

SIMATIC

Bus links

DP/PA coupler, active field distributors, DP/PA Link and Y Link

Operating Instructions

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Preface

Purpose of the operating instructions

These operating instructions provide important information to configure, mount, wire, and commission the DP/PA coupler, the active field distributors AFD, AFS and AFDiS and the DP/PA link and Y link bus links.

Basic knowledge required

To understand these operating instructions you should have general experience in the field of automation engineering.

When using the AFDiS you should be familiar with the fundamentals of explosion protection, the identification of explosion-protected equipment and the regulations regarding explosion protection.

Range of validity of these operating instructions

These operating instructions apply for the following products:

- IM 153-2: 6ES7153-2BA02-0XB0
- IM 153-2 (Outdoor): 6ES7153-2BA82-0XB0
- DP/PA coupler FDC 157-0: 6ES7157-0AC83-0XA0
- DP/PA coupler Ex [i]: 6ES7157-0AD82-0XA0
- Y coupler: 6ES7197-1LB00-0XA0
- Bus modules
 - BM PS/IM: 6ES7195-7HA00-0XA0
 - BM PS/IM SIPLUS extreme: 6AG1195-7HA00-2XA0
 - BM IM/IM: 6ES7195-7HD10-0XA0
 - BM IM/IM (Outdoor): 6ES7195-7HD80-0XA0
 - BM FDC: 6ES7195-7HF80-0XA0
 - BM FDC/FDC (redundant): 6ES7195-7HG80-0XA0
 - BM Y coupler: 6ES7654-7HY00-0XA0

Description of the components

2.1 DP/PA coupler FDC 157-0

Applications

The DP/PA coupler FDC 157-0 is designed for the following applications:

- Non-redundant operation:
 - Stand-alone operation without additional components
 - Replacement for the DP/PA coupler with order number 6E7157-0AC82-0XA0
 - Operation in the DP/PA link on a simple DP master system or with two interface modules IM 153-2, for example on an S7-400H
- Redundant operation:
 - Ring redundancy when using the active field distributor AFD or AFDiS
 - Coupler redundancy when using the AFS
 - Operation in the DP/PA link on a simple DP master system or with two interface modules IM 153-2, for example on an S7-400H

Availability

- Increased availability through ring redundancy and coupler redundancy
- Automatic isolation of defective partial segments including automatic bus terminator
- Repair and extension of the bus segment is possible in during operation

Commissioning

- Simplified commissioning through extended diagnostic possibilities and automatic bus terminator.

Properties

The DP/PA coupler FDC 157-0 is designed for the following applications:

- Electrical isolation between PROFIBUS DP and PROFIBUS PA
- Implementation of the transmission physics between RS 485 and symmetric bus physics in accordance with IEC IEC 61784-1:2002 Ed1 CP 3/2
- DP slave: adjustable PROFIBUS address 1 to 125 via DIL switch
- Diagnostics via LED displays
- Diagnostics function via PROFIBUS DP:
 - Current value or voltage value as user data
 - Local LifeList
 - Wire-break/short circuit
- Selection of the redundancy mode via DIL switch
- Transmission rate of 45.45 kBaud to PROFIBUS DP
- Transmission rate to 31.25 kBaud on PROFIBUS PA
- Integrated supply unit for PROFIBUS PA
- Integrated bus terminator for PROFIBUS PA
- Extended environmental conditions

Configuration

The DP/PA coupler FDC 157-0 can be used as a stand-alone device on all DP masters that support 45.45 kBaud.

Configuration of the DP/PA coupler FDC 157-0 as a DP slave is necessary in the following situations:

- If the diagnostic functions will be effective.
- If you want to operate the DP/PA couplers with ring redundancy or coupler redundancy.

Note

If you use the IM 153-2 together with the DP/PA couplers as DP/PA link, in this case the PROFIBUS DP connections to the DP/PA couplers are not required. The IM 153-2 and the DP/PA couplers are connected via the S7 backplane bus.

2.10 Compatibility with predecessor modules

Compatibility DP/PA coupler FDC 157-0:

The DP/PA coupler FDC 157-0 with order number 6E7157-0AC83-0XA0 replaces the DP/PA coupler with order number 6E7157-0AC82-0XA0. The bus module does not need to be replaced.

On the DP/PA coupler FDC 157-0 the PROFIBUS address is factory set to 0. Thus the diagnostic function is deactivated, the DP/PA coupler is transparent. This means that it is compatible to the predecessor module as a replacement part. Configuration is not required.

Note**Diagnostics function**

If you would like to use the diagnostic function of the DP/PA coupler FDC 157-0 in existing systems as well, then set the PROFIBUS address on the DP/PA coupler and in the configuration > 0.

Note**Redundancy mode**

If you would like to use the DP/PA coupler FDC 157-0 with ring redundancy or coupler redundancy, then you must use the BM FDC/FDC (redundant) bus module.

Bus module BM FDC/FDC (redundant)

The bus module BM FDC (redundant) with order number 6ES7195-7HG80-0XA0 can only be used together with the DP/PA coupler FDC 157-0 with order number 6ES7157-0AC83-0XA0.

Compatibility of the IM 153-2 and the IM 157

You can find information on compatible versions of interface modules IM 153-2 and IM 157 on the Internet (<http://support.automation.siemens.com/WW/view/en/23372259>).

Compatibility of the Y coupler

Der Y coupler 6ES7197-1LB00-0XA0 **cannot** be used as a spare part for Y coupler 6ES7654-0YK00-0AB0.

Compatibility of the bus modules

The bus module BM IM/IM 6ES7195-7HD80-0XA0 can only be used together with the following interface modules:

- IM 153-2BAx1-0XB0
- IM 153-2BAx2-0XB0
- IM 157-0AA82-0XA0

It can **not** be used as a spare part for 6ES7195-7HE80-0XA0.

Installation location

The DP/PA FDC 157-0 coupler or the DP/PA-Koppler Ex [i] or the DP/PA link with DP/PA Ex [i] couplers can be operated in hazardous areas, Zone 2, if they are installed in a suitable enclosure. The bus cable for PROFIBUS PA may lead from the hazardous area zone 2, into the following zones:

- in the case of 6ES7157-0AD81-0XA0 into zone 0
- in the case of 6ES7157-0AD82-0XA0 into zone 0 /zone 20

DANGER

In the case of DP/PA coupler Ex [i] 6ES7157-0AD82-0XA0 the intrinsically safe PROFIBUS PA is approved for the following intrinsically safe electrical equipment:

- Device category 1G, 2G and 3G for zones 0, 1, and 2
- Device category 1D, 2D and 3D for zones 20, 21, and 22

As a PROFIBUS node you can use the DP/PA coupler Ex [i] of device category 3G in zone 2-type hazardous areas (or in the safe area).

If you want to use the DP/PA coupler Ex [i] in zone 21 or 22, then you must install it in an enclosure that is certified and approved for these zones.

Enclosure for zone 2

The DP/PA coupler Ex [i], or the DP/PA link with DP/PA coupler Ex [i] must be installed in an enclosure with minimum degree of protection IP 54. A manufacturer's declaration for zone 2 must be submitted for the enclosure (in accordance with EN 60079-15).

Use the following threaded cable glands:

- Power supply and PROFIBUS DP Ex i: Cable gland with manufacturer's declaration for zone 2
- PROFIBUS PA Ex i: Degree of protection Ex i

DANGER

Under some circumstances, sparks capable of ignition or unacceptable surface temperatures can occur during installation.

Never install under explosive conditions!

Switch off the voltage supply to the plant and adhere to the safety regulations.

You can obtain enclosures for zone 2 from:

Siemens AG, I IA CE S EN
Siemensallee 84
D-76187 Karlsruhe

E-mail: helmut.heib@siemens.com (<mailto:<helmut.heib@siemens.com>>)

5.2.2 Mounting the DP/PA coupler for redundancy mode

Configuration with bus modules

For operation with ring redundancy or coupler redundancy the two FDC 157-0 DP/PA couplers must be installed with the BM FDC 157-0 bus module.

Combination with non-redundant DP/PA couplers

A combination of non-redundant and redundant DP/PA couplers is possible. You can install a maximum of 5 DP/PA couplers FDC 157-0, of which one coupler pair is installed in redundancy mode at the end of the configuration.

Components required

- Rail for configuration with active bus modules ("Rail for module change during operation")
- For ring redundancy or coupler redundancy:
 - Bus module BM FDC/FDC (redundant)
 - Maximum 2 DP/PA couplers FDC 157-0
- Optional for non-redundant DP/PA couplers:
 - Bus module BM FDC
 - Maximum 3 DP/PA couplers FDC 157-0

Installing bus modules and modules

1. Hang the *BM FDC* bus modules first, then the *BM FDC/FDC (redundant)* bus module on the mounting rail and press them into the rail.
2. Slide the bus modules together, so that the module connections have contact.
3. Insert the DP/PA couplers in the bus modules. To do so use the lateral guides of the bus module.
4. Screw the modules tight. This also fixes the bus modules to the rail.

Removing bus modules and modules

Remove the DP/PA coupler in the reverse sequence.

If the device is already in operation then disconnect its 24-V DC power supply beforehand.

5.2.3 Swapping DP/PA couplers FDC 157-0

Introduction

Swapping a DP/PA coupler 157-0 is possible during operation with ring redundancy or coupler redundancy. The PA field devices that are connected to the redundant DP/PA coupler remain in operation.

Requirement

The following prerequisites must be satisfied to remove a DP/PA coupler FDC 157-0 during operation.

- The ACT LED of the DP/PA coupler cannot be illuminated. If the ACT LED is illuminated, then multiple PA field devices can fail.
- The power supply of the DP/PA coupler FDC 157-0 must be disconnected.

Removing and inserting modules

NOTICE
Removing a DP/PA coupler FDC 157-0 It is only possible to remove a DP/PA coupler FDC 157-0 if it is de-energized. Prior to removing an FDC 157-0 DP/PA coupler, disconnect its 24 V DC power supply.

NOTICE
Failure of a DP/PA coupler FDC 157-0 If you remove an FDC 157-0 DP/PA coupler under voltage then the overvoltage protection can permanently respond. You can reset this switch-off if you turn off the mains for at least 10 seconds. Prior to removing an FDC 157-0 DP/PA coupler, disconnect its 24 V DC power supply.

6.1.4 Operation with ungrounded reference potential

Application

In extensive plants (e.g. in the chemical industry or in power stations) it may become necessary to operate the modules with ungrounded reference potential, for example for the purpose of ground fault monitoring.

Discharging interference current

When operating with ungrounded reference potential, interference currents that arise are discharged via RC networks integrated into the IM 153-2 and DP/PA couplers to the protective conductor (refer to figure below).

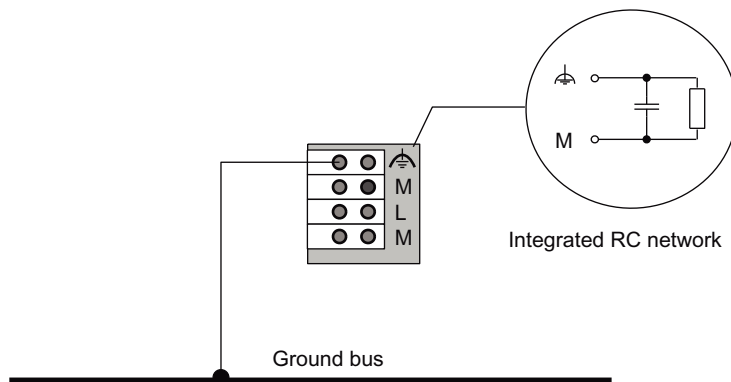


Figure 6-3 Configuration with ungrounded reference potential

Power supply

If the IM 153-2 and the DP/PA coupler FDC 157-0 are operated from the same supply, then the electrical isolation of the DP/PA coupler FDC 157-0 between the 24 V supply and the S7 backplane bus is cancelled by the potential bonding of the IM 153-2 between the 24 V supply and backplane bus. The cancellation of the electrical isolation can only be prevented by two electrically isolated 24 V power supplies.

Note

In an ungrounded configuration with common power supply, observe that the DP/PA coupler FDC 157-0 (6ES7157-0AC83-0XA0) has an additional internal 1 MOhm resistance that is active in parallel to the 10 MOhm resistance between electrical ground and earth on the IM 153-2.

6.5 Connecting the power supply

Introduction

For all modules described the power supply is connected in the same way.

Tools required

To connect the power supply you require a 3 mm screwdriver.

Power supply unit

You must only use SELV-type power supply units with protective extra-low voltage with safe electrical isolation ($\leq$ DC 60 V).

The size of the power supply unit depends on the power consumption of the connected components.

Connection for power supply

The 4-pin screw-type terminal for the 24 V power supply is located behind the front door at the bottom on the IM 153-2. The connections have the following functions:

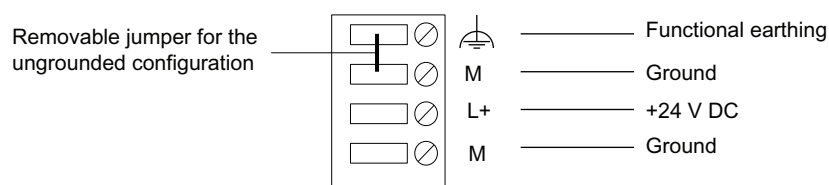


Figure 6-10 Power supply for the IM 153-2

The maximum cross-section of the connection is 2.5 mm². There is no mains lead cleat.

See also

Wiring the DP/PA coupler for stand-alone mode (Page 93)

Wiring the DP/PA link for non-redundant mode (Page 102)

Wiring the DP/PA link for redundant operation (Page 103)

Connecting Y link (Page 104)

DP/PA coupler FDC 157-0 in redundancy mode

To ensure availability in redundancy mode we recommend using an separate power supply module for each DP/PA coupler.

PA bus terminator switch

You can loop through the PROFIBUS PA on DP/PA couplers with a PA bus terminator switch. The PA bus terminator switch is available on the following DP/PA couplers:

- DP/PA coupler FDC 157-0 (6ES7157-0AC83-0XA0)
- DP/PA coupler (6ES7157-0AC82-0XA0)

Note

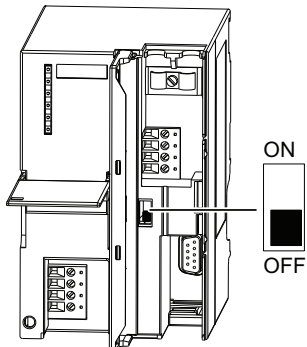
The PA bus terminator switch is used to operate the DP/PA coupler with ring redundancy without function.

NOTICE

DP/PA Ex [i] coupler (6ES7157-0AD82-0XA0)

In the DP/PA coupler Ex [i] the bus terminator cannot be switched off.

Consequently the DP/PA coupler Ex [i] must be located at the beginning or the end of a PA segment.

DP/PA coupler	PA bus terminator switch	
	ON	OFF
	ON	The bus terminating resistors are activated. PROFIBUS PA may not be looped through.
	OFF	The bus terminating resistors are deactivated. You can loop PROFIBUS PA through and connect bus terminating resistors at both ends of the PA segment .

Commissioning the DP/PA coupler FDC 157-0

Basic procedure:

1. Optional: Configuring the DP/PA coupler.
2. Set the PROFIBUS addresses in the DP/PA couplers.
3. Select the redundancy mode on the DP/PA couplers.
4. Switch on the power supply for the DP/PA couplers.
5. Download the configuration to the PLC.

Applications DP/PA coupler FDC 157-0

The following table shows the applications and the available functions for the DP/PA coupler and the settings that are required. For ring redundancy and coupler redundancy the settings are required on the DP/PA coupler pair.

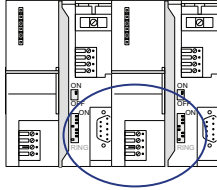
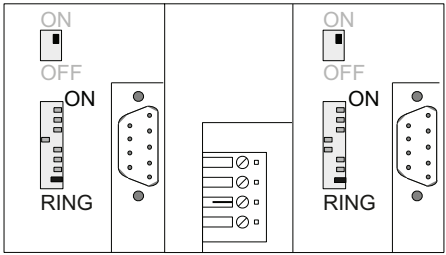
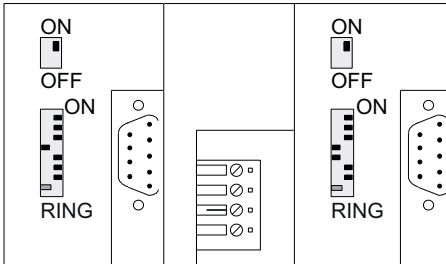


Table 7- 1 Applications DP/PA coupler FDC 157-0 and required settings

Applications - DP/PA coupler FDC 157-0 (standalone or in the DP/PA link)	Functions	Settings on the DP/PA coupler / on the DP/PA coupler pair	Settings in the configuration
- Non-redundant operation of DP/PA coupler ¹ - Redundant operation of a DP/PA coupler pair	Diagnostic function deactivated ²	PROFIBUS address = 0	PROFIBUS address = 0
	Diagnostic function activated	PROFIBUS address > 0 (1 to 125)	PROFIBUS address > 0 (1 to 125)
Redundant operation of a DP/PA coupler pair	Ring redundancy activated	 RING ON	Redundancy mode Ring redundancy
	Coupler redundancy activated	 RING OFF	Redundancy mode Coupler redundancy
¹ Also as replacement for the DP/PA coupler with order number 6E7157-0AC82-0XA0 ² DP/PA couplers transparent in the DP/PA link.			

11.2 Replacing DP/PA couplers

Requirement

If replacing a DP/PA coupler FDC 157-0, its ACT LED should not light up. If the ACT LED is illuminated, then multiple PA field devices can fail.

Replacing DP/PA couplers

To replace a defective DP/PA coupler, perform the following steps:

1. Disconnect the power supply of the faulty module.
2. Disconnect the PROFIBUS PA connection of the defective module.
3. Unplug the bus connector from the PROFIBUS DP interface of the defective module.
4. Replace the defective module.
5. When using the diagnostic function of the DP/PA coupler FDC 157-0:
Set the PROFIBUS address at the DIL switches.
6. When using the redundancy mode of the DP/PA coupler FDC 157-0:
Set the redundancy mode at the DIL switches.
7. Connect the PROFIBUS PA to the new DP/PA coupler.
8. Plug the bus connector into the PROFIBUS DP interface of the new module.
9. Connect the power supply of the new module,

Change systems to redundancy

To use the ring redundancy or coupler redundancy, you can upgrade an existing system by means of DP/PA couplers FDC 157-0. Install the redundant DP/PA coupler pair to the right of the remaining DP/PA couplers (max. 3).

Use the BM FDC 157-0 bus module for the redundant DP/PA coupler pair.

13.1.2 LED displays of the DP/PA coupler FDC 157-0

Status and error messages of the DP/PA coupler FDC 157-0

Table 13- 2 Status and error messages of the DP/PA coupler FDC 157-0

SF		Batch error (red)
BF		Bus fault (red)
DP		Bus monitoring PROFIBUS DP (yellow)
PA		Bus monitoring PROFIBUS PA (yellow)
ACT		DP/PA coupler activated, feeding/transmitting (yellow) - only with PA redundancy
ON		24 V power supply for DP/PA coupler (green)

LEDs						Meaning	Remedy
SF	BF	DP	PA	ACT	ON		
*	*	*	*	*	On	Voltage is applied to the DP/PA coupler. The DP/PA coupler is ready to operate.	-
Off	Off	*	*	Off	On	DP/PA coupler without diagnostic message	-
On	Off	*	*	Off	On	DP/PA coupler with diagnostic message	-
*	*	*	*	Off	Off	- There is no voltage applied to the DP/PA coupler. - Error in the DP/PA coupler.	- Check the 24 V voltage supply of the DP/PA coupler, - Contact your Siemens representative.
*	*	*	*	*	Flashes	PROFIBUS PA overloaded	Check the number of connected PA field devices and the total current.
*	Flashes	*	*	*	On	DP/PA coupler not or not correctly configured. Causes: - PROFIBUS addresses do not match in the configuration and on the DP/PA coupler. - Redundancy mode	Check the PROFIBUS addresses in the configuration and on the DP/PA coupler.

14.3 Technical data DP/PA coupler FDC 157-0 (6ES7157-0AC83-0XA0)

Data for connecting lower-level bus components	
DP/PA coupler can be connected	Max. 5
Y coupler can be connected	1
Lower-level slaves can be connected	Max. 64
Number of slots in lower-level slaves	(244 minus number of PA field devices), but not more than 236
Delay Update for the I/O image	
• Single mode	15 ms
• Redundancy mode – Detect PrmCMD primary side – Changeover without CFG changes – Changeover with CFG changes	30 ms 3 x Ttr 4 x Ttr

14.3 Technical data DP/PA coupler FDC 157-0 (6ES7157-0AC83-0XA0)

Technical specifications	
Order number	6ES7157-0AC83-0XA0
Dimensions and weight	
Dimension W x H x D (mm)	80 x 125 x 130
Weight	Approx. 515 g
Module-specific data	
Transmission speed on PROFIBUS DP	45.45 kBaud
Transmission speed on PROFIBUS PA	31.25 kBaud
Bus protocol	PROFIBUS DP
Voltages, currents, potentials	
Rated supply voltage	24 VDC (20.4 V to 28.8 V)
• Polarity reversal protection	Yes
• Overvoltage protection	Yes
Output voltage for PA section:	31 VDC ± 1 V
• Voltage monitoring	15.5 V
• Voltage monitoring	U > 35 V; latching cutoff
• Power failure bypass	Min. 5 ms
Electrical isolation of the 24 V power supply	
• PROFIBUS DP / PROFIBUS PA	Yes
• PROFIBUS DP / supply	Yes
• PROFIBUS PA / supply	Yes
• All electric circuits / FE	Yes
Insulation tested with	500 VDC

14.3 Technical data DP/PA coupler FDC 157-0 (6ES7157-0AC83-0XA0)

DP/PA coupler power consumption (24 VDC)	Max. 2.3 A
Output current PA section (for dimensioning the PA configuration)	1 A
Power loss of the module	Max. 13.4 W
Status, interrupts, diagnostics	
Status display	No
Interrupts	None
Diagnostics function	Yes
• Group error	Red LED "SF"
• Bus fault	Red LED "BF"
• PROFIBUS DP bus monitoring	Yellow LED "DP"
• PROFIBUS PA bus monitoring	Yellow LED "PA"
• DP/PA coupler monitoring	Yellow LED "ACT"
• Monitoring 24 V power supply	Green "ON" LED
Data for selecting the PA field devices	
Connection to DP/PA couplers	• max. power consumption of the PA field devices together 1 A • Field devices with certification for PROFIBUS PA • Field devices are located outside the hazardous area • max. 31 PA field devices can be connected