DCP485

Fully Isolated DIN Rail RS-232 to RS-485 Converter/Line Driver

Description

The DCP485 is a compact RS-232 to RS-485 converter which features a complete electrical isolation barrier and heavy duty electrical surge protectors. These devices feature a DIN rail mountable enclosure for application to a junction box, a panel, a relay rack, the sides of computer equipment, or anywhere a DIN rail can be mounted. Isolation is provided by optical couplers and a transformer isolated DC-to-DC converter. The RS-232 connection is through male or female EIA 9-pin D-sub connectors, or a 3-wire RS-232 connection can be made through convenient pluggable screw terminals. The RS-485 connections are made through convenient pluggable solderless screw terminals.

The DCP485 series is designed for full duplex operation over two wire pairs. Outputs are tri-state, allowing multidropping of up to 32 units over one pair. Data rates are DC to 115.2k bits per second (baud). Four diagnostic LED indicators are provided for installation guidance and system troubleshooting. The RS-232 interface includes Request To Send (RTS) and Data Terminal Ready (DTR) either of which can be used via DIP switches to enable the RS-485 transmitter. Alternately, the DCP485 offers automatic line switching in which the RS-485 transmitter is enabled automatically by each character sent on the RS-232 Transmit Data (TD) line. Additionally, the RS-485 transmitter and receiver may be independently enabled continuously or under RS-232 control. A convenient null modem switch is provided for the data lines. Also, line termination switches independently connect line termination and line bias resistors to the RS-485 lines. The units are powered from wide-range voltages of +10 to +30VDC through pluggable solderless screw terminals.

▶ Features

- Complete Isolation with Optical Couplers and Transformer-Coupled DC-to-DC Converter
- Industrial Surge Protection Devices and 15kV ESD Protected RS-232 Inherent
- Four LED Diagnostic Indicators
- 38.4k bps (baud) at 1 Mile (1.6km), 115.2k bps (baud) at 0.8 Mile (1.3km)
- RTS, DTR, or Auto RS-485 Transmitter Control
- Tri-state Outputs for Multidrop Applications, up to 32 Devices
- Selection of Connectors
- Wide Operating Temperature Range
- Pluggable Solderless Screw Terminal Field Connections
- CE Compliant

Dataforth does not authorize or warrant its products for use in life support/ critical applications.

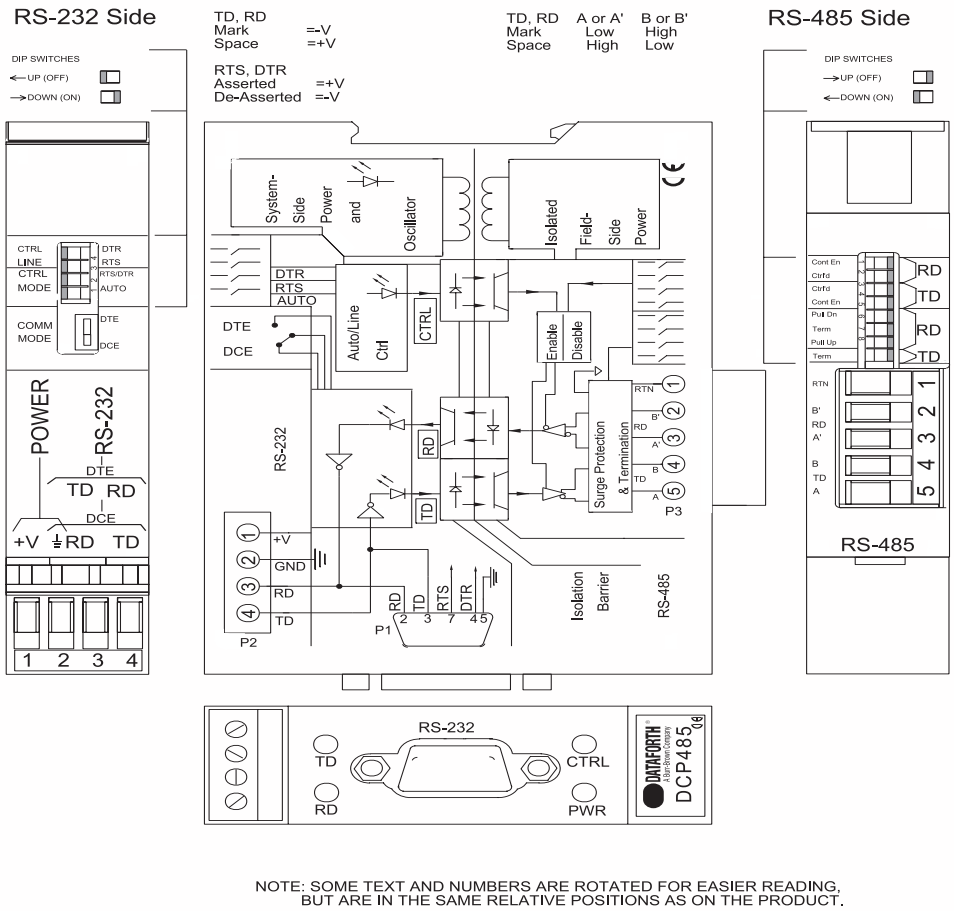
Specifications

Model	DCP485
Baud Rate Range	0-115.2k bps (Baud)
Baud Rate	115.2k 57.6k 38.4k 19.2k 9.6k 4.8k 2.4k-0
Distance(miles)	0.8 0.9 1.0 2.0 3.0 4.0 7.0
Distance(km)	1.3 1.5 1.6 3.2 4.8 6.4 11.3
Wire Capacitance	Equal to 25pf per foot and up to 32 multidrop units
Max Multidrop Units	32
Common Mode Isolation	Surge: 6000VDC, 1 min. Continuous: 1500Vrms
Differential Mode Surge Protection (9 devices)	(DC input and RS-232 inputs and outputs) ANSI/IEEE C37.90.1 (all RS-485 inputs and outputs)
Modes	Asynchronous 4-wire full-duplex, 2-wire half-duplex, 2-wire simplex
Channel Lines(1)	TD, RD
Control Lines(1)	RTS, DTR
Null Modem Switch	1 (Reverses RS-232 pins 2 and 3)
RS-485 Output Drive	28mA max/output
RS-485 Input Impedance	12kΩ min/input
Power	+10 to +30 VDC at 150mA max

Model	DCP485
Environmental:	
Operating Temperature Range	-40°C to +60°C
Storage Temperature Range	-40°C to +70°C
Relative Humidity	0-95% non-condensing
Altitude	to 15000 ft (4574 m)
Dimensions	4.3" x 3.3" x 0.89" (109mm x 84mm x 22.5mm)
Weight	4.6 oz (130g)
MTTF(2)	>100,000 hrs

NOTES:
(1) TD = Transmit Data, RD = Receive Data, RTS = Request To Send, DTR = Data Terminal Ready.
(2) Ground-benign environmental conditions (no salt atmosphere, <50°C ambient temperature).

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NOTE: SOME TEXT AND NUMBERS ARE ROTATED FOR EASIER READING, BUT ARE IN THE SAME RELATIVE POSITIONS AS ON THE PRODUCT.

Figure 1: DCP485 Block Diagram

Front

DB-9

RS-232 standard 9 position D-sub pinout with pin 9 not connected (see **RS-232 P1 Pin Descriptons** in table below).

LEDs

TD - shows state of RS-232 Transmit Data - is on when TD is a SPACE (logic 0, +V) and is off when TD is a MARK (logic 1, -V) - should be off when system is configured correctly, powered, and no data - should be pulsing from bright with low speed high density data to dim with high speed low density data.

RD - shows state of RS-232 Receive Data - is on when RD is a SPACE (logic 0, +V) and is off when RD is a MARK (logic 1, -V) - should be off when system is configured correctly, powered, and no data - should be pulsing from bright with low speed high density data to dim with high speed low density data.

LEDs

CTRL - shows state of RS-232 control line (DTR or RTS) or data enabled automatic RS-485 transmitter/receiver control line - LED is on when control line is asserted and off when de-asserted. May be on or off upon initial power depending on CTRL MODE DIP switches settings and the state of the control lines. **Warning - this LED does not necessarily indicate the enable state of the RS-485 transmitter/receiver especially when the RS-485 TD Cont En (Continuous Enable) DIP switch is down(on) and the TD Ctrl'd (Controlled) DIP switch is up(off).**

PWR - is on when DCP485 is supplied with +10 to +30V DC power.

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RS-232 Side

Terminal Block

Includes DCP485 power input and optional RS-232 TD, RD and Ground connections shared with power input (see **RS-232/POWER P2 Pin Descriptions** in table below). The optional RS-232 connections are for those applications which need the minimum number of cables and can be configured for either 4-wire RS-485 or 2-wire RS-485 using CTRL MODE AUTO, the data enabled automatic RS-485 transmit/receive mode. This terminal block is pluggable for easy replacement of the RS-232/Power cable or the DCP485 module.

DIP Switches

COMM MODE DCE / DTE - reverses pins 2 & 3 of the DB-9 connector and screw terminals 3 & 4 of the RS-232/Power terminal block. In DCE, TD is DB-9 pin 3 and screw terminal 4 and RD is DB-9 pin 2 and screw terminal 3. The factory default setting is DCE.

CTRL MODE AUTO / RTS/DTR - RTS/DTR switch down(on) & AUTO switch up(off) selects RTS or DTR to be control lines to enable the RS-485 transmitter. RTS/DTR switch up(off) & AUTO switch down(on) selects AUTO mode. AUTO mode enables the RS-485 transmitter for one character time and then sets it to a high impedance state. The timeout is set so that AUTO will work from 4800 bits per second (bps/Baud) to 115.2k bps. This timeout can be custom set at the factory for higher or lower minimum data rates by request. The factory default setting is RTS/DTR down(on) & AUTO up(off).

LINE RTS / DTR - RTS switch down(on) & DTR switch up(off) selects RTS to enable the RS-485 transmitter. RTS switch up(off) & DTR switch down(on) selects DTR to enable the RS-485 transmitter. The factory default setting is DTR down(on) & RTS up(off).

Internal Jumpers - are provided to connect RTS to CTS and DTR to DSR and/or to RLSD(DCD). These can be custom set by request to any configuration at the factory. The factory default setting is DTR connected to DSR.

RS-485 Side

Terminal Block

Includes four RS-485 terminals and one isolated return terminal (see **RS-485 P3 Pin Descriptions** in table below). Four RS-485 terminals make a convenient 4-wire or 2-wire connection choice. The isolated return, although not necessary for RS-485 operation, provides a convenient connection for a shield. This terminal block is pluggable for easy replacement of the RS-485 cable or the DCP485 module.

DIP Switches

TD Term - switches a 120Ω termination resistor across the RS-485 transmit data lines TD A & TD B when the switch is in the down(on) position. In a two-wire or four-wire multidrop network, only the RS-485 devices at the extreme ends of the main lines should have a termination resistor in the circuit. In a two-wire network, only one is needed at each end, either TD or RD Term. In a four-wire network, both TD & RD Terms may be needed at each end. The network configuration will determine whether a termination resistor should be in the circuit. Use the setting that gives the most reliable data transfer. The factory default setting is TD Term switch up(off).

RD Pull Up / Term / Pull Dn - three switches determine the RS-485 receive data line configuration. RD Term switches a 120Ω termination resistor across the RS-485 receive data lines RD A' & RD B' when the switch is in the down(on) position. See the discussion in TD Term above for applications of termination resistors. RD Pull Up & RD Pull Dn switch a pull up resistor to RD B' and a pull down resistor to RD A', respectively, when their switches are in the down(on) position. These two resistors work in conjunction with each other and with RD Term but they are switchable independently. Use the settings that give the most reliable data transfer. The factory default settings are: RD Pull Up down(on), RD Term down(on), and RD Pull Dn down(on).

TD Ctrl'd / Cont En - TD Ctrl'd down(on) & TD Cont En up(off) puts the selected RS-232 side signal in control of the RS-485 transmitter. TD Ctrl'd up(off) & TD Cont En down(on) continuously enables the RS-485 transmitter. This setting overrides any RS-232 side CTRL MODE setting. Therefore, even if the CTRL LED is off, the RS-485 transmitter is still enabled. If the CTRL LED is desired on, the internal jumpers should be in the factory default setting, then set the RS-232 side CTRL MODE to RTS/DTR and set LINE to DTR. The factory default settings are: TD Ctrl'd down(on) & TD Cont En up(off).

RD Ctrl'd / Cont En - RD Ctrl'd down(on) & RD Cont En up(off) puts the selected RS-232 side signal in control of the RS-485 receiver. This mode is useful in 2-wire configurations when the echoing of transmitted data is not desirable. RD Ctrl'd up(off) &RD Cont En down(on) continuously enables the RS-485 receiver. The factory default settings are: RD Ctrl'd up(off) & RD Cont En down(on).

RS-232 P1 Pin Descriptions

Pin 1	RLSD (DCD)	Receive Line Signal Detect (Data Carrier Detect)
Pin 2	RD	Receive Data
Pin 3	TD	Transmit Data
Pin 4	DTR	Data Terminal Ready
Pin 5	SG	Signal Ground
Pin 6	DSR	Data Set Ready
Pin 7	RTS	Request To Send
Pin 8	CTS	Clear To Send
Pin 9	NC	Not Connected

RS-232/POWER P2 Pin Descriptions

Pin 4	TD	Transmit Data
Pin 3	RD	Read Data
Pin 2	GND	Ground (also Signal Ground)
Pin 1	+V	+10 to +30VDC

RS-485 P3 Pin Descriptions

Pin 5	TD A	Transmit Data A
Pin 4	TD B	Transmit Data B
Pin 3	RD A'	Receive Data A'
Pin 2	RD B'	Receive Data B'
Pin 1	RTN	Return, Isolated

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RS-232 Side

Factory Default Switch Settings

Switch	Setting
CTRL LINE	
DTR	ON
RTS	OFF
CTRL MODE	
RTS/DTR	ON
AUTO	OFF
COMM MODE	DCE

Selected Applications - Switch Settings

COMM MODE set complementary to connected port - DCE, DTE or DTE, DCE.

	Loopback Self Test	4-wire Point-to-Point	2-wire Multidrop
CTRL LINE			
DTR	ON	See Text Below	See Text Below
RTS	OFF	See Text Below	See Text Below
CTRL MODE			
RTS/DTR	ON	ON	See Text Below
AUTO	OFF	OFF	See Text Below
CTRL LED	ON	ON switch setting and control line state	Depends on DIP

DIP switch settings for 2-wire multidrop configurations depend on your equipment's hardware and software capabilities.

If your equipment's hardware and software can support RTS or DTR data control, set CTRL MODE RTS/DTR to ON and AUTO to OFF. Then for RTS control, set CTRL LINE DTR to OFF and RTS to ON. For DTR control, set CTRL LINE DTR to ON and RTS to OFF.

If your equipment's hardware and software cannot support RTS or DTR data control or if you prefer AUTO mode, set CTRL MODE RTS/DTR to OFF and AUTO to ON.

Remember, AUTO mode timeout is set so that AUTO mode will work from 4800 bits per second (bps/Baud) to 115.2k bps. The DCP485 automatically enables the RS-485 transmitter for 2.5ms (4800 bps 12 bit character time) for each character sent. This means there will be an up to 2.4ms delay at the end of each message before another transmitter can transmit. This timeout can be custom set at the factory for higher or lower minimum data rates by request.

RS-485 Side

Selected Applications - Connections

Loopback Self Test

Function		Terminal	Terminal	Function	
TD	A	5	3	A'	RD
TD	B	4	2	B'	RD

Other Manufacturers' Nomenclature:

Dataforth		Other Manufacturers
A, A'	=	-, DATA -, or DATA* (Inverse Data)
B, B'	=	+,DATA +, or DATA (True Data)

RS-485 Side

Factory Default Switch Settings

Switch		Setting
TD	Term	OFF
RD	Pull Up	ON*
	Term	ON*
	Pull Dn	ON*
TD	Cont En	OFF
	Ctrl'd	ON
RD	Ctrl'd	OFF
	Cont En	ON

Selected Applications - Switch Settings

		Loopback Self Test	4-wire Point-to-Point	2-wire Multidrop	
RD	Cont En	ON*	ON*	OFF	
	Ctrl'd	OFF	OFF	ON*	
TD	Ctrl'd	OFF	OFF	ON*	
	Cont En	ON*	ON*	OFF	
RD	Pull Dn	OFF	ON*	Ends	ON*
				Middles	OFF
	Term	OFF	ON*	Ends	ON*
				Middles	OFF
	Pull Up	OFF	ON*	Ends	ON*
				Middles	OFF
TD	Term	OFF	ON*	Ends	OFF
				Middles	OFF

DIP switch settings for 2-wire multidrop configurations depends partly on preferences and partly on network configuration and environment.

RD Cont En and Ctrl'd settings depend on whether your system requires local data be echoed or not. For echoed data, set the switches opposite to table settings.

*Termination DIP switches settings are given according to good transmission line practice. In general, any transmission line longer than 100 feet (30.5 m) should be terminated at the extreme ends. Any line drivers in the middle between the extreme ends should not be terminated. However, you may find for your line configuration and environment, you may need to terminate under 100 feet (30.5 m) or you can terminate one end but not the other or you may or may not need RD Pull Up or Pull Dn. Also if mixing RS-485 and RS-422 devices or for any other reason, you may not want to use the built-in 120Ω termination but substitute an external higher resistance, such as, 240Ω. Set the terminations for the most reliable data transfer.

RS-485 Side

Selected Applications - Connections

4-wire Point-to-Point

Function		Terminal	Terminal	Function	
TD	A	5	3	A'	RD
TD	B	4	2	B'	RD
RD	A'	3	5	A	TD
RD	B'	2	4	B	TD
Return, Isolated	RTN	1	1	RTN	Return, Isolated

NOTES: (1) Return, Isolated not required. Use for shield if desired.

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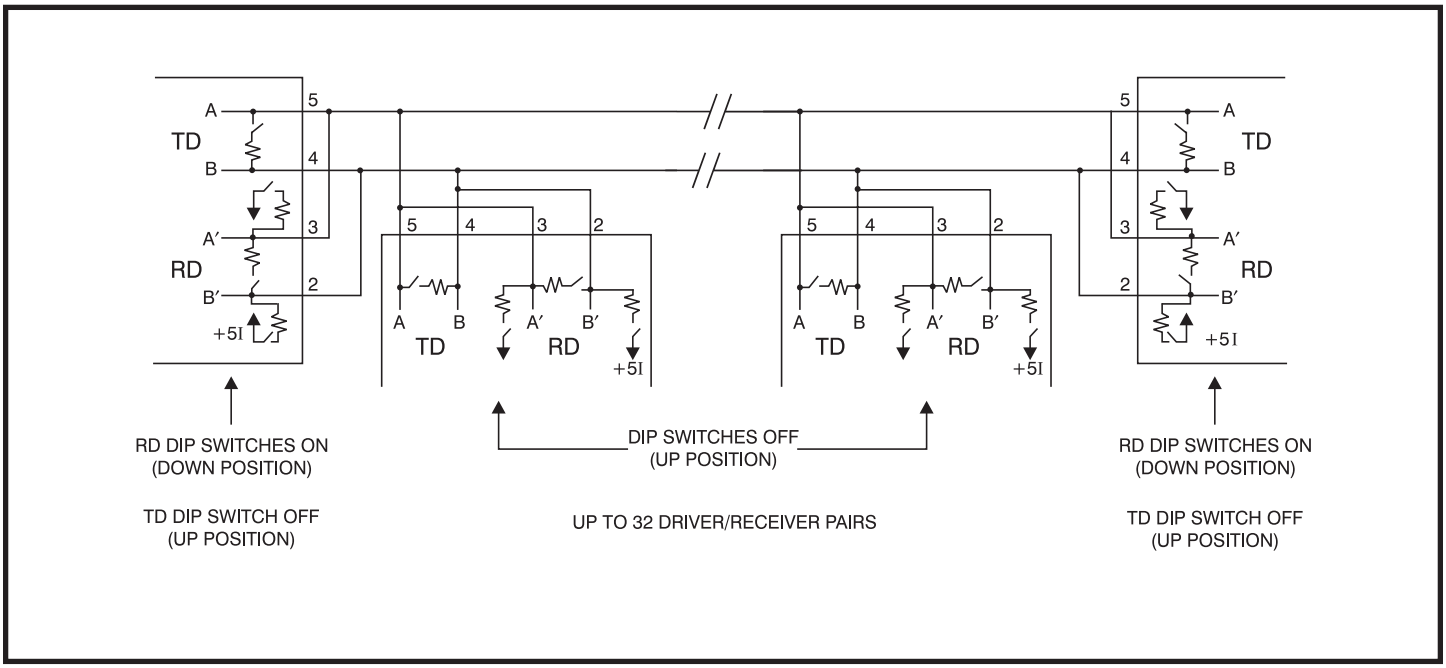


Figure 2: DCP485 2 Wire Multidrop Configuration

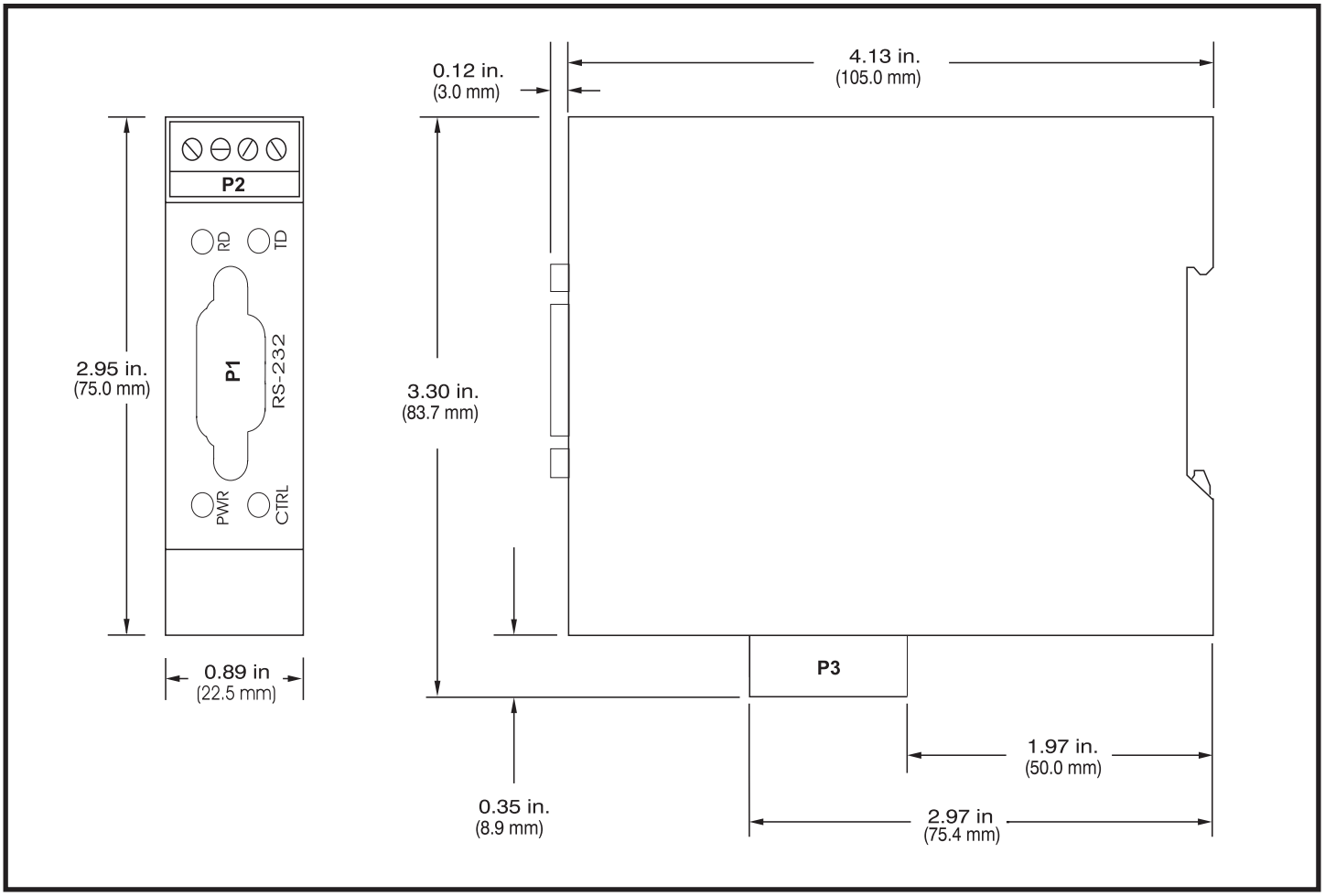


Figure 3: DCP485 Mechanical Drawing

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Cable Capacitance Effects On Distances

The distances in the specifications are for wire sizes 18-24 AWG (0.82-0.20mm^2) with a maximum capacitance of 25pF/ft (82pF/m). Typical low cost, nonshielded, twisted pair cables are Belden 8442 or Signal 1172. For higher capacitance cables, decrease distance specifications for 2400 bps (baud) and above by a proportionate amount. For example, shielded cable with 50pF/ft (164pF/m) would reduce the distances by 50%.

For data rates of 1200 and below, distances are limited by DC voltage drop. For 2400 bps (baud) and above, distances are limited by pulse distortion. The use of low-capacitance cable can extend the distances shown. Belden 9182 and 9184 are, respectively, single and dual twisted-pair cables that are especially designed for high-speed data communications applications. With these cables, the distances can be extended by 50%. However, the DC-resistance-limited distance given under 1200 bps (baud) may not be exceeded.

Cable capacitance for individually shielded wire pairs is usually given by manufacturers as capacitance between wires and capacitance from each wire to the shield. The effective transmission line capacitance is approximately the interwire capacitance plus one-half of the wire-to-shield capacitance.

Ordering Information

Model	Description
DCP485-P	Male RS-232 connector
DCP485-S	Female RS-232 connector
Power Supply	DIN Rail Mount 85-264 VAC, 47-63 Hz In
PWR-PS5RA	24 VDC, 0.31 A Out

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