RS 485 driver

PROFIBUS is based on RS 485 technology. However, to achieve the defined length and baudrates within PROFIBUS, the driver has to fulfill certain requirements. By using PROFIBUS up to 12 Mbaud, the use of the LSI ALS176D driver from Texas Instruments is highly recommended.

Please compare the data sheet if you want to use a different driver (differential output voltage and pulse skew are most important).

5V power supply

If a device on PROFIBUS is using a 9 pin D-sub connector it has to supply power (5V, GND) at the PROFIBUS connector in order to provide power for the external termination. The standard defines 10mA as minimum. However, today are several different products available which use the 5V output power from the device as well. Optical link connectors and the active cable are examples. Optical connectors are connected to the regular 9 pin connector and transform the signal for the use with fiber optic. Since a manufacturer never knows how the end customer plans to use a device, a maximum of 90mA at the 5V output (not counting the current for the integrated circuit) should be provided.

Galvanic Isolation - Optocoupler for PROFIBUS connections

The recommended optocoupler type for PROFIBUS DP up to 12 Mbaud, the HCPL-7101, is no longer available.

The new recommended types are HCPL-7721 and HCPL-0721 from Hewlett Packard. The use of these new types for 12 Mbaud devices is highly recommended. 12 Mbaud applications need to fulfill certain requirements and therefore the optocoupler needs to be designed for these requirements

Details:

|	HCPL-7101	HCPL-7721, HCPL-0721
Housing		Besides DIP 8 and Gull wing SO-8 is also available .
VDE0884	Standard	Optional available The VDE 0884 is a German standard and is not suitable for a DP device.
Pin7	Output Enable, connected to Gnd	Not Connected, The circuit does not need to change; a pull down resistor is not necessary.
Pin3		This pin is not allowed to be used

The datasheet can be downloaded from the Hewlett Packard webpage:

http://www.hp.com/HP-COMP/isolator/hcpl7720.html
ftp://ftp.hp.com/pub/accesshp/HP-COMP/isolator/hcpl7720.pdf

The standard does not describe the detailed circuit diagram for a PROFIBUS device. It is highly recommended that a PROFIBUS device should have a galvanic isolation between the PROFIBUS part and the application itself.
The following diagram shows how to do this:
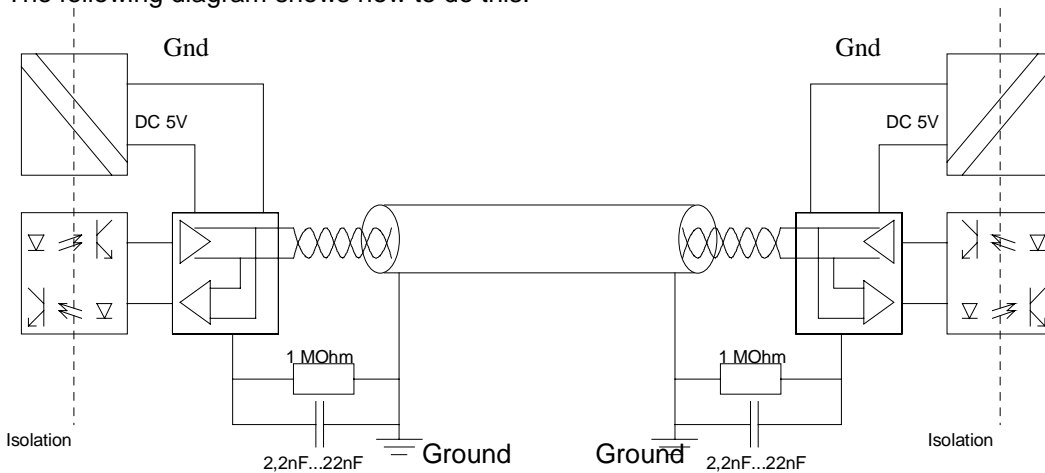
RS 485 connection drawing

PROFIBUS allows distances between 100m and 1000m per segment (depending on the baudrate) and baudrates between 9.6 kBaud and 12 MBaud. In order to ensure the proper functionality within the maximum distances and the possible baudrates, the network must be electrically correct in terms of reflections and connections.
Each device has a certain capacity on PROFIBUS based on the inner circuit. This capacitance creates reflections on the cable and under certain circumstances communication is not possible anymore.
The problem is based on distance of the cable, baudrate and the capacitance of the connected devices. In order to avoid this problem, the connection to the device needs to have a built-in inductivity. Based on extensive tests, the inductivity needs to be built into the connector like the following drawing shows. The reason for this is that the interface with the Inductors inside reflects a part of the cable. Inductors built into the device does not solve the problem.
Each Inductivity has a certain resistance as well and if the resistance on the network is too high the defined length of cabling can not be reached anymore. Therefore, it is recommended to use Inductors with the following technical data. The recommended type is Murata LQH1CR12M04:

Inductivity: 120nH
Max. current: 970mA
Max. DC resistance: 80mohm

 The technical data sheet can be downloaded from the Murata webpage
www.iijnet.or.jp/murata/products/english/catalog/o05e3.pdf.
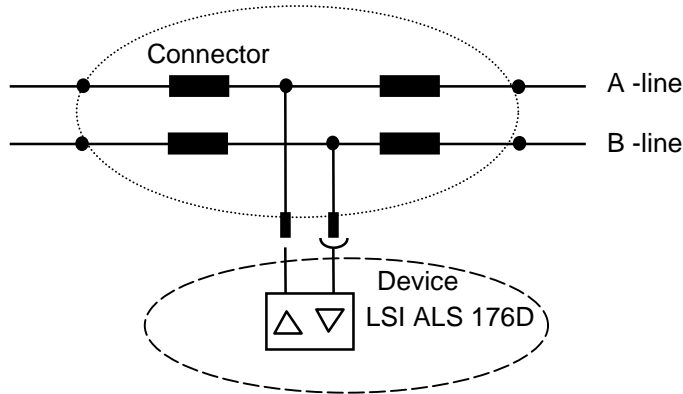
The following line parameters were used for dimensioning the length inductors of L = 120 nH based on the following assumptions:

Line Type A
Typical connection capacity for a bus station (connector, line length to the RS 485 driver, RS 485 driver, components, etc.): ~30pF.

Note:
The calculation of the inductance takes into account the capacitance of the connected station. When removing such connectors, mismatching may occur that may have an interfering effect on the bus.

PROFIBUS PA, 45.45kBaud

The PROFIBUS standard has a definiton(PROFIBUS PA) to meet the requirements for the Process Automation industry. PROFIBUS PA is based on PROFIBUS DP and the extension PROFIBUS DPV1. Therefore, a PROFIBUS PA system is always based on a PROFIBUS DP system and the connection to the different bus physics is achieved with the use of segment coupler. There are several different types of segment coupler available The easiest version converts the RS 485 physics to IEC 1158 physics. PROFIBUS PA runs strictly with one Baudrate of 31.25Kbaud. By using the simple segment coupler, the PROFIBUS DP part needs to run with 45.45kBaud. The ASICs LSPM2, SPM2, SPC3, SPC4 and ASPC2 from Siemens support this baudrate automatically. In order to use this baudrate, it needs to be defined in the GSD file: 45.45_supp=1; MaxTsdr_45.45=250.

Disclaimer:
This information is provided by the PROFIBUS Certification lab in Fuerth and Johnson City. The content is our recommendation based on our experience.

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