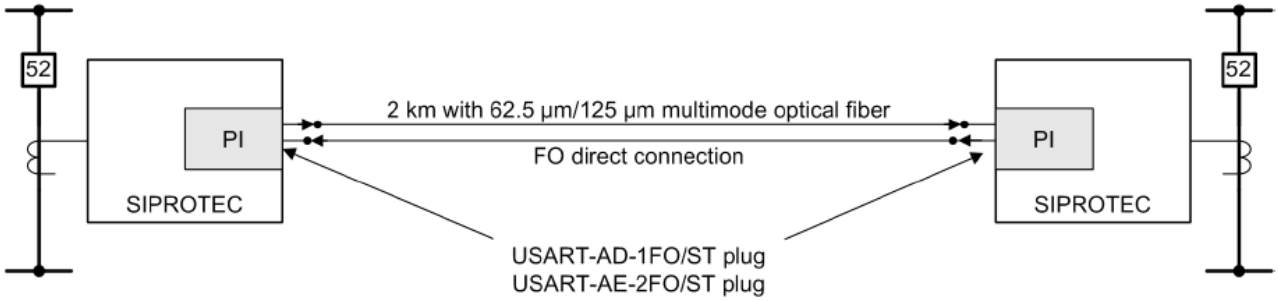


Fig. 3:

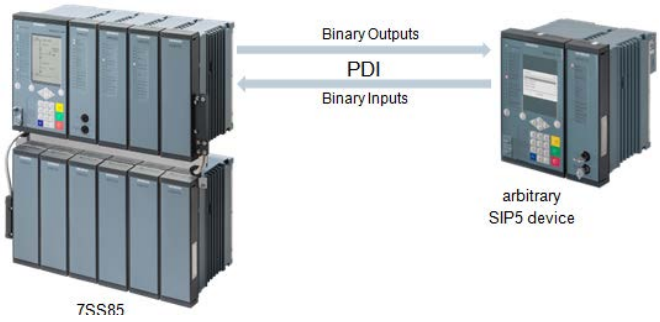
The USART plug-in module types can be used in slots E and F in the base module as well as in slots N and P in the CB202 expansion module. The plug-in module position M is intended for a measuring-transducer module only.

With the communication module USART-AE-2FO a ring topology can be created which provides more safety.

The communication ring has the advantage over the communication chain that the entire communications system also works if one of the communication connections fails or if a device in the topology is taken out of operation. The devices detect failure or logging off, and switch over automatically to the remaining communication routes within 20 ms.

1.3 Protection Data Interface PDI and Protection Topology

The protection data interface function enables data exchange between the devices via synchronous serial point-to-point connections from 64 Kbits/s to 2048 kbits/s. The communication takes place via direct fiber-optic connections, via communication networks or via 2-wire copper conductors. The direct fiber-optic connection is recommended, as this offers the highest transmission rate of 2048kBit/s and is immune to failures in the communication route while offering the shortest transmission time. This also enables the interchange of a large amount of information from e.g. bay controller SIPROTEC 6MD8x to the SIPROTEC 7SS85.



The protection communication in a device can be either type 1 or type 2. Type 2 is created for devices like the busbar protection SIPROTEC 7SS85, and is used for data transmission. Using type 2 protection communication, a maximum of two additional SIPROTEC 5 devices can be connected to one SIPROTEC 7SS85.

There are 3 different priorities in the Type 2 when transferring protection-interface information:

- **Priority 1**: Use **Priority 1** for the transmission of fast protection signals that are transferred and updated at a maximum of every 20 ms in a telegram. Transfer up to 96bit.
- **Priority 2**: Use **Priority 2** for the transmission of fast single-point or double-point indications that are transferred and updated at a maximum of every 40 ms. Transfer up to 200bit.
- **Priority 3**: Use **Priority 3** for all indications, measured, and metered values that are transferred and updated a maximum of every 100 ms. Transfer up to 1.024bit.

The PDI supports variable baud rates. From a baud rate of 256kBit/s onward there is no priority difference between priority 1 and 2.

To sum up, priority 1 and 2 are available with high priority. Thus 296 Bit can be transmitted fast, either 296 BI or 296 BO or 148 BI and 148 BO. Measured values can also be transmitted, but not for protection purposes.

Further information of the protection data interface are described in the device manual of the line protection devices e.g. 7SA87 as well in the application note SIP5-APN-005.

1.4 Test results

The below table with real measure delay time is the result from the input measurement of an Omicron device.

Binäreingänge / Trigger				
Bay1 Trip	○	☐		9,100 ms
Bay8 Trip	○	☐		9,100 ms
Bay15 Trip	○	☐		9,600 ms
Bay1 PDI	○	☐		15,60 ms
Bay8 PDI	○	☐		15,60 ms
Bay15 PDI	○	☐		15,90 ms
Bay1 GOOSE	○	☐		13,50 ms
Bay8 GOOSE	○	☐		16,20 ms
Bay15 GOOSE	○	☐		19,30 ms
Nicht verw.				
Überlast	○	☐		n/v

In total nine time measurements. The used BO are for all cases is the commonly BO “fast” which is recommended for trip circuit control. The trip decision derived from BBP and a heavy fault current internal fault. The 9,100ms up to 9,600 ms are typically for this fault cases tripped by a 7SS85 BBP.

The first three measurements are tripping times of the internal BO of the device. The next three are coming from the same feeders. The tripping relays are in a second device. The signal transfer is with the protection data interface PDI. The resulting average delay time is 5.5ms.

The last three values are again from the same feeder. The signal transfer to the second device is via IEC 61850 GOOSSE message. The resulting delay time is between 4,4 and 9,3ms.

1.5 Conclusion

By using the well proven high-performance protection data interface PDI a fast and secure data transmission between devices can be realized. Therefore a high amount of binary inputs and outputs can be extended easily on a SIPROTEC 5 device, mainly in applications with the central busbar protection SIPROTEC 7SS85 with a high amount of binary inputs.

Due to the faster transmission time of the tests and the easier engineering the protection data interface is recommended. Nevertheless, IEC 61850 GOOSE can also be used.

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