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Restriction of warranty:

No warranty is given for the complete correctness of this manual, because errors can never be avoided completely despite utmost care. Hints are always welcome and gratefully accepted.

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# 1 Safety hints

Following the enclosed safety hints 9499 040 07101 is indispensable.

For hints on the power supply to be used, see section **3.3 Power supply**.

## 1.1 Electromagnetic compatibility

The unit conforms to European guideline 89/336/EEC and is provided with CE marking. The following European generic standards are met:

**Electromagnetic emission: EN 50081-1 and electromagnetic immunity: EN 50082-2**

For compliance with EN50082-2, all I/O and interface cables must be screened.

### CE marking

The DC 150 Profibus version, no. 9407 700 60331, doesn't have a CE mark. The unit is provided for mounting in control cabinets or boxes for electrical equipment. The CE mark is subject to application in conjunction with the overall system.

The other available DC 150 versions are provided with CE marking.

## 2 General

DC 150 provides transparent automation solutions with distributed intelligence. Apart from its pure control functionality, the module is predestinated for use in fast processes due to its high calculation capacity and its high I/O measurement frequency (1 ms).

In addition to real-time processor technology, the module is equipped with the following 'on-board' facilities: 8 digital inputs, 8 individually configurable digitale inputs/outputs, 8 analog inputs and 8 analog (current or voltage) outputs.

An on-board real time lock and serial interfaces for connection of supervisory computer, engineering PC and modem are also provided.

Due to its low space requirement of only 124 x 170 mm with a depth behind panel of 85,5 mm, DC 150 is ideal for decentral solutions.

The module is suitable for snap-on mounting on standard top-hat rails. The control units and further modules for I/O extension are connected in a network via the CAN bus.

The module is provided with a CANopen master/slave implementation, which is available as a library to IEC 1131.

### 2.1 Versions

This operating note is valid for the versions listed below.

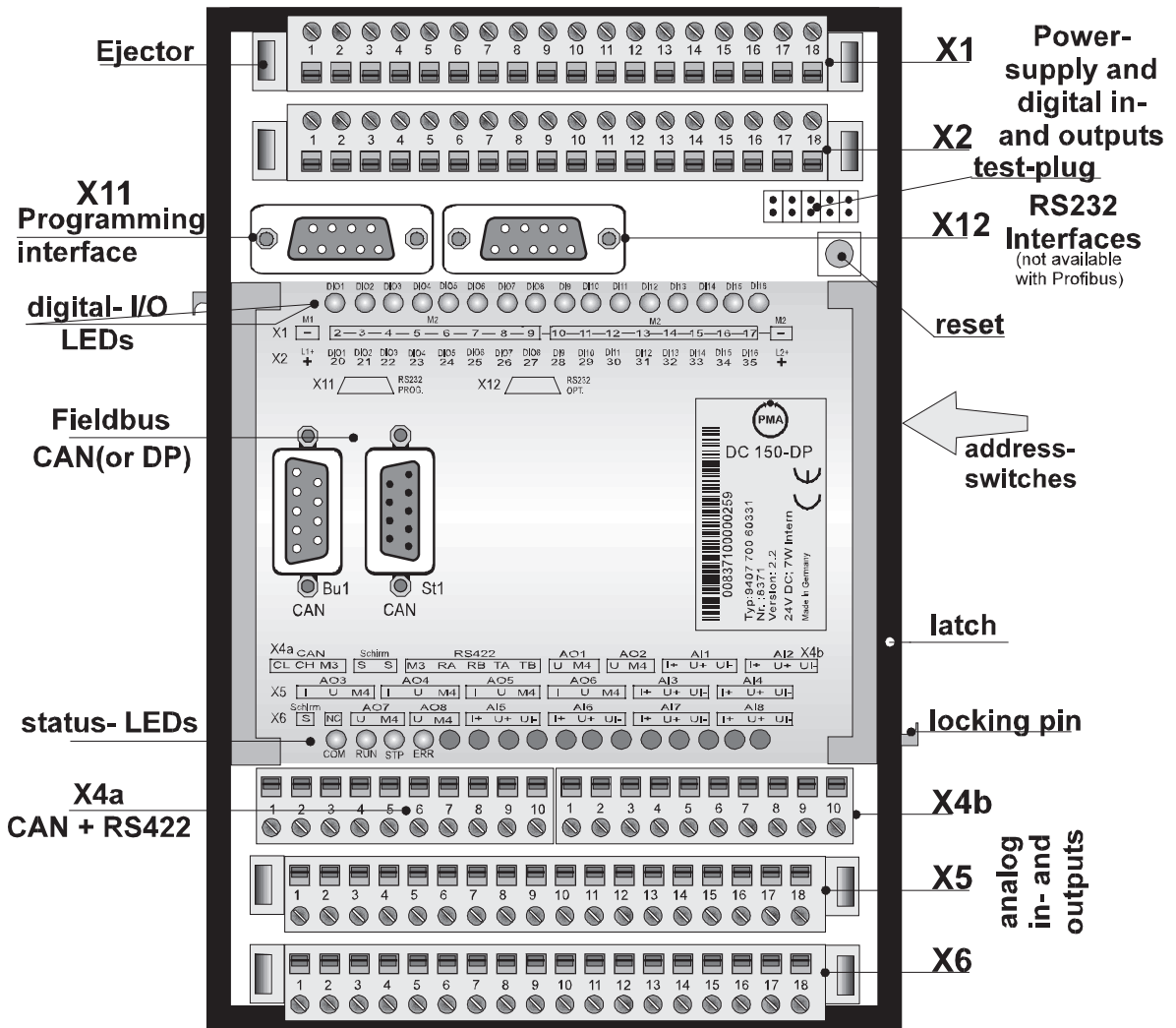
9407 700 5 X X X 1	DC 150-CAN(CANopen)
9407 700 6 X X X 1	DC 150-DP(Profibus DP)
0	1 x RS232, 1 x CAN or. Profibus DP
1	1 x RS232, 1 x RS485, 1 x CAN or Profibus DP
2	2 x RS232, 1 x RS485, 1 x CAN or Profibus DP
3	1 x RS232, 1 x RS485, 2 x CAN or Profibus DP + CAN
4	2 x RS232, 1 x RS485, 2 x CAN or Profibus DP + CAN
0	16 DI / DO
1	16 DI / DO, 8AI (I / U)
2	16 DI / DO, 8AI (I / U), 4 AO (I / U)
3	16 DI / DO, 8AI (I / U), 4 AO (I / U), 4 AO (U)
0	1 MB FLASH, 1 MB SRAM
1	3 MB FLASH, 1 MB SRAM
2	5 MB FLASH, 1 MB SRAM
3	9 MB FLASH, 1 MB SRAM

#### **Momentarily only the following codenumbers are available:**

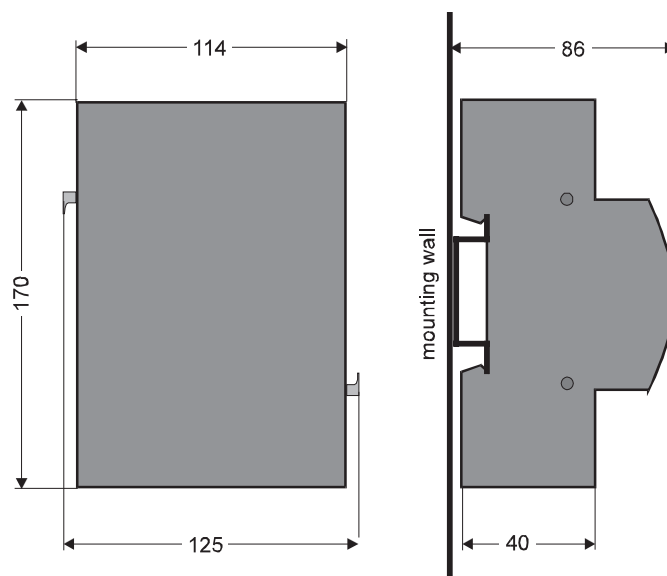
9407 700 51121	2 x RS232, RS485, 1 x CAN, 8AI, 3 MB FLASH
9407 700 52121	2 x RS232, RS485, 1 x CAN, 8AI, 5 MB FLASH
9407 700 52321	2 x RS232, RS485, 1 x CAN, 8AI, 8AO, 5 MB FLASH
9407 700 50341	2 x RS232, RS485, 2 x CAN, 8AI, 8AO, 1 MB FLASH
9407 700 60331	1 x RS232, RS458, 1 x CAN, 1 x DP, 8AI, 8AO, 1MB Flash

On versions with only one CAN bus, connection of the CAN bus is via the (Phoenix) connector. In this case, the Sub-D connectors on the lid are not fitted.

On the Profibus version, the Sub-D connectors are used for Profibus connection. The CAN bus is accessible via the (Phoenix) terminals.



General view of DC 150



Overall dimensions DC 150

Watch out that the unit is fixed on a large area of the grounded mounting wall.

## 2.2 Mounting

DC 150 is provided for mounting on a standard rail 35 x 7,5 (top-hat rail) to EN 50 022, EN 50 035, EN 50 045.

Grounding the DC 150 is done via a spring on the top-hat rail. Note that the rail must have a good conducting connection to the grounded mounting wall. (layer of paint, non-conducting mounting wall, Eloxal, ...). If necessary, the top-hat rail must be grounded with a separate connection.

### Individual unit:

For mounting, pull two catches at both sides (see fig. 1 on page 5) upwards by 5 mm via stop and snap the unit onto the rail. Press the catches down to fix the unit to the rail.

### Several units:

With several units, mounting can be done as follows:

1. Mount the units side by side like several single units at a distance of approx. 10 mm. As the side connections possible with the unit are not used in this case, this mounting method should be preferred, in order to facilitate replacement of a defective "inner" unit (see also: Dismantling 2.)

2. With high-density mounting of several units, snap the first unit onto the guide rail and lock only the side on which no further unit must be mounted. Snap the second unit in position similarly, at a distance of approx. 10 mm from the first unit and connect it with the first one by shifting it sideways to click the catches into position, and press down the second catch of the first unit.

## 2.3 Dismounting

For dismounting, the leads need not be disconnected. Before removing the upper parts of the connectors, the upper parts and the corresponding lower parts must be marked, because the terminals are distortion-proof but not confusion-proof. For releasing the upper part of a terminal, the two red ejectors of a terminal row must be pressed towards the p.c.b. using a screwdriver, if necessary. As terminals X4a and X4b do not have ejectors, this auxiliary means is not available. Simply withdraw these connectors from the sockets.

1. To release the unit from the mounting rail, pull the two lateral catches forwards by approx. 5 mm (unit is released) and remove the unit from the rail by tipping it upwards or downwards.

2. For replacing an "inner" unit of several ones mounted side by side, start by releasing the catch of a unit (and the catch of the next one!) at one end of the row and shift the unit laterally. Repeat this procedure up to the unit to be replaced. When its catches are released at both sides, it can be removed from the rail by tipping it up or downwards.

### 3 Electrical connections

- Max. 50 V r.m.s. against earth are admissible for measurement and signal leads.
- Mains cables must be kept separate from signal and measurement leads.
- For output protection and interference suppression, connected contactors must be provided with protective circuitry to manufacturer specifications.

#### 3.1 Terminals

All terminals leading to the process are designed as (plug-in type) screw or screwless spring-clamp terminals.

The terminals are not delivered with the unit and must be ordered separately.

Make: **PHOENIX COMBICON**

Two types are available:

<b>Screw terminal</b>	4 x FRONT-MSTB 2,5/18-ST-5,08 2 x FRONT-MSTB 2,5/10-ST-5,08
<b>Spring-clamp terminal</b>	4 x FK-MSTBP 1,5/18-ST-5,08 10-pole cannot be used

Test measurements: The screw terminals are shown in the DC 150 figures.  
On this version, the screwheads are used for test measurements.  
With spring-clamp terminals, separate "test sockets" are provided.

#### Connecting capacity

	FRONT-MTSB 2,5/...-ST		FK-MTSBP 1,5/...-ST	
	rigid	flexible <sup>1)</sup>	rigid	flexible <sup>1)</sup>
One conductor [mm <sup>2</sup> ]	0,2 - 2,5	0,25 - 2,5	0,2 - 1,5	0,25 - 1,5
Several conductors [mm <sup>2</sup> <sup>2)</sup>	0,3 - 1,5	0,25 - 1,0	0,2 - 1,0	0,5 - 0,75

<sup>1)</sup> with end crimps

<sup>2)</sup> 2 conductors of equal cross-section

<sup>3)</sup> with TWIN end crimps

Make: **WAGO multi-connector system MIDI**

<b>Spring-clamp terminal</b>	4 x connector strip with CAGE CLAMP connection order no. 231-318/026-000 2 x connector strip with CAGE CLAMP connection order no. 231-310/026-000
------------------------------	--

**Connecting capacity** only one conductor: 0,08 - 2,5 mm<sup>2</sup>, single-wire, multi-wire, fine-wire, end crimp, cable shoe.

## 3.2 Power supply

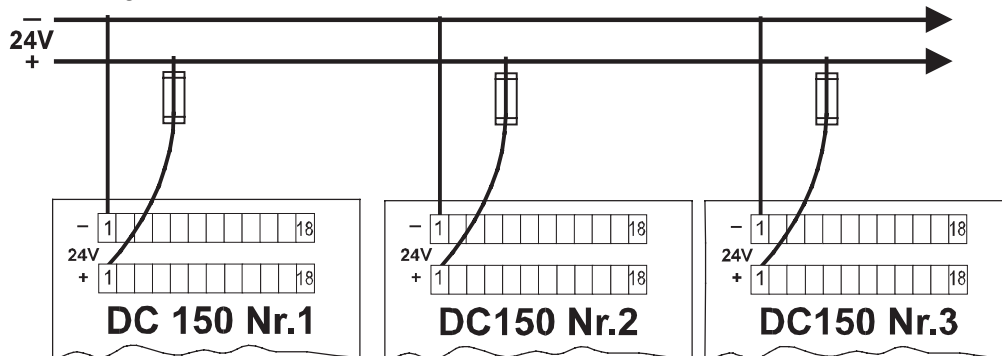
### 3.2.1 Electronics power supply

DC 150 was designed for a nominal 24V DC supply, range 19,2 V to 30 V, residual ripple 5%.

The supply voltage must meet the conditions for protective low voltage (SELV) to IEC 364-4-41 [VDE 0100-410].

The neative polarity of the supply voltage is connected via terminal 1 of connector X1.  
The positive polarity is connected via terminal 1 of connector X2.

We recommend using terminals with built-in fuse.



supply voltage connection with several DC150 units

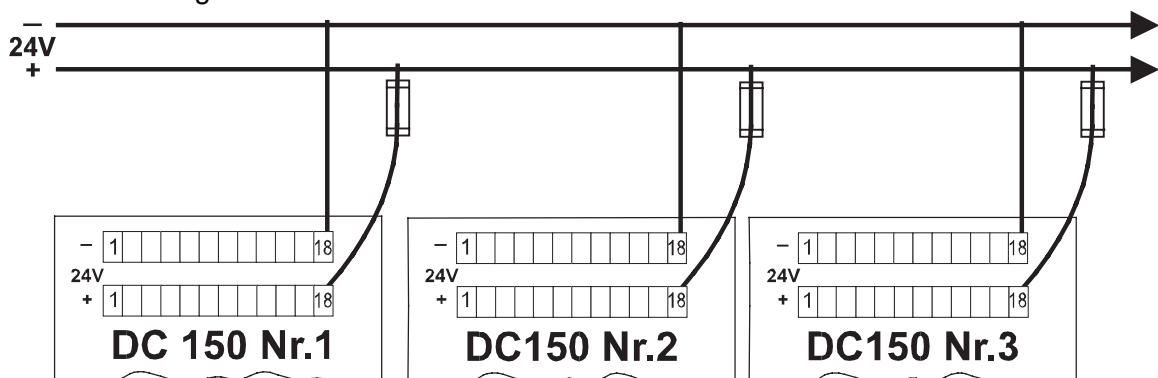
### 3.2.2 Digital output supply voltage

DC 150 was designed for nominal 24V DC supply, range 19,2 V to 30V, residual ripple 5%.

The supply voltage must meet the conditions for protective low voltage (SELV) to IEC 364-4-41 [VDE 0100-410].

The **neative** polarity is connected via terminal **18** of connector **X1**.  
The **positive** polarity is connected via terminal **18** of connector **X2**.

We recommend using terminals with built-in fuse.



Connection of the supply voltage of the digital inputs

### 3.3 Fuses

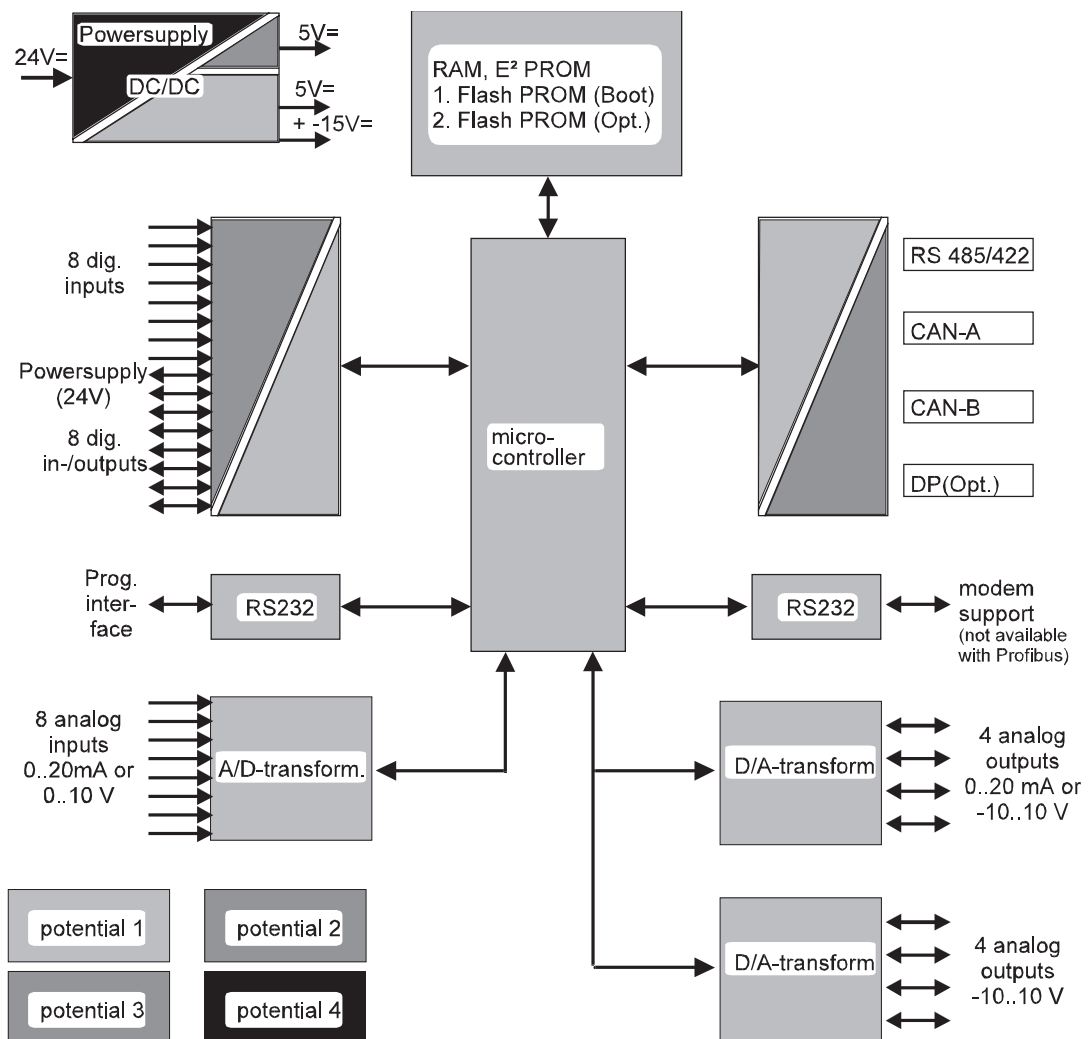
Each unit must be protected with a separate 2A slow-blowing fuse (fitted in the terminal).

If none of the LEDs is lit with the supply voltage applied (check fuse and polarity), the unit is defective and must be returned to the manufacturer.

### 3.4 Galvanic isolations

Galvanic isolations are shown in the following DC 150 figure: identical block shading means that the blocks are galvanically connected. I.e. all interfaces (except RS 232) are galvanically isolated from the remaining circuitry.

Additionally, the digital I/O's are galvanically isolated.

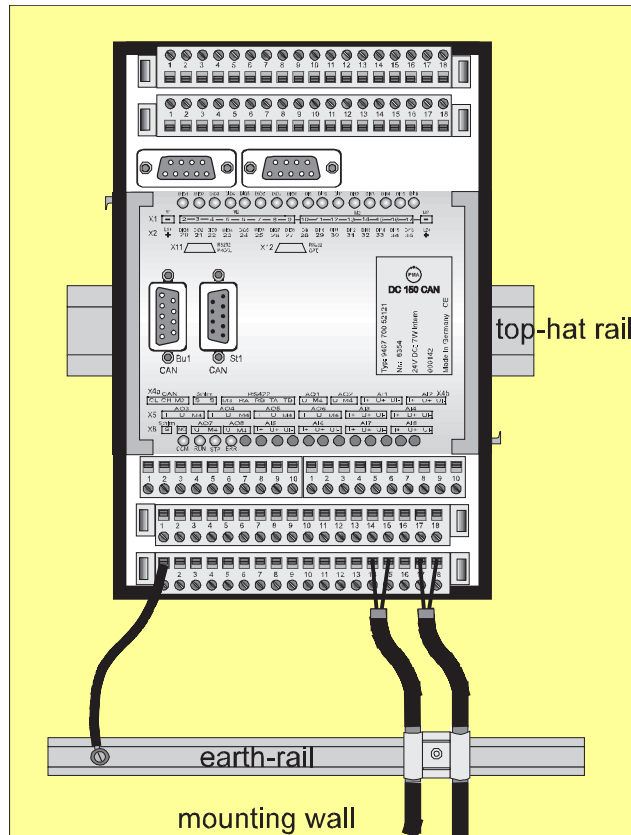


DC 150 block diagram and galvanic isolation

## 4 Inputs

### 4.1 Signal lead screening

Only screen connecting leads must always be used. This is applicable to all analog and digital inputs and outputs and for the interface connections.



Screening: The screening of connecting leads must be connected to an earth rail via the shortest possible cable. The earth rail must be connected additionally with pin 1 (91) of connector X6 via a low-impedance connection.

Watch out that the unit is fixed on a large area of the grounded mounting wall. Note that the rail must have a good conducting connection to the grounded mounting wall. (layer of paint, non-conducting mounting wall, Eloxal, ...). If necessary, the top-hat rail must be grounded with a separate connection. (The complete DC 150 connecting diagram is given in section 6.)

### 4.2 Analog inputs AI1...AI8

The analog input can be configured always as voltage or current inputs in groups of two.

#### 4.2.1 Direct voltage (0...10V differential)

These values can be scaled via software settings. The input resistance is approx. 100 kOhm.

#### 4.2.2 Direct current (0...20mA)

These values can be scaled via software settings. The input shunt is 200 Ohm.

### 4.3 Digital inputs DIO 01..DIO 08 and DI9..DI16

Dependent of configuration, DC 150 contains between 8 and 16 digital inputs.

Digital inputs DI 09 to DI 16 thereof are always available.

DIO 01 to DIO 08 are configured either as digital inputs or as digital outputs.

The inputs are "high-active" and designed as current sink to IEC 1131 type 1.

The current requirement is approx. 5 mA. Logic "0" = -3...5 V logic "1" = 15...30 V. Unused digital inputs need not be connected.

## 5 Outputs

(The complete connecting diagram is given in section 6.).

### 5.1 Analog outputs AO1...AO8

Four of the analog outputs can be used as voltage or current outputs. The other four outputs are configured as voltage outputs.

#### 5.1.1 Voltage outputs AO1, AO2, AO7 and AO8 (-10...10V)

These four analog outputs are configured as voltage outputs.

The output voltage is -10..10V (min. load resistance 2 kOhm).

The short-circuit current of the short circuit proof output is approx. 22mA.

#### 5.1.2 Voltage or current outputs AO3..AO6 (-10...10V or 0..20mA)

These four analog outputs can be used as voltage or as current outputs.

With voltage output, the output voltage is -10..10V (min. load resistance 2 kOhm).

The short circuit current of the short circuit proof output is approx. 22mA.

With current output, the output current is 0..20mA with a maximum load of 600 Ohm.

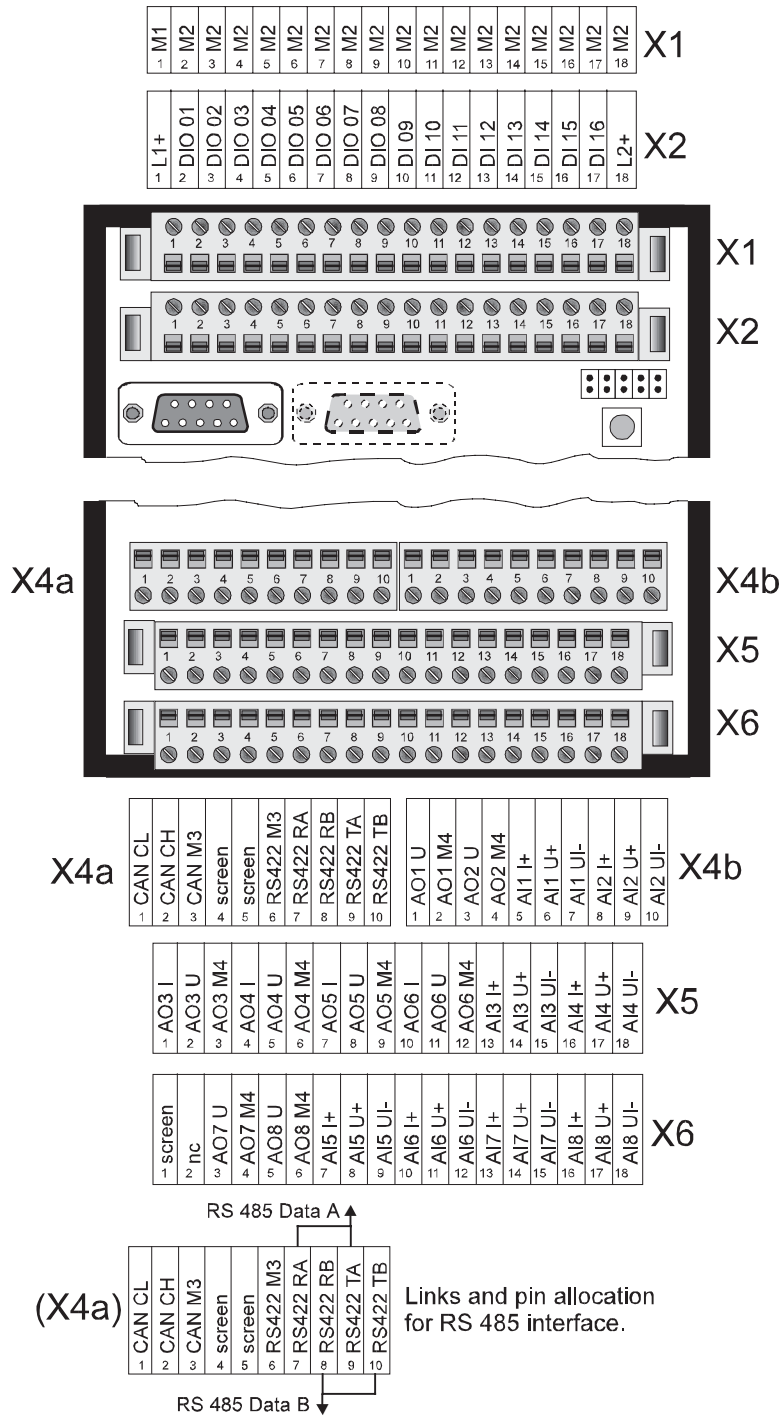
### 5.2 Digital outputs DIO 01..DIO 08

The eight digital inputs/outputs DIO 01 to DIO 08 can be configured individually as inputs or outputs.

The output voltage is 24V (min. load resistance 300 Ohm).

The outputs are short circuit proof.

# 6 Connecting diagram



## 7 Interfaces

Communication with the intelligent DDC control and PLC module DC 150 is via the digital interfaces.

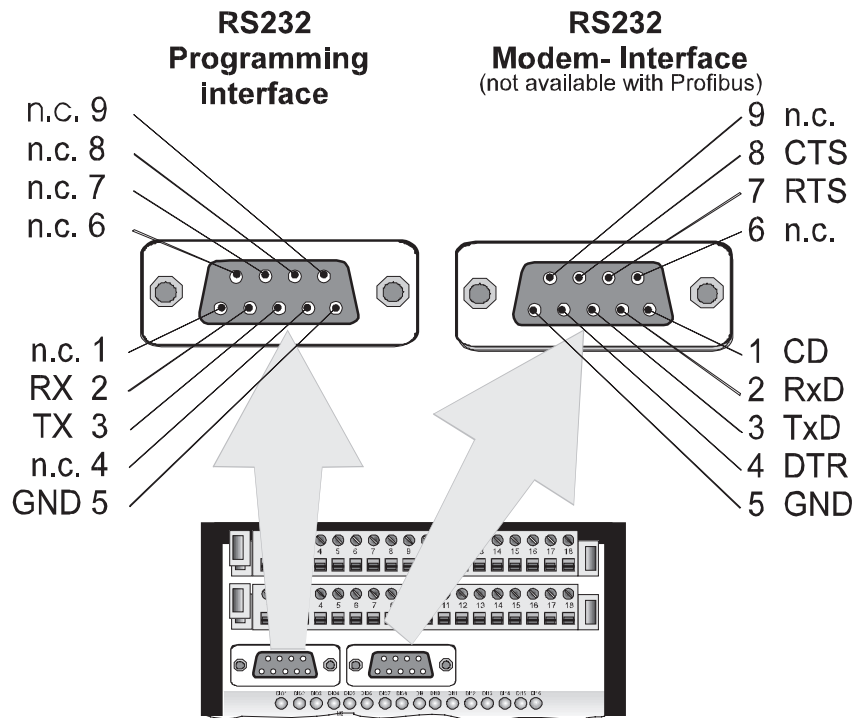
### 7.1 Programming interface

The programming interface is provided on all versions. It is a normal "PC" interface. DC 150 can be configured by means of the relevant software.

### 7.2 Modem interface

The modem interface is only available as an option. On the Profibus version, this interface is not possible for technical reasons.

The special modem interface is intended for remote diagnostics and servicing. Via a normal commercially available modem, remote DC 150 configuration and read-out of current and saved data are possible.

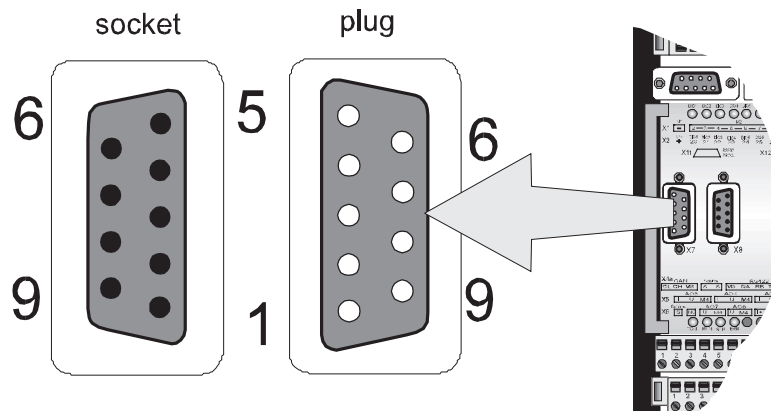


## 7.3 BUS interfaces

This interface is used for connecting the DC 150 to a PLC, a PC or a visualization unit. Dependent of version, it is designed for CANbus, Profibus or as RS 422/485 (see section 2.1). 9-pole Sub-D-connector and socket are equivalent. They are used for connecting several units in a loop to the bus.

Due to the high Profibus transfer rate (max. 12 MBd), looping-through is not possible with Profibus.

## 7.4 BUS connector



Fieldbus-connector of the DC 150

Socket and connector contacts with identical names are connected (1:1).

Pin allocation		
Contact	CANbus	Profibus/DP
1	n.c.	n.c.
2	CAN-L	n.c.
3	CAN-GND	RxD/TxD-P
4	n.c.	RTS
5	N.c.	GND
6	CAN-GND	VP(+5V)
7	CAN-H	n.c.
8	n.c.	RxD/TxD-N
9	n.c.	n.c.

n.c.: Do not use as solder lug!

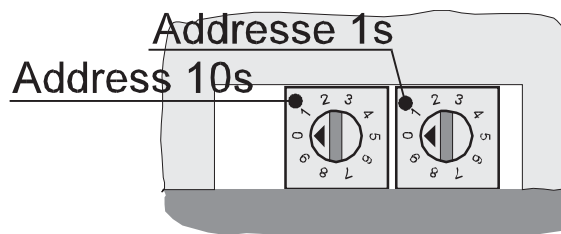
### 7.4.1 Terminating resistors

All DC 150 versions are delivered without termination resistors at the bus connections. The resistors required for each bus must be added externally at the last unit at both ends of the bus cable: either in the last connector (socket), or in a separate termination connector (socket), which plug into the free bus connection of the last unit. In particular, the standards or standard drafts of the relevant bus system are applicable.

### 7.5 Address switches

Hardware adjustment of the device address is only possible on the Profibus version. With the RS232 and CANbus version, only software addressing is possible.

On the Profibus units, two rotary switches on the right side of the unit (see also overall view of DC 150) for adjusting the device address are provided. In position "00", the device address must be defined via software. With the address adjusted via these switches (  $01 < \text{Adr} > 99$  ), this address is valid and cannot be changed via software any more.



## 8 Indicator LEDs

### 8.1 Digital I/O LEDs

The 16 upper LEDs indicate the digital input/output status. The LEDs are lit, when a high signal is applied.

### 8.2 COM, RUN, STP and ERR LED

The signification of the four lower LEDs is:

**COM - LED** This LED is only important for CANbus and RS 422/485. It is lit, when the DC 150 transmits data to the PLC PC or visualisation).

**RUN - LED** This LED is on, when the DDC control and PLC module is in RUN status.

**STP - LED** This LED is on, when the DDC control and PLC module is in STOP status.

**ERR - LED** This LED is on, when the DDC control and PLC module is in ERROR status.

If none of the LEDs should be lit with the operating voltage applied, the DDC control and PLC module is defective.

## 9 Maintenance and behavior in case of trouble

The DDC control and PLC module DC 150 does not need any particular maintenance and is not equipped with parts which need preventive maintenance or care.

If necessary, the aluminium and plastics parts must be cleaned carefully with spirit.

**Caution:** Do not use cleaning agents which contain solvents or scouring agents.

### 9.1 Trouble shooting

To start with, all possibilities of error in other equipment and connections (input leads, cables, equipment connected in the output circuit) should be examined. If the error cannot be located with the hints given in this section, we recommend returning the unit to the manufacturer:

**PMA Prozeß- und Maschinen- Automation GmbH  
Service Department  
Miramstraße 87  
D 34123 Kassel**

If the trouble is due to failure of a fuse, the cause must be determined and removed. The spare fuse must be of the same rating as the original type.

If none of the LEDs COM, RUN, STP or ERR is lit despite correct supply voltage polarity, the module is defective. In this case, the DC 150 is defective and must be returned to the manufacturer for repair.

### 9.2 Shut-down

**Before Disconnecting the unit, switch off the power supply or the unit and check that all other equipment in the overall installation is not affected.**

**WARNING!** When safe operation seems not possible any more, shut down the unit and protect it against accidental switch-on.

For dismounting the unit, see section 2.3.

### 9.3 Customer Support Hotline

With questions related to DC 150 in addition to these operating instructions, please call number 0-49(0)561/505-3333 from Monday to Friday between 8 a.m. and 16 p.m.

