



SM800

HARDWARE REFERENCE

Nota Bene Technology, Inc.

952-928-8872

<http://www.nbtinc.com>

1. OVERVIEW	4
1.1 How To Use This Manual.....	4
1.2 SM805 Overview	4
2. ANATOMY 101 - RECOGNIZING THE SM805	5
2.1 Internal I/O Card.....	5
2.1.1 4311 Card.....	5
2.1.2 2240 Card.....	5
2.2 Internal Modem Cards.....	6
2.2.1 Bell 202.....	6
2.2.2 Dial.....	7
2.2.3 RS485	7
2.3 Central Processing Unit.....	8
2.4 CPU Card Configuration	9
2.4.1 LED's.....	9
2.4.2 Dip Switches.....	9
2.4.3 External Jumpers.....	10
2.4.4 Serial Port	11
2.4.4.1 Pin Assignments.....	11
3. INSTALLATION & CONNECTIONS	12
3.1 Mounting	12
3.1.1 Dimensions.....	12
3.1.2 Back Plate - Actual Size (front view)	13
3.2 Powering the SM805.....	14
3.3 Wiring Diagrams.....	14
3.4 Connecting to PC's.....	14
3.5 Phone and Serial Connections.....	15
3.6 Connecting to Expansion Modules.....	15
4. APPENDIX – OPTIONAL CONFIGURATIONS.....	16
4.1 4311 I/O Card.....	16
4.1.1 LED's.....	16
4.1.2 Wiring Diagram.....	16
4.1.3 Internal Configuration.....	17
4.1.3.1 Analog Full Scale Adjustment.....	17
4.1.3.2 Voltage vs. Current Output.....	17
4.1.3.3 Using A Separate Power Supply	17

4.2	2240 I/O Card.....	18
4.2.1	LED's.....	18
4.2.2	Wiring Diagram.....	18
4.2.3	Internal Configuration.....	19
4.2.3.1	Analog Full Scale Adjustment.....	19
4.3	Internal Bell 202 Modem Option	20
4.3.1	LED's.....	20
4.3.2	RJ-11.....	20
4.3.2.1	2 Wire Pin Assignment.....	20
4.3.2.2	4 Wire Pin Assignment.....	20
4.3.2.3	RJ-11 Carrier Sense Pin Assignment.....	20
4.3.3	Pots.....	21
4.3.4	Jumpers.....	22
4.3.4.1	Typical 2 Wire Set Up.....	22
4.3.4.2	Typical Radio (4 Wire) Set Up.....	23
4.3.4.3	Internal Settings Defined.....	25
4.3.4.4	External Settings Defined.....	26
4.3.4.5	Pin Assignments.....	27
4.3.4.6	Related Jumpers.....	27
4.4	Internal Dial Modem Option.....	28
4.4.1	LED's.....	28
4.4.2	RJ-11.....	28
4.4.3	Internal Jumpers.....	29
4.4.4	Serial Port.....	30
4.4.4.1	Pin Assignments.....	30
4.5	Internal RS485 Option	31
4.5.1	LED's.....	31
4.5.2	RS485 Port.....	31
4.5.3	Jumpers.....	32
4.5.4	Serial Port.....	34
4.5.4.1	Pin Assignments.....	34
4.5.4.2	Related Jumpers.....	34

1. Overview

1.1 *How To Use This Manual*

This manual is designed as a reference to help you identify your SM805 configuration and components quickly and easily. The first section shows the different board options and where they are located. The next section describes the connections available on the SM805. Then, after identifying what you're looking at, or if you already know, simply refer to the appropriately section in the appendix for the physical details of any particular card.

1.2 *SM805 Overview*

The SM805 is a versatile and powerful piece of equipment. It functions as a PLC, data logger, and communications controller all in one. **Each SM805 is comprised of three internal cards: an I/O card, a modem, and a CPU.** Two different I/O cards and several modems are available as options. The typical SM805 provides one RJ-11 jack and two DB9 serial ports. However, the different options will provide a different combination of connections. All options will be described in this reference.

2. Anatomy 101 - Recognizing The SM805

2.1 Internal I/O Card

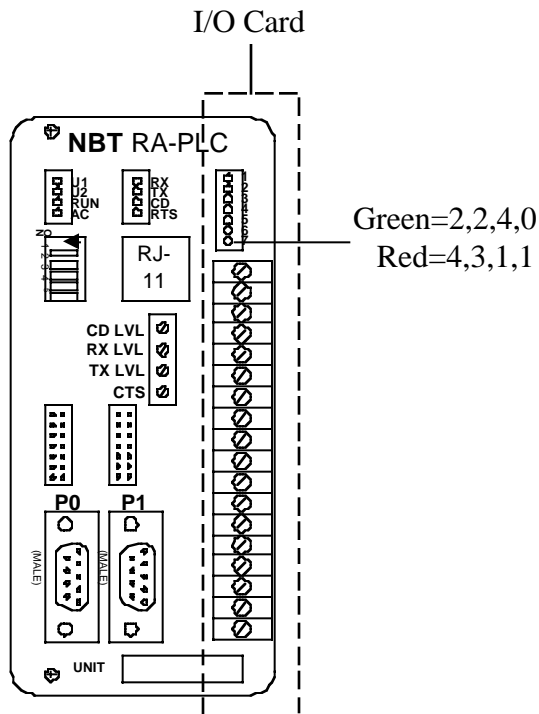
The I/O card is the right-most card that holds the terminal block. Two types of I/O cards are available with the SM805, and their names indicate the I/O availability (shown below). To determine which card you have installed look at the row of LED's above the terminal block. If the bottom (or number 7) LED is *red* then you have a **4,3,1,1** card. If the bottom (or number 7) LED is *green* then you have a **2,2,4,0** card. Details about the I/O cards are provided in the appendix of this reference.

2.1.1 4311 Card

- 4 Digital Inputs
- 3 Digital Outputs
- 1 Analog Input (0-5V or 4-20mA)
- 1 Analog Output

2.1.2 2240 Card

- 2 Digital Inputs
- 2 Digital Outputs
- 4 Analog Inputs
- 0 Analog Outputs



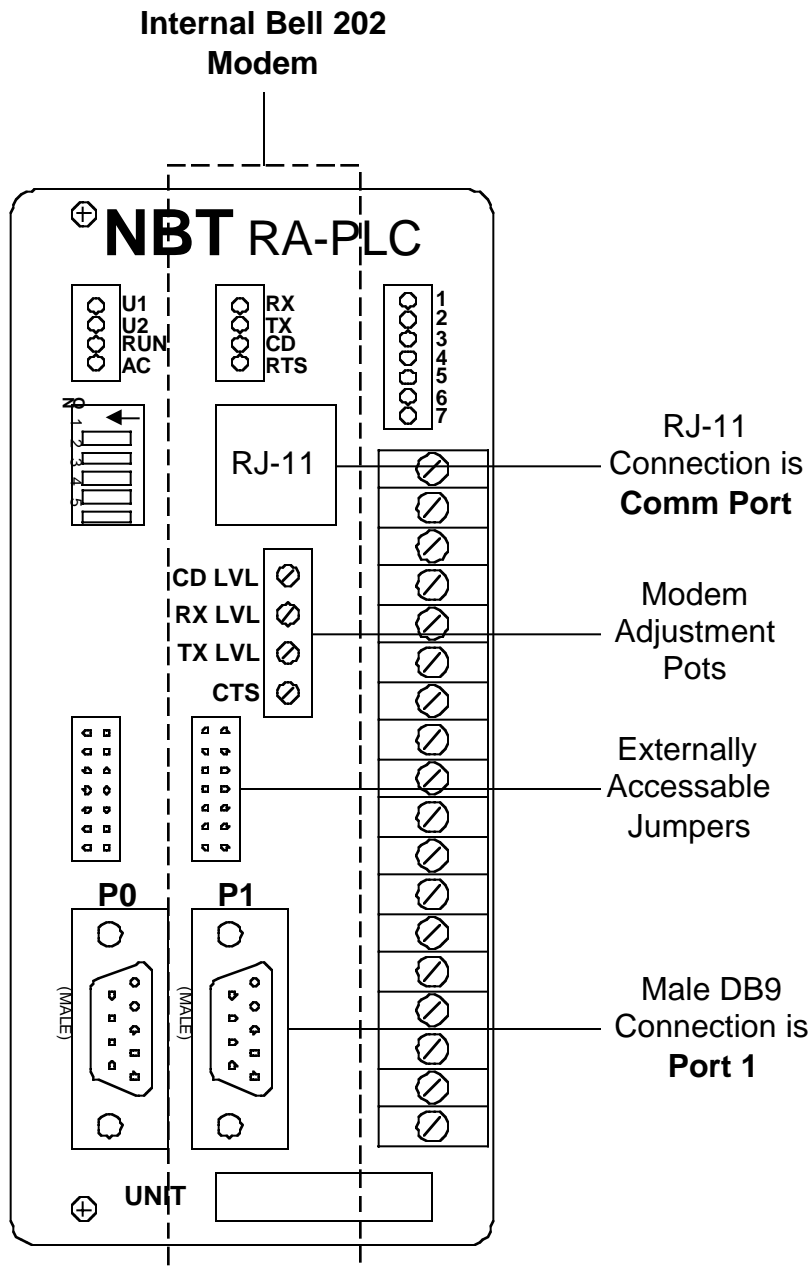
2.2 Internal Modem Cards

The internal modems (the middle card) available in the SM805 are:

- Bell 202
- Dial (with or without fax capability)
- RS485 (can also be configured as RS422 or RS232 upon request)

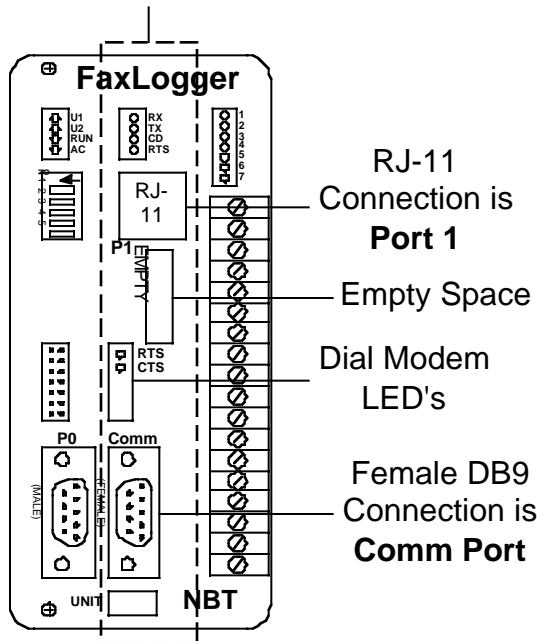
The physical differences are noted to the right of each picture. Details for each modem are provided in their respective areas of the appendix.

2.2.1 Bell 202



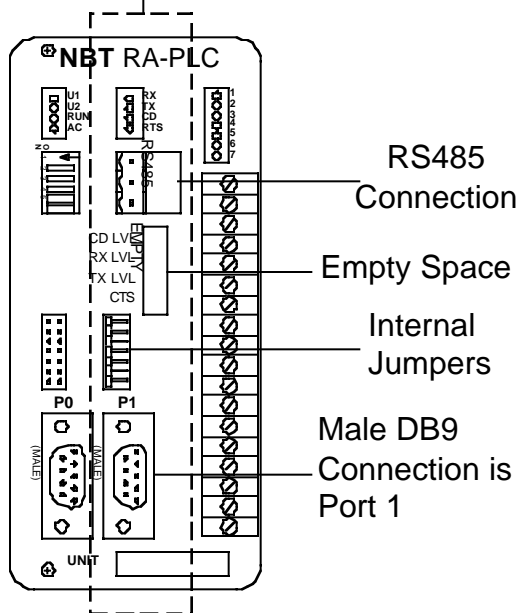
2.2.2 Dial

Internal Dial Modem



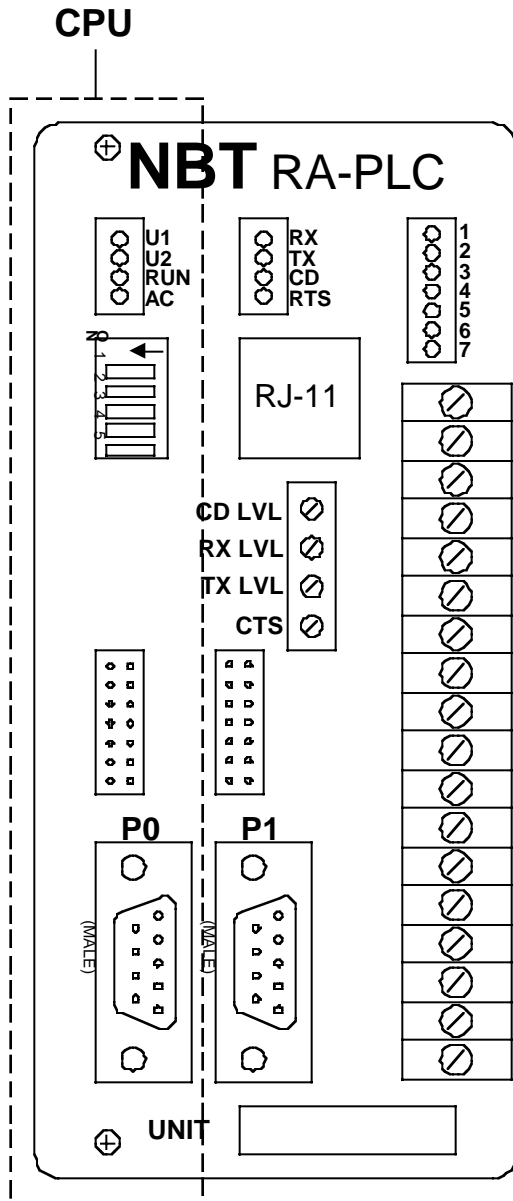
2.2.3 RS485

Internal RS485 Modem



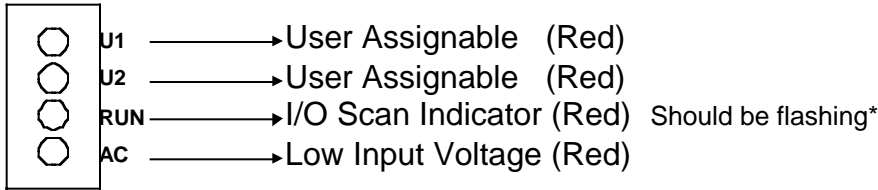
2.3 Central Processing Unit

The left-most card is the CPU card, and its external appearance does not change. A memory chip is available internally which increases the number of samples from 5,600 to 22,000. If you are unsure of your configuration, please call NBT. Details about the CPU are provided in the appendix of this reference.



2.4 CPU Card Configuration

2.4.1 LED's

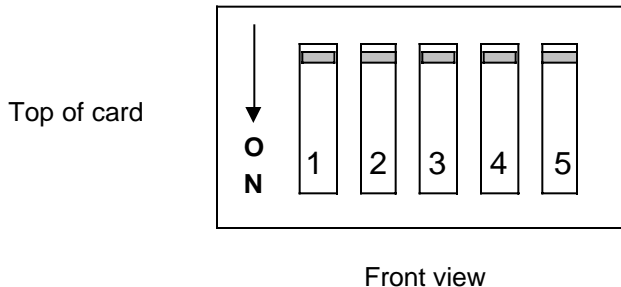


The user assignable LED's can be used by referencing them in Table 1 of the RTU. The addresses are as follows:

U1: Register 1, Bit 0
 U2: Register 1, Bit 1

* If not flashing, the "scan" must be manually re-enabled in Table 1 of the RTU.
 Note: after downloading a program, the scan is automatically disabled.

2.4.2 Dip Switches

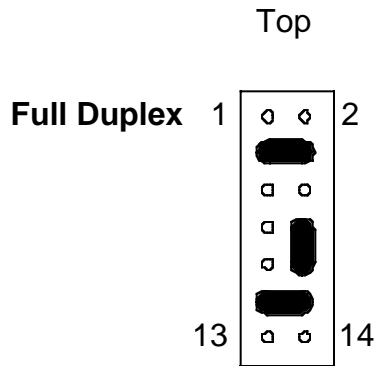


The dip switches affect only the startup conditions of the SM805. They generally are not used after powering the unit. Normally, all switches should be UP. *Note: Switch 5 in the down position will clear **all** memory on power up.*

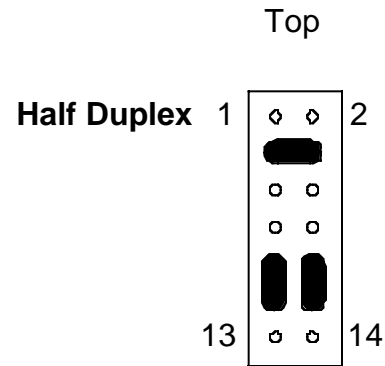
Dip Switch Settings

Switch	OFF (Normal)	ON (Left or Down)
1	BASIC autoexec OFF	BASIC autoexec ON
2	Default password	Assigned password
3	9600 baud (port 0)	2400 baud (port 0)
4	9600 baud (port 0)	1200 Baud (port 0)

2.4.3 External Jumpers



Typical configuration for
connection to a PC or
desk top modem



Typical configuration for
connection to an external
radio modem

JP5:

Pins 1,2: ON = manual key transmit
OFF = normal operation (shown above)

Pins 3,4: ON = normal CTS (shown above)
OFF = lengthened CTS drop out

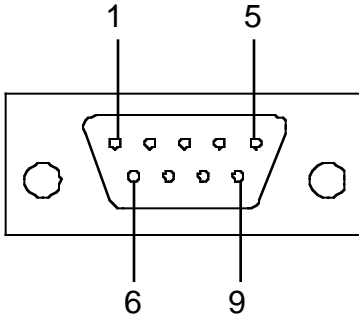
Pins 5,6: Not used

Pins 8,10 & 11,12 ON = sets port 0 to full duplex (jumpers shown above left)

Pins 9,11 & 10,12 ON = sets port 0 to half duplex (jumpers shown above right)

2.4.4 Serial Port

2.4.4.1 Pin Assignments



PORT 0 (“P0”)

- 1 - Open
- 2 - TXD (transmit data)
- 3 - RXD (receive data)
- 4 - Open
- 5 - Ground
- 6 - Pulled high
- 7 - CTS (clear to send)
- 8 - RTS (request to send)
- 9 - Open

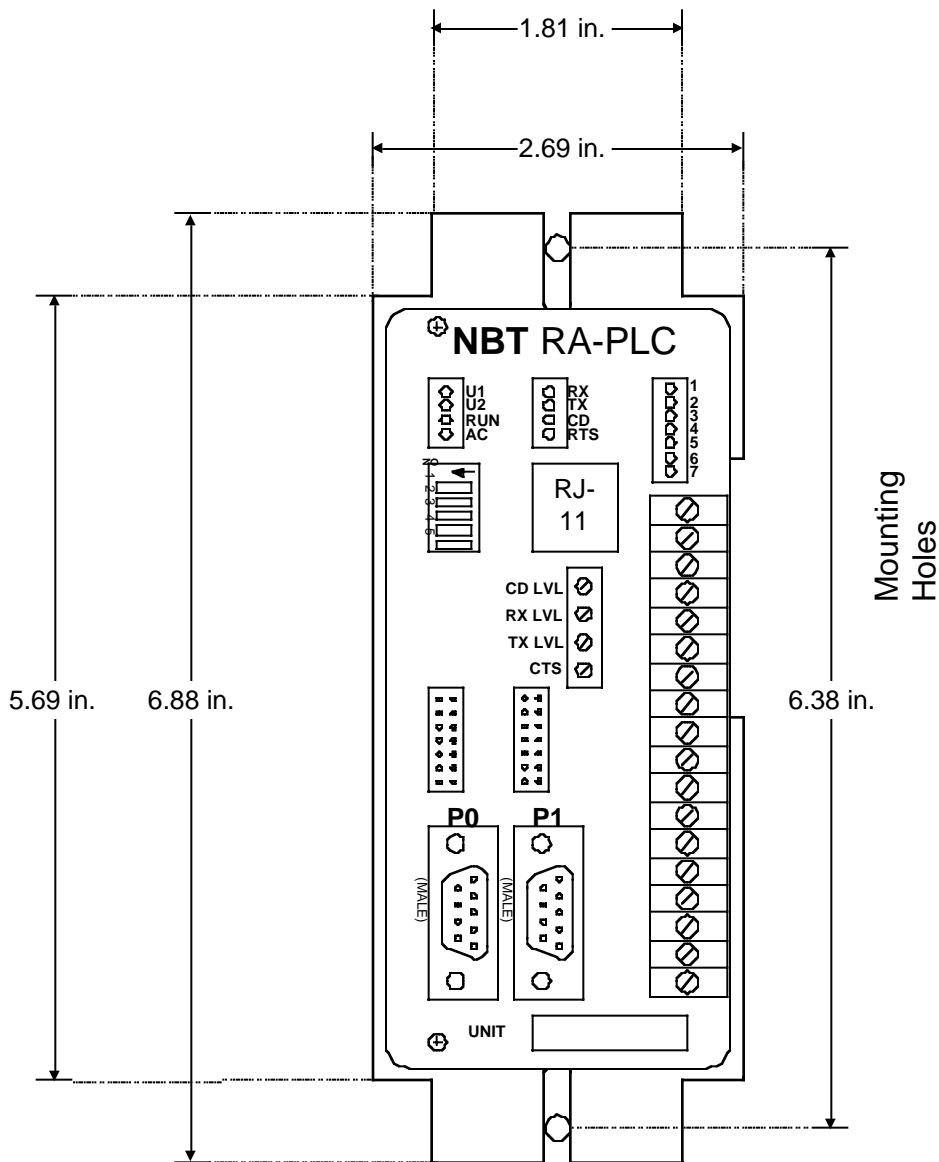
3. Installation & Connections

3.1 Mounting

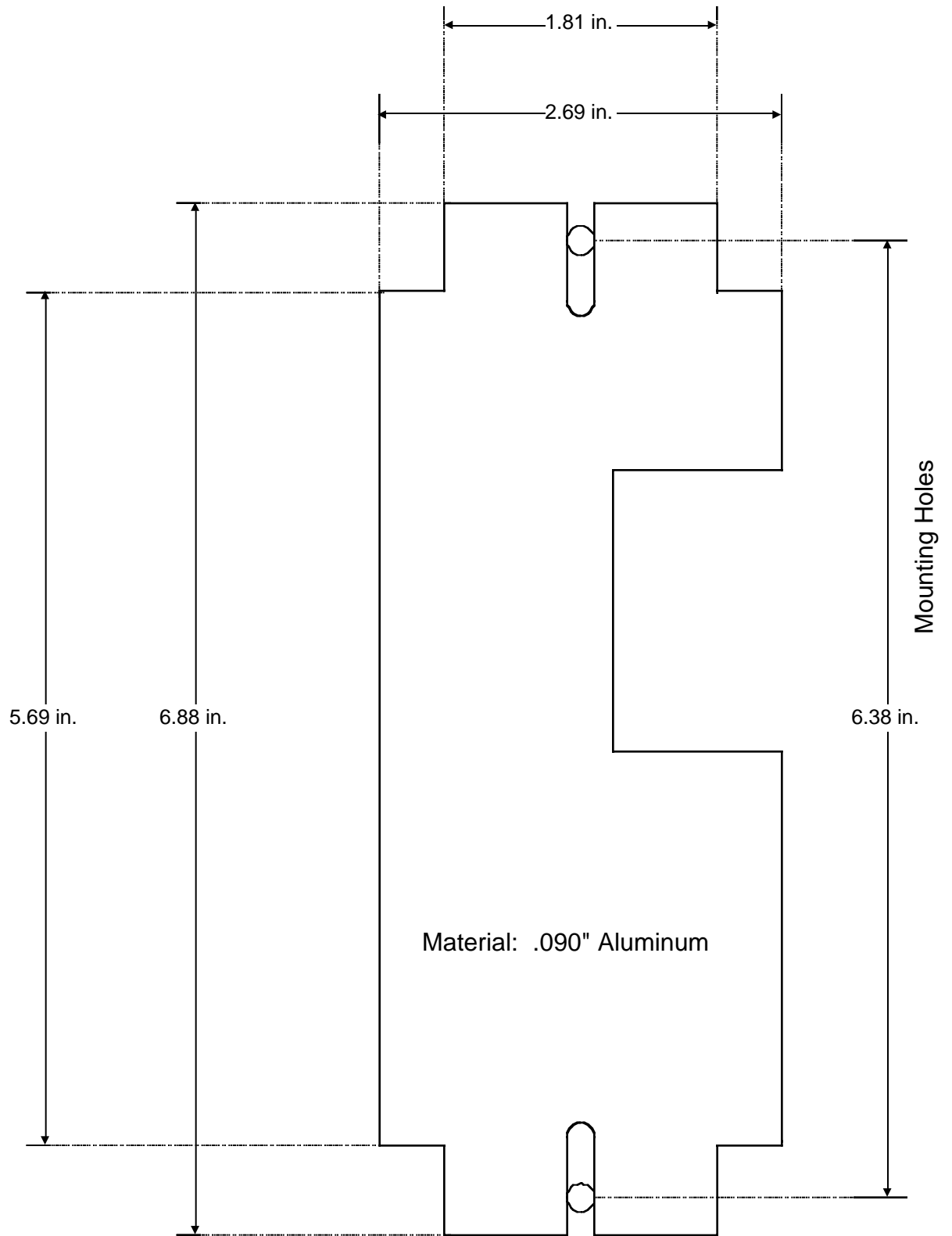
The SM805 comes with a steel and aluminum enclosure with a bracket suitable for wall mounting or within an NEMA enclosure. The brackets can be directly fastened to a panel or be mounted in split apart snap track for easy insertion or removal. Brackets should have good ground contact for surge suppression.

The mounting hole spacing for the SM805 and expansion modules is 6.38 inches.

3.1.1 Dimensions

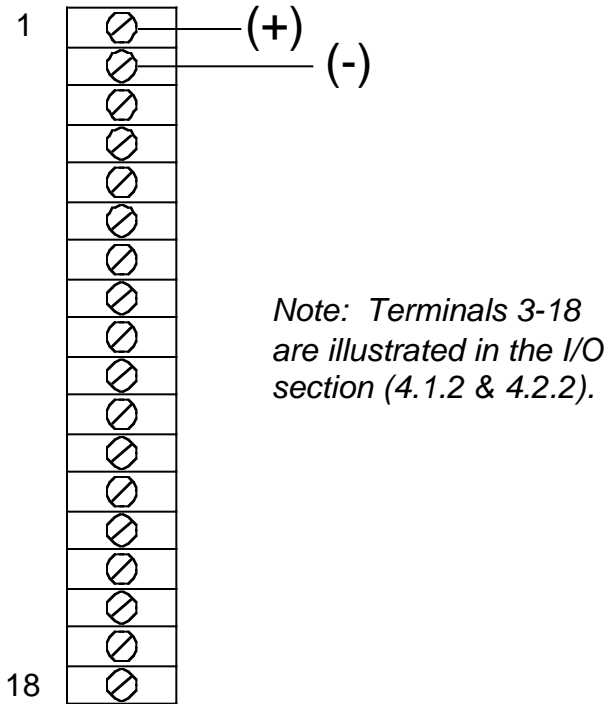


3.1.2 Back Plate - Actual Size (front view)



3.2 Powering the SM805

The SM805 requires a primary power input of 12-24 volts DC at 150 mA. Connect as shown below:



3.3 Wiring Diagrams

The wiring diagrams for the SM805 are in the I/O section of the appendix (section 4, pages 13 or 15). If you are not sure which I/O card your SM805 has, please refer to section 2.1, Anatomy 101 - Internal I/O Cards, for detailed descriptions.

3.4 Connecting to PC's

Use a female DB9 serial cable from the SM805 port 0 (P0) to one of the computer's serial ports. Port 0 (P0) details are covered in the CPU section.

3.5 Phone and Serial Connections

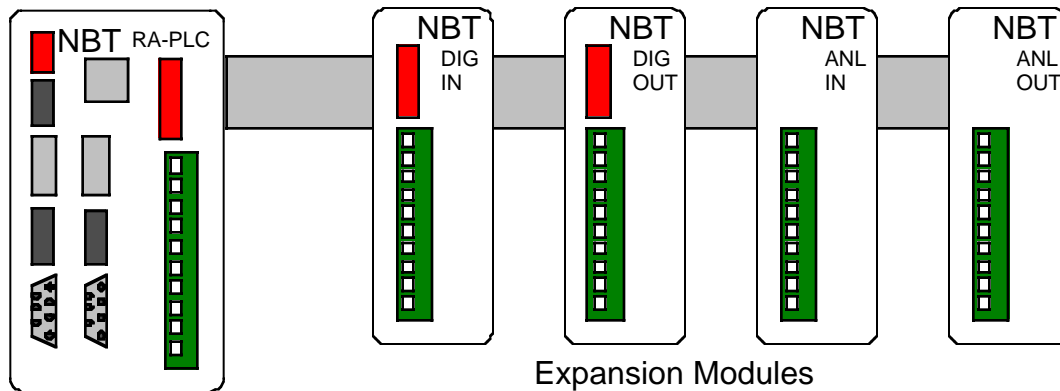
A standard six position RJ-11 jack is located on the center card of the SM805 (except for the RS485 card). This provides connection to dial lines, radio, or wire lines for communications with the master station or remotes. The pin assignments are specified in the modem sections of this reference (i.e., Internal 202 or Dial Modem).

Two nine pin connectors are available for serial port connection. The first, port 0 (“P0”, located on the CPU card), configured DCE, is usually used for connection to a PC for setup and operation of the unit (as noted above in “Connecting to PC’s”). A straight-thru cable is used to connect to a PC; null-modem is used for connection to an external modem.

The second DB9 connector on the option board provides an additional RS232 interface.

3.6 Connecting to Expansion Modules

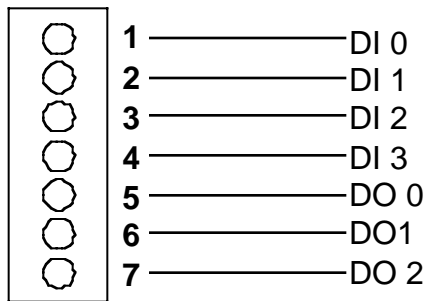
The connection between the SM805 and expansion modules requires a 26 pin flat ribbon cable (included with the purchase of any expansion module). The SM805’s connector is located on the right hand side to the rear, and the connector for the expansion module is on the back side. Up to 15 expansion modules may be connected to the SM805.



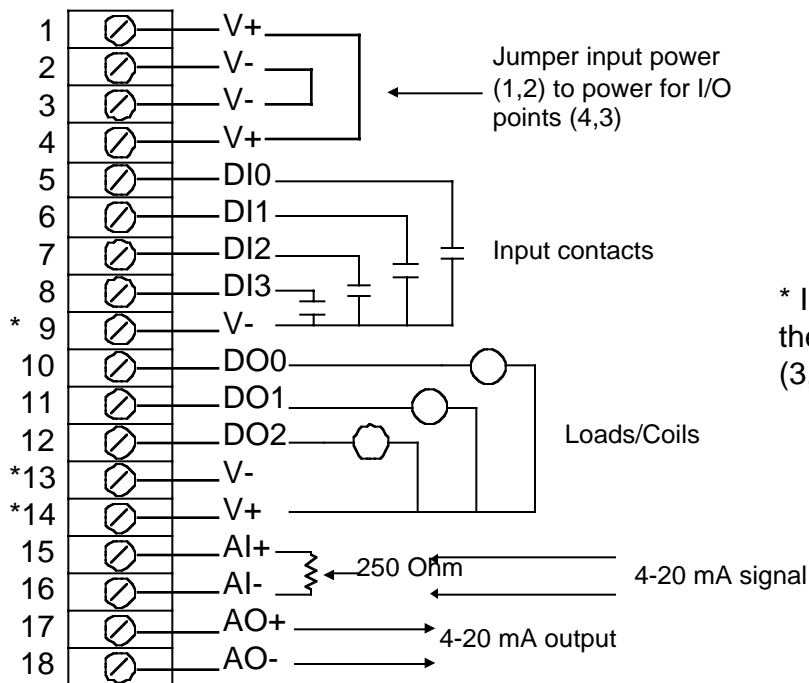
4. Appendix – Optional Configurations

4.1 4311 I/O Card

4.1.1 LED's

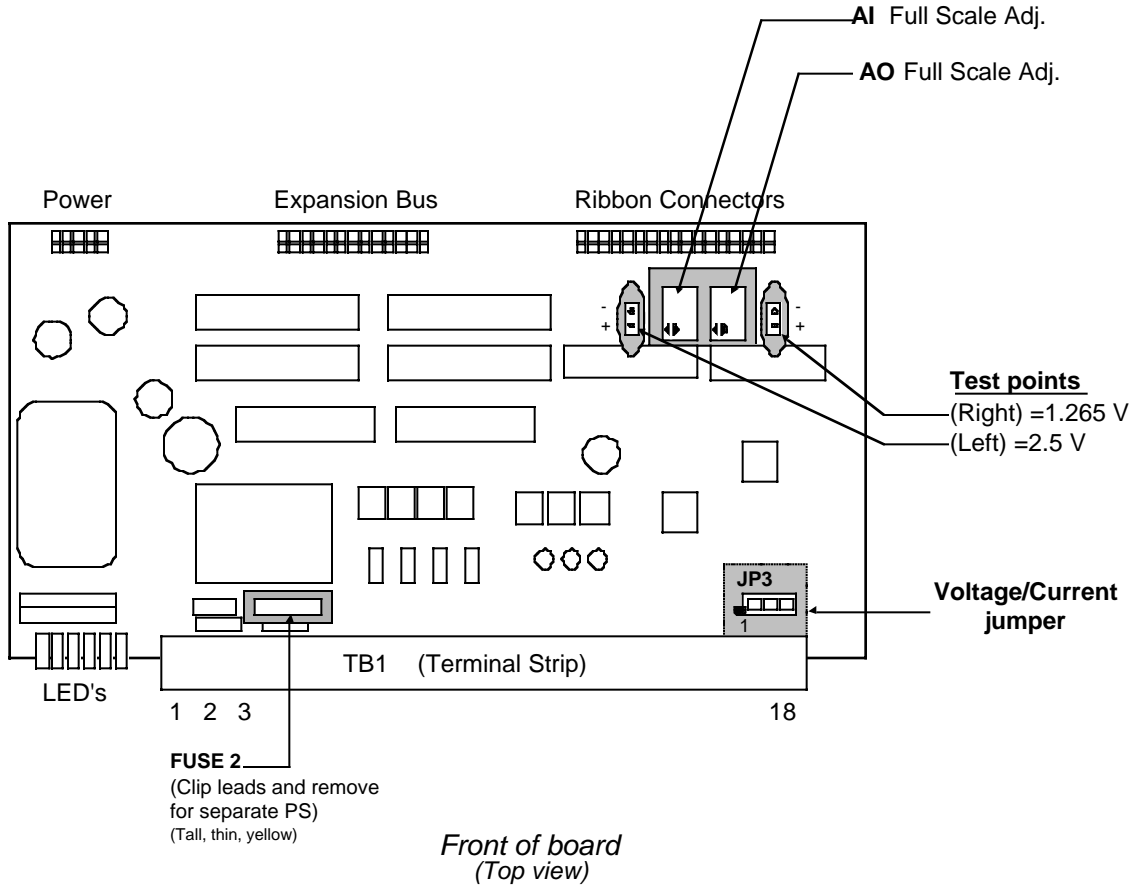


4.1.2 Wiring Diagram



4.1.3 Internal Configuration

Note items highlighted in gray.



4.1.3.1 Analog Full Scale Adjustment

Analog in and analog out full scale adjustment pots are located to the top right side of the board (top view) as noted above. Note the test points next to them, **DO NOT** place a jumper on either of these.

4.1.3.2 Voltage vs. Current Output

To set the analog output to voltage or current mode, use jumper “JP3” as follows:

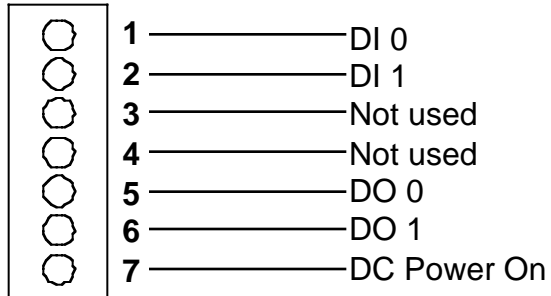
- Pins 1,2 = analog output voltage mode (0-5 V)
- Pins 2,3 = analog output current mode (4-20 mA)

4.1.3.3 Using A Separate Power Supply

When using a separate power supply, clip leads and remove “Fuse 2” as noted above. The commons in the terminal strip (2&3) are normally externally jumped together for the same power supply operation. Eliminate this jumper if using a separate power supply with a separate common.

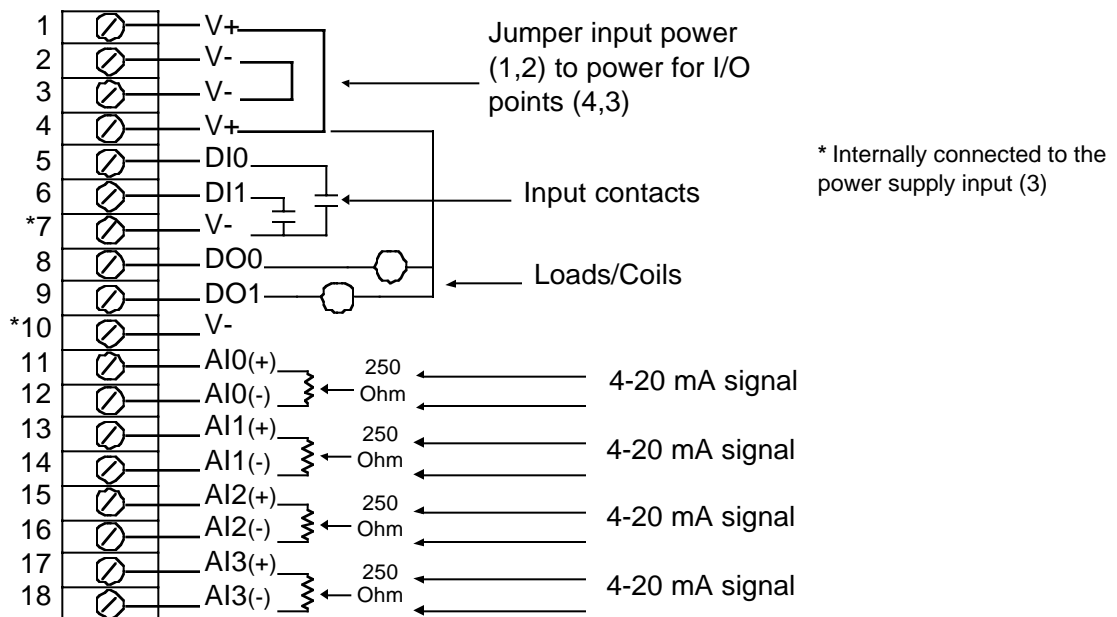
4.2 2240 I/O Card

4.2.1 LED's



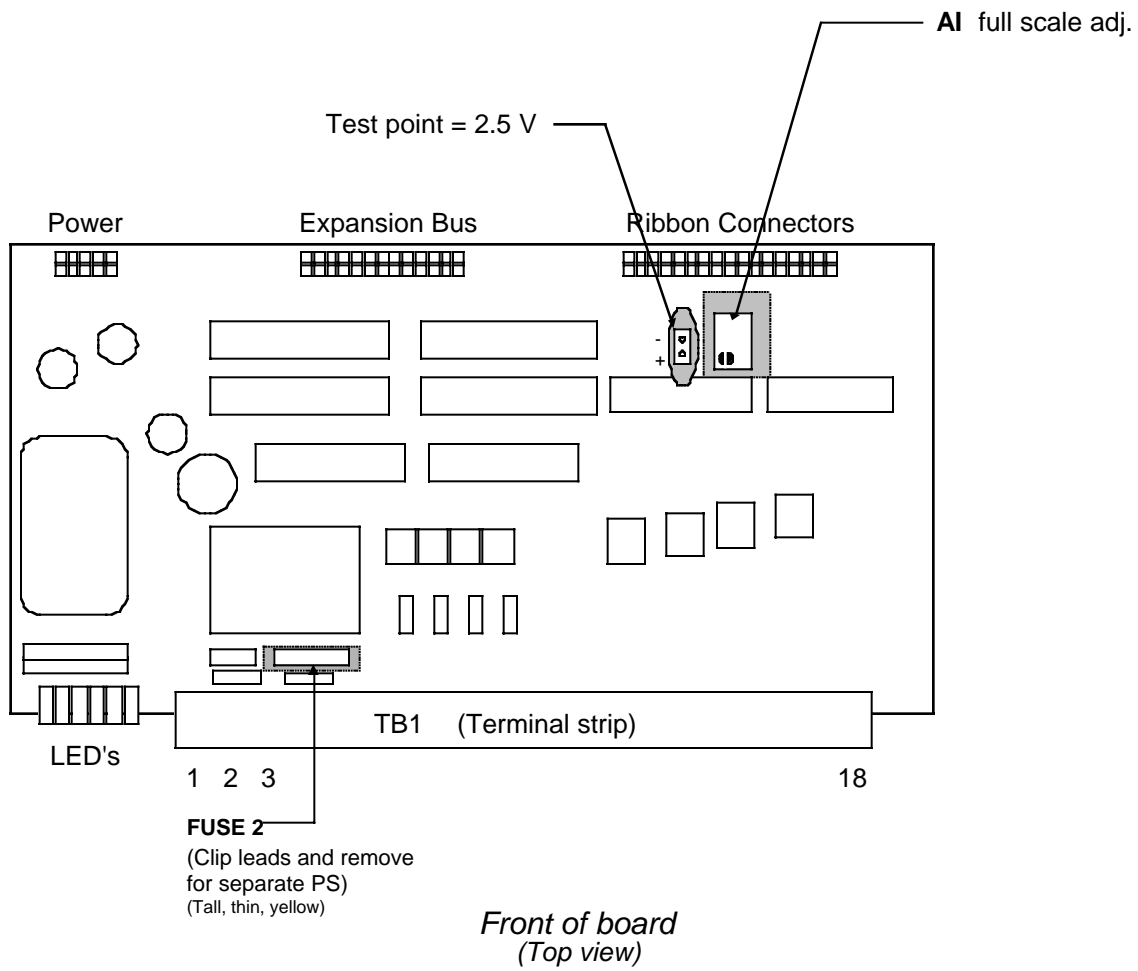
4.2.2 Wiring Diagram

2,2,4,0 Terminal Block



4.2.3 Internal Configuration

Note items highlighted in gray.

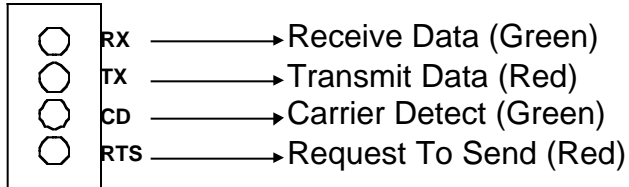


4.2.3.1 Analog Full Scale Adjustment

The analog in full scale adjustment pot is located on the top right side of the board (top view) as noted above. Note the test point to the left of the pot, **DO NOT** jumper these pins together.

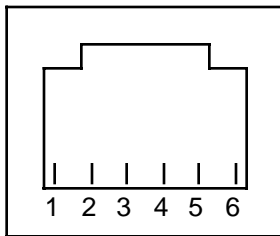
4.3 Internal Bell 202 Modem Option

4.3.1 LED's



4.3.2 RJ-11

The RJ-11 jack is the **COMM PORT** on the Bell 202 modem



4.3.2.1 2 Wire Pin Assignment

Tx/Rx 3,4 (center pins)

4.3.2.2 4 Wire Pin Assignment

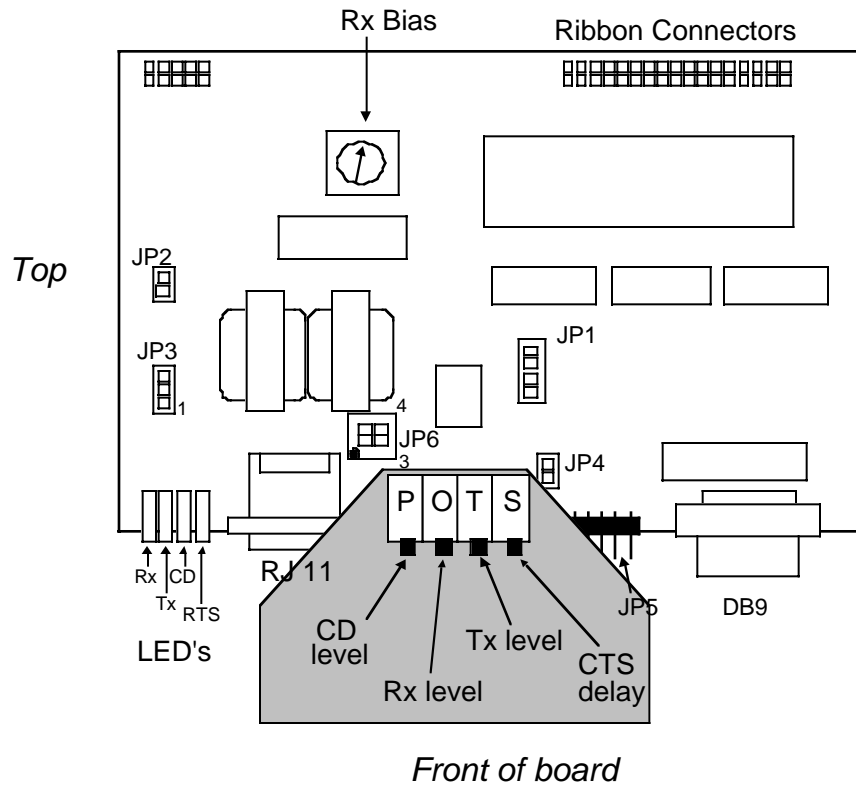
Tx 3,4 (center pins)
Rx 2,5
PTT 1 (open collector)
Ground 6

4.3.2.3 RJ-11 Carrier Sense Pin Assignment

!PTT 1
RX 2,4
TX 3,4 (4 is common)
Carrier Sense 5
Ground 6

4.3.3 Pots

Note items highlighted in gray.

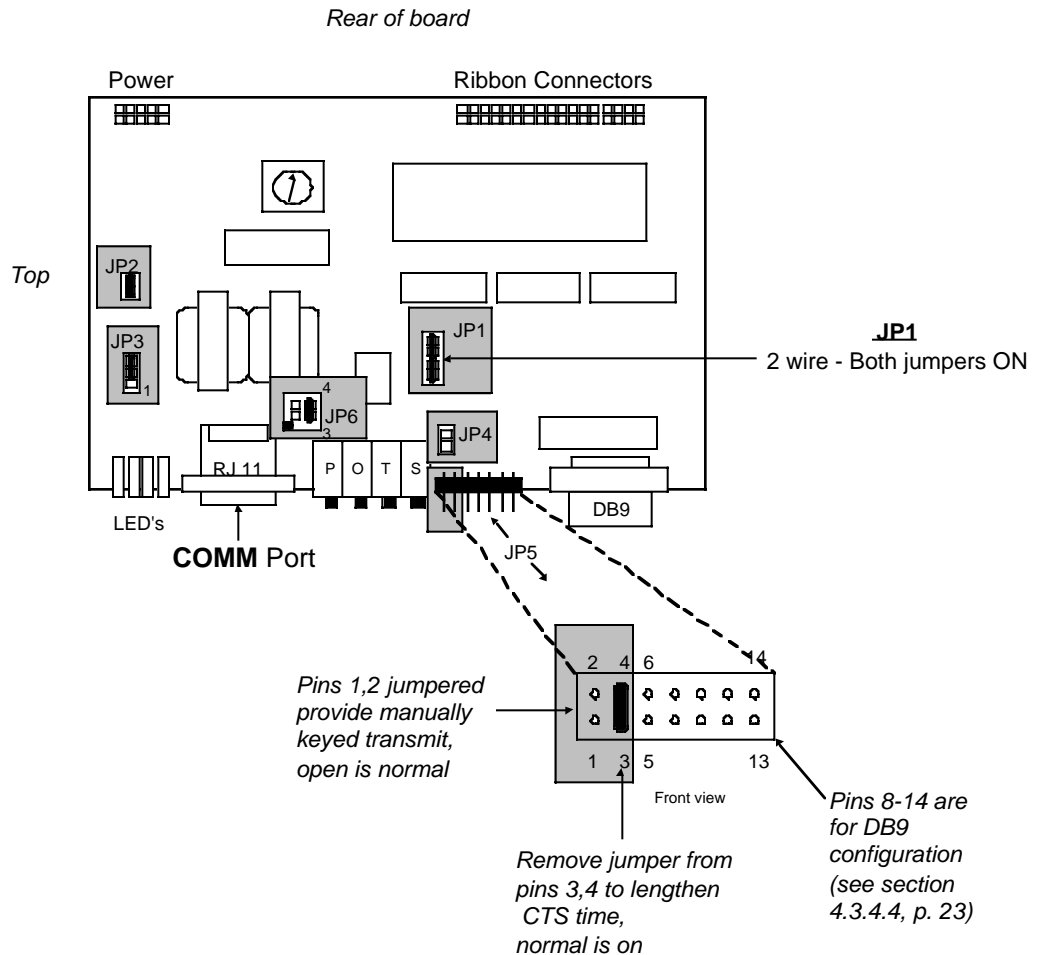


CD Level:	Clockwise	= less sensitive
	Counterclockwise	= more sensitive
Rx Level:	Clockwise	= increase gain
	Counterclockwise	= decrease gain
Tx Level:	Clockwise	= increase level
	Counterclockwise	= decrease level
CTS Delay:	Clockwise	= lengthen delay (maximum ~500ms)
	Counterclockwise	= shorten delay

4.3.4 Jumpers

Note items highlighted in gray.

4.3.4.1 Typical 2 Wire Set Up



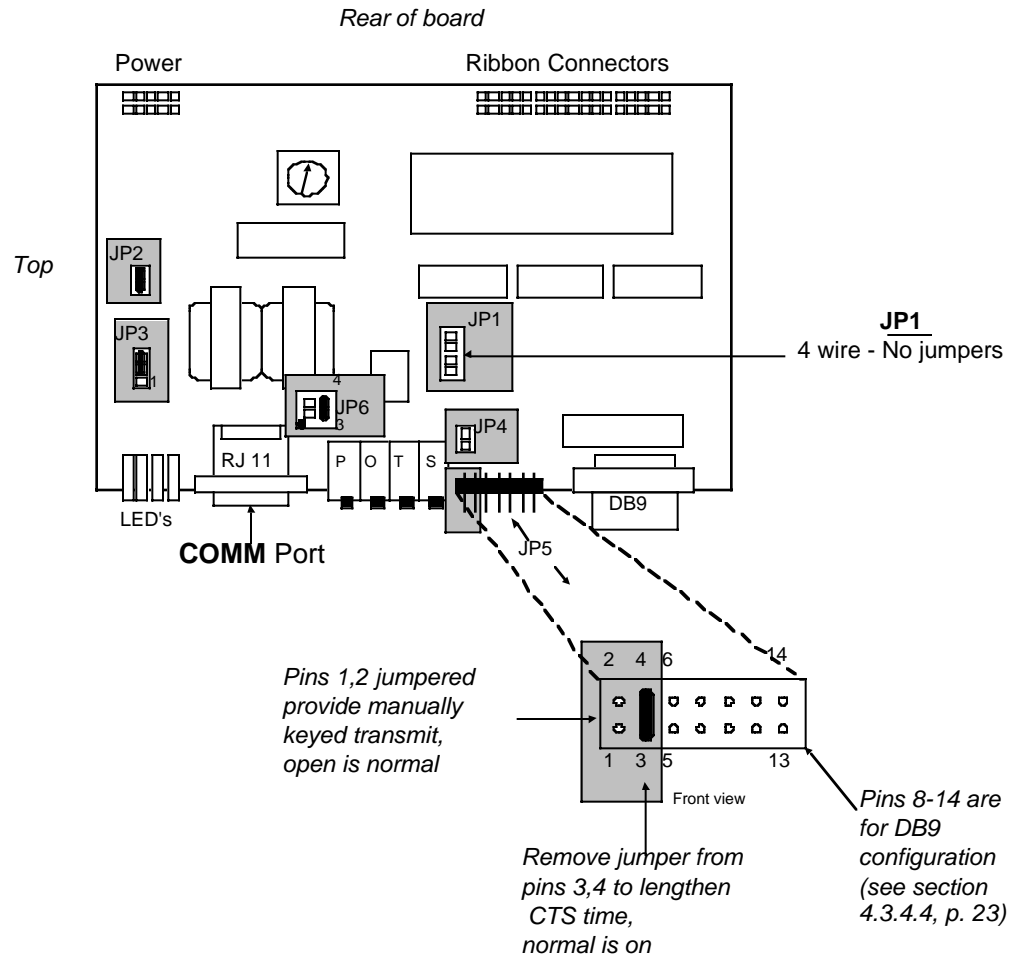
Typical jumper set up is as shown in the above diagram. The only difference between 2 wire mode and 4 wire mode, in terms of set-up, is the setting of the jumper “JP1”.

JP1: 1,2-IN & 3,4-IN (as shown above)

The other jumpers, as shown above, are either in a “normal” configuration or do not affect the 2 wire mode.

4.3.4.2 Typical Radio (4 Wire) Set Up

Note items highlighted in gray



Typical jumper set up is as shown in the above diagram. The only difference between 2 wire mode and 4 wire mode, in terms of set-up, is the setting of the jumper “JP1”. However, the radio/4 wire mode has some special cases which require different jumper settings. These options are listed below:

Use of microphone input on radio:

Remove jumper from JP2 if the PTT and audio are on the same pin.

Repeater use:

Sometimes when repeaters are used, an extended clamp of Rx is needed to prevent detection of the repeater signal. To clamp Rx until end of CTS insert jumper in JP4.

You may also need a longer CTS time for the same reason. To lengthen the CTS, *remove* the jumper from JP5 pins 3,4.

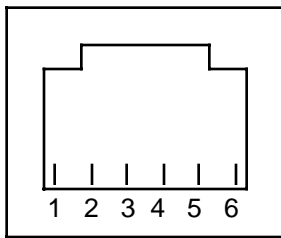
Use of carrier sense:

If your radio has RSSI (Receive Signal Strength Indicator) it can be connected to the Bell 202 modem, which will detect carrier sense from the radio interface to avoid collisions with other channel traffic.

To enable carrier sense insert jumpers on JP6, pins 1,3 & 2,4.

Use JP3 pins 1,2 for active high carrier sense, and pins 2,3 for active low carrier sense.

Note the RJ-11 pin changes (below) when using carrier sense.

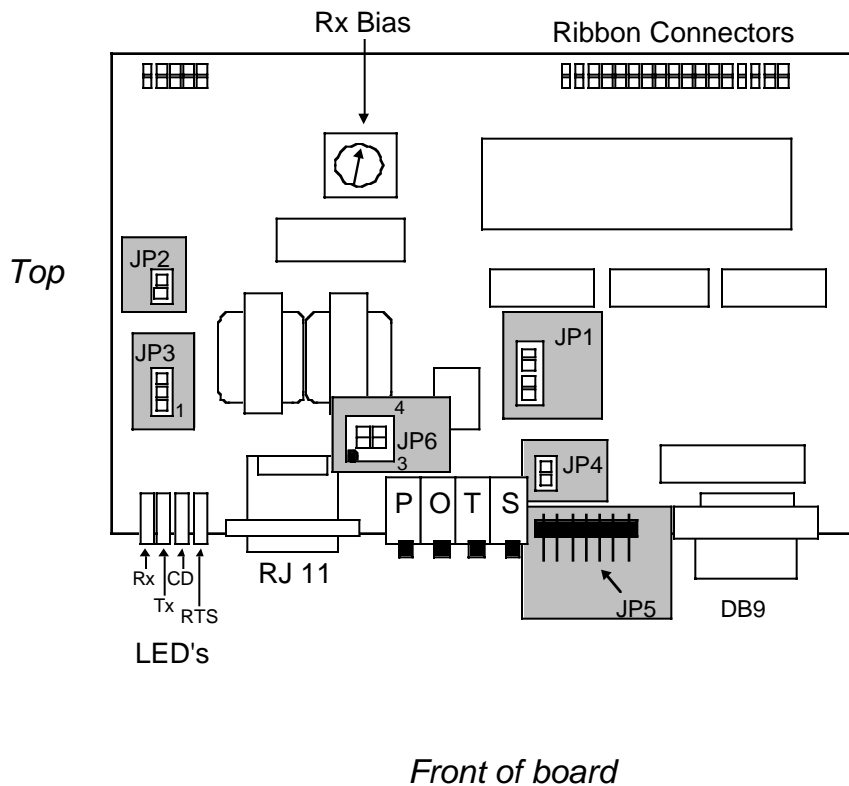


RJ-11 Carrier Sense Pin Assignment

!PTT	1
RX	2,4
TX	3,4 (4 is common)
Carrier Sense	5
Ground	6

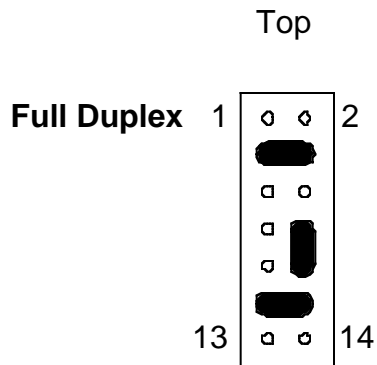
4.3.4.3 Internal Settings Defined

Jumper locations highlighted in gray.

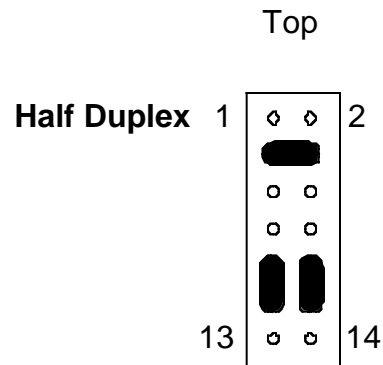


- JP1:** 2 Wire = 1,2-IN 3,4-IN
4 Wire = 1,2-OUT 3,4-OUT
- JP2:** IN = PTT pull to ground (open collector) (RJ11 pin 1)
OUT = PTT pull down via 1K resistor (for microphone lines)
- JP3:** 1,2 IN = active high carrier sense
2,3 IN = active low carrier sense
- JP4:** IN = clamp RX until end of CTS
OUT = clamp RX only while RTS (normal)
- JP6:** 3,4 IN = normal operation
1,3 & 2,4 IN = enable carrier sense operation
Note: with carrier sense enabled, RJ11 pin 4 is common for RX (pin 2) and TX (pin 3)

4.3.4.4 External Settings Defined



Typical configuration for
connection to a PC or
desk top modem



Typical configuration for
connection to an external
radio modem

JP5:

Pins 1,2: ON = manual key transmit
OFF = normal operation (shown above)

Pins 3,4: ON = normal CTS (shown above)
OFF = lengthened CTS drop out

Pins 5,6: Not used

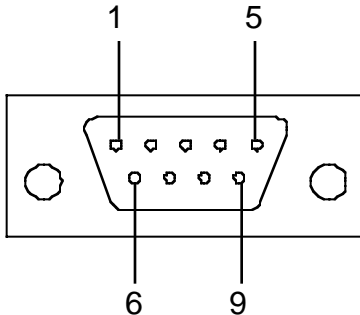
Pins 8,10 & 11,12: ON = sets port 1 to full duplex (jumpers shown above left)

Pins 9,11 & 10,12: ON = sets port 1 to half duplex (jumpers shown above right)

Note: Port P1 is DCE, so use straight-thru cable for connection to PC, null-modem cable for connection to external modem.

Serial Port

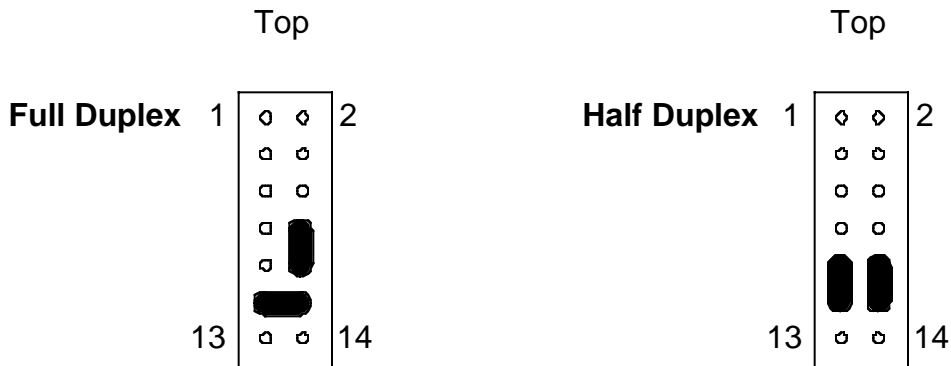
4.3.4.5 Pin Assignments



The serial port for the Bell 202 modem **PORT 1 (“P1”)**

- 1 - Open
- 2 - TXD (transmit data)
- 3 - RXD (receive data)
- 4 - Open
- 5 - Ground
- 6 - Pulled high
- 7 - CTS (clear to send)
- 8 - RTS (request to send)
- 9 - Open

4.3.4.6 Related Jumpers



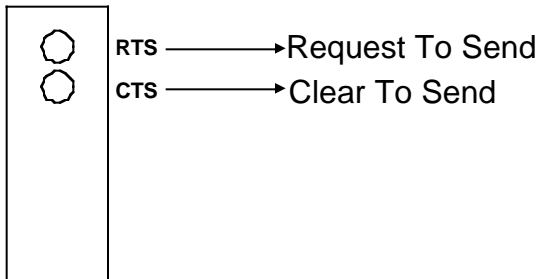
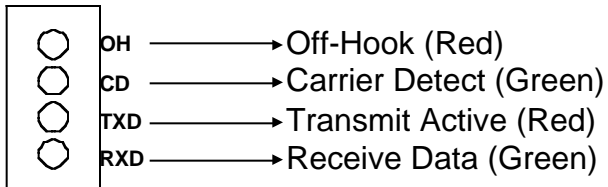
Pins 8-12 configure port 1 (male DB9 on Bell 202 modem card)

- Pins 8,10 & 11,12 ON = sets port 1 to full duplex (above left)
- Pins 9,11 & 10,12 ON = sets port 1 to half duplex (above right)

Note: Port P1 is DCE, so use straight-thru cable for connection to PC, null-modem cable for connection to external modem.

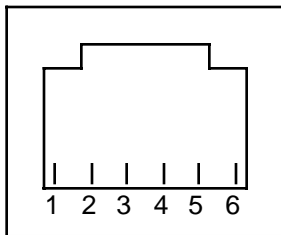
4.4 Internal Dial Modem Option

4.4.1 LED's



4.4.2 RJ-11

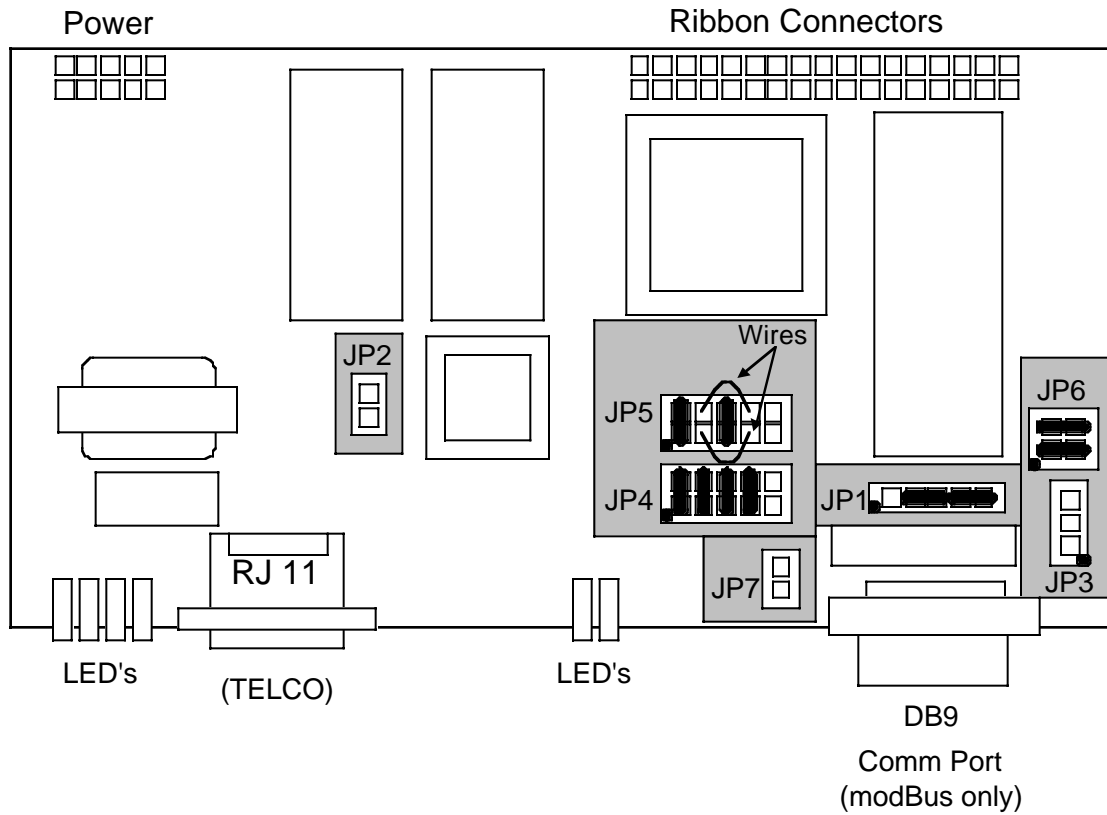
The RJ-11 Jack for the dial modem is **PORT 1** (“P1”)



Line Tip 3
Ring 4

Note: This is also the normal phone jack pin assignment.

4.4.3 Internal Jumpers

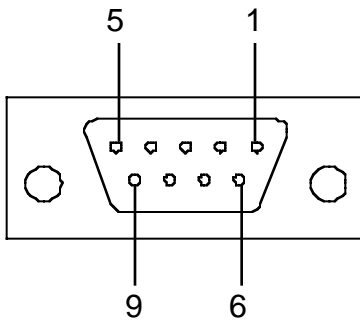


Front of board

This picture shows the normal position of the internal jumpers for the dial modem. They should not need to be changed for normal applications. Please contact NBT for further questions.

4.4.4 Serial Port

4.4.4.1 Pin Assignments



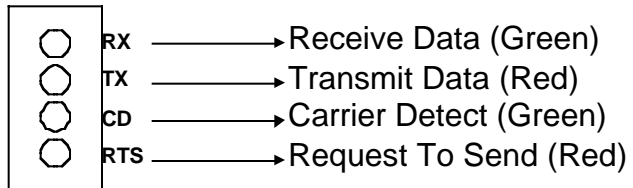
The serial port for the dial modem is the **COMM PORT (“Comm”)**

Note: This port communicates in Modbus at 1200 baud only. You cannot use this port to log on to the RTU, whereas the other serial ports may be used to do so.

- 1 - Open
- 2 - TXD (transmit data)
- 3 - RXD (receive data)
- 4 - CD (carrier detect)
- 5 - Ground
- 6 - Pulled high
- 7 - CTS (clear to send)
- 8 - RTS (request to send)
- 9 - Open

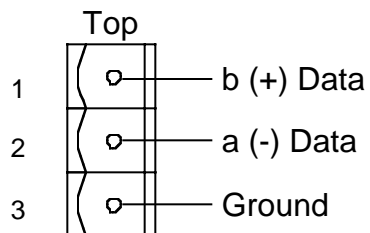
4.5 Internal RS485 Option

4.5.1 LED's



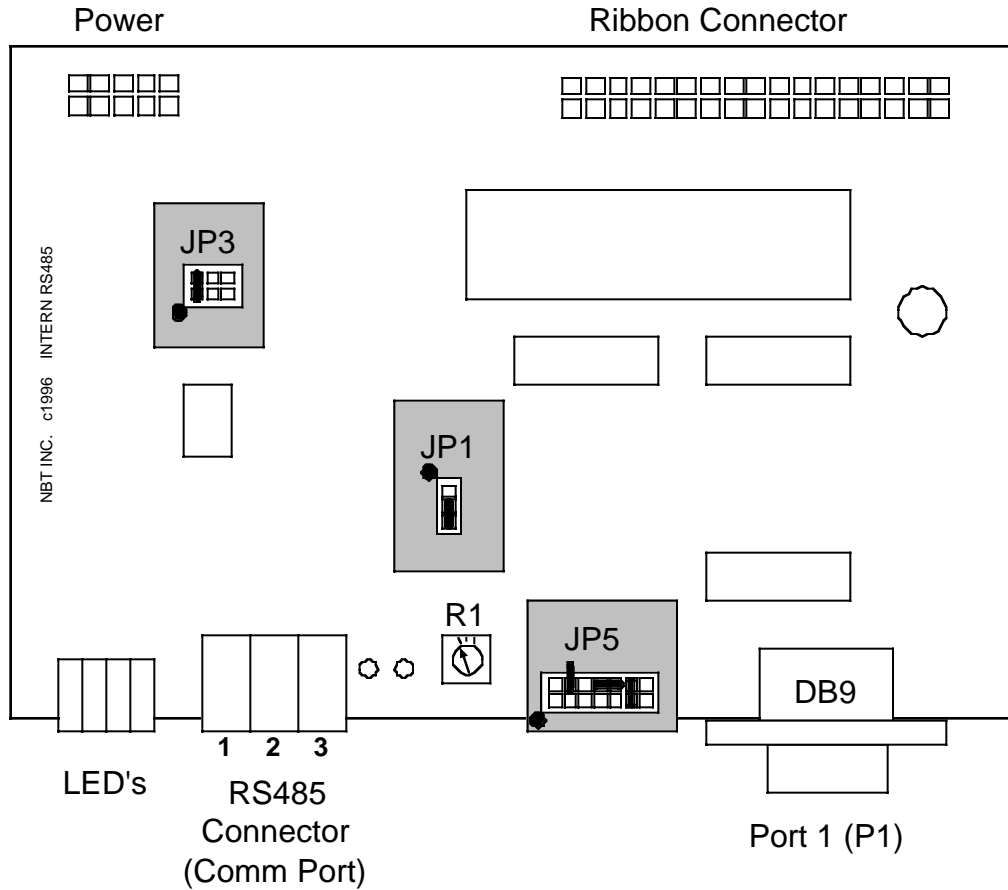
4.5.2 RS485 Port

The RS485 connector is the **COMM Port** (“Comm”) on this card



4.5.3 Jumpers

Note items highlighted in gray.



JP1: 1,2 IN = minimum RTS to CTS delay
 2,3 IN = delay* CTS leading edge, minimum delay on trailing edge
 (as shown above)

No Jumpers = delay* CTS on leading edge and trailing edge

**Delay length is determined by the pot "R1" (shown above next to JP5).*

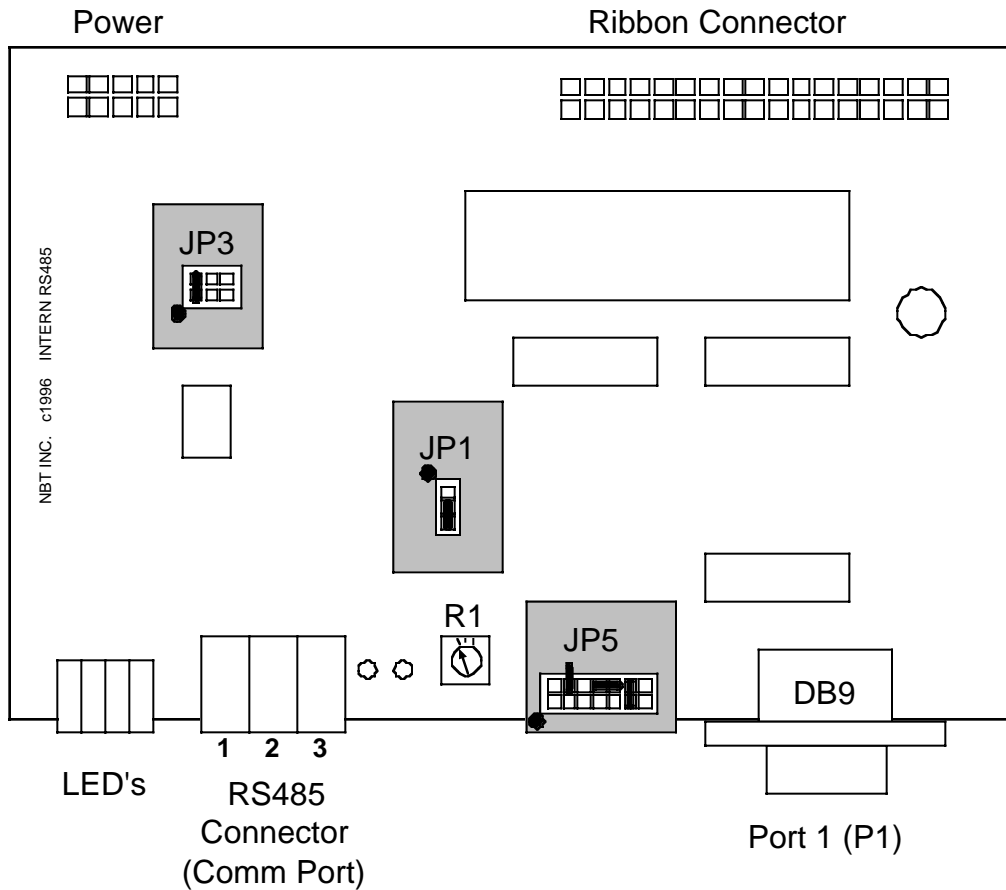
Minimum delay ~ 5 ms

Maximum delay ~ 50 ms

Counterclockwise = decrease length of delay

Clockwise = increase length of delay

RS485 Jumpers continued



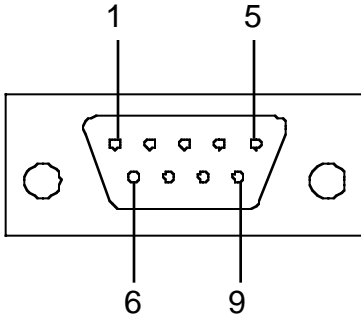
JP3: Do Not change this jumper from the factory setting

JP5:

1,2 IN	= continuous RTS (transmit on Comm port)
1,2 OUT	= normal operation
3,4 IN	= 8E1 (Comm port)
3,4 OUT	= 8N1 (Comm port)
8,10 & 11,12 IN	= sets port 1 (DB9) to full duplex (as shown above)
9,11 & 10,12 IN	= sets port 1 (DB9) to half duplex

4.5.4 Serial Port

4.5.4.1 Pin Assignments

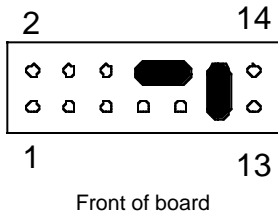


The serial port for the RS485 is **PORT 1 (“P1”)**

- 1 - Open
- 2 - TXD (transmit data)
- 3 - RXD (receive data)
- 4 - Open
- 5 - Ground
- 6 - Pulled high
- 7 - CTS (clear to send)
- 8 - RTS (request to send)
- 9 - Open

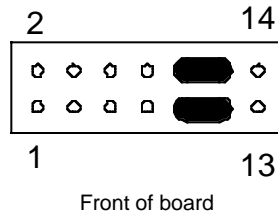
4.5.4.2 Related Jumpers

Top view,
looking down on
card



Full Duplex

Top view,
looking down on
card



Half Duplex

- Pins 8,10 & 11,12 ON = sets port 1 to full duplex (above left)
- Pins 9,11 & 10,12 ON = sets port 1 to half duplex (above right)

Note: Port P1 is DCE, so use straight-thru cable for connection to PC, null-modem cable for connection to external modem.