ACCES I/O PRODUCTS INC.
10623 Roselle St., San Diego CA 92121-1506
Tel (858)550-9559 FAX (858)550-7322

CONV232/422 SERIAL DATA CONVERTER

DATA SHEET

Model CONV232/422 is a bidirectional RS-232 to RS-422 converter. It converts full-duplex, single ended communication Tx and Rx signals from your RS-232 port to full or half-duplex, differential signal RS-422 operation. Conversion from/to RS-485 both 2-wire and 4-wire are also supported, see details following.

FEATURES:

- Modes of Operation: RS-422, RS-485 4-wire, RS-485 2-wire
- Data Rate: Up to 230K Baud
- Low Power Consumption: Port Powered from RTS and DTR lines or External Power, uses all CMOS circuits
- Miniature Size Standard DSub 9-pin connectors

Connector Pin Assignments			
J1, RS-232 DB9 Female	PIN	J2, RS-422 DB9 Male	PIN
NC	1	Receive- (Rx-)	1
Transmit Out	2	Transmit+ (Tx+)	2
Receive In	3	Transmit- (Tx-)	3
DTR	4	NC	4
Gnd	5	Gnd	5
NC	6	NC	6
RTS	7	NC	7
NC	8	Optional External PWR	8
NC	9	Receive+ (Rx+)	9

TABLE 1

OPERATION

RS-422 full duplex:

The Converter Transmit lines connect to the other RS-422 device receive lines of the same polarity (TX+ to RX+, TX- to RX-) and the Converter Receive lines connect to the other RS-422 device Transmit lines of the same polarity (RX+ to TX+, RX- to TX-).

RS-485 (two wire) half duplex:
The Converter transmit and receive lines are connected together at the RS-422 Port Connector by the user (TX+ to RX+, TX- to RX-). The combined lines connect to the other RS-485 device(‘s) lines of the same polarity. The user's software control must enable the RTS signal only during the transmit cycle and then disable RTS to allow the other RS-485 devices to drive the network during transmission. The characters transmitted by the Converter will be echoed to the Converter receiver.

RS-485 (four wire) full duplex:
When the Converter is plugged into the host Computer, being used as the “MASTER”
The Converter transmit lines connect to the SLAVE(‘s) device receive lines of the same polarity. The transmit lines should remain enabled by the RTS signal. The Converter receive lines connect to the SLAVE(‘s) transmit lines of the same polarity.

When the Converter is connected at a device that is being used as a “SLAVE”
The Converter transmit lines connect to the MASTER device receive lines of the same polarity. The transmit lines must be enabled by the RTS signal only during the transmission from the slave unit and disabled when other slave units are talking The Converter receive lines connect to the MASTER device transmit lines of the same polarity.

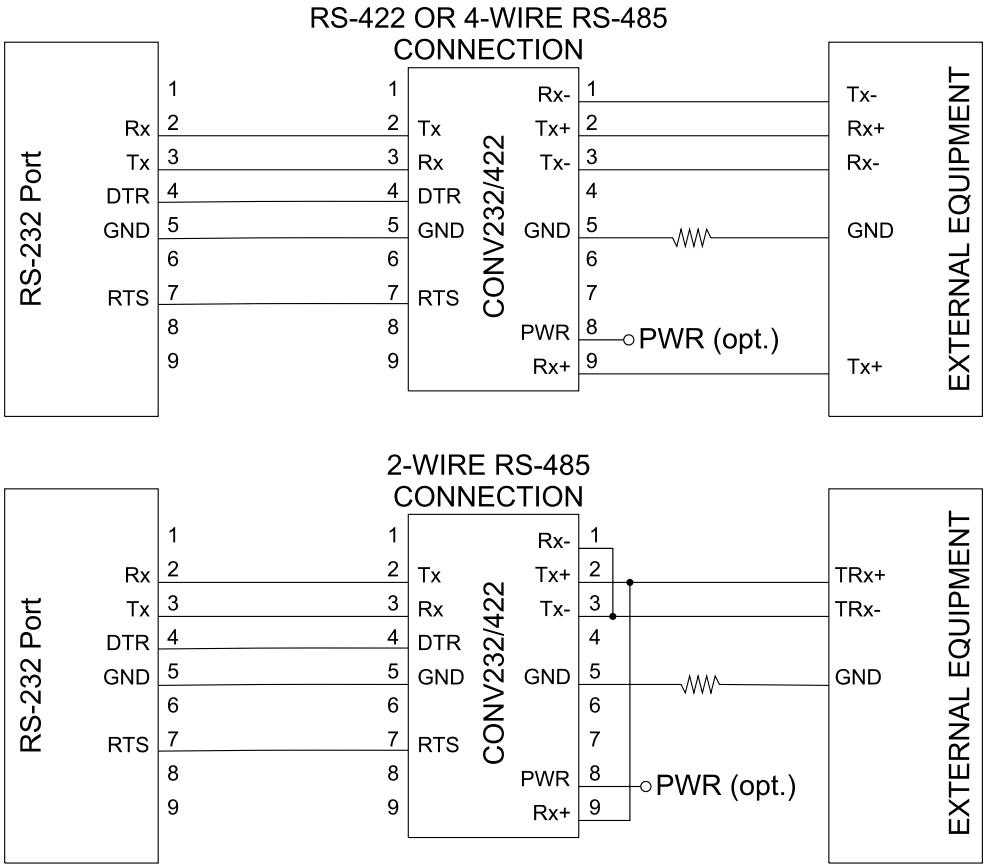

FIGURE 1, CONNECTION DIAGRAM

Termination

In order to avoid noise and reflections in long lines, a cable with a characteristic impedance of 120Ω should be selected and the line should be terminated on both ends with 120Ω resistors. For short lines (when the propagation of the signal is less than 4% of the time to transmit a bit), the termination might not be needed. This simplifies the network and eliminates the need of external biasing resistors. See NOTE 1 after **SPECIFICATIONS** for further details.

Bias

Two 4.7KΩ biasing resistors on the CONV232/422 RS-422 receive lines are provided to avoid erroneous signal reception when all the transmitters are disabled. Whenever the RS-422 transmitter is enabled, the driver has full control of the transmission line. When the network is terminated with 120Ω on both ends of the transmission line and configured with multiple (up to 32) nodes the total bias in the network should be 620Ω pull up and 620Ω pull down resistors (or lower resistance for a stronger bias). This is to satisfy the minimum requirement of 200mV of differential signal.

Grounding

The operation of an RS-422 system requires proper grounding. The presence of a signal reference for both sides of the interconnected equipment is required. An extra conductor in the cable is an easy way to achieve this connection. Alternatively, you could achieve this by connecting the ground pin of each device to earth ground on each end of the network. A 100Ω ½ W resistance must be added between the earth ground and the signal ground on one side of the network to limit any recirculating currents.

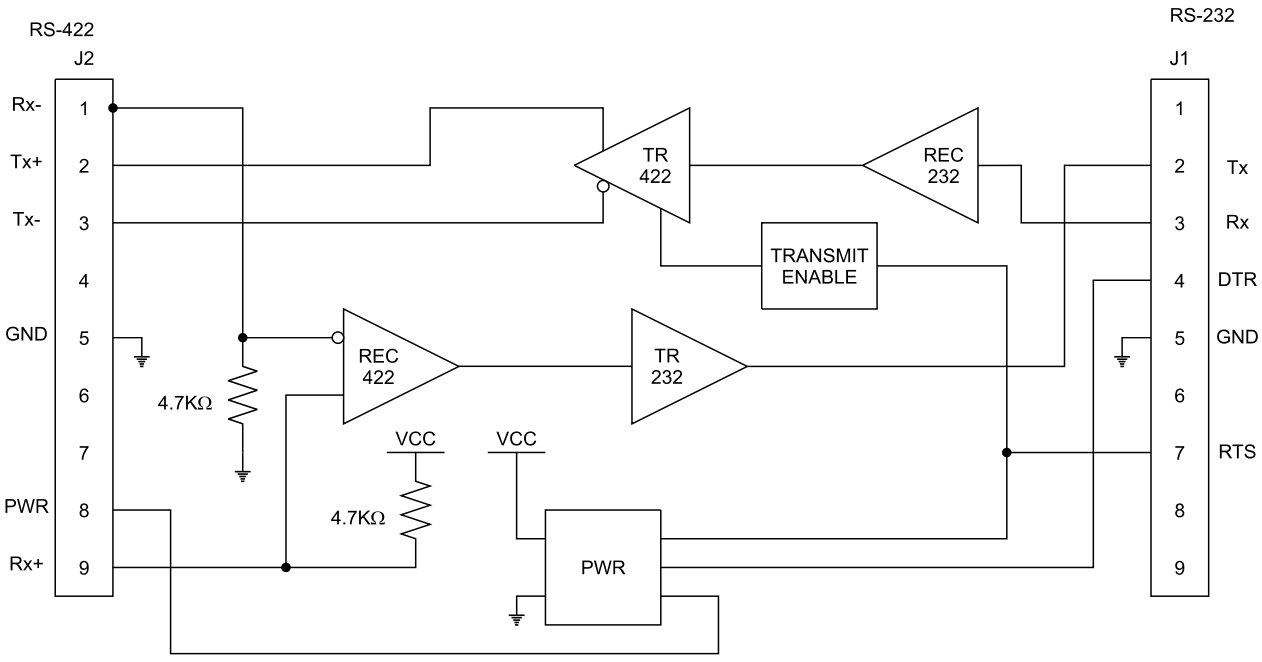

FIGURE 2, FUNCTIONAL BLOCK DIAGRAM

POWER CONSIDERATIONS

The Unit is powered from RS-232 handshake lines RTS and DTR or from an external power source. When powered from the handshake lines, DTR will provide power to the unit and RTS provides both power for the unit, and control for the transmitter. The RS-422 transmitter is enabled only when RTS is high (See Table 2). The RS-422 receiver is always enabled. When the RTS signal is being used to control the RS-422 transmitter, the CONV232/422 can be used as an RS-232 to two wire and four wire RS-485 converter.

The CONV232/422 should be powered from external power when the line is terminated with 2x120Ω resistors and the network is configured with multiple nodes (up to 32).

Control of RTS and DTR

DOS, Linux: these signals (RTS & DTR) are both high unless your software specifically exerts a control over them to bring them low.

WindowsNT**:** these signals can be somewhat controlled under “hardware flow control” in the properties tab under the Ports applette. Do not set to “Hardware” flow control. For best results, set to “none”.

Windows9x: the signals are controlled under Control Panel, System, Device Manager, Ports, “hardware flow control”. Do not set to “Hardware” flow control. For best results, set to “none”.

Converter Power and Control Considerations			
RTS STATE (Control and Power line)	DTR STATE	EXT. POWER	FUNCTIONS
Low	Low	Off	None
Low	High	Off	RS-422/485 RX only
High	High	Off	RS-422/485 RX/TX
High	Low	Off	RS-422/485 RX/TX
High	Don’t care	On	RS-422/485 RX/TX
Low	Don’t care	On	RS-422/485 RX only

TABLE 2

SPECIFICATIONS

Optional External Power:	+5.5VDC to +16VDC @ 30mA typical to RS-422 Port connector pin 8 with return via J2 pin 5.	
Data Rate:		Up to 230K Baud.
Minimum Sensitivity of RS-422 Receiver:		200mV
Driver Output Voltage:	Unloaded:	4.1V (peak typical)
	w/50Ω Load:	2.0V p/p (minimum)
Common Mode Voltage, RS-422 Receiver:		-7V<Vcm<12V
Bias Resistors:	4.7KΩ pull-up and 4.7KΩ pull-down on Receive lines	
ESD Protection:	+/-15KV Air-Gap Discharge	
	+/-4KV Contact Discharge	

NOTE 1: The receiving UART is sampling the incoming transmission in the center of the bit. 4% of the transmitted bit is based on the assumption that it takes a reflection to complete three round trips before dissipating and that the signal propagation time is 0.7 of the speed of light. The Bit transmission is the reciprocal of the transmission speed expressed in baud.

Example of the calculation:

For transmission speed of 57.6Kbaud and 250 feet of cable, the propagation time of the signal is:

t=l/v where t=propagation time in usec
l=length of the cable in feet
v=propagation speed in cable (v=0.7xc=700 ft/usec)
c=speed of light

The reflection will subside at 3 round trips
t=0.35x6=2.1usec.

Duration of a bit at 57.6Kbaud is 1/57,600=17.3usec

The receiving UART will sample bits in the middle, 17.3/2=8.65usec. Previously calculated time when reflections will subside was 2.1usec. Therefore the distortion of the signal will be insignificant and termination is not necessary to absorb reflections. Note however that noise in the terminated line can sometimes be improved.