DC302

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FIRST IN FIELDBUS

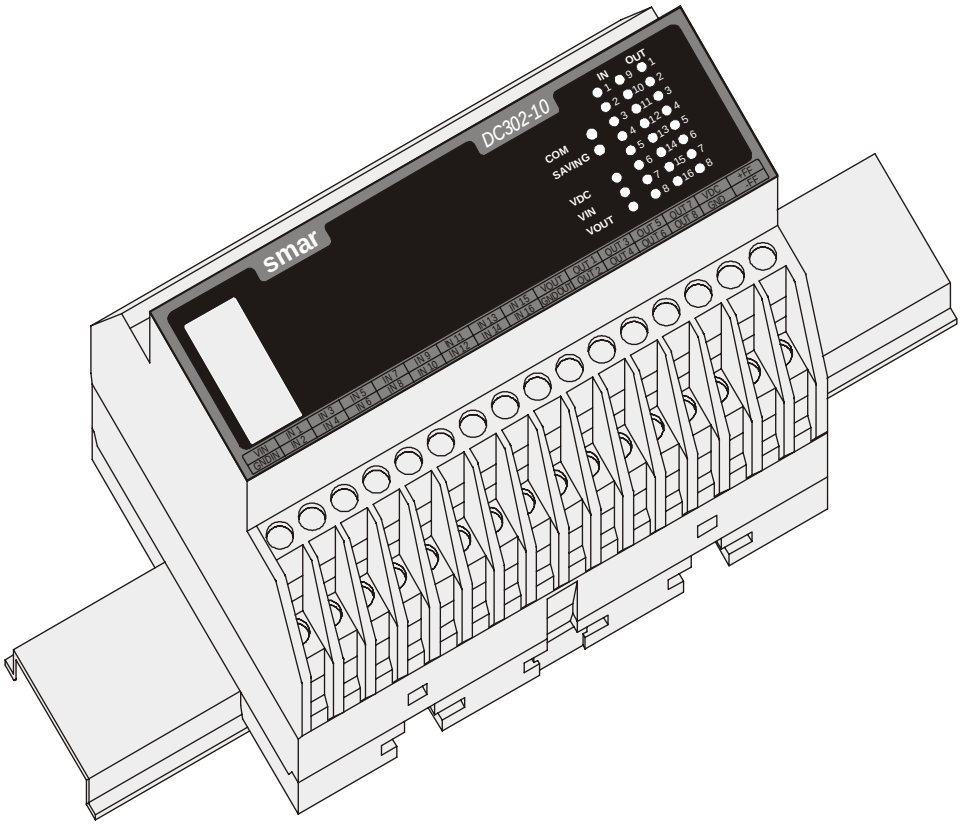
DC302

MAR/01
VERSION 1

FOUNDATION™

OPERATION & MAINTENANCE INSTRUCTIONS MANUAL

FIELDBUS REMOTE I/O



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Introduction

Until all types of devices are available with FOUNDATION™ Fieldbus systems will have to be of a hybrid nature accepting both Fieldbus and conventional signals. A mixed traditional and fieldbus environment is inevitable during the transition to a Fieldbus technology. DC302 makes integration of Fieldbus and conventional I/O easy. Discrete devices such as pressure switches, push buttons, on/off valves, pumps and conveyors are integrated to the system over the FOUNDATION™ H1 field-level network using DC302. The DC302 remote I/O units can be distributed into the field where they are mounted close to the conventional devices without the need to run the conventional wiring to the control room. The DC302 is an integral part of SYSTEM302 but also it integrates into other systems supporting FOUNDATION™ Fieldbus.

The DC302 makes conventional analog and discrete inputs and outputs available using standard FOUNDATION™ Function blocks making the system homogenous and control strategy configuration easy as conventional I/O appears as if they were regular Fieldbus devices. Control loops are implemented consistently regardless of I/O being conventional or Fieldbus based. Only a single programming language has to be used.

The DC302 is a simple low-cost DIN-rail mounted unit. The DC302 is a single integrated easy to use piece of equipment including power, control, networking and I/O under one compact device requiring less panel space than other solutions.

An extensive function block library enables the DC302 to perform logic and regulatory control functions in the field integrating the control strategy with other H1 Fieldbus devices on the same network. Instantiable function blocks provide great flexibility in control strategy. Conventional discrete I/O now works together with pure Fieldbus devices on the same network and in the same loop. The DC302 is fully configured from the Syscon software in SYSTEM302 or any other FOUNDATION™ Fieldbus configuration tool. Function blocks provide logic such as AND, OR, NAND etc. as well as latches etc. Link master capability allows the DC302 to work as a backup LAS for greater availability of network communications.

The DC302 may be installed close to the sensors and actuators, thereby eliminating long wire runs and associated marshalling panels and cable trays for the conventional I/O, with subsequent savings further reducing overall system cost. Use DC302 to make it possible to distribute I/O at various locations in the field and connect them via H1 Fieldbus. DC302 is ideal to connect motor control centers, variable speed drives, and electrical actuators and motor operated valves to H1 Fieldbus.

Get the best result of the DC302 by carefully reading these instructions.

WARNING
This Manual is compatible with version 3.XX, where 3 denotes software version and XX software release. The indication 3.XX means that this manual is compatible with any release of software version 3.

Table of Contents

INSTALLATION

General

The overall accuracy of measurement and control depends on several variables. Although the Fieldbus Remote I/O has an outstanding performance, proper installation is essential, in order to maximize its performance.

Among all factors, which may affect the accuracy, environmental conditions are the most difficult to control. There are, however, ways of reducing the effects of temperature, humidity and vibration. Locating the Fieldbus Remote I/O in areas protected from extreme environmental changes can improve its performance.
In warm environments, the Fieldbus Remote I/O should be installed to avoid, as much as possible, direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided.

Use of sunshades or heat shields to protect the Fieldbus Remote I/O from external heat sources should be considered, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the protection cover must be provided.
For details of mounting, please, refer to Figure 1.1 and Figure 1.2

Mounting

Use DIN rail (TS35-DIN EN 50022 or TS32-DIN EN50035 or TS15 DIN EN50045), as shown in Figure 1.1 – Mechanical Mounting. The DC302 can optionally be supplied preinstalled in an enclosure ready for field mounting.

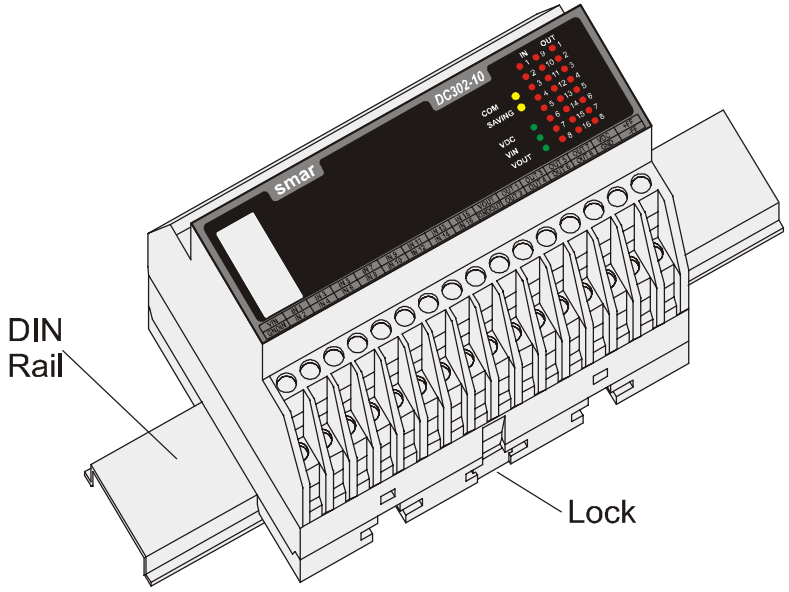
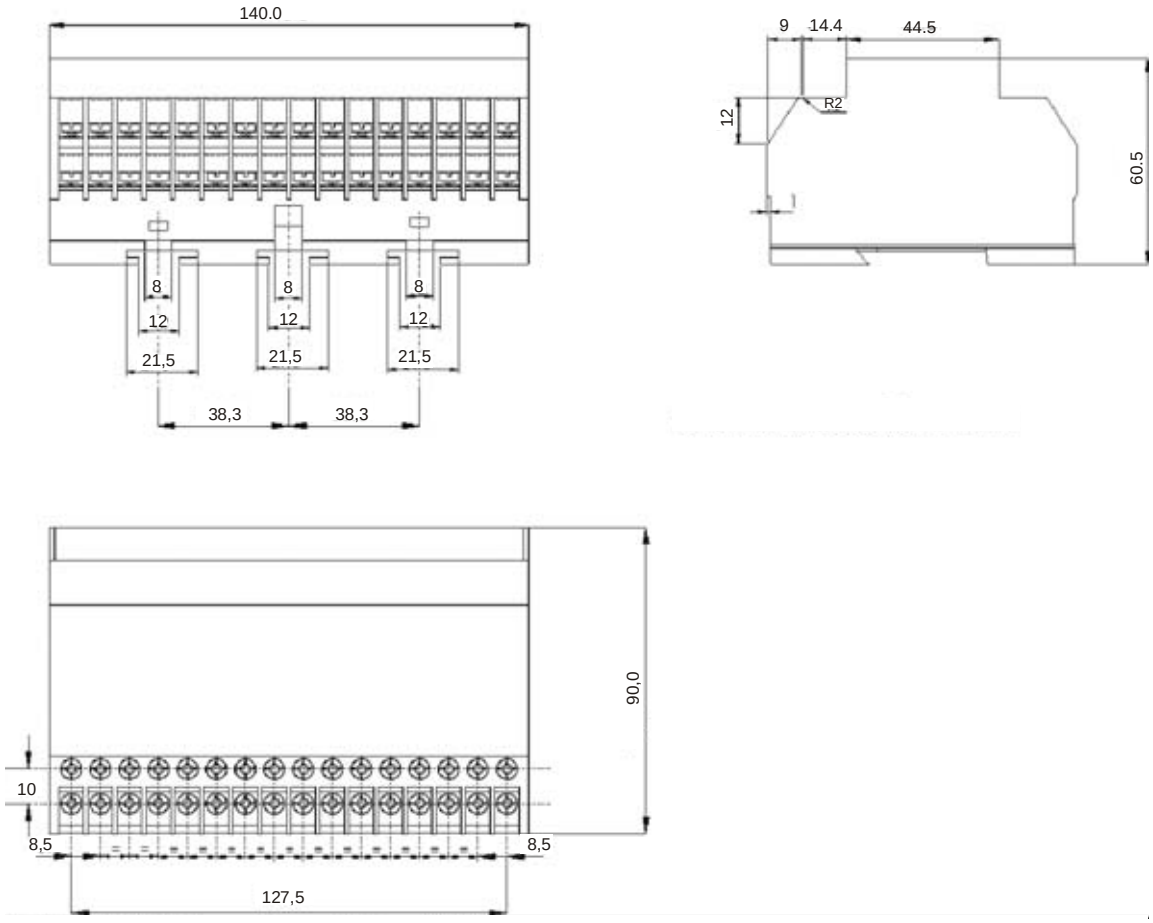


Figure 1.1- Mechanical Mounting



NOTE
The measurements are in mm.

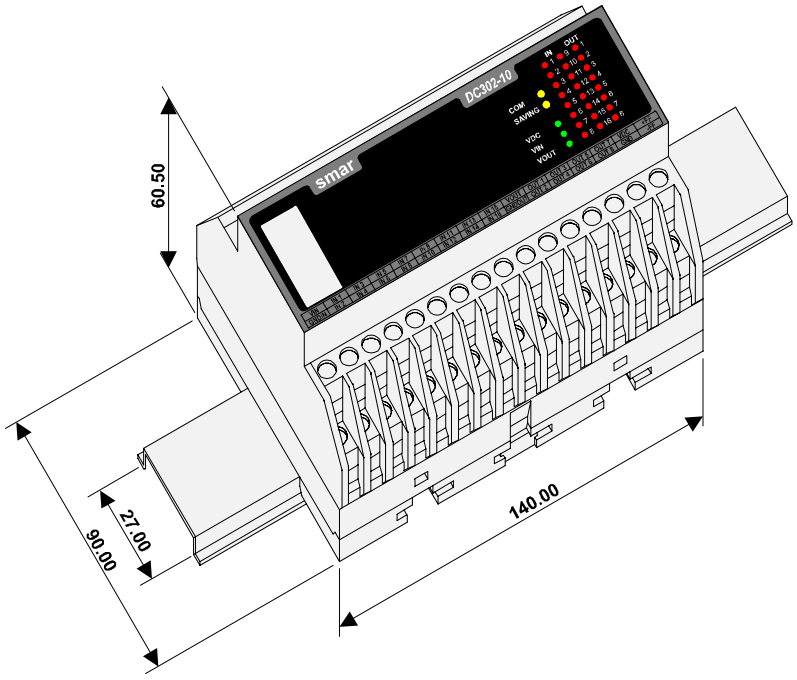


Figure 1.2 - Mechanical Mounting and Dimensional Drawing for DC302

Electric Wiring

Access the wiring block by the front View with label for inputs, outputs power supply and bus connection. The connections are made using the screws.
The used connections should be plugged accordingly. For examples, please see the Figure 1.4 and Figure 1.5.

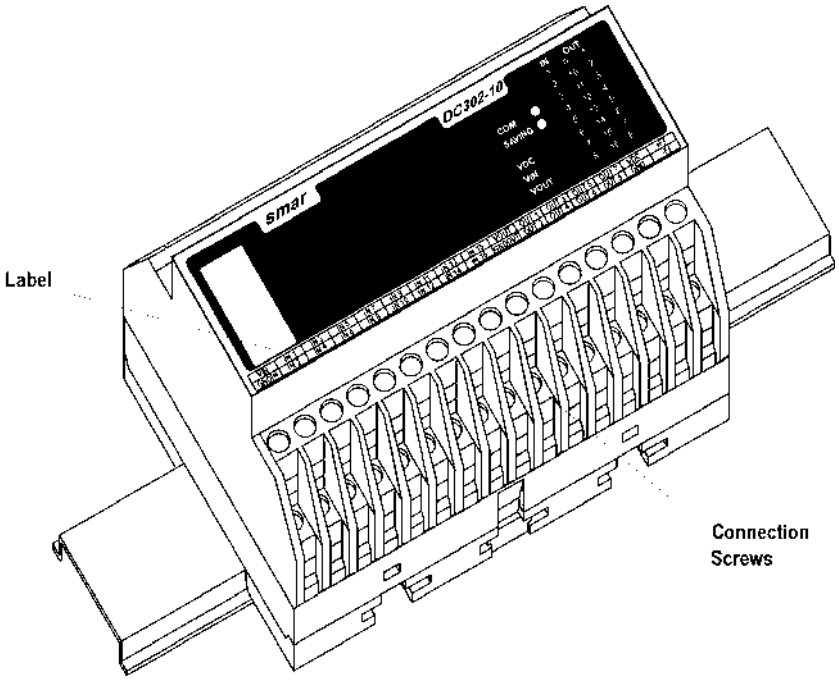


Figure 1.3 - Terminal Block Connections

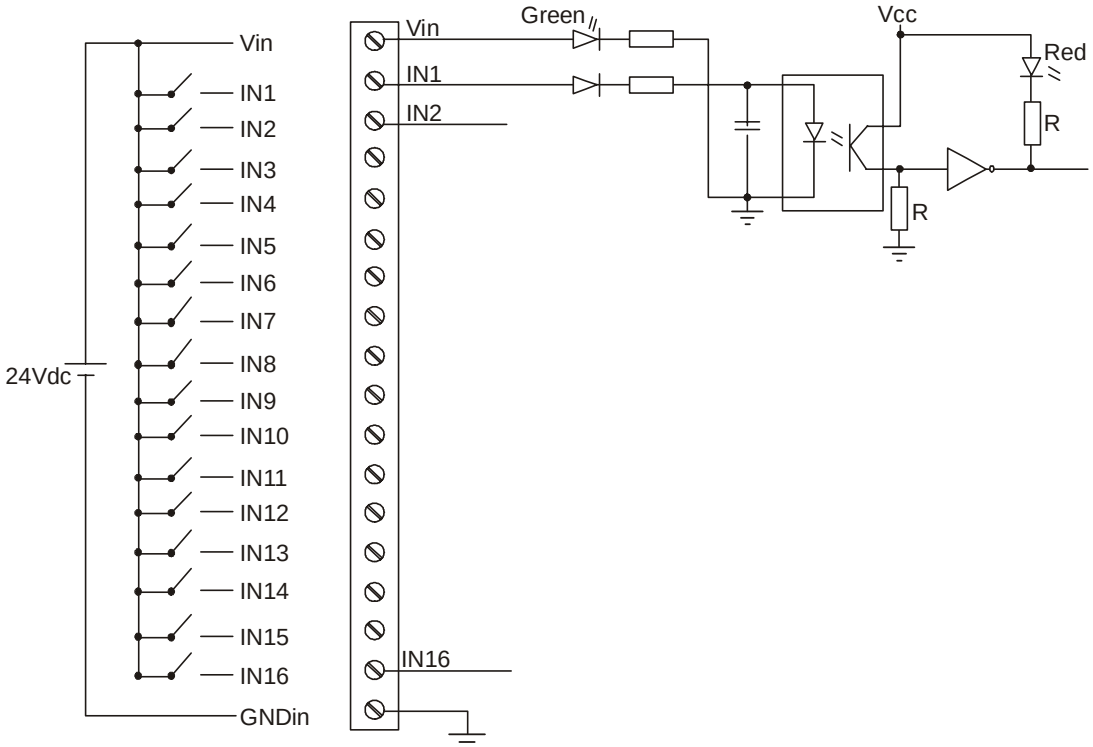


Figure 1.4 – Example of Input Connections

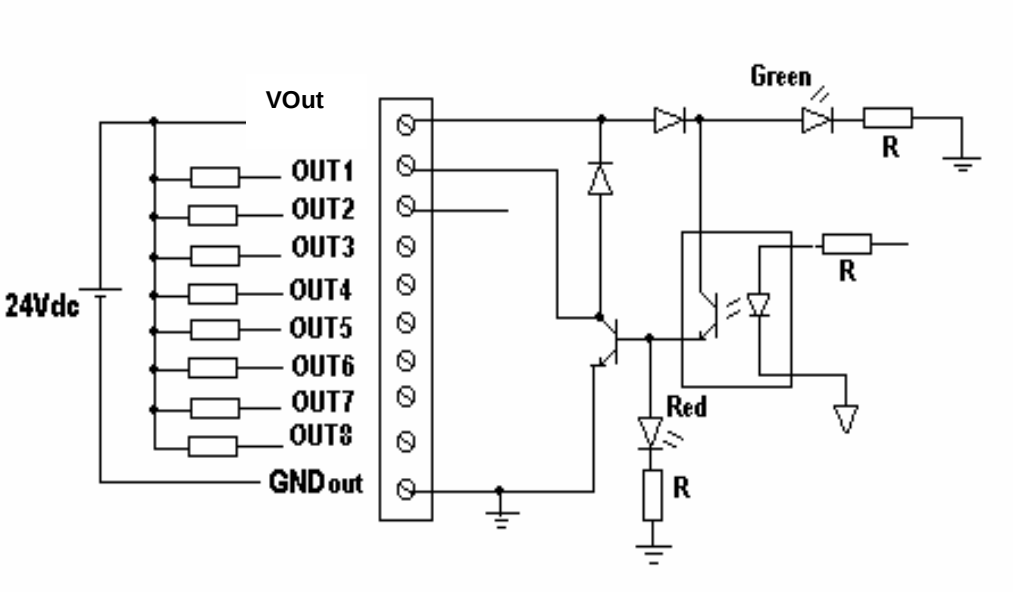


Figure 1.5 – Example of Output Connections

The DC302 is a non bus-powered device. The DC302 uses a 31,25 Kbit/s voltage mode option for the physical signaling. Various types of Fieldbus devices may be connected on the same bus, being bus-powered or non-bus-powered. When bus-powered, the devices must use the same signaling. Up to 16 devices can be connected in parallel along the same fair of wires.

In hazardous area, the number of devices may be limited by intrinsically safe restrictions.

The **DC302** is protected against reverse polarity, and can withstand ±35 VDC without damage.

NOTE
Please refer to the General Installation, Operation and Maintenance Manual for more details.

WARNING
HAZARDOUS AREAS In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed. Cable access to wiring connections is obtained by the two conduit outlets. Conduit threads should be sealed by means of code-approved sealing methods.

Topology and Network Configuration

Bus topology (See Figure 1.6 - Bus Topology) and tree topology (See Figure 1.7 - Tree Topology) are supported. Both types have a trunk cable with two terminations. The devices are connected to the trunk via spurs. The spurs may be integrated in the device giving zero spur length. A spur may connect more than one device, depending on the length. Active couplers may be used to extend spur length.

Active repeaters may be used to extend the trunk length.

The total cable length, including spurs, between any two devices in the Fieldbus should not exceed 1900m.

The connection of couplers should be kept less than 15 per 250m.

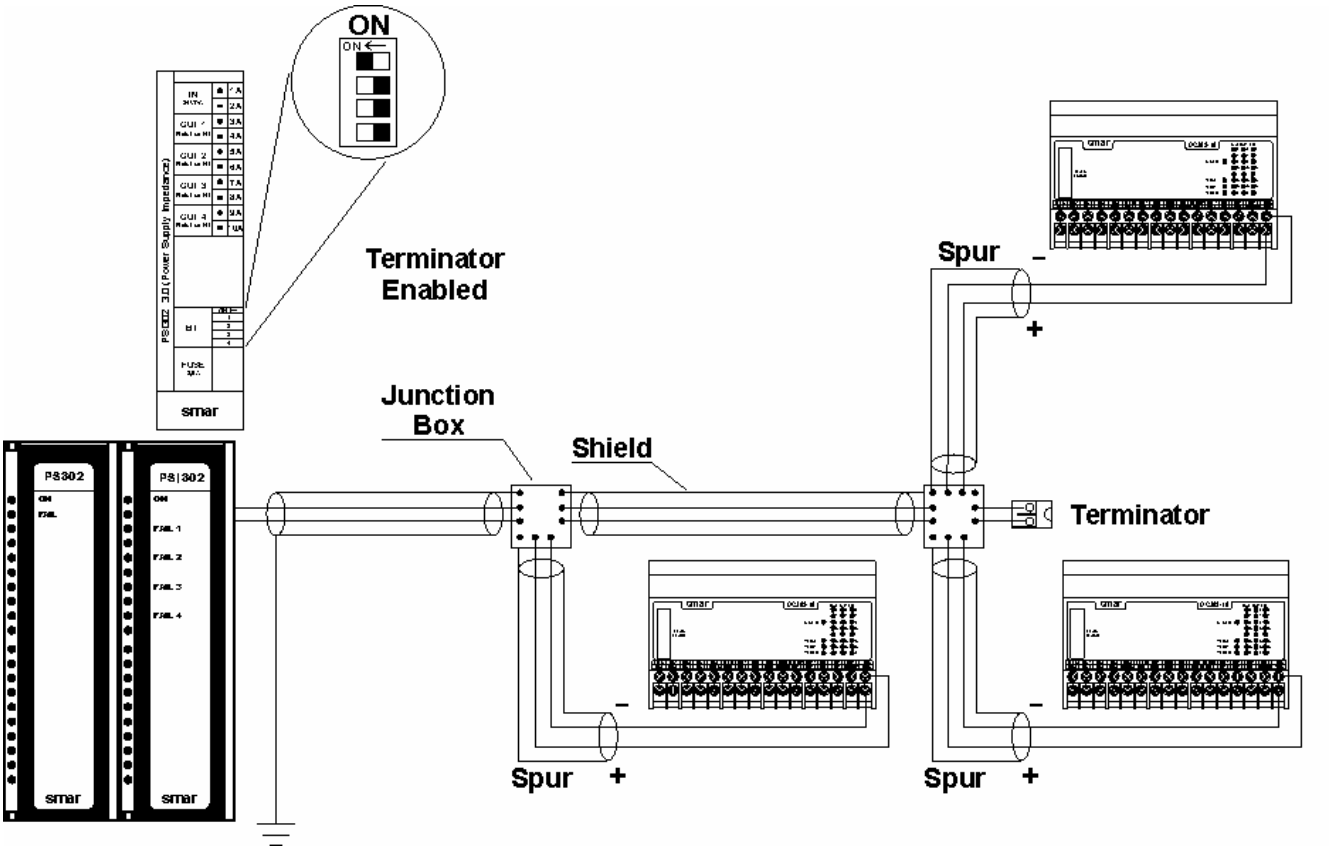


Figure 1.6- Bus Topology

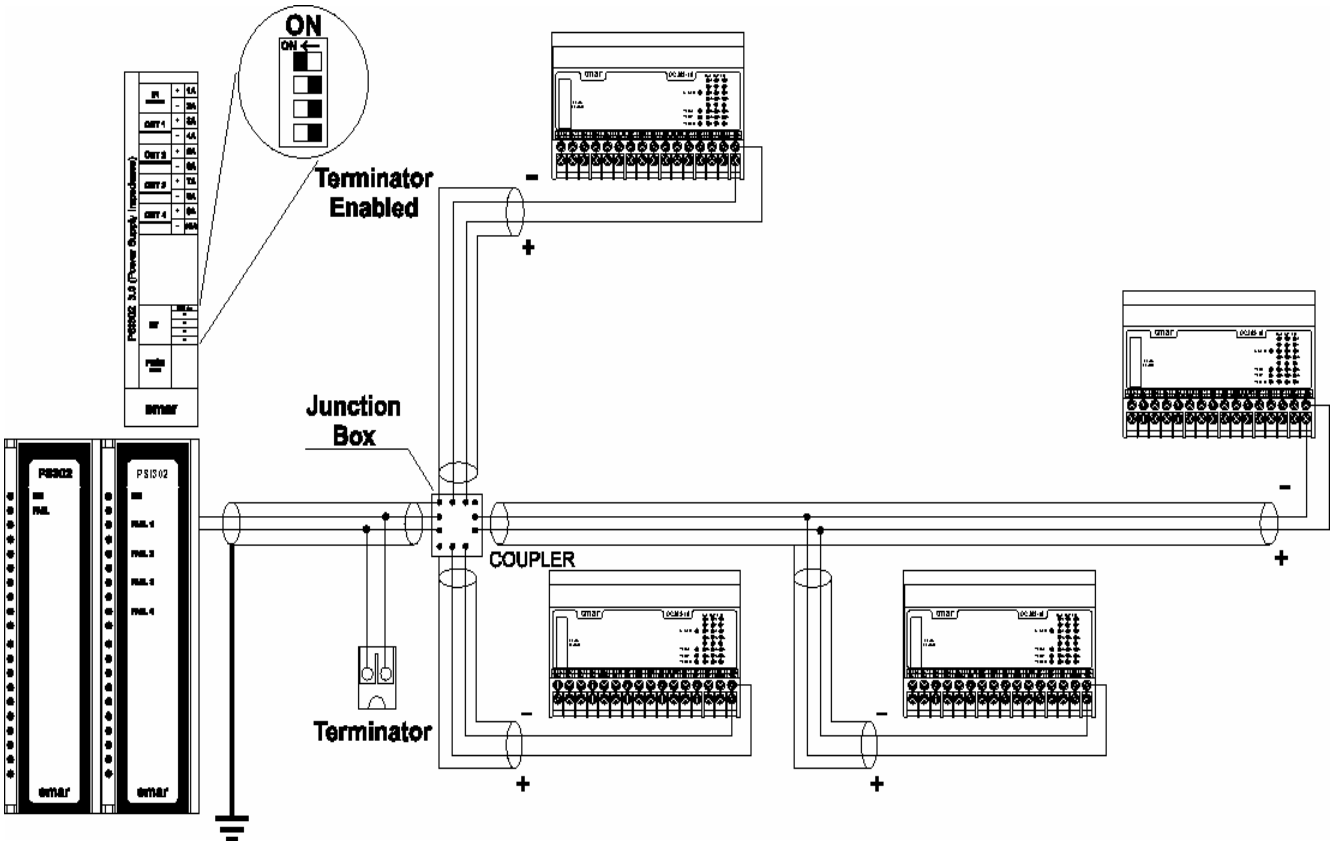


Figure 1.7 - Tree Topology

General System

According to the figure below, we can see a general network topology where the DC302 is integrated in a simple Fieldbus network.

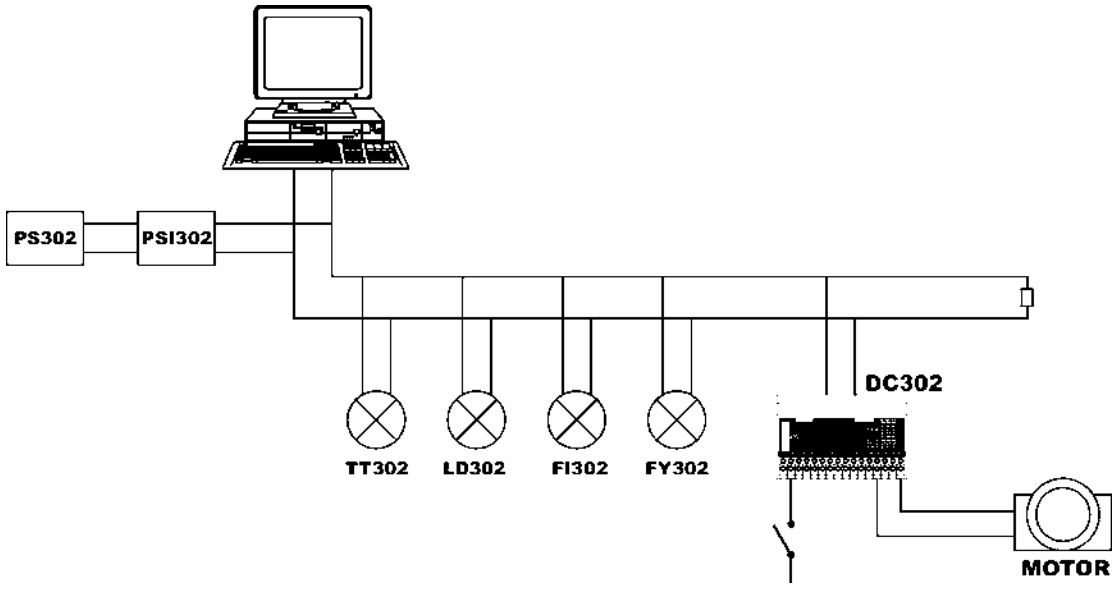


Figure 1.8 – DC302 and a general Fieldbus System

Section 2

OPERATION

The **DC302** accepts up to 16 optically isolated inputs and up to 8 open collector outputs. It is therefore ideal for interfacing exisisting discrete points to a Fieldbus system.

An extensive Function Blocks library enables the DC302 to execute logic and functions of regulatory and descrete control integrated via H1 Bus. Function Blocks provide great flexibility to control strategies.

The conventional discrete I/Os work together with Fieldbus devices integrated in the same network and in the same control loop.
Output function blocks include standard Foundation safety mechanism in case of failures.

Inputs and Outputs are isolated from each other and are accessed via communication network through the function blocks channel. The leds are used to indicae the I/Os status. The use of Foundation™ Functional Blocks make the system homogeneous in a way that the device with convencional discrete and analog I/Os can be available in order to make the control strategies configuration easy.

Functional Description – Electronics

Refer to the block diagram (See Figure 2.1 – *DC302 Block Diagram*). The function of each block is described below.

(CPU) Central Processing Unit, RAM and FLASH
The CPU is the intelligent portion of the Fieldbus Remote I/O, being responsible for the management and operation of block execution, self-diagnostics and communication. The program is stored in Flash memory. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off, however the device also has a nonvolatile EEPROM where data that must be retained are stored. Examples of such data are configuration and identification data.

Communication Controller
It monitors line activity, modulates and demodulates the signal from network line.

Power Supply
Takes power of the loop-line to power the Discrete Controller circuitry.

Factory Reset
The factory reset inscription can be found on the superior left side of the DC302 housing. In order to accomplish this operation, simply short-circuit the contacts on the circuit board, turn-on the DC302 in this short-circuit condition, and keep the key until the saving led goes to on state.

They are two mechanical contacts to perform the factory reset.

Input Latches
They are latches to hold the condition of inputs.

Otput Latches
They are latches to hold the condition of outputs.

Optical Isolation
Optical isolation for inputs and outputs.

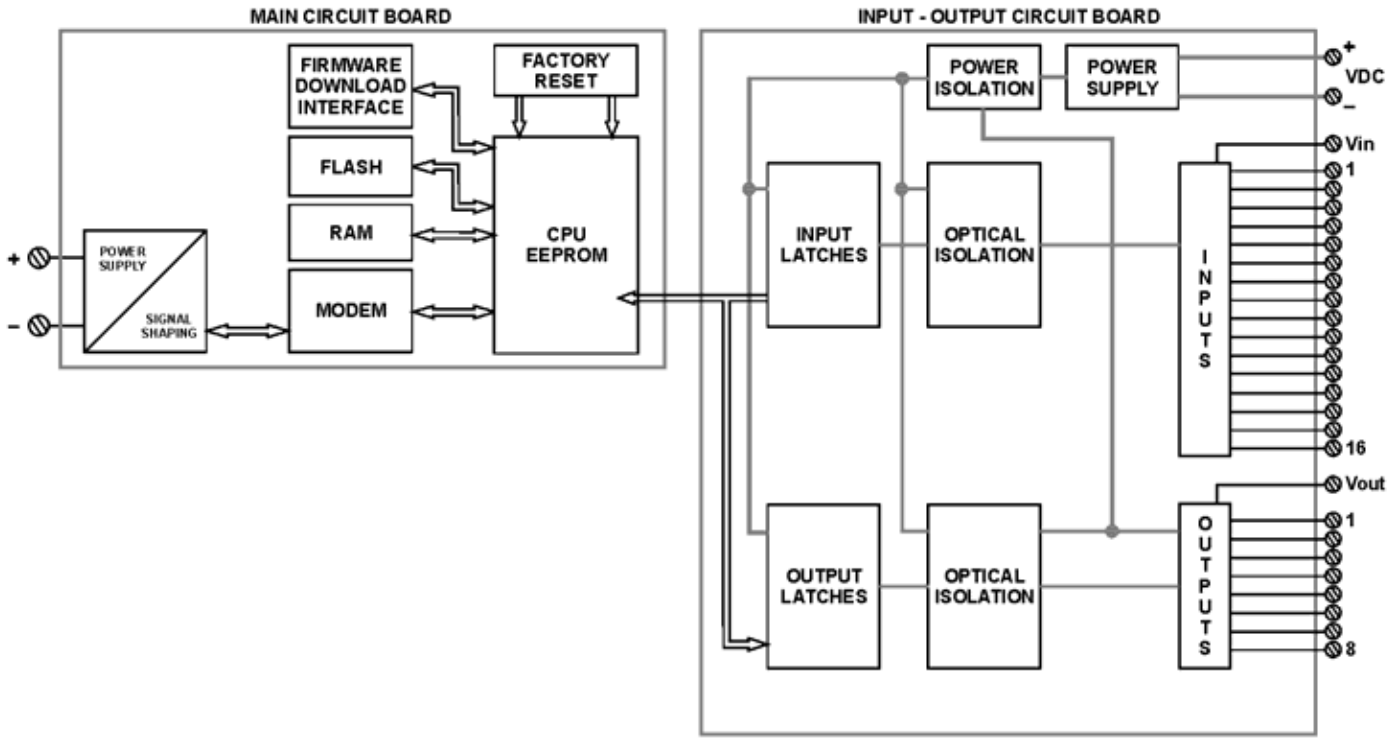


Figura 2.1 – DC Block Diagram

CONFIGURATION

One of the many advantages of Fieldbus is that device configuration is independent of the configuration tool. The **DC302** may be configured by a third party terminal or operator console.

The **DC302** has several Function Blocks built in, such as Flip-Flop and Edge Trigger, Analog Alarm, Timer and Logic, Discrete Input, Discrete Output, Multiple Discrete Input, Multiple, Discrete Output, Arithmetic, Input Select, PID controller, PID Step and Flexible Function Block.

Function Blocks are not covered in this manual. For explanation and details of function blocks, see the *Function Blocks Manual.*

The DC302 can share its Function Blocks with other connected devices using the SYSCON.

For explanation and details for using SYSCON, please see the *SYSCON Manual.*

Connecting physical signals to Digital Input Block

The DI block takes the discrete input data, selected by channel number, and makes it available to other function blocks at its output.
For details, please see the Function Block Manual.

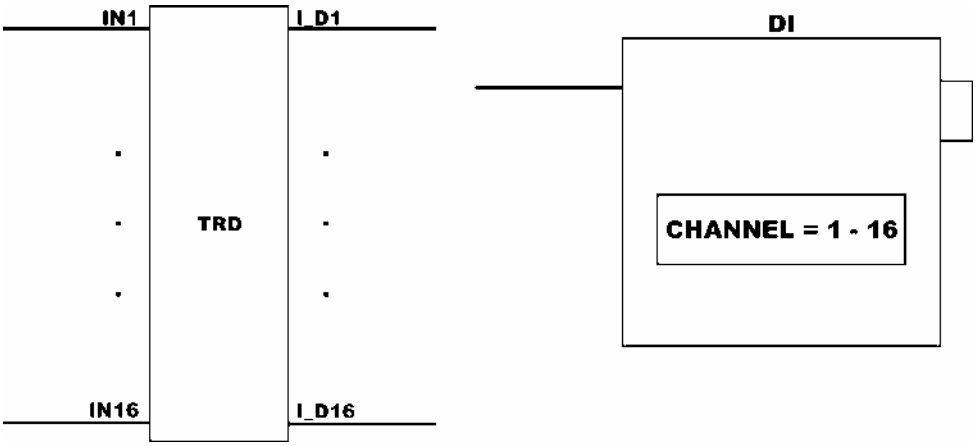


Figure 3.1 - DC302 and DI Block connections

Connecting physical signals to Digital Output Block

The DO block converts the value in SP_D to something useful for the hardware through the CHANNEL selection.
For details, please see the Function Blocks Manual.

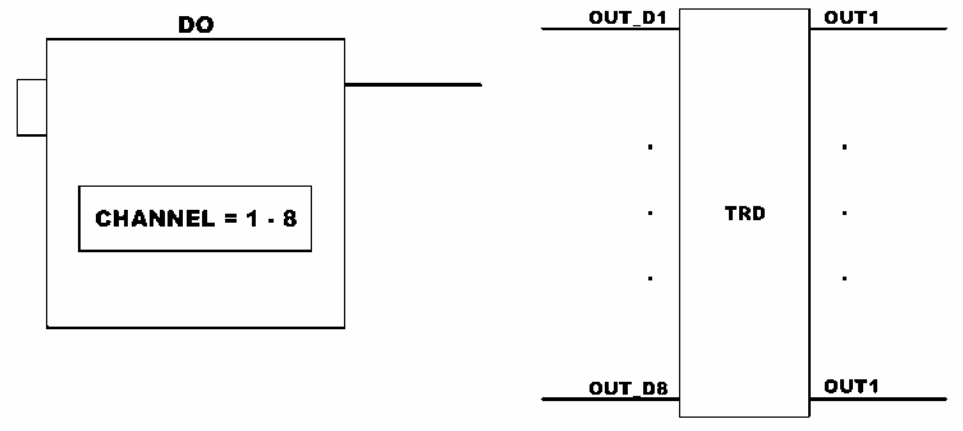


Figure 3.2 - DC302 and DO Block connections

Connecting physical signals to Multiple Digital Input Block

One MDI block makes available for the FF network eight discrete variables of the I/O subsystem through its eight output parameters OUT_D1 through OUT_D8. Status indication in the output parameters OUT_Dx depends on the I/O. For example, if there is individual detection of sensor failure, it will be indicated in the status of related OUT_Dx parameter. Problem in the interface to the I/O subsystem will be indicated in the status of all OUT_Dx as BAD – Device Failure.
For details, please see the Function Block Manual.

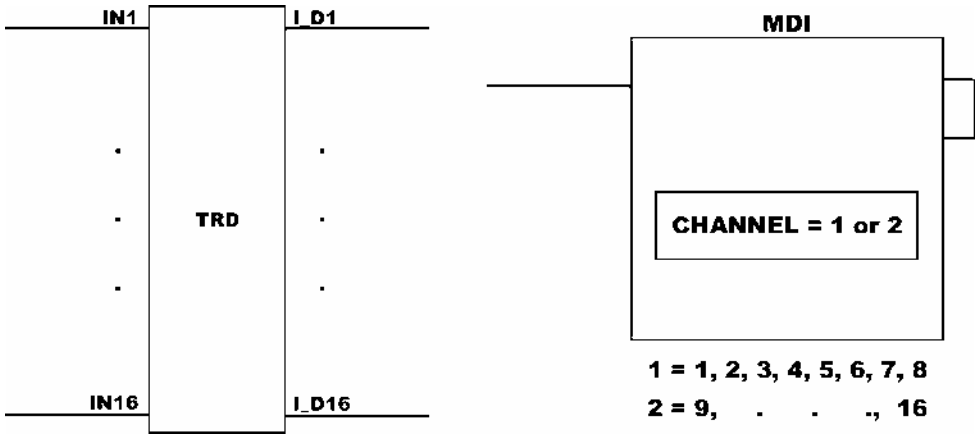


Figure 3.3 - DC302 and MDI Block connections

Connecting physical signals to Multiple Digital Output Block

The MDO block makes available to the I/O subsystem its eight input parameters IN_D1 through IN_D8.
This function block has the same fault state characteristics as the DO block. It includes option to hold the last value or go to a preset value when fault state activates individual preset values for each point, besides a delay time to go into the fault state. The actual mode will be LO only due to the resource block, otherwise bad status in input parameter and configuration of MO_STATUS_OPTS will not affect the mode calculation. However the functionality of fault state will be done only for that input parameter. The parameter FSTATE_STATE shows which points are in fault state active.
For details, please see the Function Block Manual.

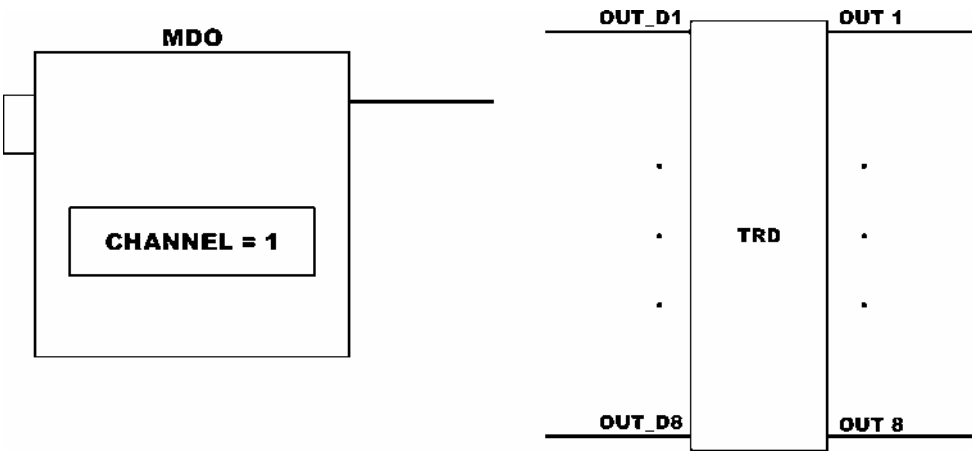


Figure 3.4 - DC302 and MDO Block connections

Connecting physical signals to PID Step

A Step Control Output block is used most commonly, when the final control element has an actuator driven by an electric motor. The final control element is positioned by rotating the motor clockwise or counterclockwise, which is accomplished by activating a discrete signal for each direction. A control valve, for example, needs a signal to open and another to close. If none of the signals is present, the valve stem would stay at the same position. Fieldbus actuators and switch gears are the transducer blocks of this block. For details, please see the Function Block Manual.

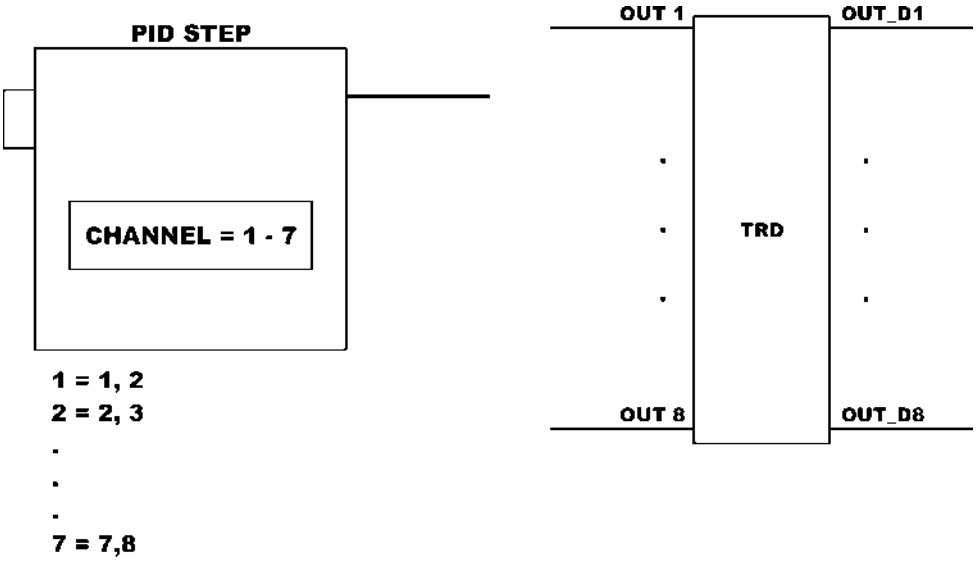


Figure 3.5 - DC302 and PID Step Block connections

Examples of Applications

Application 1: From the computer the input and output can be manipulated.

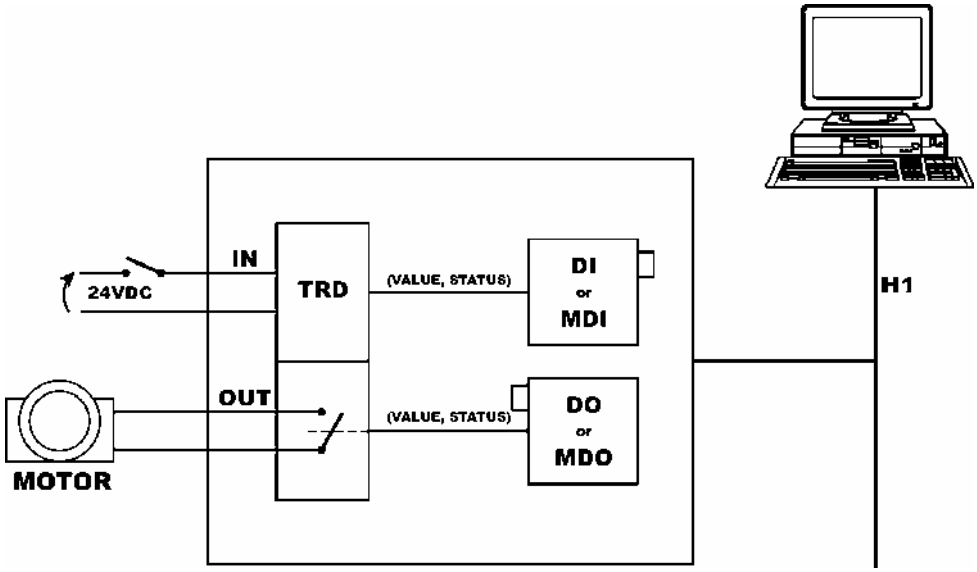


Figure 3.6 - DC302 – Appplication 1

Application 2: Distributed control (Level limit will start a motor, a pump, or open/close an on/off valve).

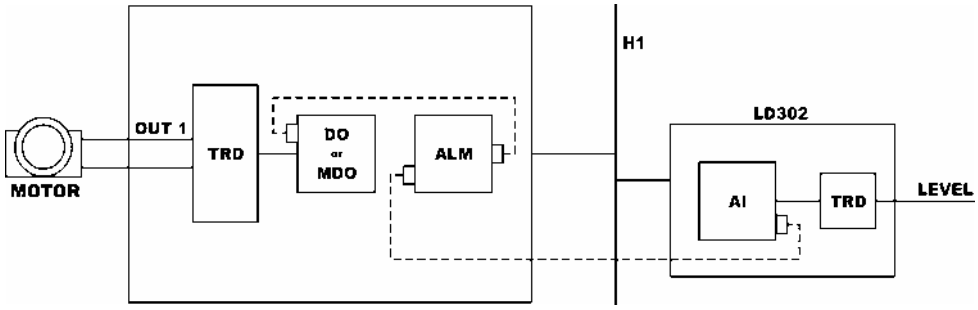


Figure 3.7 - DC302 – Appplication 2

Application 3: Distributed control (PID step).

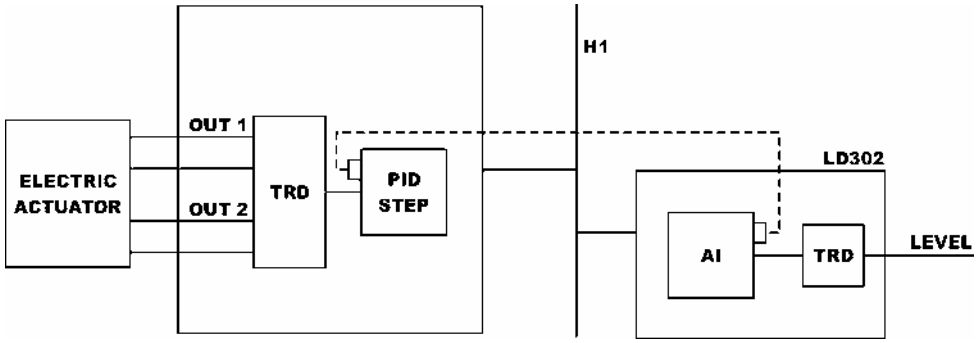


Figure 3.8 - DC302 – Appplication 3

Application 4: Distributed discrete control using TIME & FFET Function Blocks.

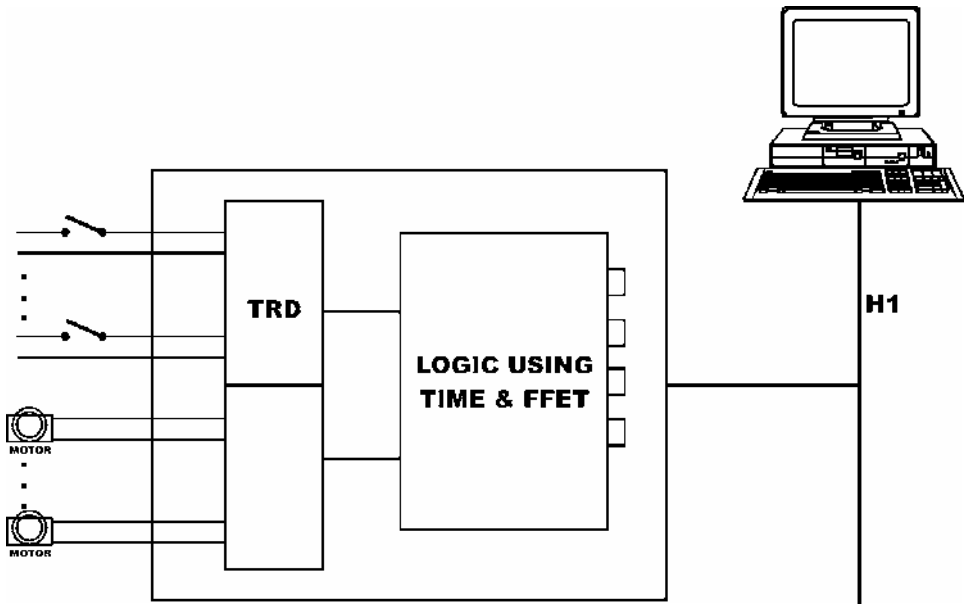


Figure 3.9 - DC302 – Appplication 4

Application 5: General application for DC302.

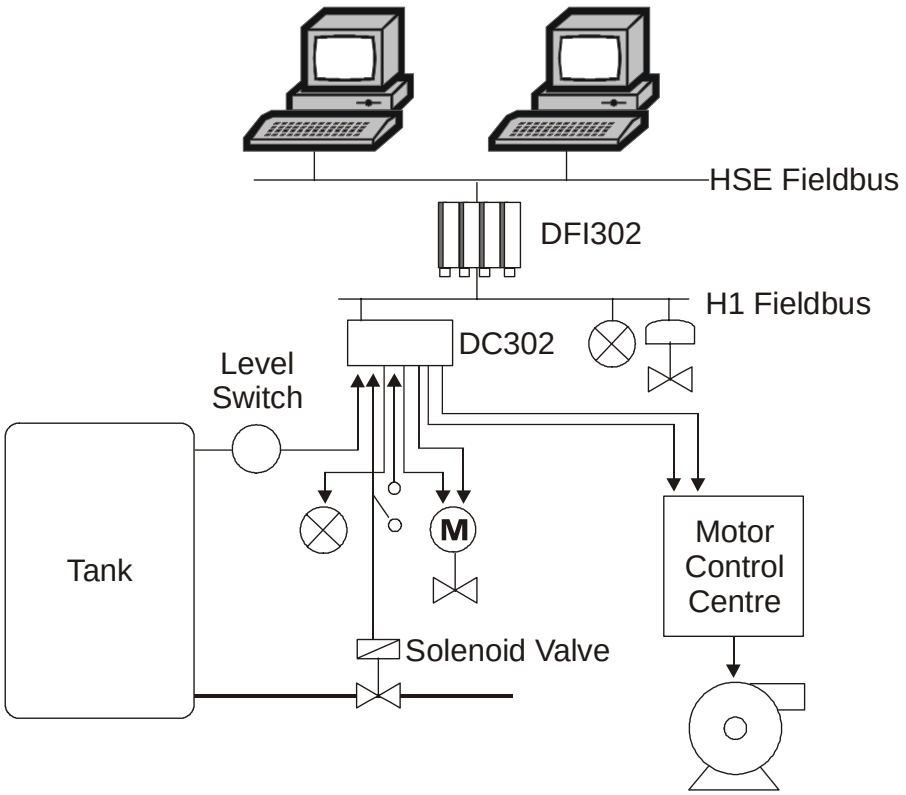


Figure 3.10 - DC302 – Appplication 5

Section 4

MAINTENANCE PROCEDURES

General

SMAR **DC302** Fieldbus Remote I/O are extensively tested and inspected before delivery to the end user. Nevertheless, during their design and development, consideration was given to the possibility of repairs by the end user, if necessary.

In general, it is recommended that the end user do not try to repair printed circuit boards. Instead, he should have spare circuit boards, which may be ordered from SMAR whenever necessary.

Troubleshooting	
Symptom	***Probable Sources of Trouble***
No Quiescent Current	**Fieldbus Remote I/O Connections:** Check wiring polarity and continuity. **Power Supply:** Check power supply output. The voltage at the DC302 Fieldbus terminals must be between 9 and 32 VDC. **Electronic Circuit Failure:** Check the boards for defect by replacing them with spare ones.
No Communication	**Network Connections:** Check the network connections: devices, power supply, and terminators. **Network Impedance:** Check the network impedance (power supply impedance and terminators). **Controller Configuration:** Check configuration of communication parameters of controller. **Network Configuration:** Check communication configuration of the network. **Electronic Circuit Failure:** Try to replace the controller circuit with spare parts.
Incorrect Inputs	**Input Terminals Connection:** Check wiring polarity and continuity. **Power supply for Inputs:** Check power supply. The voltage must be between 18 and 30 VDC and the typical consumption when all input is ON is 120mA.
Incorrect Outputs	**Output Terminals Connection:** Check wiring polarity and continuity. **Power supply for Outputs:** Check power supply. The voltage must be between 20 and 30 VDC and the maximum current per output is 0.5 A.

Disassembly Procedure

Refer to the Figure 4.1 DC302 Exploded view. Make sure to disconnect power supply before disassembling the DC302.

WARNING
The boards have CMOS components, which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

Loose the lateral locks that attach the housing cover and then the main lock. You will have the access to the main circuit board and the I/O electronic board. Gently pull out the main board. To remove the electronic boards, first unscrew the screws that anchors them to the housing, and gently pull out the boards.

Reassembly Procedure

- Put the boards into housing.
- Anchors the board with their screws.
- Make sure all inter connecting pins are connected.
- Observi the LEDs mounting positions, gently lock the housing cover in the lateral locks and the main lock.

Boards Interchangeability

Main and I/O boards can be changed independently.

Returning Materials

Should it become necessary to return the DC302 to SMAR, simply contact your local agent or SMAR office, informing the defective controller's serial number, and return it to our factory.

In order to expedite analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as many details as possible. Other information concerning the instrument operation, such as service and process conditions, is also helpful.

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
BC302	Fieldbus/RS232 Interface
SYSCON	System Configuration Tool
PS302	Power Supply
PSI302	Power Supply Impedance
BT302	Terminator
PCI	Process Control Interface

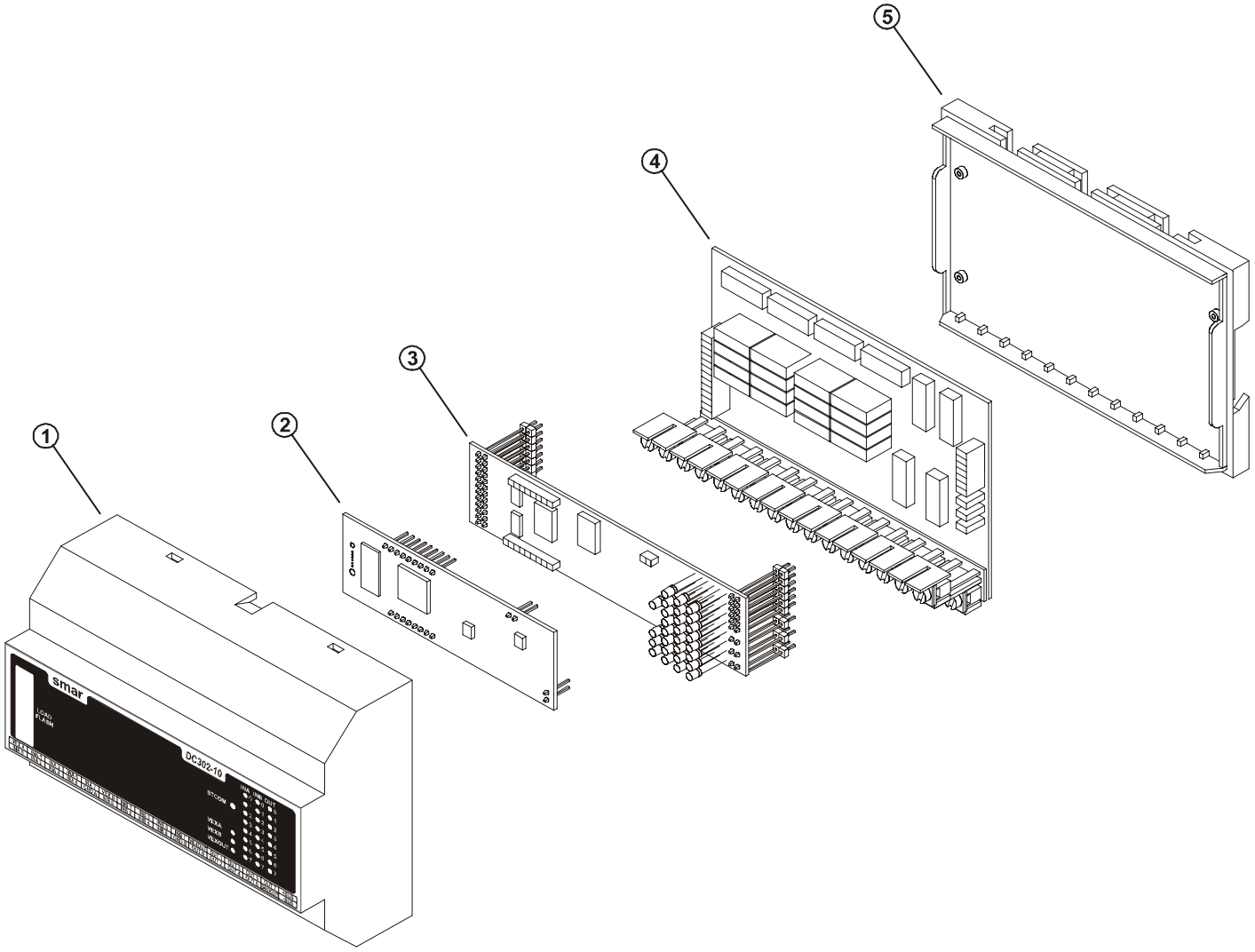


Figure 4.1 – DC Exploded view

Spare Parts

NAME	POSITION	CODE
Enclose	*1and 5*	400 - 0367
Main Electronic Board	*2*	400 - 0368
Interface Board	*3*	400 - 0369
I/O Board	*4*	400 - 0370

Section 5

TECHNICAL SPECIFICATIONS

General

Signal (Communication)	Digital only. Fieldbus, 31.25 Kbits/s voltage mode
Power Supplies	If there are requirements for power supply isolation between inputs and outputs, it is recommended to use at least two power supplies, one for inputs and another one for outputs and VDC. If the application does not require isolation between inputs and outputs, only one power supply could be used for inputs, outputs and VDC. Inputs and outputs are optically isolated from each other.
Current consumption quiescent	150 mA from VDC power supply
Turn-on Current	400 mA during the first 20s after power
Turn-on Time	Approximately 10 seconds.
Update Time	Approximately 0.5 second.
Output impedance	Non-intrinsic safety from 7.8 kHz - 39 kHz should be greater or equal to 3 k. Intrinsic safety output impedance (assuming an IS barrier in the power supply) from 7.8 kHz - 39 kHz should be greater or equal to 400.
Vibration Effect	Meets SAMA PMC 31.1.
Temperature Limits	**Operation:** -40 to 85ºC (-40 to 185 ºF) **Storage: -**40 to 110ºC (-40 to 230 ºF)
Housing	**Housing Shell and Base:** Polycarbonate, 10% Glass Filled **Terminals:** Pressure Plate /Terminal Screws: Zinc Plated, Yellow Chromated Steel **Temperature rating:** 110ºC (230 ºF) UL94VO **Protection:** it has IP20 rating (finger protected) and meets VBG4 and other European accident prevention requirements.
Mounting	Using DIN rail (TS35-DIN EN 50022 or TS32-DIN EN50035 or TS15-DIN EN50045.

DC302 Inputs

Description-Inputs

The input module senses the DC input voltage and converts it into a True (ON) or False (OFF) logic signal. It has 1 optically isolated group of 16 inputs to detect 24Vdc.

In case of failuring of input power supply there will be an indication in the BLOCK_ERR parameter for input function blocks such as DI, MDI, FFB (See Function Blocks Manual).

Technical specifications

Architecture	Number of Inputs is 16
Isolation, groups are individually isolated	Optical Isolation up to 5000 Vac
External Power	Voltage Source for Inputs 18 - 30 Vdc
Typical Consumption per group (all inputs ON)	120 mA
Power Indicator	Green LED
Inputs	ON State Level (True Logic) 15 - 30 Vdc
	OFF State Level (False Logic) 0 - 5 Vdc
Typical Impedance	3k9 Ω
Status display	Red LED
Switching Information	Time from “0” to “1”: 30 µs
	Time from “1” to “0”: 50 µs
Wire	One wire 14 AWG (2 mm^2)
	Two wires 20 AWG (0.5 mm^2)

DC302 Open Collector Outputs

Description - Outputs

The outputs are designed with open collector NPN transistors that are able to drive relays, incandescence lamps, solenoids and other DC loads with up to 0.5 A per output. All channels within a group share the same ground whereas groups are isolated from each other and the Fieldbus network.

In case of failuring of output power supply there will be an indication in the BLOCK_ERR parameter for output function blocks such as DO, MDO, FFB, STEP_PID (See Function Blocks Manual).

Technical specifications

Architecture	Number of Outputs 8
Isolation	Optical Isolation up to 5000 Vac
External Power	Voltage Source for Outputs 20 to 30 Vdc
Maximum Consumption	35 mA
Power Indicator	Green LED
Outputs	Maximum Switched Voltage 30 Vdc
	Maximum Saturation Voltage 0.55 V @ 0.5 A
	Maximum Current per Output 0.5 A
	Status Display Red LED
	Indicator Logic ON when the transistor is on
	Maximum Leakage Current 100 µA @ 35 Vdc
	Maximum Power Consumption for Bulbs 15 W
Output Status During: **Power-Up** **Firmware Download** **Configuration Download**	OFF
Independent Protection per Output	Thermal Shutdown 165 ^{o}C
	Thermal Hysteresis 15 ^{o}C
	Over-Current Protection 1.3 A @ 25 Vdc maximum
Clamp Diode, switching information	Time from 0 to 1: 250 µs
	Time from 1 to 0: 3 µs
Wire	One wire 14 AWG (2 mm^2)
	Two wires 20 AWG (0.5 mm^2)

Ordering Code

MODEL	DESCRIPTION
DC302-10 Fieldbus Remote I/O	- 1 Group of 16 24VDC optically isolated inputs. - 1 group of 8 optically isolated open collector outputs.