

# Momentum

## Communications Adapter for PROFIBUS DP User Manual

07/2011

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The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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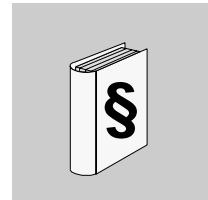
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## Safety Information



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### Important Information

#### NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



### **DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.



### **WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

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|                                                                                                  |
|--------------------------------------------------------------------------------------------------|
|  <b>CAUTION</b> |
|--------------------------------------------------------------------------------------------------|

|                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------|
| <b>CAUTION</b> indicates a potentially hazardous situation which, if not avoided, <b>can result in</b> minor or moderate injury. |
|----------------------------------------------------------------------------------------------------------------------------------|

|                |
|----------------|
| <b>CAUTION</b> |
|----------------|

|                                                                                                                                                                  |
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| <b>CAUTION</b> , used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, <b>can result in</b> equipment damage. |
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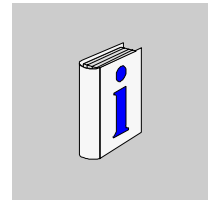
**PLEASE NOTE**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

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## About the Book



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### At a Glance

#### Document Scope

This user manual applies to Momentum I/O units connected to the PROFIBUS adapter 170 DNT 110 00.

#### Validity Note

This document is valid from Unity Pro 6.0.

#### Related Documents

**NOTE:** Up-to-date information about PROFIBUS DP is available from the PROFIBUS Website <http://www.profibus.com> as well as from the PROFIBUS user organization: PROFIBUS Nutzerorganisation e.V., Haid- und Neu-Straße 7, D-76131 Karlsruhe, Germany.

| Title of Documentation                                                                         | Reference Number |
|------------------------------------------------------------------------------------------------|------------------|
| Momentum I/O Units, User Manual                                                                | 870 USE 002 00   |
| Quantum PROFIBUS DP in Concept, User Manual                                                    | 840 USE 487 00   |
| Quantum PROFIBUS DP in Modsoft, User Manual                                                    | 840 USE 468 00   |
| Profibus DP Configurator, 332 SPU 931 01 (Version 2) (part of Software Package 332 SPU 833 02) | 840 USE 454 00   |

You can download these technical publications and other technical information from our website at [www.schneider-electric.com](http://www.schneider-electric.com).

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## Product Related Information

### CAUTION

**When controllers are used for applications with technical safety requirements, please follow the relevant instructions.**

For reasons of safety and the maintenance of the documented system data, components should only be repaired by the manufacturer.

**Failure to follow these instructions can result in injury or equipment damage.**

## User Comments

We welcome your comments about this document. You can reach us by e-mail at [techcomm@schneider-electric.com](mailto:techcomm@schneider-electric.com).



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# PROFIBUS DP and PROFIBUS DP configuration with Momentum



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## Introduction

This Part contains General Information about PROFIBUS DP, configuration with Momentum as well as connecting the communications adapter and installing the network.

## What's in this Part?

This part contains the following chapters:

| Chapter | Chapter Name                                            | Page |
|---------|---------------------------------------------------------|------|
| 1       | PROFIBUS DP and PROFIBUS DP Configuration with Momentum | 11   |
| 2       | Use of I/O Base and Communications Adapter              | 15   |
| 3       | Mounting the Components and the Connecting the Cables   | 23   |
| 4       | EMC Measures for the Communications Adapter             | 31   |
| 5       | Ordering Details for PROFIBUS DP Components             | 35   |



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# PROFIBUS DP and PROFIBUS DP Configuration with Momentum

# 1

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## Introduction

This Chapter gives an overview of the PROFIBUS DP, the 170 DNT 110 00 Communications Adapter and the configuration of PROFIBUS DP with Momentum.

## What's in this Chapter?

This chapter contains the following topics:

| Topic                                   | Page |
|-----------------------------------------|------|
| Introduction to PROFIBUS DP             | 12   |
| PROFIBUS DP Configuration with Momentum | 13   |
| PROFIBUS DP Configuration Limits        | 14   |

## Introduction to PROFIBUS DP

### Introduction

PROFIBUS DP is an open industrial standard for integrated communication. It is a serial fieldbus, which provides a decentralized connection between sensors, actuators and I/O modules produced by various manufacturers, and connects them to the superset control level. PROFIBUS DP is a version of PROFIBUS optimized for performance, and was specifically designed to meet time critical communications requirements between the controller level and peripheral process devices.

The PROFIBUS DP network supports multiple communications master devices and several slaves. A master may be a PLC (e.g a Quantum with communication module PTQ PDP MV1), a PC or another controller device. A Momentum I/O module with communications adapter 170 DNT 110 00 is a typical PROFIBUS DP slave.

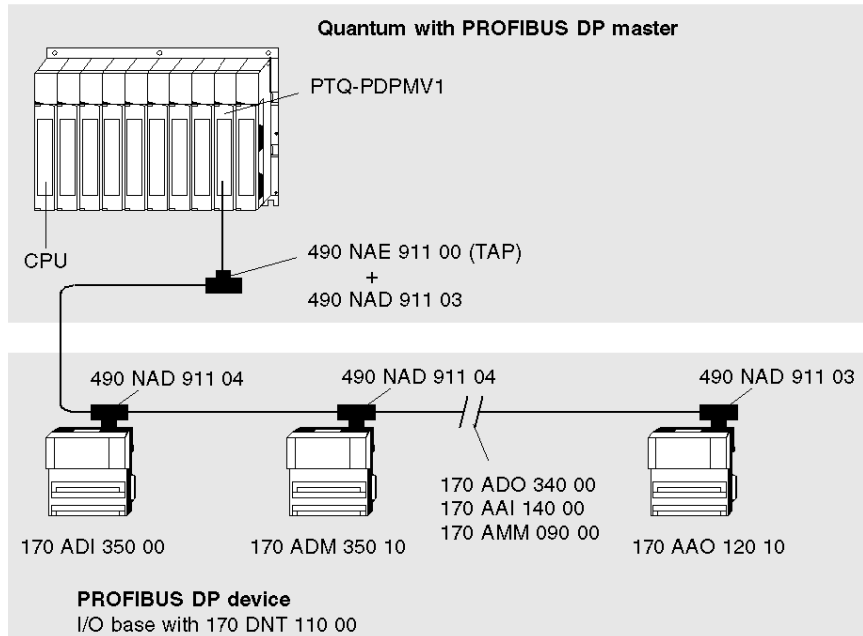
A PROFIBUS DP network supports a data rate of 12 Mbps over distances of 100m and a data rate of 93.75 kbps over distances up to 1200m. The cable consists of 2-wire shielded cable.

A PROFIBUS DP network can support up to 125 devices (recommended configuration: one master per network) with up to 32 slaves per network segment. The individual segments are connected by repeaters. A typical PROFIBUS DP configuration with Momentum modules can be found in the *Configuration, page 13* section.

## PROFIBUS DP Configuration with Momentum

### Configuration

The following example shows the use of Momentum I/O modules with the PROFIBUS DP.



**NOTE:** A PROFIBUS terminating connector (e.g. 490 NAD 911 03) must always be used at the front and back ends of the bus.

Detailed information about PROFIBUS DP standards can be found on the PROFIBUS website ([www.profibus.com](http://www.profibus.com)).

Further details about topology and configurations are contained in the manuals for the relevant PROFIBUS DP masters.

## PROFIBUS DP Configuration Limits

### Requirements

The configuration limits assume a Quantum with a PTQ PDP MV1 as a master (see also the hardware description of the 170 DNT 110 00 communications adapter).

### Configuration Limits

The following configuration limits apply to the PROFIBUS DP:

| Parameter                           | Limitations                             |
|-------------------------------------|-----------------------------------------|
| max. number of devices              | 125 with repeater (max. 32 per segment) |
| max. number of I/O points per slave | 244 bytes each                          |
| Transfer rate                       | 9.6 kBit / s to 12 MBit / s             |

### Bus Length

Bus Length as a Function of the Transfer Rate

| Bus Length          | Transfer Rate                 |
|---------------------|-------------------------------|
| Max 1.200 m (100 m) | 9.6 ... 19.2 ... 93.75 kBit/s |
| Max 1000 m          | 187.5 kBit/s                  |
| Max 400 m           | 500 kBit/s                    |
| Max 200 m           | 1.5 MBit/s                    |
| Max 100 m           | 3 ... 6 ... 12 MBit/s         |

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# Use of I/O Base and Communications Adapter



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## Introduction

This chapter describes the relationship between the I/O base and the communications adapter

## What’s in this Chapter?

This chapter contains the following topics:

| Topic                                                                        | Page |
|------------------------------------------------------------------------------|------|
| General Information about Communications Adapter 170 DNT 11000               | 16   |
| Architecture and Functionality of the Communications Adapter for PROFIBUS DP | 18   |
| Potential Isolation of the PROFIBUS DP Bus Interface                         | 21   |

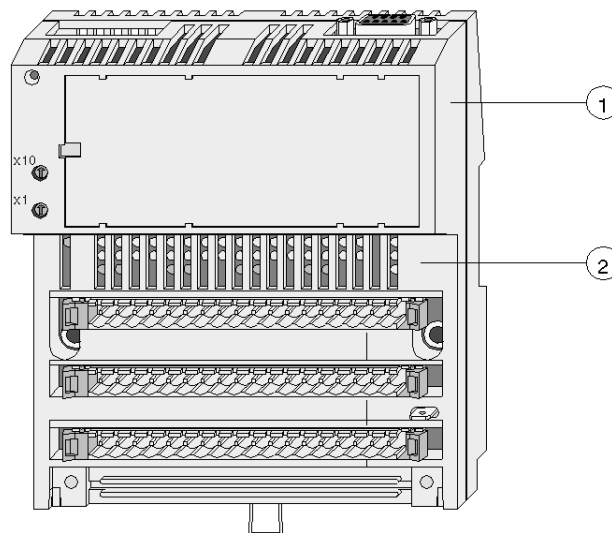
## General Information about Communications Adapter 170 DNT 11000

### General Information about Structure

The communications adapter can be combined with any I/O base from the Momentum family. Together they form a functional I/O module for the PROFIBUS DP network. These I/O modules can be used in a network together with other PROFIBUS DP compatible devices.

### Representation of I/O Base with Adapter

View of an I/O base with PROFIBUS DP adapter installed:



- 1 170 DNT 110 00 Communications adapter
- 2 I/O base

A fill-in label is shipped with the I/O base. This label fits into an area on the front of the adapter. The signal names belonging to the sensors and actuators can be written here. On the right hand side of the label is a clear window, through which the name of the communications adapter can be seen.



## Identification of decentralized I/O modules

Every Momentum I/O module in the PROFIBUS DP network needs an individual address, which can be assigned using the address switches on the front of the 170 DNT 110 00 communications adapter. Address settings are described in the section *Address Settings, page 43*. This enables the PLC to communicate with each module individually via the PROFIBUS DP master.

The PROFIBUS DP adapter has a PNO ident number (7512 hex). This ident number is used for the internal administration of the PROFIBUS.

The I/O unit also has an ident number, which is evaluated by the communications adapter and output (via the bus) to the master for identification purposes. This acts as a safeguard against configuration error. The evaluation of the I/O base ident number is described in the Section *Ident Codes for Momentum I/O Bases, page 70*.

## Compatibility with TIO Modules

If a TIO (Terminal Block I/O) is replaced with a suitable Momentum module, a reconfiguration of the bus is necessary, (because Momentum module ident numbers differ from those of the TIOs). However, the user files remain the same.

Similarly, I/O errors will be represented differently from standard TIOs. If TIOs are replaced by Momentum modules, the byte must be queried for > 0, in order to remain compatible with standard TIOs (see *I/O Error (Diagnostic Byte 8), page 67*).

## Environmental Specifications

The communications adapter and the I/O units that can be mounted on it conform to the same environmental specifications. This information about I/O bases can be found in the system data in the user manual *I/O Units for Momentum*.

## Architecture and Functionality of the Communications Adapter for PROFIBUS DP

### Hardware Function Blocks

The communications adapter consists of 4 hardware function blocks:

- *RS 485 PROFIBUS DP Interface, page 18*
- *ATI I/O Base Interface, page 18*
- *Protocol Execution, page 18* (EPROM with firmware)
- *Voltage Supply, page 19*

### RS 485 PROFIBUS DP Interface

The communications adapter has a standard fieldbus interface for the PROFIBUS DP. The interface contains the PROFIBUS protocol chip and complies with the PROFIBUS DP standards per EN 50170 (DIN 19245 Parts 1 and 3 are integrated). The signals are executed as differential signals.

### ATI I/O Base Interface

The ATI interface is an internal interface. It allows data exchange between the communications adapter and the I/O base.

### Protocol Execution

The firmware for protocol execution is stored in an EPROM. The communications adapter's firmware executes the protocols between the I/O module and the master. The transfer mode is half-duplex.

Integral functions are:

- After voltage is applied or reset is activated, the communications adapter receives information about the data size requirement of the I/O base. The communications adapter also receives the I/O base group and code information. This information is provided by the I/O base.
- The PROFIBUS DP master sends each slave (I/O module) the configuration data specified in the GSD file. Typical configuration data is e.g.: Identification of the I/O base, I/O data size etc. The I/O module compares the configuration data with its own actual data. If the data match, the master parameterizes the I/O module, and communication can be established.
- If the I/O base detects an I/O error, the error signal is sent to the master as part of a (non-cyclic) diagnostic message (see evaluation of the, *I/O Error (Diagnostic Byte 8)*, page 67 diagnostic message).

## Voltage Supply

The internal voltage supply (Vcc) is provided by the I/O base. Vcc is monitored and a reset signal is generated if and when Vcc is not within tolerance. The isolated voltage (Vcx) for the PROFIBUS DP interface is generated via a DC/DC converter and is not monitored.

## Message Types and Data Transfer

The 170 DNT 110 00 PROFIBUS DP communications adapter recognizes three types of messages:

- USER DATA (input and output data and parameters)
- Diagnostic data
- Bus configuration

These messages are transferred in different cycles between the master and the I/O module (slave). The 170 DNT 110 00 communications adapter handles this task for the I/O module:

| Transfer Cycle                                            | Description                                                                                                                                                                                       |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cyclical transfer of the USER DATA                        | A transfer sequence in which input data is read from the DP slave by the master, and then output data is written to the DP slave. The parameters for analog modules are included in the I/O data. |
| Non-cyclic transfer of status information for diagnostics | If new diagnosis data is detected, a flag is set by the slave. This causes the master to poll the data.                                                                                           |
| One-time transfer of PROFIBUS DP internal parameters      | Bus parameters, e.g. the ident number of the DP master that configures the slaves.                                                                                                                |

## Error Control

A serial microprocessor controls all of the operations within the 170 DNT 110 00

These include:

- Sending a module error to the master via the PROFIBUS DP whenever an I/O base detects an I/O error.
- The microprocessor controls a LED, which provides information about the data transfer (BF = Bus Fault), to provide a visual display of a network fault.
- Setting the Data Control Time (DCT) for the DP master, which must take into consideration all the slave watchdog settings (e.g. if slave timeout is set for 250 ms, the DCT may be set to 1500 ms, a ratio of 6 to 1)

**NOTE:** The Data Control Time (DCT) and the watchdog times are entered with the corresponding bus projection tool during bus projection.

The master checks whether it had application data transmission with all slaves.

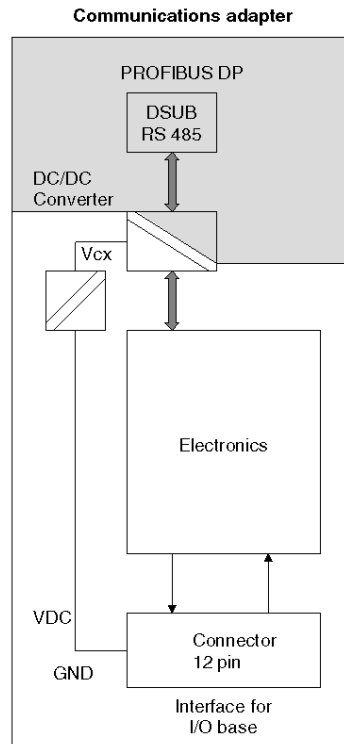
The watchdog time is set for each slave. If the slave hadn't been polled by the master during this time, it sets its outputs to the defined shutdown value.

Additional information can be found in the software documentation for your PROFIBUS DP master.

## Potential Isolation of the PROFIBUS DP Bus Interface

### Potential Isolation

The bus interface is always isolated, as shown in the illustration.





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# Mounting the Components and the Connecting the Cables



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## Introduction

This Chapter describes the mounting of the I/O base and the communications adapter and the connection of the connection cable.

## What's in this Chapter?

This chapter contains the following topics:

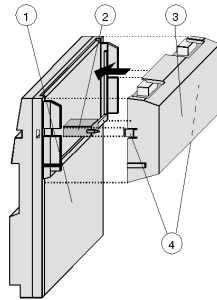
| Topic                                          | Page |
|------------------------------------------------|------|
| Mounting of the bus adapter                    | 24   |
| Mounting the I/O Module                        | 25   |
| Connection to the PROFIBUS DP                  | 27   |
| Constructing the Bus Cable for the PROFIBUS DP | 28   |

## Mounting of the bus adapter

### Mounting of the bus adapter

The bus adapter is connected to the I/O unit with a plug. The spring clips serve as a lock and insure a mechanically secure fit.

Diagram of the mounting of the bus adapter onto the I/O unit:



- 1 I/O unit
- 2 Connecting plug (ATI interface)
- 3 Bus adapter (with 1 or 2 bus plugs depending on the bus type)
- 4 Spring clips

### **⚠ CAUTION**

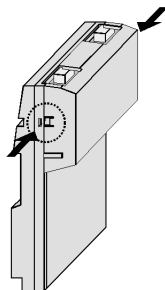
**The I/O module corresponds to protection type IP20. i.e. these modules must be mounted in enclosed switch cabinets in electrical equipment rooms.**

When working at switch cabinets, the user must electrically discharge themselves to protect the modules from electrostatic charges.

**Failure to follow these instructions can result in injury or equipment damage.**

### Disconnection of the bus adapter

The adapter can be disconnected using a screwdriver (see arrow).

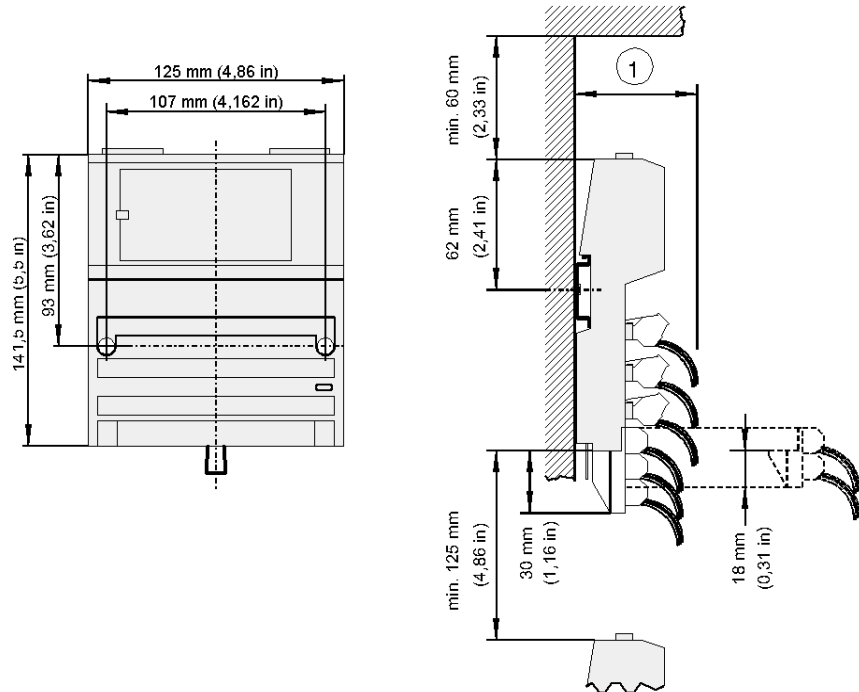




## Mounting the I/O Module

### Dimensions of the I/O Module

The following illustration shows the dimensions of the I/O module with communications adapter:



1

| Type of module      | Depth             |
|---------------------|-------------------|
| Direct Current      | 60 mm (2.72 inch) |
| Alternating Current | 65 mm (2.53 inch) |

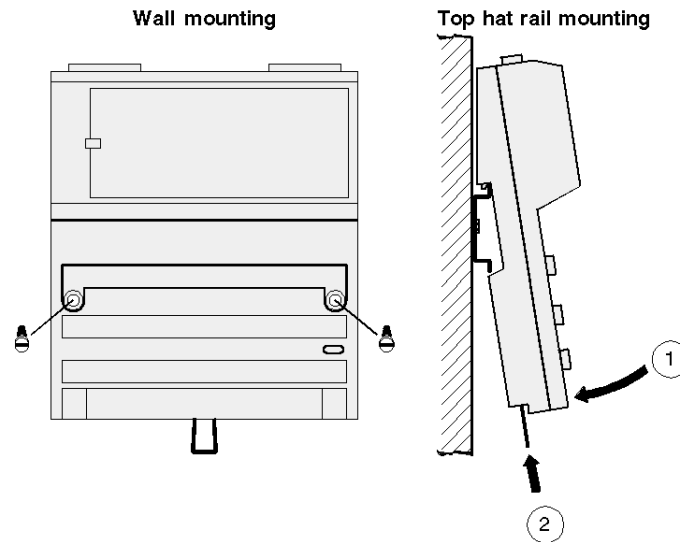
## mounting the I/O Module

The I/O module can be mounted on a DIN bearing rail or on a wall or to a machine casing using just 2 screws.

A spring on the back of the casing produces a ground connection with the bearing rail.

Top hat rail mounting requires an additional ground connection to be made from the module's PE screw to the top hat rail.

Representation of wall and top hat installation:



**NOTE:** Please pay close attention to the comprehensive notes about installing and grounding the module in the user manual for Momentum product family I/O units, and for information about ordering this, see the *Related Documents* section.

## Connection to the PROFIBUS DP

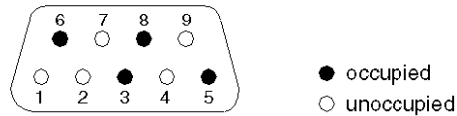
### Connector

The following connectors can be used for the connection to the PROFIBUS DP.

| Description                                               | Part No.       |
|-----------------------------------------------------------|----------------|
| PROFIBUS connector with termination (yellow)              | 490 NAD 911 03 |
| PROFIBUS connector node (gray)                            | 490 NAD 911 04 |
| PROFIBUS connector node with diagnostics interface (gray) | 490 NAD 911 05 |

### Communications Adapter Interface Assignment

Communications adapter pin assignment (sockets)



Interface assignment

| Terminal          | Signal    | Meaning                                                           |
|-------------------|-----------|-------------------------------------------------------------------|
| 3                 | RxD/TXD-P | Incoming data (RxD) positive,<br>Outgoing data (TxD) positive     |
| 5                 | DGND      | Reference potential for terminations (supplied by the I/O module) |
| 6                 | VP        | Supply voltage for terminations (+5 V supplied by the I/O module) |
| 8                 | RxD/TXD-N | Incoming data (RxD-N) negated,<br>Outgoing data (TxD-N) negated   |
| 1, 2, 4, 7, 9     |           | Pin not connected                                                 |
| Connector housing |           | Cable shield connection (internally connected)                    |

## Constructing the Bus Cable for the PROFIBUS DP

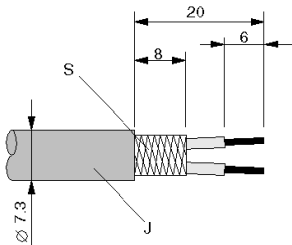
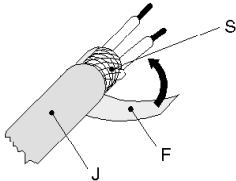
### Overview

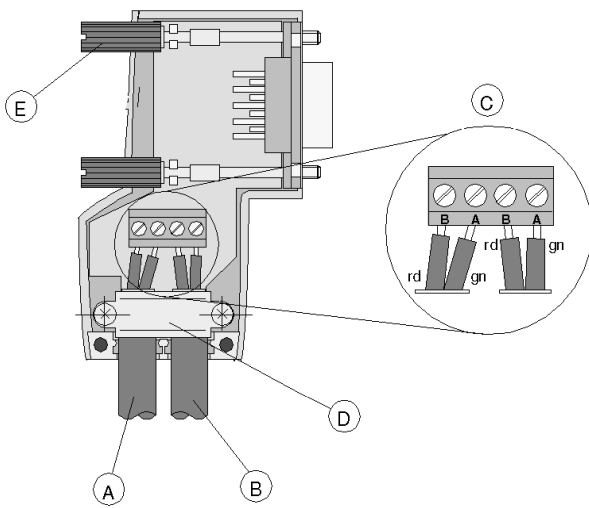
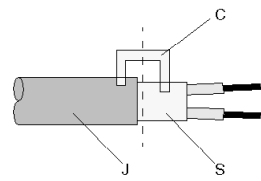
The bus cable for connecting PROFIBUS DP devices must be constructed by the user.

A special PROFIBUS cable (2 conductor, shielded) is required, this is available as an individual item from Schneider among others, see *Ordering Details for PROFIBUS DP Components*, page 37. Furthermore, three different *Connector*, page 27 are available.

### Constructing the Bus Cable

To construct the cable, proceed as follows:

| Step | Action                                                                                                                                                                                                                                                                                                                                                                                           |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Cut the cable to the required length.                                                                                                                                                                                                                                                                                                                                                            |
| 2    | <p>Prepare the cable ends as shown in the illustration (dimensions in mm):</p>  <p><b>J</b> PVC jacket<br/><b>S</b> Braided shielding</p>                                                                                                                                                                       |
| 3    | Remove the PVC jacket <b>J</b> to the length shown.                                                                                                                                                                                                                                                                                                                                              |
| 4    | <p>Wrap the supplied copper foil shielding <b>F</b> round the shielded braiding <b>S</b>:</p>  <p><b>J</b> PVC jacket<br/><b>S</b> Braided shielding<br/><b>F</b> Copper foil shielding</p> <p>Additional foil can be obtained from 3 M, see <i>Ordering Details for PROFIBUS DP Components</i>, page 37.</p> |

| Step | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5    | <p>Plug the leads of the corresponding cable(s) into the terminals as shown:</p> <ul style="list-style-type: none"> <li>● <b>Green</b> lead in terminal <b>A</b></li> <li>● <b>Red</b> lead in terminal <b>B</b></li> </ul> <p><b>Note:</b> Do <b>not</b> screw the corresponding screws in yet.<br/>           Connection terminal assignment on the PROFIBUS DP (example: 490 NAD 911 04 PROFIBUS connector):</p>  <p><b>A</b> Incoming cable KAB PROFIB<br/> <b>B</b> Outgoing cable KAB PROFIB (not available with 490 NAD 911 03)<br/> <b>C</b> Connection terminals (only once (B,A) with 490 NAD 911 03)<br/> <b>D</b> Cable cleat for relieving weight<br/> <b>E</b> Bus connector screws</p> |
| 6    | <p>Attach the cables with the available cable cleat to create a robust shielded connection and relieve weight as shown:</p>  <p><b>J</b> PVC jacket<br/> <b>S</b> Braided shielding with foil shielding<br/> <b>C</b> Cable cleat</p> <p><b>Note:</b> Half of the cable jacket must lie under the cable cleat.<br/>           Pay attention to the installation direction of the cable cleat.</p>                                                                                                                                                                                                                                                                                                    |

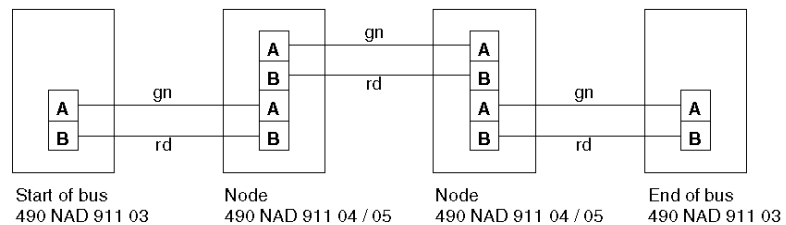
| Step | Action                                                                                                                                                                                       |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7    | The shielding of the two cables are each internally connected with the metal housing of the connector.                                                                                       |
| 8    | Close the connector housing.                                                                                                                                                                 |
| 9    | Perform the central discharge function for the shielding in accordance with <i>Central Discharge Function for the PROFIBUS DP</i> , page 32, before connecting the bus cable to the modules. |
| 10   | Plug the PROFIBUS DP connector into the corresponding module and secure it with the screws.                                                                                                  |

### Start of Bus and End of Bus

The PROFIBUS connector with termination (490 NAD 911 03) is required for the start and end of the bus. These connectors emulate the line impedance.

It is recommended that at least one connector with diagnostics interface (490 NAD 911 05) is used.

Wiring diagram for a PROFIBUS DP cable



---

# EMC Measures for the Communications Adapter



---

## Introduction

This Chapter contains notes about the central discharge function of the PROFIBUS DP and surge protection for bus leads.

## What's in this Chapter?

This chapter contains the following topics:

| Topic                                                 | Page |
|-------------------------------------------------------|------|
| Central Discharge Function for the PROFIBUS DP        | 32   |
| Surge Protection for Bus Leads (Lightning Protection) | 33   |

## Central Discharge Function for the PROFIBUS DP

### Central Discharge Function

Each cable shield should be galvanically grounded with the earth using FE/PE grounding clamps immediately after the cable has been connected to the cabinet.

### Static Discharge

In the case of a very long bus cable, which has been installed but not yet connected, you must discharge the static as follows:

| Step | Action                                                                                                                  |
|------|-------------------------------------------------------------------------------------------------------------------------|
| 1    | Select <b>the</b> PROFIBUS DP connector <b>closest to the FE/PE grounding clamp</b> .                                   |
| 2    | Touch the <b>metal of the connector housing</b> to the cabinet's FE/PE grounding clamp to carry out a static discharge. |
| 3    | Now connect the bus connector to the device.                                                                            |
| 4    | Discharge the other PROFIBUS DP cable connectors as described in steps 2 and 3.                                         |

### Note

**NOTE:** During mounting, the metal part of the PROFIBUS DP connector is connected internally to the cable shield. When the bus cable connector is inserted into the module's PROFIBUS port, a short connection between the shield and the FE/PE is created automatically.



## Surge Protection for Bus Leads (Lightning Protection)

### Surge Protection for Bus Leads up to 12 Mbps Signals

To protect transmission systems from extraneous surges (lightning), the PROFIBUS DP lead should be equipped with suitable surge protection equipment once it extends outside a building.

The nominal discharge current should be at least 5 kA.

Examples of compatible lightning arrestors include **Type CT MD/HF5** and **Type CT B110** made by the firm Dehn und Söhne GmbH & Co KG. For supplier addresses and order numbers, see *Ordering Details for PROFIBUS DP Components*, page 37.

For adequate protection of a PROFIBUS DP cable, two sets of protection equipment are required for each building. The first set of protection devices (type B110), located where the cable enters the building, works as a lightning conductor, the second (type MD/HF5), located near the first device, works as a surge protection device.

### Connection Rules for Protection Equipment

Before connecting the protection equipment, please pay close attention to the following rules:

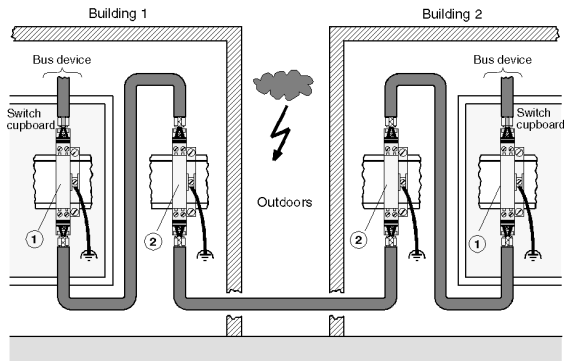
- Install a functional ground (potential-equalization rod)
- Install the protection equipment near the functional ground, to keep surge current path as short as possible.

Keep the lead to the functional earth as short as possible. (minimum 6mm<sup>2</sup>)

- The maximum lead length depends on the transfer rate.
  - **Up to 500 kbps** you may configure a maximum of **4 outdoor sections** with 8 pairs of protection devices (CT B110 and CT MD/HF5).
  - **From 1MBaud** up to the highest transfer rate you may only configure **1 outdoor section** with 2 pairs of protection devices.
- Do **not** mix up the IN and OUT sides of the lightning conductors (IN = outdoor side)
- Carry out a shield grounding (*see page 34*) of the PROFIBUS DP lead according to the type of lightning conductor (type CT B110 or CT MD/HF5) being used.

Connection Plan for Protection Devices

Connection plan of the protection devices:



Type and number of lightning conductors made by the firm Dehn und Söhne GmbH &Co KG suitable for a PROFIBUS DP cable

| No. | Type       | Number per Group |
|-----|------------|------------------|
| 1   | CT MD/HF 5 | 2                |
| 2   | CT B110    | 2                |

**NOTE:** Information about mounting and connecting the leads can be found in the relevant installation instructions, which are enclosed with the lightning conductors.

Shield Grounding of Surge Protection Devices

The protection devices permit direct or indirect shield grounding. The gas-type surge protector acts as an indirect ground.

In both cases EMC spring terminals grasp the input and output sides of the cable shield.

**NOTE:** When the system permits it, we recommend you use direct shield grounding.

Types of shield grounding assignment

| Type of grounding                                      | Assignment                                                                                                                                                             |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Direct shield grounding                                | Connect the shield of the incoming cable to the IN terminal, and that of the outgoing cable to the OUT terminal. The shields are now galvanically connected to the PE. |
| Indirect shield grounding via gas-type surge protector | Connect shields as described for direct shield grounding. Insert the gas-type surge protector in the rack beneath the cabinet connection terminals on the input side.  |

**NOTE:** Information about grounding and shield grounding can be found in the relevant installation instructions which are enclosed with the lightning conductors.

---

# Ordering Details for PROFIBUS DP Components



---

## Overview

This Chapter contains ordering details for PROFIBUS DP components as well as the necessary accessories.

## What's in this Chapter?

This chapter contains the following topics:

| Topic                                       | Page |
|---------------------------------------------|------|
| Ordering Details                            | 36   |
| Ordering Details for PROFIBUS DP Components | 37   |

## Ordering Details

### Overview

You can order the following PROFIBUS DP products for the Momentum family:

- Communications Adapters
- File with the Device Data Base
- Cables and Connectors
- Surge Protection Equipment

## Ordering Details for PROFIBUS DP Components

### Communications Adapter and Device Data Base

The following communications adapters and diskettes containing the device data base are available:

| Description                            | Part No.                             |
|----------------------------------------|--------------------------------------|
| Communications Adapter for PROFIBUS DP | 170 DNT 110 00                       |
| Device data base file                  | 381 SWA 000 00 *)                    |
| Label                                  | Corresponding to the I/O base in use |
| *) diskette is part of this manual     |                                      |

### Cables and Connectors

The following cables and connectors are available for the construction of PROFIBUS DP cables:

| Description                                                 | Part No.          |
|-------------------------------------------------------------|-------------------|
| PROFIBUS cable (by the meter)                               | KAB PROFIB        |
| PROFIBUS connector termination                              | 490 NAD 911 03    |
| PROFIBUS connector node                                     | 490 NAD 911 04    |
| PROFIBUS connector node with interface for programming unit | 490 NAD 911 05    |
| Foil shielding                                              | 3M, part no. 1183 |

**NOTE:** Foil shielding supplier:

3M Deutschland GmbH, Carl-Schurz-Straße 1, D-41 453 Neuss, Germany

## Surge Protection Equipment

The following protection equipment and accessories can be connected to the PROFIBUS DP, and are available from the firm Dehn und Söhne GmbH & Co KG.

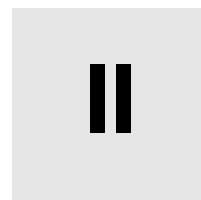
| Description                                              | Part No.               |
|----------------------------------------------------------|------------------------|
| Lightning conductor type CT MD/HF 5                      | Dehn, part no. 919 570 |
| Lightning conductor type CT B 110                        | Dehn, part no. 919.510 |
| Base component for lightning conductor type CT           | Dehn, part no. 919.506 |
| Gas-type surge protector for lightning conductor type CT | Dehn, part no. 919.502 |
| EMC spring terminals                                     | Dehn, part no. 919.508 |

**NOTE:** Supplier for the lightning conductors and accessories:

Dehn und Söhne GmbH & Co KG, Postfach 1640, D-92306 Neumarkt/Opf, Germany.

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## **Module Descriptions for PROFIBUS DP Modules**







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# Module Descriptions for the 170 DNT 110 00 Communications Adapter



---

## Overview

This Chapter describes the 170 DNT 110 00 communications adapter for PROFIBUS DP.

## What’s in this Chapter?

This chapter contains the following topics:

| Topic                                                         | Page |
|---------------------------------------------------------------|------|
| Brief Description                                             | 42   |
| Description of the Display and Operational Control Components | 43   |
| Technical Specifications                                      | 46   |

## Brief Description

### General Information

The 170 DNT 110 communications adapter is the interface between the Momentum I/O bases and the PROFIBUS DP network. It can be connected to any Momentum I/O base.

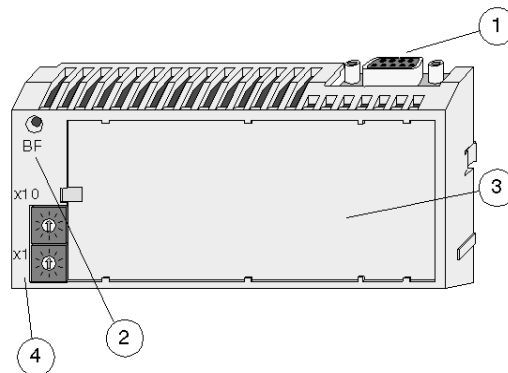
### Physical Structure of the Adapter

The adapter has 1 interface for connection to the PROFIBUS DP and 2 address switches for setting the PROFIBUS DP address.

The operating mode is displayed by 1 LED.

### Position of the Adapter Components

Position of the adapter components



- 1 PROFIBUS DP connector (sockets)
- 2 LED display
- 3 Area for label (near to the I/O base)
- 4 PROFIBUS DP address switch

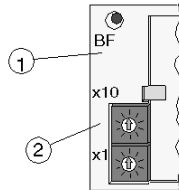
### Software Linkages

A device data base file is needed to integrate the I/O base into the user program. The diskette is part of this manual. A README file with further information is contained on the diskette.

## Description of the Display and Operational Control Components

### Layout of the Components

Layout of the Display and Operational Control Components



- 1 LED
- 2 Address switch for the PROFIBUS DP address

### Status of the LED Display

Status of the LED display:

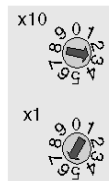
| LED | Status | Meaning                                                                    |
|-----|--------|----------------------------------------------------------------------------|
| BF  | Red    | Bus error:<br>The internal watchdog has responded or a reset has occurred. |
|     | Off    | The module is working in a data exchange cycle.                            |

### Address Settings

The user must assign a PROFIBUS DP address to each device. For Momentum family slaves, this address is between 1 and 99. The address allocation is dependent on the physical arrangement of the modules on the PROFIBUS DP.

The address is set on the front side of the communications adapter, and must be identical to the one allocated during bus configuration. This ensures that all outgoing and incoming messages within the network reach the device for which they are intended.

Setting the PROFIBUS DP address to 36



## Possible PROFIBUS DP addresses

| PROFIBUS DP Address | Upper Address Switch (x 10) | Lower Address Switch (x 1) |
|---------------------|-----------------------------|----------------------------|
| 1 ... 9             | 0                           | 1 ... 9                    |
| 10 ... 19           | 1                           | 0 ... 9                    |
| 20 ... 29           | 2                           | 0 ... 9                    |
| 30 ... 39           | 3                           | 0 ... 9                    |
| 40 ... 49           | 4                           | 0 ... 9                    |
| 50 ... 59           | 5                           | 0 ... 9                    |
| 60 ... 69           | 6                           | 0 ... 9                    |
| 70 ... 79           | 7                           | 0 ... 9                    |
| 80 ... 89           | 8                           | 0 ... 9                    |
| 90 ... 99           | 9                           | 0 ... 9                    |

 **CAUTION****Addressing on the PROFIBUS DP**

Do not begin operating any module before the slave address has been set. See your network administrator to find out the correct device addresses.

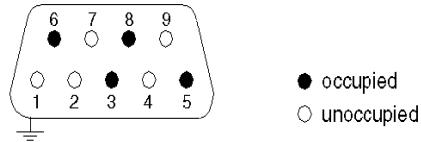
Should you need to modify the addresses while the module is in operation, the power supply must be switched off and then on again. This is because addresses are only uploaded at the point when voltage is applied.

No duplicate addresses may be used with the PROFIBUS, because this can lead to conflicts on the bus.

**Failure to follow these instructions can result in injury or equipment damage.**

## Interface Assignment

Communications adapter pin assignment (sockets)



Interface assignment

| Terminal          | Signal    | Meaning                                                                                                           |
|-------------------|-----------|-------------------------------------------------------------------------------------------------------------------|
| 3                 | RxD/TXD-P | Incoming data (RxD) positive,<br>Outgoing data (TxD) positive                                                     |
| 5                 | DGND      | Reference potential for terminations, only applies to<br>connectors with termination (supplied by the I/O module) |
| 6                 | VP        | Supply voltage for terminations, only applies to connectors<br>with termination (+5 V supplied by the I/O module) |
| 8                 | RxD/TXD-N | Incoming data (RxD-N) negated,<br>Outgoing data (TxD-N) negated                                                   |
| 1, 2, 4, 7, 9     |           | Pin not connected                                                                                                 |
| Connector housing |           | Cable shield connection (internally connected)                                                                    |

## Technical Specifications

### General Data

General technical specifications:

|                   |                                          |
|-------------------|------------------------------------------|
| Power supply      | 5 VDC / 250 mA (from the I/O base)       |
| Power consumption | 250 mA at 5 V (supplied by the I/O base) |
| Power dissipation | 1.2 W (type)                             |

### Potential Isolation

Potential isolation bus interface:

|      |                               |
|------|-------------------------------|
| RS85 | Isolated from remaining logic |
|------|-------------------------------|

### Error Detection

Error detection

|               |                                                                                                                                                                             |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data exchange | Red LED for bus error (BF) and<br>I/O Error message at the master for digital inputs and outputs,<br>Parameter Control (prm_control) message at the master for complex I/Os |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Fuses

Fuses:

|                    |                                              |
|--------------------|----------------------------------------------|
| Supply voltage Vcc | Internal (for communications adapter) - none |
|--------------------|----------------------------------------------|

### PROFIBUS DP Data Interface

Interface assignment:

|        |                                                   |
|--------|---------------------------------------------------|
| RS 485 | See <i>Connection to the PROFIBUS DP, page 27</i> |
|--------|---------------------------------------------------|

**Bus Data**

Bus length, transfer rate and protocol:

|                                               |                                            |                               |
|-----------------------------------------------|--------------------------------------------|-------------------------------|
| Transfer mode                                 | Half-duplex                                |                               |
| Protocol transfer                             | PROFIBUS DP as per DIN 19245 parts 1 and 3 |                               |
| Transfer rate as a function of the bus length | <b>Bus Length</b>                          | <b>Transfer Rate</b>          |
|                                               | Max 1200 m                                 | 9.6 ... 19.2 ... 93.75 kBit/s |
|                                               | Max 1000 m                                 | 187.5 kBit/s                  |
|                                               | Max 400 m                                  | 500 kBit/s                    |
|                                               | Max 200 m                                  | 1.5 MBit/s                    |
|                                               | Max 100 m                                  | 3 ... 6 ... 12 MBit/s         |





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# PROFIBUS DP Module Software Linkage



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## Introduction

This Part contains information about the format, size and mapping of the I/O data when using the communications adapter for PROFIBUS DP. Additionally, it also contains notes about diagnostics and trouble shooting.

## What's in this Part?

This part contains the following chapters:

| Chapter | Chapter Name                                        | Page |
|---------|-----------------------------------------------------|------|
| 7       | Communications Adapter Data Mapping for PROFIBUS DP | 51   |
| 8       | Diagnostics                                         | 63   |



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# Communications Adapter Data Mapping for PROFIBUS DP



---

## Introduction

This Chapter contains information about the format, size and mapping of the I/O data when using the communications adapter for PROFIBUS DP.

## What’s in this Chapter?

This chapter contains the following topics:

| Topic                                                     | Page |
|-----------------------------------------------------------|------|
| I/O Data Format and Size                                  | 52   |
| Data Mapping with I/O Bases                               | 55   |
| Example of a PROFIBUS DP Configuration                    | 57   |
| Example of State Memory Addressing in Concept and Modsoft | 59   |

## I/O Data Format and Size

### Overview

The I/O data contains discrete I/O points for these modules, as well as analog values and parameters for the complex (analog) I/O bases.

Each I/O unit is identified immediately after voltage is applied. Data exchange can then begin.

I/O modules with discrete, analog or mixed I/O bases are each sent messages using different data formats:

| Type of I/O Base                                  | Data Format |
|---------------------------------------------------|-------------|
| Discrete                                          | Byte        |
| Analog                                            | Word        |
| Discrete and analog combination / special modules | Word        |

### Number of Words for analog I/O Bases

Number of I/O words for analog I/O bases:

| Description    | Function                                     | Input Words                | Output Words                        |
|----------------|----------------------------------------------|----------------------------|-------------------------------------|
| 170 AAI 030 00 | 8 input channels                             | 8                          | 2                                   |
| 170 AAI 140 00 | 16 input channels                            | 16                         | 4 (for parameters)                  |
| 170 AAI 520 40 | 4 input channels, RTD, thermoelements        | 4                          | 4 (for parameters)                  |
| 170 AAO 120 00 | 4 output channels                            | 0                          | 5 (of which 1 word for parameters)  |
| 170 AAO 921 00 | 4 output channels                            | 0                          | 5 (of which 1 word for parameters)  |
| 170 AMM 090 00 | 4 inputs, 2 outputs (discrete)               | 1 (8 bits for diagnostics) | 1                                   |
|                | 4 input channels, 2 output channels (analog) | 4                          | 4 (of which 2 words for parameters) |
| 170 ANR 120 90 | 8 inputs, 8 outputs (discrete)               | 12                         | 12                                  |
|                | 6 input channels, 4 output channels (analog) |                            |                                     |

**Number of Words for Special Modules**

Number of I/O words for special modules:

| Description    | Function                                            | Input Words | Output Words |
|----------------|-----------------------------------------------------|-------------|--------------|
| 170 ADM 540 80 | 6 inputs, 3 outputs (120 VAC)<br>1 Modbus interface | 16          | 16           |
| 170 AEC 920 00 | Counter                                             | 8           | 8            |

**Number of Bytes for discrete I/O Bases, 24 VDC**

Number of Bytes for discrete I/O Bases, 24 VDC)

| Description    | Function              | Input Byte                             | Output Byte |
|----------------|-----------------------|----------------------------------------|-------------|
| 170 ADI 340 00 | 16 inputs             | 2                                      | 0           |
| 170 ADI 350 00 | 32 inputs             | 4                                      | 0           |
| 170 ADO 340 00 | 16 outputs            | 0                                      | 2           |
| 170 ADO 350 00 | 32 outputs            | 0                                      | 4           |
| 170 ADM 350 10 | 16 inputs, 16 outputs | 2                                      | 2           |
| 170 ADM 350 11 | 16 inputs, 16 outputs | 2                                      | 2           |
| 170 ADM 370 10 | 16 inputs, 8 outputs  | 2                                      | 2           |
| 170 ADM 390 10 | 16 inputs, 12 outputs | 6 (2 discrete<br>and 4<br>diagnostics) | 2           |
| 170 ADM 390 30 | 10 inputs, 8 outputs  | 2                                      | 2           |

**Number of Bytes for discrete I/O Bases, 120/230 VAC**

Number of bytes for discrete I/O Bases, 120/230 VAC)

| Description    | Function                        | Input Byte | Output Byte |
|----------------|---------------------------------|------------|-------------|
| 170 ADI 540 50 | 16 inputs / 240 VAC             | 2          | 0           |
| 170 ADI 740 50 | 16 inputs / 120 VAC             | 2          | 0           |
| 170 ADO 530 50 | 8 outputs / 120 VAC             | 0          | 2           |
| 170 ADO 540 50 | 16 outputs / 120 VAC            | 0          | 2           |
| 170 ADO 730 50 | 8 outputs / 230 VAC             | 0          | 2           |
| 170 ADO 740 50 | 16 outputs / 230 VAC            | 0          | 2           |
| 170 ADM 690 50 | 10 inputs, 8 outputs<br>120 VAC | 2          | 2           |

| Description    | Function                                     | Input Byte | Output Byte |
|----------------|----------------------------------------------|------------|-------------|
| 170 ADM 690 51 | 10 inputs, 8 outputs<br>120 VAC              | 2          | 2           |
| 170 ARM 370 30 | 10 inputs (24 V), 8 relay outputs<br>120 VAC | 2          | 2           |

# Data Mapping with I/O Bases

## Discrete I/O Bases

With discrete Momentum modules, each terminal I/O point is mapped according to the following principle:

- Each is mapped to bytes (max 4 bytes for 32 inputs or 32 outputs).
- The least significant byte (LSB) is sent or received first.
- The bytes (output words) sent from the communications adapter to the I/O base represent the output values.

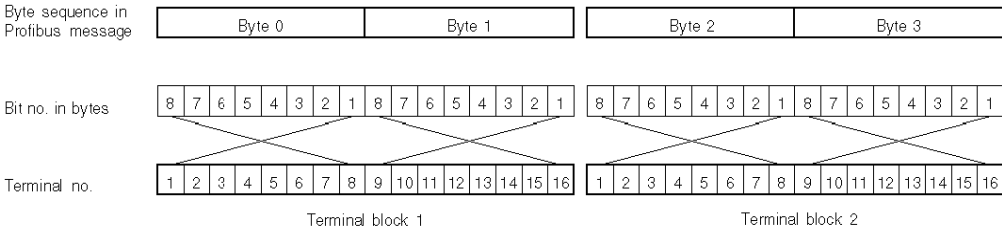
The bytes (input words) sent from the I/O unit to the communications adapter represent the input values and status statement.

- The register addressing is compatible with standard TIOs.

The following message structure illustrates the data exchange between the master and the slaves (I/O modules) for 2 discrete I/O bases.

| Byte No. | Significance | 170 ADI 350 00 input data | 170 ADI 350 00 output data |
|----------|--------------|---------------------------|----------------------------|
| 0        | LSB          | Inputs 8...1              | Outputs 8 ... 1            |
| 1        | -            | Inputs 16 ... 9           | Outputs 16 ... 9           |
| 2        | -            | Inputs 24 ... 17          | Outputs 24 ... 17          |
| 3        | MSB          | Inputs 32 ... 25          | Outputs 32 ... 25          |

The I/O bits are mapped via the bus as follows:



## Analog I/O Bases

With analog Momentum modules, each terminal I/O value is mapped according to the following principle:

- Each analog value is mapped onto one word.
- The least significant word (LSW) is sent or received first.

- The words (output registers) sent to the I/O base represent the output values and the parameters; the words (input registers) sent from the I/O base to the communications adapter represent the field values and status statement.
- Analog value representation occurs in compliance with IDS 3000. Sign and value are flush left (nominal range is +/- 32,000) The resolution depends on the selected measuring or output range. Negative values are represented as double complements.

The following message structure illustrates the data exchange between the master and the slave (I/O module) for the 170 AMM 090 00 module

| Word No. | Significance | Input data             | Output data                      |
|----------|--------------|------------------------|----------------------------------|
| 0        | LSW          | Value, input channel 1 | Parameter input channels 1 ... 4 |
| 1        | -            | Value, input channel 2 | Parameter output channels 1,2    |
| 2        | -            | Value, input channel 3 | Value, output channel 1          |
| 3        | -            | Value, input channel 4 | Value, output channel 2          |
| 3        | MSW          | Discrete inputs        | Discrete outputs                 |

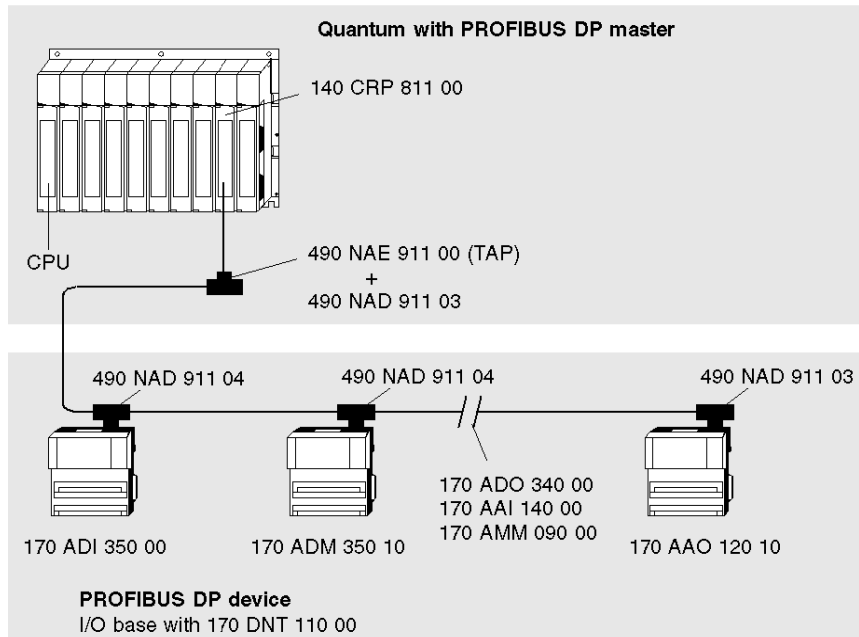
Further information is contained in the *Momentum I/O Bases* user manual.



## Example of a PROFIBUS DP Configuration

### Example of a PROFIBUS DP Configuration

The following illustration shows an example configuration for the PROFIBUS DP. Only Momentum I/O modules are used:



**NOTE:** A PROFIBUS terminating connector (e.g. 490 NAD 911 03) must always be used at the front and back ends of the bus.

The following tasks must be executed to prepare a PROFIBUS DP network for operation:

- Configure the bus by
  - *Constructing the Bus Cable for the PROFIBUS DP, page 28* according to the configuration.
  - *Address Settings, page 43* of the devices
- Configure the bus with an appropriate tool, which is independent of the installed system (e.g. SyCon in the case of Modicon Quantum with Concept and Premium with PL7), as well as *Installation of the Device Data Base File (GSD), page 58*
- Allocate the I/O points for state RAM addressing using the relevant software program (e.g. Concept, PL7)

**NOTE:** Analog Momentum I/O bases only attain data exchange status when a complete set of valid parameters together with the user data are transferred to them.

### **Installation of the Device Data Base File (GSD)**

In PROFIBUS DP, the performance features of the devices are documented by the manufacturer and provided for the user in the form of an equipment data sheet and a device data base file (GSD) and are made available to the user. The contents and codification of the device data bases correspond to accepted standards, and are therefore independent of the master. They enable the configuration of any desired number of DP slaves using various manufacturers' configuration equipment.

The device data base file is delivered in the form of a diskette (file ASA\_7512.GSD for Momentum modules) and is part of this user manual (see also *Ordering Details for PROFIBUS DP Components*, page 37). A README file with further information is contained on this diskette. How to import this GSD file is described in *Parameterizing the Master*.

## Example of State Memory Addressing in Concept and Modsoft

### Overview

PROFIBUS DP slaves require the following different memory areas:

- for USER DATA
- for diagnostic data

### Example of User Data

The required bytes and words are provided by the selection of the I/O modules (see *I/O Data Format and Size*, page 52).

The following memory assignment was selected for the *Example of a PROFIBUS DP Configuration*, page 57:

| Slave Address | Momentum Module | Input Length | Output Length | Input Type | Address Inputs    | Address Outputs   |
|---------------|-----------------|--------------|---------------|------------|-------------------|-------------------|
| 3             | 170 ADI 350 00  | 4 bytes      | 0 bytes       | BOOL       | 300 001 - 300 002 | -                 |
| 4             | 170 ADM 350 10  | 2 bytes      | 2 bytes       | BOOL       | 300 003           | 400 001           |
| 5             | 170 ADO 340 00  | 0 bytes      | 2 bytes       | BOOL       | -                 | 400 002           |
| 6             | 170 AAI 140 00  | 16 words     | 4 words       | UINT16     | 300 004 - 300 019 | 400 003 - 400 006 |
| 7             | 170 AMM 090 00  | 5 words      | 5 words       | UINT16     | 300 020 - 300 024 | 400 007 - 400 011 |
| 8             | 170 AAO 120 00  | 0 words      | 5 words       | UINT16     | -                 | 400 012 - 400 016 |

In the example, memory was allocated when the master was parameterized. The word format (because the I/O base is analog) was also selected when the master was parameterized.

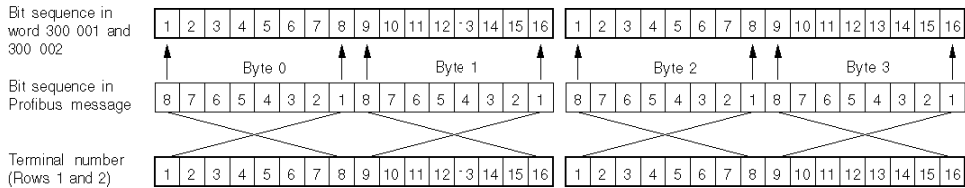
In this example, data transfer via the bus for discrete I/Os occurs in bytes and in accordance with the following rules:

- The user data is shifted flush left in the word
- Byte 0 is the first byte to be sent, followed by bytes 1, 2 and 3 with 32 inputs or outputs

**NOTE:** For discrete I/O bases, 0x and 1x references can also be selected.

In the example, the bus master converts bytes into words, before they are stored in the PLC memory. For the slave 3 (170 ADI 350 00), the input bits are stored in the words 300 001 and 300 002.

Within the words, the I/O base's inputs are as follows:



This leads to the following data mapping (input type BOOL):

| Byte No.             | Byte 0 |   |   |   |   |   |   |   | Byte 1 |    |    |    |    |    |    |    |
|----------------------|--------|---|---|---|---|---|---|---|--------|----|----|----|----|----|----|----|
| Bits in word 300.001 | 8      | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 16     | 15 | 14 | 13 | 12 | 11 | 10 | 9  |
| Terminal No.: Row 1  | 1      | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9      | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

| Byte No.             | Byte 2 |   |   |   |   |   |   |   | Byte 3 |    |    |    |    |    |    |    |
|----------------------|--------|---|---|---|---|---|---|---|--------|----|----|----|----|----|----|----|
| Bits in word 300 002 | 8      | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 16     | 15 | 14 | 13 | 12 | 11 | 10 | 9  |
| Terminal No.: Row 2  | 1      | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9      | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

### Example of Diagnostic Data

A diagnostic message includes 19 bytes per I/O module. The bytes are mapped onto words.

The meaning of the bytes is described in the *Structure of the Diagnostic Message*, page 64 section. Bytes 1 and 8 are required for error evaluation. For complex modules (analog), byte 9 is also required (it displays, among other things, whether a parameter default is valid or invalid).

In the example therefore, only the first 8 or 9 bytes of each module are saved in the controller.

The following memory is reserved:

- Eight words are required for the discrete modules' diagnostic data (bytes 1 ... 8)
- Nine words are required for the analog modules' diagnostic data (bytes 1 ... 9).

If the ident code (bytes 18 and 19) is to be likewise evaluated, 19 words must be reserved for 19 bytes. These options must be considered during the parameterization of the master.

The memory partitions for the example can be constructed as follows:

| Slave Address | Momentum Module | Input Length | Input Diagnostic Address |
|---------------|-----------------|--------------|--------------------------|
| 3             | 170 ADI 350 00  | 8 words      | 300 301 - 300 308        |
| 4             | 170 ADM 350 10  | 8 words      | 300 309 - 300 316        |
| 5             | 170 ADO 340 00  | 8 words      | 300 317 - 300 324        |
| 6             | 170 AAI 140 00  | 9 words      | 300 325 - 300 333        |
| 7             | 170 AMM 090 00  | 9 words      | 300 334 - 300 342        |
| 8             | 170 AAO 120 00  | 9 words      | 300 343 - 300 351        |

For example, the following table displays the data mapping for the slave's diagnostic byte 1 with address 7 (170 ADI 350 00) in word 300 301 (input type UINT8).

| Diagnostic Byte No.        |    |    |    |    |    |    |    |   | Byte 1 |   |   |   |   |   |   |   |
|----------------------------|----|----|----|----|----|----|----|---|--------|---|---|---|---|---|---|---|
| Bit no. in diagnostic byte |    |    |    |    |    |    |    |   | 8      | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Bit no. in word 300 301    | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8      | 7 | 6 | 5 | 4 | 3 | 2 | 1 |



---

# Diagnostics

8

---

## Introduction

This chapter contains information about diagnostics and trouble shooting.

## What’s in this Chapter?

This chapter contains the following topics:

| Topic                                                | Page |
|------------------------------------------------------|------|
| Evaluation of the PROFIBUS DP Diagnostic Message     | 64   |
| Ident Codes for Momentum I/O Bases                   | 70   |
| Trouble Shooting via PROFIBUS DP Diagnostic Messages | 72   |

# Evaluation of the PROFIBUS DP Diagnostic Message

## Overview

During the addressing of the PROFIBUS devices, the diagnostic data addresses are given as well as the input and output data addresses.

Input references are assigned to the diagnostic data. These do not have to have any connection to the Momentum module's input data but can be assigned to any input area in the PLC's state memory.

If new diagnostic data is issued, a bit is set by the slave (e.g. by a Momentum I/O module). If the master detects this bit, it automatically requests the diagnostics.

## Structure of the Diagnostic Message

The diagnostic data includes 19 bytes per Momentum module:

- 6 bytes of standard diagnostic data and
- 13 bytes of enhanced diagnostics

The standard diagnostics are identical for all DP slaves, the length and content of the enhanced diagnostics is manufacturer-specific.

Structure of the diagnostic message

| Byte No. | Diagnostics Type     | Contents                                    |
|----------|----------------------|---------------------------------------------|
| 1        | Standard diagnostics | Station status 1                            |
| 2        |                      | Station status 2                            |
| 3        |                      | Station status 3                            |
| 4        |                      | Master address                              |
| 5        |                      | Ident no. of the 170 DNT 110 00 (high byte) |
| 6        |                      | Ident no. of the 170 DNT 110 00 (low byte)  |



| Byte No. | Diagnostics Type                                    | Contents                                            |
|----------|-----------------------------------------------------|-----------------------------------------------------|
| 7        | Enhanced diagnostics<br>(specifically for Momentum) | Diagnostics header for I/O bases                    |
| 8        |                                                     | I/O error                                           |
| 9        |                                                     | Parameter control (prm_control)                     |
| 10       |                                                     | Firmware version and index of the<br>170 DNT 110 00 |
| 11       |                                                     |                                                     |
| 12       |                                                     |                                                     |
| 13       |                                                     |                                                     |
| 14       |                                                     |                                                     |
| 15       |                                                     |                                                     |
| 16       |                                                     | reserved                                            |
| 17       |                                                     | reserved                                            |
| 18       |                                                     | Ident code of the I/O base (high byte)              |
| 19       |                                                     | Ident code of the I/O base (low byte)               |

**NOTE:** If you want to save memory, please note that bytes 10 .. 19 **do not** have to be stored in the PLC's state memory.

### Station Byte 1 (Diagnostic Byte 1)

Diagnostic byte 1

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Bit | Function               | Meaning, if Bit = 1                                                                          |
|-----|------------------------|----------------------------------------------------------------------------------------------|
| 0   | Station Non Existent   | Master cannot establish communication with slave                                             |
| 1   | Station Not Ready      | Slave cannot establish communication with master                                             |
| 2   | Config Fault           | Error in configuration data for slave                                                        |
| 3   | Extended Diagnosis     | Slave provides extended diagnostics as well as standard diagnostics                          |
| 4   | Not supported          | A function has been called that the slave does not support                                   |
| 5   | Invalid Slave Response | Master received an implausible response from slave                                           |
| 6   | PRM Fault              | Set by the slave in the case of incorrect bus parameters                                     |
| 7   | Master Lock            | The slave was parameterized by another master from the one that provided the diagnostic data |

**Station Byte 2 (Diagnostic Byte 2)**

Diagnostic byte 2

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Bit | Function           | Meaning, if Bit = 1                                            |
|-----|--------------------|----------------------------------------------------------------|
| 0   | PRM Request        | Slave requires new bus parameters                              |
| 1   | Static Diagnostics | Slave reports that it has received invalid I/O data/parameters |
| 2   | Const. 1           | Slave reports that it is ready for operation                   |
| 3   | Watchdog On        | Watchdog is active                                             |
| 4   | Freeze Mode        | Slave received the "freeze" command                            |
| 5   | Sync Mode          | Slave received the "Sync" command                              |
| 6   | Not used           |                                                                |
| 7   | Deactivated        | Master reports that the slave is inactive                      |

**Station Byte 3 (Diagnostic Byte 3)**

Diagnostic byte 3

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Bit    | Function                    | Meaning, if Bit = 1                                       |
|--------|-----------------------------|-----------------------------------------------------------|
| 0... 6 | Not used                    |                                                           |
| 7      | Extended Diagnosis Overflow | Set by the master when the diagnostic buffer has overrun. |

**Station Byte 4 (Diagnostic Byte 2)**

Diagnostic byte 4

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Bit    | Meaning                                                                                                                                            |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 0... 7 | Address of the master that parameterized the slave (e.g. 1). In the case of a connection interruption the value here is 255 (decimal) or FF (hex). |

**Ident No. of the Slave (Diagnostic Bytes 5 and 6)**

Diagnostic bytes 5 and 6

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Byte | Bit No. |   |   |   |   |   |   |   | Meaning                                                           |
|------|---------|---|---|---|---|---|---|---|-------------------------------------------------------------------|
|      | 7       | 6 | 5 | 4 | 3 | 2 | 1 | 0 |                                                                   |
| 5    | 0       | 1 | 1 | 1 | 0 | 1 | 0 | 1 | The value here must be 75 hexadecimal or 117 decimal (high byte). |
| 6    | 0       | 0 | 0 | 1 | 0 | 0 | 1 | 0 | The value here must be 12 hexadecimal or 18 decimal (high byte).  |

**NOTE:** If the connection to the master is interrupted, both bytes have the value 0.

**Diagnostic Header 7 (Diagnostic Byte 7)**

Diagnostic byte 7

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Byte | Bit No. |   |   |   |   |   |   |   | Meaning                                             |
|------|---------|---|---|---|---|---|---|---|-----------------------------------------------------|
|      | 7       | 6 | 5 | 4 | 3 | 2 | 1 | 0 |                                                     |
| 7    | 0       | 0 | 0 | 0 | 1 | 1 | 0 | 1 | The value here must be D hexadecimal or 13 decimal. |

**I/O Error (Diagnostic Byte 8)**

Analog I/O bases can report an I/O error, e.g. if they detect a hardware or firmware error in a self test (timeout).

With discrete I/O bases, an I/O error is reported if, for example, there is a short circuit or overload, and with 170 ADM 390 10 if there is an open circuit.

This byte should always contain the value 0.

Diagnostic byte 8

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Byte | Bit No. |   |   |   |   |   |   |   | Meaning                               |
|------|---------|---|---|---|---|---|---|---|---------------------------------------|
|      | 7       | 6 | 5 | 4 | 3 | 2 | 1 | 0 |                                       |
| 8    | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | There have been <b>no</b> I/O errors. |
|      | 1       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | There has been <b>one</b> I/O error.  |

**Parameter Control (Diagnostic Byte 9)**

This byte is meaningless for discrete I/O bases. In the case of complex I/O bases, it displays whether new parameters have been sent to and accepted by the I/O base.

Diagnostic byte 9

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Bit     | Function          | Meaning, if Bit = 1                                         |
|---------|-------------------|-------------------------------------------------------------|
| 0       | Not Ready         | I/O base is not ready for operation (not yet parameterized) |
| 1       | Parameter invalid | I/O base received invalid parameters                        |
| 2 ... 7 | Not used          |                                                             |

**Firmware Identification (Diagnostic Bytes 10 ... 15)**

Diagnostic bytes 10 ... 15

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Byte | Bit No. |   |   |   |   |   |   |   | Meaning                                                                         |
|------|---------|---|---|---|---|---|---|---|---------------------------------------------------------------------------------|
|      | 7       | 6 | 5 | 4 | 3 | 2 | 1 | 0 |                                                                                 |
| 10   | 0       | 0 | 1 | 0 | 0 | 0 | 0 | 0 | The value here must be 32 decimal or 20 hexadecimal (ASCII code for a blank).   |
| 11   | 0       | 1 | 1 | 1 | 0 | 0 | 0 | 0 | The value here must be 112 decimal or 70 hexadecimal (firmware identification). |
| 12   | 1       | 0 | 0 | 0 | 0 | 1 | 0 | 1 | The value here must be 133 decimal or 85 hexadecimal (firmware identification). |
| 13   | 0       | 1 | 0 | 1 | 0 | 0 | 0 | 1 | The value here must be 81 decimal or 51 hexadecimal (firmware identification).  |
| 14   | 0       | 0 | 0 | 0 | 0 | 0 | 1 | 0 | The value here must be 2 (firmware index).                                      |
| 15   | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The value here must be 0 (firmware sub-index, only in test versions > 0).       |

**Ident Code of the I/O Base (Diagnostic Bytes 18 and 19)**

Diagnostic bytes 18 and 19

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Byte | Meaning                                                                                                                                  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|
| 18   | The ident code high byte for the I/O base appears here, e.g. E0 hex.<br>This byte is required for unique identification on the PROFIBUS. |
| 19   | The ident code low byte for the I/O base appears here, e.g. 2.<br>This byte is required for internal data administration.                |

An overview of the ident codes can be found in the *Ident Codes for Momentum I/O Bases*, page 70 section.

## Ident Codes for Momentum I/O Bases

### General Information about Ident Codes

All Momentum I/O modules have an internal ident code. It is required so that a DP master can identify the types of connected devices. The master compares byte 1 of the ident code of the connected DP devices with the ident codes in the configuration data provided by the service terminal. Application data transmission begins only when the proper device types with the correct device addresses are connected to the bus. In this way, a relatively high security from configuration errors is achieved.

The ident code is visible to you only if it has been entered in the appropriate files (for Momentum modules, file ASA\_7512.GSD on diskette 381 SWA 000 00). The user should always use the current GSD file.

From the ident code you can tell which module type has sent a diagnostics message.

### Ident Codes for analog I/O Bases

Ident codes for analog I/O bases can be found here:

| Description    | Function                                                                       | Ident code byte 18 | Ident code byte 19 |
|----------------|--------------------------------------------------------------------------------|--------------------|--------------------|
| 170 AAI 030 00 | 8 input channels                                                               | C0 hex             | 02 hex             |
| 170 AAI 140 00 | 16 input channels                                                              | C1 hex             | 04 hex             |
| 170 AAI 520 40 | 4 input channels, RTD, thermoelements                                          | C2 hex             | 04 hex             |
| 170 AAO 120 00 | 4 output channels                                                              | C3 hex             | 01 hex             |
| 170 AAO 921 00 | 4 output channels                                                              | C4 hex             | 01 hex             |
| 170 AMM 090 00 | 4 inputs, 2 outputs (discrete)<br>4 input channels, 2 output channels (analog) | E0 hex             | 02 hex             |
| 170 ANR 120 90 | 8 inputs, 8 outputs (discrete)<br>6 input channels, 4 output channels (analog) | 17 hex             | E3 hex             |

### Ident codes for special modules

Ident codes for special modules can be found here:

| Description    | Function                                            | Ident code byte 18 | Ident code byte 19 |
|----------------|-----------------------------------------------------|--------------------|--------------------|
| 170 ADM 540 80 | 6 inputs, 3 outputs, 120 VAC;<br>1 Modbus interface | E2 hex             | 11 hex             |
| 170 AEC 920 00 | Counter                                             | A0 hex             | 04 hex             |

### Ident Codes for discrete I/O Bases, 24 VDC

Ident codes for discrete I/O bases can be found here:

| Description    | Function              | Ident code byte 18 | Ident code byte 19 |
|----------------|-----------------------|--------------------|--------------------|
| 170 ADI 340 00 | 16 inputs             | 02 hex             | 00 hex             |
| 170 ADI 350 00 | 32 inputs             | 01 hex             | 00 hex             |
| 170 ADO 340 00 | 16 outputs            | 06 hex             | 00 hex             |
| 170 ADO 350 00 | 32 outputs            | 09 hex             | 00 hex             |
| 170 ADM 350 10 | 16 inputs, 16 outputs | 08 hex             | 00 hex             |
| 170 ADM 350 11 | 16 inputs, 16 outputs | 08 hex             | 00 hex             |
| 170 ADM 370 10 | 16 inputs, 8 outputs  | 0B hex             | 00 hex             |
| 170 ADM 390 10 | 16 inputs, 12 outputs | 0C hex             | 00 hex             |
| 170 ADM 390 30 | 10 inputs, 8 outputs  | 0A hex             | 00 hex             |

### Ident Codes for discrete I/O Bases, 120/230 VAC

Ident codes for discrete I/O bases can be found here:

| Description    | Function                                     | Ident code byte 18 | Ident code byte 19 |
|----------------|----------------------------------------------|--------------------|--------------------|
| 170 ADI 540 50 | 16 inputs / 120 VAC                          | 03 hex             | 00 hex             |
| 170 ADI 740 50 | 16 inputs / 240 VAC                          | 28 hex             | 00 hex             |
| 170 ADO 530 50 | 8 outputs / 120 VAC                          | 16 hex             | 00 hex             |
| 170 ADO 540 50 | 16 outputs / 120 VAC                         | 14 hex             | 00 hex             |
| 170 ADO 730 50 | 8 outputs / 230 VAC                          | 17 hex             | 00 hex             |
| 170 ADO 740 50 | 16 outputs / 230 VAC                         | 15 hex             | 00 hex             |
| 170 ADM 690 50 | 10 inputs, 8 outputs, 120 VAC                | 0A hex             | 00 hex             |
| 170 ADM 690 51 | 10 inputs, 8 outputs, 120 VAC                | 09 hex             | 00 hex             |
| 170 ARM 370 30 | 10 inputs (24 V), 8 relay outputs<br>120 VAC | 18 hex             | 00 hex             |

## Trouble Shooting via PROFIBUS DP Diagnostic Messages

### Trouble Shooting General Information

In addition to the evaluation of the diagnostic message, there are the following important error possibilities:

- Comparison of the configured module type
- Examination of the voltage supplies to the modules
- Comparison of the configured addresses with the specified addresses on the bus adapter
- Examination of the parameterization in the case of complex (analog) modules
- Taking into consideration EMC measures and potential equalization
- Examining cabling (bus connector screws, correct cable assignment, terminal resistors, appropriate connectors etc.)
- General contact problems with connections

### Overview of diagnostic Examples

The diagnostic data of a 170 AMM 090 00 in the following cases can be found in the table:

| Case No. | Meaning                                                                                                                                                                                                                      |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Output state<br>The I/O base is supplied with voltage, the Profibus is correctly configured and running. The "BF" LED on the communications adapter of the AMM 090 is off. The I/O base has not, however, been parametrized. |
| 2        | Error in parameterization.<br>The I/O base was mistakenly parameterized as 170 AAO 921 during the bus configuration. The PROFIBUS is running but the "BF" LED on the communications adapter of the AMM is lit.               |
| 3        | Slave is not reporting (master diagnostics):<br>One slave was properly configured. However, it cannot be found because the bus connector was disconnected or the voltage supply was interrupted.                             |
| 4        | Valid parameters:<br>One set of valid parameters has been transferred to the AMM 090                                                                                                                                         |
| 5        | Invalid parameters:<br>One set of invalid parameters has been transferred to the AMM 090                                                                                                                                     |



## Normal state of the diagnostic data at program start

The normal state of the diagnostic data at program start is displayed in this table.

Position of the bits in the respective diagnostic byte:

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

| Diagnostic Byte |                                                  | Format | Contents |          |          |
|-----------------|--------------------------------------------------|--------|----------|----------|----------|
| No.             | Meaning                                          |        | Case 1   | Case 2   | Case 3   |
| 1               | Station status 1                                 | Bin    | 00001000 | 00000110 | 00000001 |
| 2               | Station status 2                                 | Bin    | 00001100 | 00000101 | 00000000 |
| 3               | Station status 3                                 | Bin    | 00000000 | 00000000 | 00000000 |
| 4               | Master address                                   | Dec    | 1        | 255      | 255      |
| 5               | Ident no. of the 170 DNT 110 00 (high byte)      | Hex    | 75       | 75       | 0        |
| 6               | Ident no. of the 170 DNT 110 00 (low byte)       | Hex    | 12       | 12       | 0        |
| 7               | Diagnostics header for I/O bases                 | Hex    | D        | D        | D        |
| 8               | I/O error                                        | Bin    | 00000000 | 00000000 | 00000000 |
| 9               | Parameter control                                | Bin    | 00000001 | 00000000 | 00000001 |
| 10              | Firmware version and index of the 170 DNT 110 00 | Hex    | 20       | 20       | 20       |
| 11              |                                                  | Hex    | 70       | 70       | 70       |
| 12              |                                                  | Hex    | 85       | 85       | 85       |
| 13              |                                                  | Hex    | 51       | 51       | 51       |
| 14              |                                                  | Hex    | 2        | 2        | 2        |
| 15              |                                                  | Hex    | 0        | 0        | 0        |
| 16              | reserved                                         | Hex    | 0        | 0        | 0        |
| 17              | reserved                                         | Hex    | 0        | 0        | 0        |
| 18              | Ident code of the I/O base (high byte)           | Hex    | E0       | E0       | E0       |
| 19              | Ident code of the I/O base (low byte)            | Hex    | 2        | 2        | 2        |

### Status Changes, starting from Normal State

The changes from output status (case 1) to states 3, 4 and 5 are displayed in the table. The changes in comparison with the output status are marked in bold.

Position of the bits in the respective diagnostic byte:

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

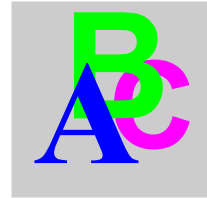
| Diagnostic Byte |                                                     | Format | Case 1<br>(Output<br>state) | Case 3<br>(No slaves<br>reporting) | Case 4<br>(Valid<br>parameters) | Case 5<br>(Invalid<br>parameters) |
|-----------------|-----------------------------------------------------|--------|-----------------------------|------------------------------------|---------------------------------|-----------------------------------|
| No.             | Meaning                                             |        |                             |                                    |                                 |                                   |
| 1               | Station status 1                                    | Bin    | 00001000                    | <b>00000001</b>                    | <b>00000000</b>                 | 00001000                          |
| 2               | Station status 2                                    | Bin    | 00001100                    | <b>00000000</b>                    | 00001100                        | 00001100                          |
| 3               | Station status 3                                    | Bin    | 00000000                    | 00000000                           | 00000000                        | 00000000                          |
| 4               | Master address                                      | Dec    | 1                           | <b>255</b>                         | 1                               | 1                                 |
| 5               | Ident no. of the 170 DNT 110 00 (high byte)         | Hex    | 75                          | <b>0</b>                           | 75                              | 75                                |
| 6               | Ident no. of the 170 DNT 110 00 (low byte)          | Hex    | 12                          | <b>0</b>                           | 12                              | 12                                |
| 7               | Diagnostics header for I/O bases                    | Hex    | D                           | D                                  | D                               | D                                 |
| 8               | I/O error                                           | Bin    | 00000000                    | 00000000                           | 00000000                        | 00000000                          |
| 9               | Parameter control                                   | Bin    | 00000001                    | 00000001                           | <b>00000000</b>                 | <b>00000011</b>                   |
| 10              | Firmware version and index of the<br>170 DNT 110 00 | Hex    | 20                          | 20                                 | 20                              | 20                                |
| 11              |                                                     | Hex    | 70                          | 70                                 | 70                              | 70                                |
| 12              |                                                     | Hex    | 85                          | 85                                 | 85                              | 85                                |
| 13              |                                                     | Hex    | 51                          | 51                                 | 51                              | 51                                |
| 14              |                                                     | Hex    | 2                           | 2                                  | 2                               | 2                                 |
| 15              |                                                     | Hex    | 0                           | 0                                  | 0                               | 0                                 |
| 16              | reserved                                            | Hex    | 0                           | 0                                  | 0                               | 0                                 |
| 17              | reserved                                            | Hex    | 0                           | 0                                  | 0                               | 0                                 |
| 18              | Ident code of the I/O base (high byte)              | Hex    | E0                          | E0                                 | E0                              | E0                                |
| 19              | Ident code of the I/O base (low byte)               | Hex    | 2                           | 2                                  | 2                               | 2                                 |

**NOTE:** With a change in status from case 4 to case 5, byte 9 has the value 0000 0010 and the I/O base continues to operate with the old parameters.

With a change in status from case 4 to case 3, byte 9 has the value 0000 0000.

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