

The logo for Baldor, featuring the word "BALDOR" in a bold, sans-serif font with a registered trademark symbol (®) at the end. The text is centered between two thick horizontal bars.

**Serial Communication
Expansion Boards**

Catalog No. EXB001A01
Catalog No. EXB002A01
Catalog No. EXB012A01

Installation and Operating Manual

4/03

MN1310

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Section 1

General Information

Introduction

The Baldor controls represent the latest technology in microprocessor based motor controls. In addition to the user programmable parameters available in every control, many different expansion boards are available from Baldor to further customize the control to most any application.

Expansion boards are categorized by compatibility into two groups: Group 1 and Group 2, see Table 1-1. A board from either group may be used alone in a control. If two boards are to be used, one board must be from Group 1 and the other from Group 2.

Note: Using two Group 1 or two Group 2 boards in the same control is not allowed.

Table 1-1 Group 1 and Group 2 Board Categories

| No Group 1 or 2 Connectors | Catalog No. | Manual No. |
|--|--------------------|-------------------|
| Isolated I/O Relay Accessory Board | ACB003A0X | MN1325 |
| Group 1 Board Name | | |
| Isolated Input | EXB003A0X | MN1314 |
| Master Pulse Reference/ Isolated Pulse Follower | EXB005A0X | MN1312 |
| DC Tachometer Interface | EXB006A0X | MN1311 |
| Isolated Encoder | EXB008A0X | MN1317 |
| Resolver to Digital Interface | EXB009A0X | MN1313 |
| Group 2 Board Name | | |
| RS-232 Serial | EXB001A0X | MN1310 |
| RS-422/RS-485 Serial | EXB002A0X | MN1310 |
| RS-232/485 Serial | EXB012A0X | MN1310 |
| Four Output Relays/3-15 PSI Pneumatic | EXB004A0X | MN1315 |
| High Resolution Analog I/O | EXB007A0X | MN1316 |
| 2 Isolated Analog Output/ 3 Relay Output | EXB010A0X | MN1319 |
| Device Net | EXB013A0X | MN1320 |
| Modbus Plus | EXB015A0X | MN1322 |
| Profibus DP | EXB014A0X | MN1323 |

Limited Warranty

For a period of two (2) years from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses.

Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Safety Notice

This equipment contains voltages that may be as great as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

PRECAUTIONS

- ⚠ WARNING: Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.**
- ⚠ WARNING: Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.**

-
- ⚠ WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury.
- ⚠ WARNING:** Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Dangerous voltages are present inside the equipment. Electrical shock can cause serious or fatal injury.
- ⚠ WARNING:** Improper operation of control may cause violent motion of the motor shaft and driven equipment. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Peak torque of several times the rated motor torque can occur during control failure.
- ⚠ WARNING:** Motor circuit may have high voltage present whenever AC power is applied, even when motor is not rotating. Electrical shock can cause serious or fatal injury.
- ⚠ Caution:** To prevent equipment damage, be certain that the electrical service is not capable of delivering more than the maximum line short circuit current amperes listed in the appropriate control manual, 230 VAC, 460 VAC or 575 VAC maximum per control rating.

Section 2

Expansion Board Description

Introduction

Any computer that provides an RS-232, RS-422, RS-485 serial interface may be used to setup and operate the control using one of the available serial communication expansion boards. A proprietary Serial Command Language is built into the control for this purpose. A computer or terminal capable of serial communications using the standard ASCII character set is required to use the Serial Command Language. A typical system consists of an MS-DOS™ compatible computer running communications software. The Serial Command Language can control any aspect of the control including running the motor, changing parameters, and viewing output conditions. Some control features are unique to the Serial Operating Mode, such as positioning and file transfer commands. Note that the Serial Communication Expansion Boards can be used with controls in operating modes other than SERIAL to change parameters and view output conditions. When used in operating modes other than Serial, the drive will not accept commands from the Host Computer.

RS-232 Serial Communications Expansion Board
Catalog No. EXB001A01

RS-422/485 Serial Communications Expansion Board
Catalog No. EXB002A01

RS-232/485 Serial Communications Expansion Board
Catalog No. EXB012A01 – Not compatible with 19H and 20H



Section 3

Installation

Board Installation

This section describes the Expansion Board installation procedure.

 **Caution:** Before you proceed, be sure to read and become familiar with the safety precautions at the beginning of this manual. Do not proceed if you are unsure of the safety precautions described. If you have any questions, contact BALDOR before you proceed.

1. Remove the expansion board from the shipping container.
2. Remove all packing material from the board.

 **Caution:** Be sure all packing materials are removed from the board. Conductive foam may be present on the connectors to prevent static build up during shipping. This can prevent proper circuit operation.

If you are installing only one board, refer to the “Single Expansion Board Installation” procedure. If you are installing two expansion boards (or a second board) refer to the “Dual Expansion Board Installation” procedure.

AC Controls

(For all 15H Inverter, 21H Line Regen Inverter, 18H Vector, 22H Line Regen Vector and 23H Servo).

Single Expansion Board Installation

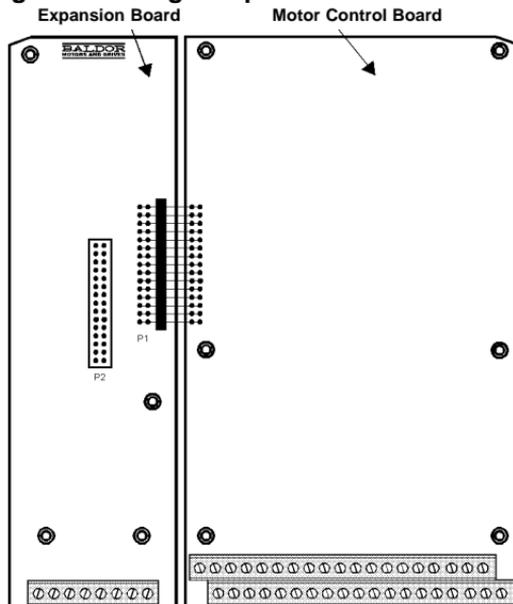
Procedure:

1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control.
3. Wait at least 5 minutes for internal capacitors to discharge.
4. Remove the four (4) Phillips head screws ($1/4$ turn) that secure the control cover. (For A & B size, remove four screws that secure the cover. On floor mounted G size enclosures, open the enclosure door).
5. Remove the control cover.
6. Slide the expansion board male connector into the female connector of the control board. See Figure 3-1.
7. Securely mount the expansion board to the sheet metal mounting plate using the #6 screws provided in the installation hardware. See Figure 3-2.
8. The mechanical installation of the expansion board is now complete. Refer to Section 4 of this manual and configure the jumpers as desired. Also complete the wiring before you proceed to step 9.
9. When complete, install the control cover using the four (4) Phillips head screws ($1/4$ turn). (For A & B size, install four screws that secure the cover. On floor mounted G size enclosures, close the enclosure door).
10. Restore all power sources to the control.
11. Restore drive operation.

AC Controls

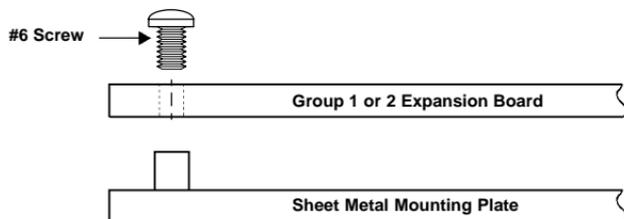
Single Expansion Board Installation (Continued)

Figure 3-1 Single Expansion Board Installation



Terminal tightening torque is 7 lb-in (0.8 Nm) maximum.

Figure 3-2 Single Expansion Board Installation



AC Controls (Continued)

Dual Expansion Board Installation

Procedure:

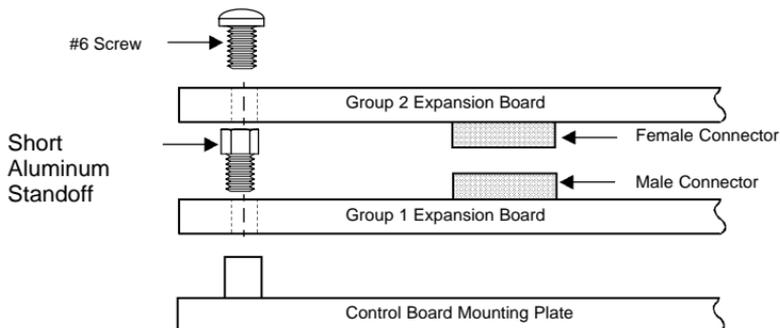
1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control.
3. Wait at least 5 minutes for internal capacitors to discharge.
4. Remove the four (4) Phillips head screws ($\frac{1}{4}$ turn) that secure the control cover. (For A & B size, remove four screws that secure the cover. On floor mounted G size enclosures, open the enclosure door).
5. Remove the control cover.
6. Slide the Group 1 expansion board male connector into the female connector of the control board. See Figure 3-1.
7. Securely mount the Group 1 expansion board to the sheet metal mounting plate using the short standoffs provided in the installation hardware. See Figure 3-3.
8. The mechanical installation of the expansion board is now complete. Refer to the manual for the Group 1 board and configure the jumpers as desired. Also complete the wiring before you proceed to step 9.
9. Install the Group 2 board on top of the previously installed Group 1 board by plugging the female connector onto the male connector of the Group 1 board as shown in Figure 3-3.
10. Secure this Group 2 board to the Group 1 board using the #6 screws provided. See Figure 3-3.
11. The mechanical installation of the expansion board is now complete. Refer to the manual for the Group 2 board and configure any jumpers and switches as desired. Also complete the wiring for this board before you install or close the cover.

AC Controls

Dual Expansion Board Installation (Continued)

- When complete, install the control cover using the four (4) Phillips head screws ($\frac{1}{4}$ turn). (For A & B size, install four screws that secure the cover. On floor mounted G size enclosures, close the enclosure door).
- Restore all power sources to the control.
- Restore drive operation.

Figure 3-3 Dual Expansion Board Installation



SCR DC Controls

(For 19H and 20H SCR DC Controls).

Single Expansion Board Installation

Procedure:

1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control.
3. Wait at least 5 minutes for internal capacitors to discharge.
4. Slide the expansion board male connector into the female connector of the control board. See Figure 3-1.
5. Securely mount the expansion board to the sheet metal mounting plate using the #6 screws provided in the installation hardware. See Figure 3-2.
6. The mechanical installation of the expansion board is now complete. Refer to the Group 1 manual and configure the jumpers as desired. Also complete the wiring before you proceed to step 7.
7. Restore all power sources to the control.
8. Restore drive operation.

SCR DC Controls (Continued)

Dual Expansion Board Installation

Procedure:

1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control.
3. Wait at least 5 minutes for internal capacitors to discharge.
4. Slide the Group 1 board male connector into the female connector of the control board. See Figure 3-1.
5. Securely mount the Group 1 expansion board to the sheet metal mounting plate using the short standoffs provided in the installation hardware. See Figure 3-3.
6. The mechanical installation of the expansion board is now complete. Refer to the Group 1 manual and configure the jumpers as desired. Also complete the wiring before you proceed to step 7.
7. Install the Group 2 board on top of the previously installed Group 1 board by plugging the female connector onto the male connector of the Group 1 board as shown in Figure 3-3.
8. Secure this Group 2 board to the Group 1 board using the #6 screws provided. See Figure 3-3.
9. The mechanical installation of the expansion board is now complete. Refer to the manual for the Group 2 board and configure any jumpers and switches as desired. Also complete the wiring for this board before you proceed to step 10.
10. Restore all power sources to the control.
11. Restore drive operation.



Section 4

Hardware Setup

Termination

First, a few brief words about termination resistance.

What does termination or a termination resistor do?

Termination resistance is used to match the impedance of the load to the impedance of the transmission line (cable) being used. Unmatched impedance causes the transmitted signal to not be fully absorbed by the load. This causes a portion of the signal to be reflected back into the transmission line (noise). If the *Source* impedance, *Transmission Line* impedance, and *Load* impedance are all equal, these reflections (noise) are eliminated.

Termination does increase load current and sometimes changes the bias requirements and increases the complexity of the system.

What is a termination resistor?

A resistor is added in parallel with the receiver input to match the impedance of the cable being used. Typically, the resistor value that is used is 100 ohm or 120 ohm. Resistors with 90 ohms or less should never be used.

Where are these resistors placed?

Terminators or Termination resistors are placed in parallel with the receiver at both ends of a transmission line. This means that you should **never** have more than two terminators in the system (unless repeaters are being used).

How many resistors should my system have?

Terminators or Termination resistors are placed in parallel with the receiver at both ends of a transmission line. This means that you should **never** have more than two terminators in the system (unless repeaters are being used).

EXB001A01 Setup

DIP Switch Settings

This procedure will configure the RS-232 Expansion Board (DCE or Data Communications Equipment) for communication with a computer or other DTE (Data Terminal Equipment). Refer to Figure 4-1 for the following procedure.

Set DIP switches 1, 2 and 4 for the desired data format and baud rate. The RS-232 board can communicate at speeds of 1200, 4800, 9600 or 19200 baud.

Note: Baud rates greater than 9600 are not recommended for cable lengths greater than 12 feet (3.66m).

Note: Switches 3, 5, 6, 7 and 8 are not used.

Jumper Setting

Place JP3 in the RS-232 position as shown in Figure 4-1.

Cable Connection (*Null modem connection required*)

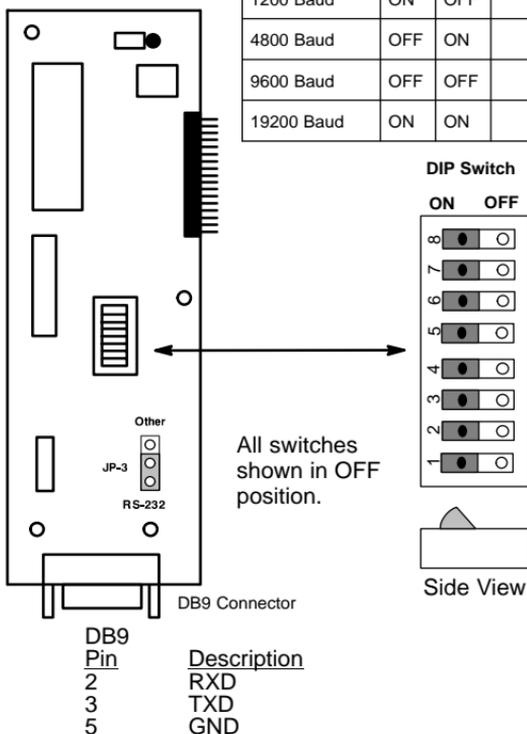
A "Null Modem" cable connection is required. Connect the customer supplied null modem cable between the DB9 connector on the expansion board (DCE) and the DB9 or DB25 RS-232 serial port of the computer or DTE equipment. Refer to Figure 4-4.

Proceed to Section 5 of this manual.

Figure 4-1 RS-232 Switch Settings

RS-232 Serial Communications Expansion Board
Catalog No. EXB001A01

| Description | Switch Number | | | | | | | |
|-------------|---------------|-----|---|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| E, 7, 1 | OFF | OFF | | ON | OFF | OFF | OFF | OFF |
| N, 8, 1 | OFF | OFF | | OFF | OFF | OFF | OFF | OFF |
| 1200 Baud | ON | OFF | | OFF | OFF | OFF | OFF | OFF |
| 4800 Baud | OFF | ON | | OFF | OFF | OFF | OFF | OFF |
| 9600 Baud | OFF | OFF | | OFF | OFF | OFF | OFF | OFF |
| 19200 Baud | ON | ON | | OFF | OFF | OFF | OFF | OFF |



EXB002A01 Setup

DIP Switch Settings Refer to Table 4-1.

This procedure will configure the Expansion Board for communication with a PC or other equipment.

Determine the address of the EXB in your system, the Baud rate of the system and if Half or Full duplex operation is being used. Set the switches as required for your installation.

Jumper Setting Refer to Figure 4-2.

RS232

Place JP3 in the "RS-232" position as shown.

Note: JP1 and JP2 are ignored in RS-232 mode and may remain in either position.

RS422 or RS485

Place JP3 in the "OTHER" position.

Place JP1 in the "TERM R" or "NO TERM" position as required.

Place JP2 in the "2 WIRE" or "4 WIRE" position as required.

Cable Connection

RS232 (Figure 4-4)

A "Null Modem" cable connection is required. Connect the customer supplied null modem cable between the DB9 connector on the expansion board (DCE) and the DB9 or DB25 RS-232 serial port of the computer or DTE equipment.

Proceed to Section 5 of this manual.

RS422/485

Connection diagrams for RS422 and RS485 systems are provided in this section. Locate the diagram for your system configuration and make the proper connections and termination resistor installation if required. Refer to Figures 4-5 to 4-7.

Proceed to Section 5 of this manual.

Figure 4-2 RS232/422/485 Switch & Jumper Location

RS232/422/485 Serial Communications Expansion Board
Catalog No. EXB002A01

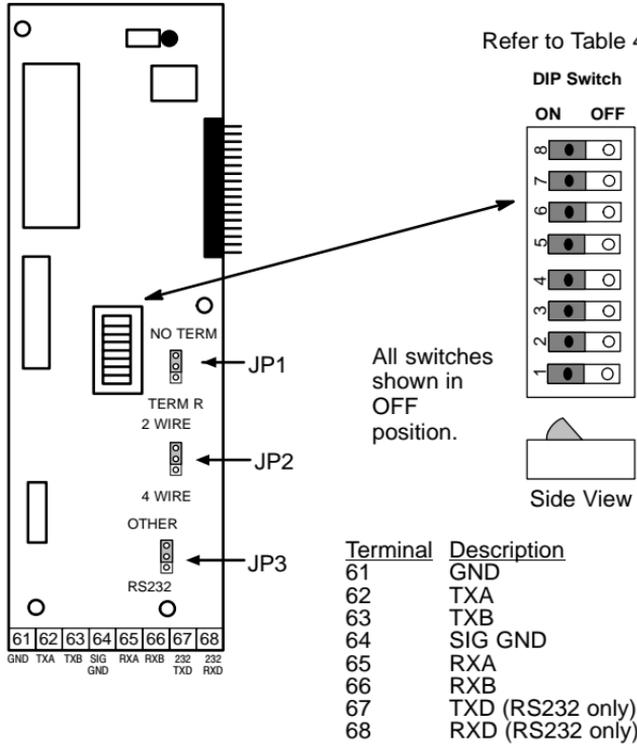


Table 4-1 Switch Settings

| Description | Switch Number | | | | | | | |
|--------------|---------------|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Address 0 | OFF | OFF | OFF | OFF | OFF | | | |
| Address 1 | ON | OFF | OFF | OFF | OFF | | | |
| Address 2 | OFF | ON | OFF | OFF | OFF | | | |
| Address 3 | ON | ON | OFF | OFF | OFF | | | |
| Address 4 | OFF | OFF | ON | OFF | OFF | | | |
| Address 5 | ON | OFF | ON | OFF | OFF | | | |
| Address 6 | OFF | ON | ON | OFF | OFF | | | |
| Address 7 | ON | ON | ON | OFF | OFF | | | |
| Address 8 | OFF | OFF | OFF | ON | OFF | | | |
| Address 9 | ON | OFF | OFF | ON | OFF | | | |
| Address 10 | OFF | ON | OFF | ON | OFF | | | |
| Address 11 | ON | ON | OFF | ON | OFF | | | |
| Address 12 | OFF | OFF | ON | ON | OFF | | | |
| Address 13 | ON | OFF | ON | ON | OFF | | | |
| Address 14 | OFF | ON | ON | ON | OFF | | | |
| Address 15 | ON | ON | ON | ON | OFF | | | |
| Address 16 | OFF | OFF | OFF | OFF | ON | | | |
| Address 17 | ON | OFF | OFF | OFF | ON | | | |
| Address 18 | OFF | ON | OFF | OFF | ON | | | |
| Address 19 | ON | ON | OFF | OFF | ON | | | |
| Address 20 | OFF | OFF | ON | OFF | ON | | | |
| Address 21 | ON | OFF | ON | OFF | ON | | | |
| Address 22 | OFF | ON | ON | OFF | ON | | | |
| Address 23 | ON | ON | ON | OFF | ON | | | |
| Address 24 | OFF | OFF | OFF | ON | ON | | | |
| Address 25 | ON | OFF | OFF | ON | ON | | | |
| Address 26 | OFF | ON | OFF | ON | ON | | | |
| Address 27 | ON | ON | OFF | ON | ON | | | |
| Address 28 | OFF | OFF | ON | ON | ON | | | |
| Address 29 | ON | OFF | ON | ON | ON | | | |
| Address 30 | OFF | ON | ON | ON | ON | | | |
| Address 31 | ON | ON | ON | ON | ON | | | |
| Full Duplex | | | | | | | | OFF |
| Half Duplex | | | | | | | | ON |
| 9600 Baud | | | | | | OFF | OFF | |
| 19,200 Baud | | | | | | ON | OFF | |
| 38,400 Baud | | | | | | OFF | ON | |
| 115,200 Baud | | | | | | ON | ON | |

EXB012A01 Setup

DIP Switch Settings

No switches are present on this expansion board.

The Baud Rate, Communication Protocol, and Address selections are made using the Baldor Keypad. Refer to the appropriate control manual for the parameter selections and ranges.

Jumper Settings refer to Figure 4-3

RS232

No Jumper change required.

Note: JP1 and JP2 are ignored in RS-232 mode and may remain in either position.

RS485

JP1 RS485 "B" Termination

Place jumper in the "120" or "NO TERM" position as required.

JP2 RS485 "A" Termination

Place jumper in the "120" or "NO TERM" position as required.

JP3 is not used and must remain open.

Cable Connection

RS232 (Figure 4-4)

A "Null Modem" cable connection is required. Connect the customer supplied null modem cable between the DB9 connector on the expansion board (DCE) and the DB9 or DB25 RS-232 serial port of the computer or DTE equipment.

Proceed to Section 5 of this manual.

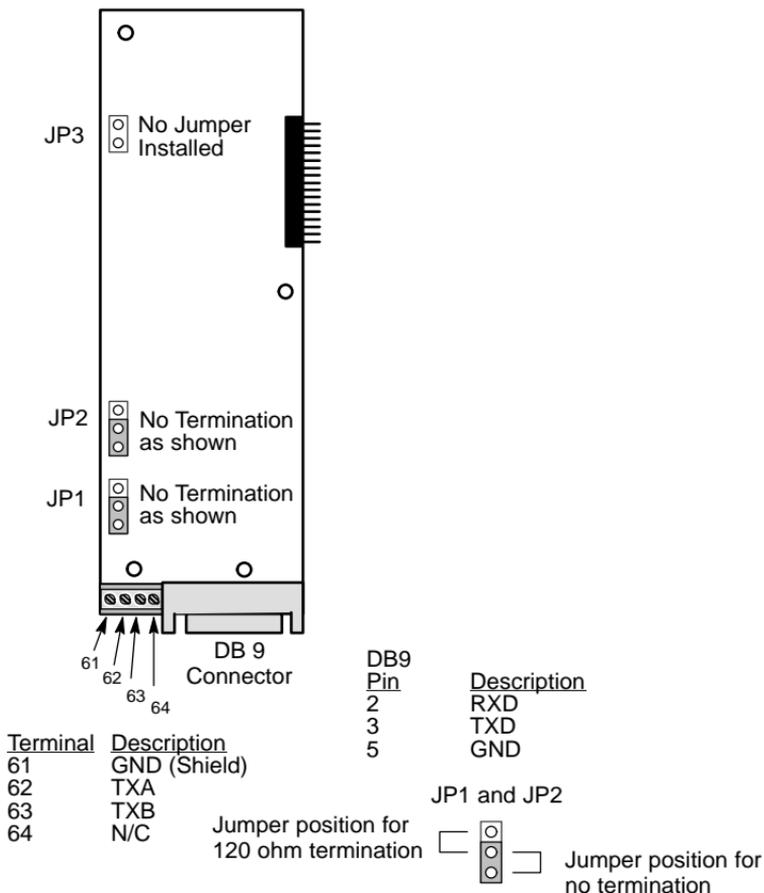
RS485 (Figures 4-5 through 4-8)

Connection diagrams for RS485 systems are provided in this section. Refer to Figure 4-8 and make the proper connections and termination resistor installation if required. RS485 connections are made at terminals 61, 62 and 63.

Proceed to Section 5 of this manual.

Figure 4-3 RS-232/485 Switch & Jumper Location

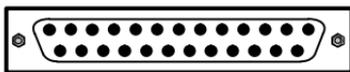
RS232/485 Serial Communications Expansion Board
Catalog No. EXB012A01



Terminal tightening torque is 7 lb-in (0.8 Nm) maximum.

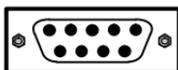
Figure 4-4 9 & 25 Pin RS-232 Cable Connections

A null modem cable (also called a modem eliminator cable) must be used to connect the expansion board and the computer COM port. This will ensure that the transmit and receive lines are properly connected. Either a 9 pin or a 25 D connector can be used.



25 Pin Connector

| <u>Pin</u> | <u>Signal</u> |
|------------|---------------|
| 3 | RXD |
| 2 | TXD |
| 7 | GND |



9 Pin Connector

| <u>Pin</u> | <u>Signal</u> |
|------------|---------------|
| 2 | RXD |
| 3 | TXD |
| 5 | GND |

Null Modem Cable Connections

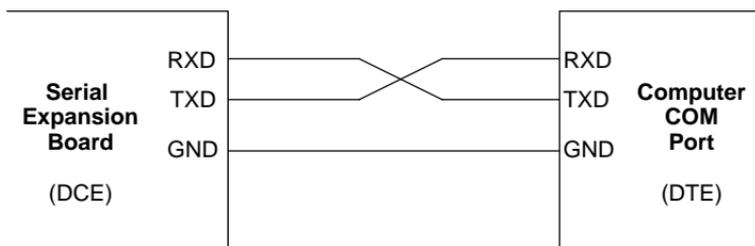
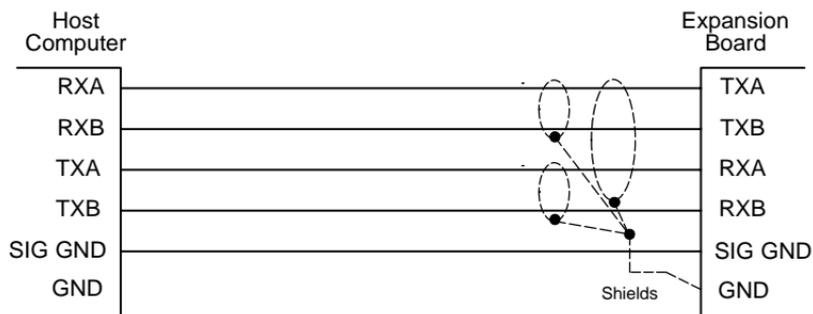


Figure 4-5 RS-422/485 Single Drop (EXB002 only)

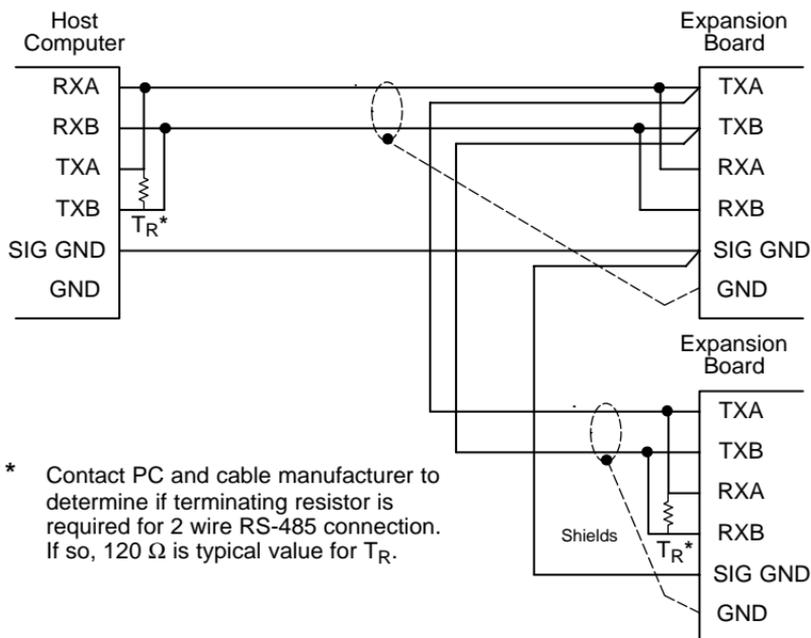


Use shielded twisted pair cable with overall shield.
Connect shields at expansion board only.

- Note: For single receiver less than 50 feet (15m) from host,
set for No Term.
For single receiver more than 50 feet (15m) from host,
set for Term R.

Figure 4-6 RS422/485 2 Wire Multi Drop (EXB002 only)

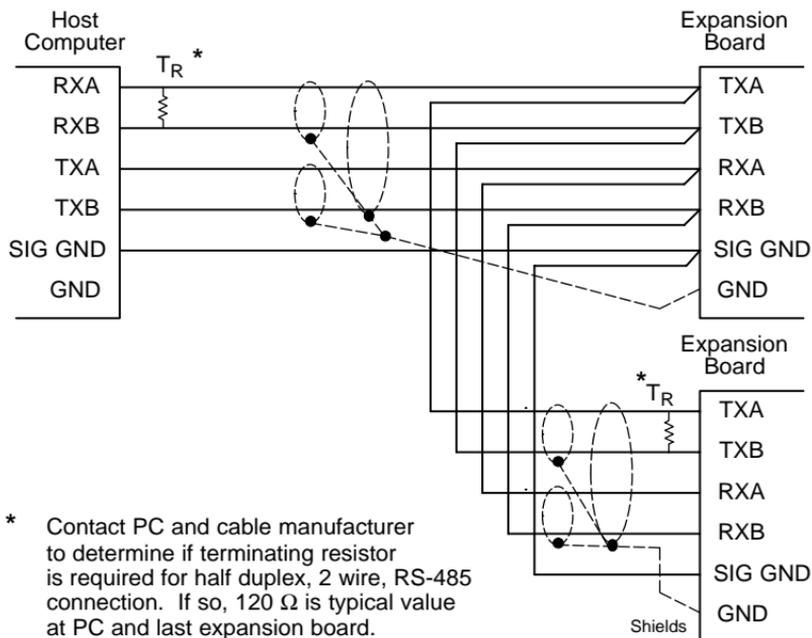
Two Wire Multi Drop connections only available with Expansion Board Catalog No. EXB002A01



Use 3 wire shielded twisted pair cable with overall shield

Figure 4-7 RS422/485 4 Wire Multi-Drop (EXB002 only)

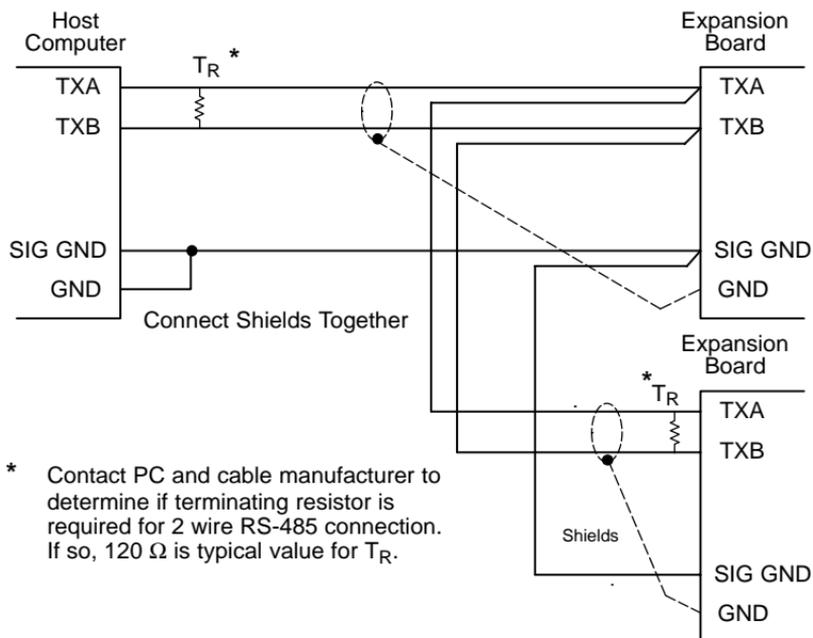
Four Wire Multi Drop connections only available with
Expansion Board Catalog No. EXB002A01



Connect all shields to GND terminal and set
JP1=Term R on last expansion board only.

Figure 4-8 RS485 2 Wire Multi Drop (EXB012 only)

Two Wire Multi Drop connections only available with Expansion Board Catalog No. EXB012A01



Note:

TXA is internally connected to both the transmitter and receiver channel A.
TXB is internally connected to both the transmitter and receiver channel B.

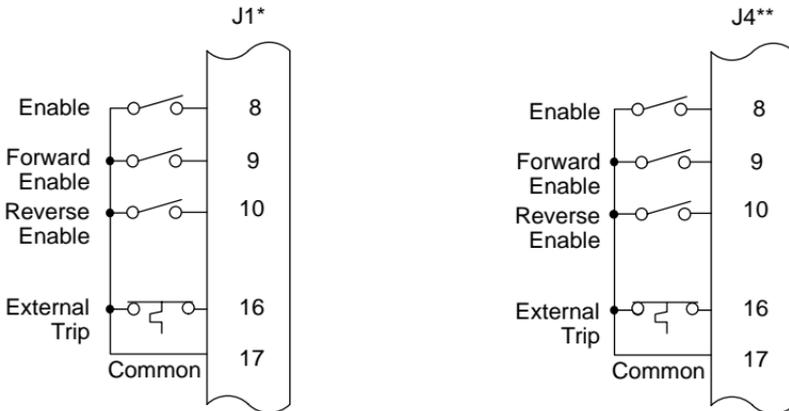
Control Terminal Strip Connections

For Serial Mode operation, the Input/Output terminal strip of the control (J1 of the Vector and DC controls and J4 of the Inverters) is wired as shown in Figure 4-9. Connect the Enable, Forward Enable Switch, Reverse Enable Switch, External Trip and Opto Common connections as shown.

Note: All opto-isolated outputs and analog outputs remain active while operating in the Serial Mode.

When these connections are complete, refer to Section 5 of this manual and set the software for Serial Mode.

Figure 4-9 Serial Opto Input Connections



* Series 18H, 19H, 20H, 22H and 23H controls.

** Series 15H and 21H controls.

Note: Open both the Forward and Reverse switches to Stop.

Section 5 Software Setup

Configure Control Software for Serial Operating Mode

Many commands in the Serial Command Language can be used regardless of the setting of the control's Operating Mode parameter (such as changing and viewing parameters). However, serial commands intended to control the motor shaft require the control be in the Serial Mode.

Note: For EXB012A01 only, the Baud Rate, Communication Protocol, and Address selections are made using the Baldor Keypad. Refer to the appropriate control manual for the parameter selections and ranges.

| Action | Description | Display | Comments |
|------------------|---|----------------------------------|--|
| Apply Power | Display illuminates | BALDOR MOTORS & DRIVES | Logo is displayed for 5 seconds. |
| | If no fault is found and control is programmed for local mode,OR, | STP MOTOR SPEED LOCAL 0RPM | Display mode. |
| | If no fault is found and control is programmed for remote mode | STP MOTOR SPEED REMOTE 0RPM | Display mode. |
| Press PROG key | Access programming mode. | PRESS ENTER FOR PRESET SPEEDS | First screen in programming mode |
| Press ▲ or ▼ key | Scroll to Level 1 Input block | PRESS ENTER FOR INPUT | Input Block. |
| Press Enter key | First selection choice | OPERATING MODE P: KEYPAD | Now in keypad mode. |
| Press Enter key | Flashing cursor indicates mode can be changed | OPERATING MODE ◄□ KEYPAD | |
| Press ▲ or ▼ key | Scroll to Serial mode | OPERATING MODE ◄□ SERIAL | Change to Serial mode. |
| Press Enter key | Saves mode change value | OPERATING MODE P: SERIAL | |
| Press ▲ key | Scroll to Command Select parameter | COMMAND SELECT P: +/-10VOLTS | Now in ±10 Volt input mode. |
| Press Enter key | Flashing cursor indicates mode can be changed | COMMAND SELECT ◄□ +/-10VOLTS | |
| Press ▲ or ▼ key | Scroll to Serial mode | COMMAND SELECT ◄□ SERIAL | Change to Serial mode. |
| Press Enter key | Saves change to serial command select | COMMAND SELECT P: SERIAL | Control is now in Serial mode. |
| Press DISP key | Returns to Display mode | STP MOTOR SPEED LOCAL 0RPM | |
| Press LOCAL key | Changes to REMOTE (Serial) Operation | STP MOTOR SPEED SERIAL 0RPM | Control is ready for Serial operation. |

The control is now configured for Serial mode and the Host software can be setup

Host Computer Setup

Be sure that the following items are complete:

1. The Serial expansion board is installed.
2. The Serial expansion board is configured for RS232, RS422 or RS485 communication.
3. The communications cable is connected between the Serial expansion board and the PC or terminal (Host Computer).
4. The Control terminal strip (J1 or J4) is wired for Serial mode.
5. A Host Computer is setup and operating with a communications software program. (If not, the Windows 3.1 Terminal Emulation program may be used. Microsoft Windows 3.1 or higher must be installed.)

If you have a communications software package installed on the Host, skip this procedure. This procedure is only for those who do not have a communications program installed or may not know how to install one.

Setup Windows 3.1 Terminal Emulation

1. Power up the Host and start Windows software.
2. In the "Windows Accessories Group" select "Terminal" ICON shown in Figure 5-1.

Figure 5-1 Terminal ICON



3. Select "Communications" from the Settings pull down menu within Terminal program.
4. Set the communications settings as shown in Figure 5-2 or as appropriate for the Communications expansion board settings.
Settings shown are:
 - 9600 Baud rate
 - 8 Data Bits
 - 1 Stop Bit
 - No Parity
 - None Flow Control
 - COM1 port of Host

Figure 5-2 Communications Settings

Communications

Baud Rate

110 300 600 1200
 2400 4800 9600 14.4K
 19.2K 38.4K 57.6K 115.2K

Data Bits

 6 7 8

Stop Bits

1 1.5 2

Parity

None
 Odd
 Even
 Mark
 Space

Flow Control

Xon/Xoff
 Hardware
 None

Connector

None ↑
COM1
COM2 ↓

Parity Check Carrier Detect

OK
Cancel

-
5. Select "Binary Transfers" from the Settings pull down menu within Terminal program.
 6. Set the Binary Transfer protocol to XModem/CRC.
 7. Close menu and save the settings.
 8. Terminal Communications settings are now complete.

Serial Mode Control Setup

1. Power up the control.
2. Type "ID" at the host keyboard. A list of Power Base ID settings, and other information should appear on your CRT display. A sample display is shown in Figure 5-3.

Note: You must use upper case characters. The control will not recognize lower case commands.

Figure 5-3 Sample Power Base ID Display

```
ID
Power Base ID = 1000 - 0000 - 0101
                STD CT   STD VT   QT CT   QT VT   PRESENT
CONT CUR      = 15.2    9.6     15.2    15.2    15.2 A RMS
PEAK CUR      = 30.4    17.5    19.2    17.5    30.4 A RMS
RATED PWM     = 2.5     2.5     8.0     8.0     2.5KHz
CURRENT SCALING = 6.08 A/V
DC BUS VOLTAGE = 325V
CONTROLLER TEMP = 24.6 C
```

Use the Serial Command Language described in Section 6 of this manual to communicate with the Control. As an example:

```
P1001 700      changes the value of parameter 1001 (Preset Speed
                #1 refer to control manual parameters) from its
                present value to 700 RPM.

V30           Changes the velocity to 30 RPM.
E             Enables the drive, motor rotates.
S             Stops and disables the drive.
```

If you type P (by itself) and press enter, a listing of all parameter values is displayed as follows:

P

| | | | | |
|-------------|---------------|---------------|---------------|--------------|
| P1001 =0.00 | P1002 =0.00 | P1003 =0.00 | P1004 =0.00 | P1005 =0.00 |
| P1006 =0.00 | P1007 =0.00 | P1008 =0.00 | P1009 =0.00 | P1010 =0.00 |
| P1011 =0.00 | P1012 =0.00 | P1013 =0.00 | P1014 =0.00 | P1015 =0.00 |
| P1101 =3.0 | P1102 =3.0 | P1103 =0 | P1104 =3.0 | P1105 =3.0 |
| P1106 =0 | P1201 =7.00 | P1202 =3.0 | P1203 =3.0 | P1204 =0 |
| P1301 =0 | P1302 =0 | P1303 =1 | P1304 =1 | P1305 =1 |
| P1306 =1 | P1307 =0 | P1308 =0 | P1309 =0 | P1401 =1 |
| P1402 =1 | P1403 =0 | P1404 =0.00 | P1405 =2.00 | P1406 =0 |
| P1501 =0 | P1502 =1 | P1503 =2 | P1504 =6 | P1505 =200 |
| P1506 =100 | P1507 =1750 | P1508 =0 | P1509 =8 | P1510 =100 |
| P1511 =100 | P1512 =1 | P1601 =1750 | P1602 =0 | P1603 =0 |
| P1604 =0 | P1605 =150 | P1606 =10 | P1607 =1.00 | P1608 =0 |
| P1609 =31 | P1610 =0 | P1611 =61.200 | P1612 =61.200 | P2001 =0 |
| P2002 =0 | P2003 =1750 | P2004 =31.00 | P2005 =2.5 | P2006 =0.004 |
| P2101 =5 | P2102 =0/1000 | P2103 =- | P2201 =1 | P2202 =0 |
| P2203 =0 | P2204 =0 | P2205 =0 | P2301 =1 | P2302 =0 |
| P2303 =0 | P2304 =1 | P2305 =100 | P2306 =0 | P2401 =0 |
| P2402 =0.00 | P2403 =9999 | P2501 =460 | P2502 =61.2 | P2503 =1750 |
| P2504 =60.0 | P2505 =0 | P2506 =1024 | P2507 =0 | P2508 =1 |
| P2601 =0 | P2602 =0 | P2603 =0 | P2701 =8 | P2702 =0 |
| P2703 =1 | P2704 =0.0 | P2705 =10.0 | P2706 =10 | P2707 =0 |
| P2708 =0.00 | P2709 =0 | P2710 =1:1 | P2711 =1:1 | P2712 =1024 |
| P2801 =0 | P2802 =0 | P2803 =0 | | |

Section 6

Serial Command Language

All commands are entered as ASCII characters followed by Enter key (hex 0D). The Enter “End of Line” character prompts the control to process the command. The Backspace character (hex 08 or Control-H) deletes the character to the left of the cursor. Control-X (hex18) deletes the line the cursor is on.

Some commands in the Serial Command Language require the control to be in the Serial Operating Mode. These commands are considered “Protected Commands”. All commands are case sensitive (UPPERCASE and lowercase).

ACK_ON

This command reports the total character string received.

Note: **This command is not available for Vector, DC or Servo controls.**

ACK_OFF

This command turns off the “ACK_ON” command.

Note: **This command is not available for Vector, DC or Servo controls.**

Ax(Address) Multi-Drop Command

The address command is used in multi-drop systems to select the control identified by **x**, for communication. Where **x** = control address from 0 - 31. Commands will be received and processed by the control with **x** address until another address is given, or a global **AA** (Address All) command is given. The control address is set by the DIP switches located on the serial expansion board.

When the control receives an address command it echoes back its control address to acknowledge that it is now on line. The Control address 0 will receive and process commands unless another address is given.

AA(Address All) *Multi-Drop Command*

This command is used in multi-drop systems to direct a command(s) to ALL controls regardless of their individual control ID. The Address All remains active until another address is given.

AUn (Auto-Tune) *Protected Command*

The Auto-Tune command starts the motor tuning procedure. The control must be externally enabled (pin 8 of the terminal strip, see Figure 4-9). Refer to the parameter list in the Control Installation and Operating Manual for the auto-tuning numbers (**AU1-AU6**) that correspond to the test. The test will either pass or fail. If the test fails, refer to the control manual.

Note: **This command is not available for Series 15H or 21H Inverters.**

Note: The **CALC** command **MUST** be given before running the auto-tuning tests.

C (Clear)

This command clears an existing fault. The control will resume operation if an **E** (Enable) command is given and no faults are present.

CALC

Calculates specific parameters based on motor rating values. This command must be given before the auto-tune tests are run. Motor rating information must be programmed into control using the operator keypad or "**P**" serial command before **CALC** command is run.

Note: **This command is not available for Series 15H or 21H Inverters.**

D (Disable) *Protected command*

Disables control output.

Note: The current status of the control can be retrieved by using the **ST** (STATUS) command.

DL (Download)

Begins the download procedure. All parameters for the current parameter table of the control are downloaded to a host file using the standard XMODEM protocol. Control-X can be used to cancel the procedure. If the XMODEM procedure is not started within 60 seconds, the **DL** command aborts.

E (Enable) *Protected command*

Enables control output. External enables at the control terminal strip must be closed and the control must be in the Serial Operating Mode. For safety reasons the control will not enable unless a valid **Vnnnn**, **Tnnnn** or **Mxxxxx** command was previously issued.

Note: The current status of the control can be retrieved by using the **ST** (STATUS) command.

ECHO_ON

Turns on the echo character function.
(Preset to do so when not in multi-drop).

ECHO_OFF

Turns off the echo character function.
(Preset to do so when in multi-drop).

F (Fault)

This command returns the current fault code. Returns 0 if no fault condition exists. See **HF** command.

GO (Process Target Register Command)

The command stored in target register will be processed.
See **TAR** command.

H (Home) *Protected Command*

Commands the control to go to the predefined home position at predefined homing speed. This command is not the same as the **W** (position to zero) command and not intended to be used with positioning commands.

Note: **This command is not available for Series 15H or 21H Inverters.**

HF (Help Fault)

This command returns the current fault code and gives a text definition of the fault. Consult the troubleshooting section of your control manual for recommended corrective action. Fault codes are defined as follows:

| Fault Code | Description | Fault Code | Description | Fault Code | Description |
|------------|---------------------|------------|----------------------|------------|--------------------|
| 0 | No Faults | 10 | Logic Supply Fault | 20 | User Fault Text |
| 1 | Line Regen Fault | 11 | Overcurrent Fault | 21 | Lost User Data |
| 2 | Encoder Loss | 12 | DC Bus High | 22 | µP Reset Fault |
| 3 | Invalid Base ID | 13 | Following Error | 23 | Memory Fault |
| 4 | Low Init. Bus Volts | 14 | Torque Proving Fault | 24 | Overload 1-Minute |
| 5 | Regen R Power Fault | 15 | DC Bus Low | 25 | Inverter Base ID |
| 6 | Current Sense Fault | 16 | Overload 3-Second | 26 | New Base ID |
| 7 | Power Base Fault | 17 | Overspeed Fault | 27 | No EXB Installed |
| 8 | Ground Fault | 18 | External Trip | 28 | Power Module Fault |
| 9 | Resolver Loss | 19 | Int Over-Temp Fault | | |

HL (Help Log)

Reports last 15 faults with time stamps. Most recent fault shown first.
Gives text description of faults.

HP or HPxxxx or HPxxxx nnnn (Help Parameters)

The **HP** command can be used in three ways:

1. **HP** gives a full list of all the parameters with a text description of the parameter and the current parameter setting.
2. **HPxxxx** gives a text description and current setting of a single parameter, where xxxx is the parameter number.
3. When the **HPxxxx** command is followed by a space and **nnnn**, parameter **xxxx** is changed to value of **nnnn**.
Where **xxxx** is a value from 0 - 9999, and **nnnn** is a value from 0 - 9999 this is the same as **Pxxxx nnnn**.

Example: HP1201

P1201 JOG SPEED = 400 RPM

Min value = 0, Max value = 1750, Factory value = 200

ID (Power Base ID)

This command returns a listing of power base settings with control bus volts, current scaling and control temperature.

Example:

ID

| | | | | | | |
|-----------------|---|--------------------|--------|-------|-------|------------|
| Power Base ID | = | 1000 - 0000 - 0101 | | | | |
| | | STD CT | STD VT | QT CT | QT VT | PRESENT |
| CONT CUR | = | 15.2 | 9.6 | 15.2 | 15.2 | 15.2 A RMS |
| PEAK CUR | = | 30.4 | 17.5 | 19.2 | 17.5 | 30.4 A RMS |
| RATED PWM | = | 2.5 | 2.5 | 8.0 | 8.0 | 2.5KHz |
| CURRENT SCALING | = | 6.08 A/V | | | | |
| DC BUS VOLTAGE | = | 325V | | | | |
| CONTROLLER TEMP | = | 24.6 C | | | | |

IO (IO Status)

This command returns current state of all terminal strip connections (J1 for Vector, Servo and DC controls and J4 for Inverters). The J1 or J4 status is as follows:

Pins 2, 4, and 5 give the status of the analog inputs. A value of 0 = -10 V, 512 = 0V and 1024 = 10 V.

Pins 6 and 7 are the analog outputs. They are scaled 0 - 256, where 256 = the maximum value of 5 V.

Jx (Jog) *Protected command*

Jogs the motor at the rate set by the Level 1, Jog Settings Block. A **J** command given with an x value of + or - (**J+** or **J-**) determines the direction of the jog. A **J** command given with an x value of **S** (**JS**) will stop the jog command at the decel rate specified in the Level 1, Jog Settings Block.

L (Log)

Sends a report of the last 31 faults with time stamps, the most recent fault first. The fault numbers displayed correspond to the fault codes found in the Troubleshooting section of the Control Installation and Operating Manual.

See also **HL** command.

M or Mxxxxx (Absolute Move) *Protected command*

The **M** command by itself (without **xxxxx**) returns the last position command.

The **M** command followed by **xxxxx**, causes the control to enter the position mode and move to the absolute position of **xxxxx** encoder counts relative to the **Z** (zero) position. Speed is the rate defined with the **V** (positioning speed) command. Where **xxxxx** is an absolute position (signed) in encoder counts X4. Positions negative to zero position must be preceded with a minus sign, (**-xxxxx**). Maximum value of **xxxxx** is $2^{31}-1$ encoder counts.

Note: **This command is not available for Series 15H or 21H Inverters.**

m or mxxxxx (Incremental Move) Protected command

The **m** command can be used in two ways:

1. The **m** command by itself (without **xxxxx**) returns the last position command.
2. The **m** command with **xxxxx** causes the control to enter the position mode and move **xxxxx** encoder counts relative to the current position. The speed is defined with the **V**(positioning speed) command. Where **xxxxx** is a (signed number) position relative to the current position in encoder counts X4. Positions negative to zero position must be preceded with a minus sign, (**-xxxxx**). Maximum value of **xxxxx** is $2^{31}-1$ encoder counts.

Note: **This command is not available for Series 15H or 21H Inverters.**

NULL

This command is used to clear the Target Register for Series 15H and 21H Inverters.

Note: **This command is not available for Vector, DC or Servo controls.**

Ox (Report)

The **O** command by itself (without **x**) returns the present values of RPM, Hz, Vrms and Arms. Values for **x** are used to return a specific operating value according to the following table:

| | |
|----------------|---------------------------------|
| 1 = RPM | 5 = % Rated Load |
| 2 = HZ | 6 = Analog Input (± 4096) |
| 3 = Motor Vrms | 7* = Opto-Outputs (0 – 15) |
| 4 = Motor Arms | 8 = Absolute Position from Zero |
| | 9 = User Scaled Display |

*Opto-output (7) report represents a 4 bit word as a decimal number. See Table 6-2.

Table 6-2 Opto-Output 7

| Decimal Number | 4 Bit Word 2 ⁰ , 2 ¹ , 2 ² , 2 ³ | Output Status |
|----------------|---|----------------------------|
| 0 | 0000 | No outputs are on. |
| 1 | 1000 | Output #1 is on. |
| 2 | 0100 | Output #2 is on. |
| 3 | 1100 | Output #1 and 2 are on. |
| 4 | 0010 | Output #3 is on. |
| 5 | 1010 | Output #1 and 3 are on. |
| 6 | 0110 | Output #2 and 3 are on. |
| 7 | 1110 | Output #1, 2 and 3 are on. |
| 8 | 0001 | Output #4 is on. |
| 9 | 1001 | Output #1 and 4 are on. |
| 10 | 0101 | Output #2 and 4 are on. |
| 11 | 1101 | Output #1, 2 and 4 are on. |
| 12 | 0011 | Output #3 and 4 are on. |
| 13 | 1011 | Output #1, 3 and 4 are on. |
| 14 | 0111 | Output #2, 3 and 4 are on. |
| 15 | 1111 | All outputs are on. |

P or Pxxxx or Pxxxx nnnn *Protected command*

The **P** command can be used in three ways:

1. The **P** command by itself (without **xxxx**) returns a list of all the parameter values.
2. When the command is **Pxxxx** the current value of parameter **xxxx** is returned. (Refer to the control manual Parameter List for the “Serial Mode Parameter Number” **xxxx**).
3. When the **Pxxxx** command is followed by a space and **nnnn**, parameter **xxxx** is changed to the value of **nnnn**. Where **xxxx** is the “Serial Mode Parameter Number”, and **nnnn** is a value from 0 – 9999.

S (STOP) *Protected command*

Issues an ALL STOP to the control.

Level 1, Keypad Setup Block, Keypad Stop Mode parameter determines if the motor coasts to a stop or decels to a stop.

SCxxxx (Security Code)

Locks and unlocks serial commands, where **xxxx** is the Security Code.

ST (STATUS)

This returns the present control status in the form of:

0 = Disabled , 1 = Enabled, 2 = Fault

STATUS (FULL STATUS)

This returns a listing of serial mode variables and their status.

Example:

STATUS

Drive Disabled

(drive status)

Serial Security Code Disabled

(security status)

Echo On

(echo status)

S1X-X.XX

(software version)

T or Tnnnn (Torque command) *Protected command*

The **T** command can be used in two ways.

1. When the **T** command is alone it enters torque control and returns the last torque command given.
2. When followed by a numeric value it enters the torque mode and commands the value, where nnnn is a numeric value. **nnnn** = ± 2048 is equal to the control current limit.
nnnn = ± 1024 is equal to half of the control current limit.

Note: **This command is not available for Series 15H or 21H Inverters.**

Note: Negative torques are indicated by a **-nnnn** (positive values may be entered by **+nnnn** but this is optional). **T+** or **T-** will (depending on the present torque direction) cause the control to reverse direction using the last commanded torque value.

TAR xxxx (Target Register)

Store a command to the Target Register for execution at a later time (**GO** command) where **xxxx** is any serial command in its normal format.

This **TAR** command uses a target register (temporary data storage location) to store the command **xxxx** given after the space. This **xxxx** command is stored and processed when a **GO** command is given. This is useful when synchronizing multiple controls on a common mark. For example, on a 3 axis system, each control could be given a "target" position and all 3 could be started at the same time with a global **GO** command.

TP (Test Points)

View the list of captured test point data in the buffer. The test point buffer consists of two channels. When the control is enabled the buffer continuously captures data. When the control becomes disabled or a fault occurs, the data capture stops and the buffer retains the last 32 points of data per channel.

Each channel can be set to buffer internal variables by setting P3001 (channel 1) and P3002 (channel 2) as follows:

Note: **Not all of the variables listed are used with the Series 15H and 21H Inverters.**

| | | |
|--------------------|---------------------|----------------------|
| 0 = Velocity | 8 = Field Weaken | 16 = Speed Command |
| 1 = Elec Angle | 9 = Following ERR | 17 = Overload Accum |
| 2 = ABS Command | 10 = Quad Control | 18 = Phase 2 Current |
| 3 = PWM Voltage | 11 = Direct Control | 19 = Phase 3 Current |
| 4 = Direct Current | 12 = AC Voltage | 20 = Position |
| 5 = CMD Direct CUR | 13 = Bus Voltage | 21 = Serial Command |
| 6 = Quad Current | 14 = Vector Angle | 22 = Delta Count |
| 7 = CMD Quad CUR | 15 = Power | |

TPF (Test Point File)

This command starts a download of all the test points to a host computer file. Follow the same procedure as the **DL** command.

TPT (Test Point Trigger)

The test point buffer is normally filled when the control is enabled and the buffer stops filling when the control is disabled or a fault occurs. If the **TPT** command is given, the test point buffer is filled for 255 points after the next "Enter" is received (example: **TPT**, Enter, **Vnnnn**, Enter). The test points can then be viewed by using the **TP** command.

UL (Upload)

This command begins the Upload procedure using XMODEM protocol. It uploads a parameter file from the computer to the control. Control-X can be used to cancel the procedure. If the XMODEM procedure is not started within 60 seconds the command aborts.

V or Vnnnn (Velocity Command) *Protected command*

The **V** command can be used in two ways:

1. The **V** command by itself returns the last velocity command.
2. The **V** command is followed by a numeric value **nnnn**, it enters the velocity mode and commands that value equal to RPM (for the vector, servo and DC controls) or Hz (for Inverters).

Note: Negative velocities are denoted by **-nnnn** (positive values may be entered by **+nnnn** but this is optional). **V+** or **V-** (depending on the current direction) will cause the control to reverse direction using the last commanded velocity value.

VX or VXnnn (Velocity Command/256) *Protected command*

The **VX** is similar to the **V** command except that it is used to command fractional RPM or less than 1 RPM.

Example:

VX128 = 0.5 RPM; VX256 = 1RPM; VX384 = 1.5 RPM.

v or vxxxx (Positioning Speed)

vxxxx changes the maximum speed used in positioning commands. Where **xxxx** is a velocity value.

Note: Value is preset to 0 at control power up.

Note: This command is not available for Series 15H or 21H Inverters.

W (Position to Zero)

This command positions the control to the absolute ZERO position as defined with the **Z** command. The command moves at the defined positioning "speed" as set by a **v** command. This is **NOT** the same as the **H** (Home) command.

Note: **This command is not available for Series 15H or 21H Inverters.**

Z (Set Current Position to Zero)

This command sets the current position to zero. It is to be used only with positioning commands.

Note: This command is not available for Series 15H or 21H Inverters.

Section 7

Communication Using a Modem

Series H Controls Remote Modem Setup

⚠ WARNING: Use extreme care when in the Remote mode. You can gain complete control of the Series H control and motor operation from any phone line available. You can initiate an operation that could be hazardous to personnel or equipment from a remote location. Baldor assumes no liability for use, installation or application of the information contained in this document.

You must have a PC compatible computer to configure the modem. You will temporarily connect the modem to the computer, configure the modem then install the modem at the Series H control.

Modem Type: US Robotics Sportster 28,800 (External).

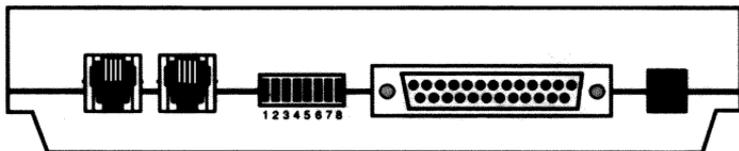
Modem Setup: Stand alone operation setup (3 wire interface).

A three wire interface consists of Receive data, Transmit data, and ground. Hardware flow control is not supported. Use the following steps to setup the modem for software flow control.

Set Modem Switches (*Switches are located on rear panel.*)

1. Rotate modem so rear panel faces you Figure 7-1. (Table 7-1 defines the function of each switch.)
2. Set switches 1 - 8 as follows:
1 & 2 = Down 4 = Down 8 = Down
3 = Up 5, 6 & 7 = Up

Figure 7-1 Modem Rear Panel



-
3. Temporarily set Switch 7 Down to prevent loading defaults at power up.
 4. Connect the modem to your computer and AC power as instructed in the modem manual. You must have communications software loaded on your computer to perform this procedure.
 5. Start your communications software and download the following commands to the modem (make a software flow control template and disable flow control):
AT&F2&W<ENTER>
AT&H0<ENTER>
AT&K0<ENTER>
AT&W0<ENTER>
 6. Turn modem power OFF then back ON to load the changes.
 7. Set Switch 7 UP to its normal position. The modem is now ready to use.

Note: You only need to do this procedure during the initial installation and if the modem is replaced with a different modem for some reason.

Table 7-1 Modem Switch Settings

| DIP Switch | Position | Description (Applies to US Robotics Sportster 28,800 Only) |
|-------------------|-----------------|--|
| 1 | Down | Data Terminal Ready; Down – override DTR |
| 2 | Down | Result Codes; Down – Numeric Codes |
| 3 | Up | Result Codes; Up – Suppress Codes |
| 4 | Down | Off-line Commands; Down – No echo commands |
| 5 | Up | Auto Answer; Up – On first ring (or more if set in RAM) |
| 6 | Up | Carrier Detect; Up – Normal |
| 7 | Up | Load Defaults; Up – Load NV RAM defaults |
| 8 | Down | Smart/Dumb Mode; Down – Smart Mode |

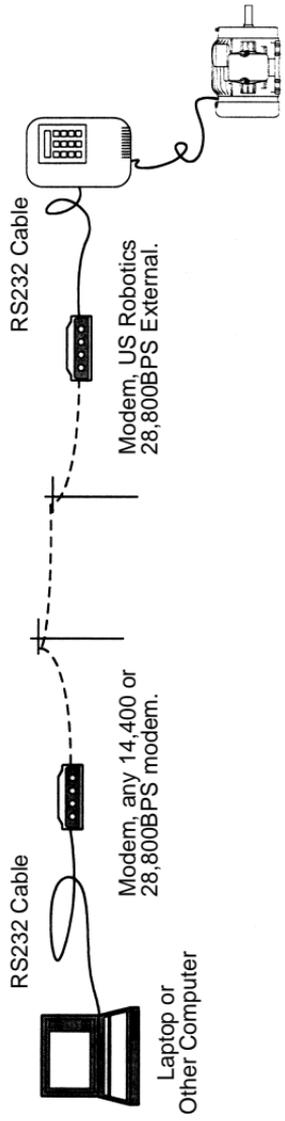
-
8. Turn OFF modem power.
 9. Disconnect the modem from your computer.
 10. Connect the modem to the RS232 port of the Series H control.
 11. Connect the phone line to the modem Phone Jack.
 12. Apply power to the modem. The modem is now ready to auto answer.

 **WARNING:** Use extreme care when in the Remote mode. You can gain complete control of the Series H control and motor operation from any phone line available. You can initiate an operation that could be hazardous to personnel or equipment from a remote location.

Baldor assumes no liability for use, installation or application of the information contained in this document.

You may communicate with the drive from any where in the world. Use the instructions located in this manual to set parameter values and operate the control. You should always call someone at the site to inform them to keep personnel away from the drive during your remote testing.

Auto answer modems from other manufacturers may be used as long as they are configured in a similar manner as outlined in these instructions.





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Serial Command Language

All commands are entered as ASCII characters followed by Enter key (hex 0D).
Enter = “End of Line” character
The Backspace (hex 08 or Control-H) deletes character to left.
Control-X (hex18) deletes the line the cursor is on.

“Protected Commands” require the control to be in the Serial Operating Mode.

All commands are case sensitive (uppercase and lowercase).

ACK_ON

This command reports the total character string received.

Note: **This command is not available for Vector, DC or Servo controls.**

ACK_OFF

This command turns off the “ACK_ON” command.

Note: **This command is not available for Vector, DC or Servo controls.**

Ax(Address) Multi-Drop Command

In multi-drop systems, selects the control at address x (0-31).
Normally address 0 unless another address is given.

AA(Address All) Multi-Drop Command

Used in multi-drop systems to direct a command(s) to ALL controls.

AUn (Auto-Tune) Protected Command

Note: The **CALC** command **MUST** be given before running the auto-tuning tests.

For Auto-Tune, the control must be externally enabled (pin 8 of the terminal strip. AU1-AU6 can be commanded. The test will either pass or fail. If the test fails, refer to the control manual.

Note: **This command is not available for Series 15H or 21H Inverters.**

C (Clear)

This command clears an existing fault. The control will resume operation if an **E** command (Enable) is given and no faults are present.

CALC

Calculates values for specific parameters based on motor rating values. Motor rating information must be programmed into control using the operator keypad or “**P**” serial command before **CALC** command is run. The **CALC** command must be given before the auto-tune tests are run.

Note: **This command is not available for Series 15H or 21H Inverters.**

D (Disable) Protected command

Disables control output.

Note: The current status of the control can be retrieved by using the **ST** (STATUS) command.

DL (Download)

Begins the download of all parameters for the current parameter table. Download to the host using XMODEM protocol. Control-X cancels the procedure.

E (Enable) Protected command

Enables control output. External enables at control terminal strip must be closed and control must be in Serial Operating Mode.

For safety reasons the control will not be Enabled unless a valid **Vnnnn**, **Tnnnn** or **Mxxxxx** command was previously issued.

Note: The current status of the control can be retrieved by using the **ST** (STATUS) command.

ECHO_ON

Turns on the echo character function. (Preset to do so when not in multi-drop).

ECHO_OFF

Turns off the echo character function. (Preset to do so when in multi-drop).

F (Fault)

This command returns the current fault code. 0 = no fault.

GO (Process Target Register Command)

Processes commands stored in target register. See **TAR**.

H (Home) Protected Command

Commands the drive to the home position.

Note: **This command is not available for Series 15H or 21H Inverters.**

HF (Help Fault)

Returns the current fault code with a text definition of the fault.

| Fault Code | Description | Fault Code | Description | Fault Code | Description |
|------------|---------------------|------------|-----------------------|------------|--------------------|
| 0 | No Faults | 10 | Logic Supply Fault | 20 | User Fault Text |
| 1 | Line Regen Fault | 11 | Overcurrent Fault | 21 | Lost User Data |
| 2 | Encoder Loss | 12 | DC Bus High | 22 | µP Reset Fault |
| 3 | Invalid Base ID | 13 | Following Error | 23 | Memory Fault |
| 4 | Low Init. Bus Volts | 14 | Torque Prov-ing Fault | 24 | Overload 1-Minute |
| 5 | Regen R Power Fault | 15 | DC Bus Low | 25 | Inverter Base ID |
| 6 | Current Sense Fault | 16 | Overload 3-Seconds | 26 | New Base ID |
| 7 | Power Base Fault | 17 | Overspeed Fault | 27 | No EXB Installed |
| 8 | Ground Fault | 18 | External Trip | 28 | Power Module Fault |
| 9 | Resolver Loss | 19 | Int Over-Temp Fault | | |

HL (Help Log)

Reports last 15 faults with time stamps.

HP or HPxxxx or HPxxxx nnnn (Help Parameters)

1. **HP** lists all parameters with a text description of the parameter and the current parameter setting.
2. **HPxxxx** gives description and current setting of a single parameter, where xxxx is the parameter number.
3. **HPxxxx nnnn**, causes parameter **xxxx** to be changed to value of **nnnn**.

ID (Power Base ID)

Llists power base settings with control bus volts, current scaling and control temperature.

IO (I/O Status)

Displays current state of all terminal strip I/O connections. For pins 2, 4, and 5; 0 = -10 V, 512 = 0V and 1024 = 10 V.

For pins 6 and 7; 0 - 256 = 0-5V.

Jx (Jog) Protected command

Jogs the motor. (**J+** or **J-**) sets jog direction. **JS** will stop the jog command.

L (Log)

Displays the last 31 faults with time stamps. See also **HL**.

M or Mxxxx (Absolute Move) Protected command

M command by itself returns the last position command.

Mxxxxx command causes the control to enter position mode and move to the absolute position of **xxxxx** encoder counts relative to the **Z** (zero) position. **xxxxx** is an absolute position (signed) and a maximum value of **xxxxx** is $2^{31}-1$ encoder counts.

Note: **This command is not available for Series 15H or 21H Inverters.**

m or mxxxxx (Incremental Move) Protected command

The **m** command can be used in two ways:

1. **m** command returns the last position command.
2. **mxxxxx** causes the control to enter position mode and move **xxxxx** encoder counts relative to the current position. Maximum value of **xxxxx** is $2^{31}-1$ encoder counts.

Note: **This command is not available for Series 15H or 21H Inverters.**

NULL

Clear the Target Register for Inverters.

Note: **This command is not available for Vector, DC or Servo controls.**

Ox (Report)

Displays present values according to the following:

- 1 = RPM 5 = % Rated Load
- 2 = HZ 6 = Analog Input (+/- 4096)
- 3 = Motor Vrms 7 = Opto-Outputs (0 - 15)
- 4 = Motor Arms 8 = Absolute Position from Zero
- 9 = User Scaled Display

*Opto-output (7) reports a 4 bit word.

| Decimal Number | 4 Bit Word 2 ⁰ , 2 ¹ , 2 ² , 2 ³ | Output Status |
|----------------|---|----------------------------|
| 0 | 0000 | No outputs are on. |
| 1 | 1000 | Output #1 is on. |
| 2 | 0100 | Output #2 is on. |
| 3 | 1100 | Output #1 and 2 are on. |
| 4 | 0010 | Output #3 is on. |
| 5 | 1010 | Output #1 and 3 are on. |
| 6 | 0110 | Output #2 and 3 are on. |
| 7 | 1110 | Output #1, 2 and 3 are on. |
| 8 | 0001 | Output #4 is on. |
| 9 | 1001 | Output #1 and 4 are on. |
| 10 | 0101 | Output #2 and 4 are on. |
| 11 | 1101 | Output #1, 2 and 4 are on. |
| 12 | 0011 | Output #3 and 4 are on. |
| 13 | 1011 | Output #1, 3 and 4 are on. |
| 14 | 0111 | Output #2, 3 and 4 are on. |
| 15 | 1111 | All outputs are on. |

P or Pxxxx or Pxxxx nnnn Protected command

- P** command displays a list of all parameter values.
- Pxxxx** displays the current value of parameter **xxxx**.
- Pxxxx nnnn**, parameter **xxxx** is changed to value **nnnn**.

S (STOP) Protected command

Issues an ALL STOP to the control.

SCxxxx (Security Code)

Lock/unlock serial commands, **xxxx** =Security Code.

ST (STATUS)

Displays control status: 0 = Disabled ,1 = Enabled, or 2 = Fault

STATUS (FULL STATUS)

Displays listing of serial mode variables and status.

T or Tnnnn (Torque command) Protected command

- T** command displays the last torque command given.
- Tnnnn** commands torque mode with control current limit (± 2048 = the control current limit, ± 1024 = 1/2 control current limit. + or - values cause direction to reverse).

Note: **This command is not available for Series 15H or 21H Inverters.**

TAR xxxx (Target Register)

Store a command in Target Register

TP (Test Points)

Display test point data in the buffer.

P3001 (channel 1) and P3002 (channel 2) as follows:

- 0 = Velocity 8 = Field Weaken 16 = Speed Command
- 1 = Elec Angle 9 = Following ERR 17 = Overload Accum
- 2 = ABS Command 10 = Quad Control 18 = Phase 2 Current
- 3 = PWM Voltage 11 = Direct Control 19 = Phase 3 Current
- 4 = Direct Current 12 = AC Voltage 20 = Position
- 5 = CMD Direct CUR 13 = Bus Voltage 21 = Serial Command
- 6 = Quad Current 14 = Vector Angle 22 = Delta Count
- 7 = CMD Quad CUR 15 = Power

Note: **Not all of the variables listed are used with the Series 15H and 21H Inverters.**

TPF (Test Point File)

Download all the test points to a host computer file.

TPT (Test Point Trigger)

The test point buffer is filled for 255 points after the next "Enter".

UL (Upload)

Upload from host using XMODEM protocol. Control-X cancels.

V or Vnnnn (Velocity Command) Protected command

- V** displays the last velocity command.
- Vnnnn** enters the velocity mode at that RPM or Hz.
+ or - values cause direction to reverse.

v or vxxxx (Positioning Speed)

vxxxx changes the maximum speed used in positioning commands. Where **xxxx** is a velocity value.

W (Position to Zero)

Positions the drive to the absolute ZERO position (Z).

Note: **This command is not available for Series 15H or 21H Inverters.**

Z (Set Current Position to Zero)

This command sets the current position to zero. It is to be used only with positioning commands.

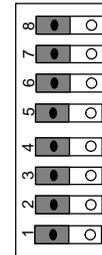
Note: **This command is not available for Series 15H or 21H Inverters.**

RS-232 Switch Settings

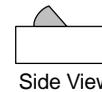
| Description | Switch Number | | | | | | | |
|-------------|---------------|-----|---|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| E, 7, 1 | OFF | OFF | | ON | OFF | OFF | OFF | OFF |
| N, 8, 1 | OFF | OFF | | OFF | OFF | OFF | OFF | OFF |
| 1200 Baud | ON | OFF | | OFF | OFF | OFF | OFF | OFF |
| 4800 Baud | OFF | ON | | OFF | OFF | OFF | OFF | OFF |
| 9600 Baud | OFF | OFF | | OFF | OFF | OFF | OFF | OFF |
| 19200 Baud | ON | ON | | OFF | OFF | OFF | OFF | OFF |

DIP Switch

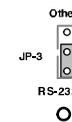
ON OFF



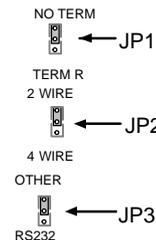
All switches shown in OFF position.



RS232
EXB001A01



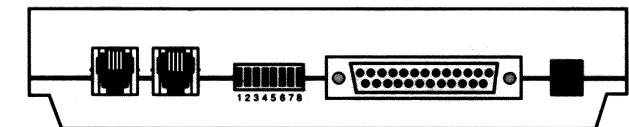
RS422/485
EXB002A01



RS-422/485 Switch Settings

| Description | Switch Number | | | | | | | |
|--------------|---------------|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Address 0 | OFF | OFF | OFF | OFF | OFF | | | |
| Address 1 | ON | OFF | OFF | OFF | OFF | | | |
| Address 2 | OFF | ON | OFF | OFF | OFF | | | |
| Address 3 | ON | ON | OFF | OFF | OFF | | | |
| Address 4 | OFF | OFF | ON | OFF | OFF | | | |
| Address 5 | ON | OFF | ON | OFF | OFF | | | |
| Address 6 | OFF | ON | ON | OFF | OFF | | | |
| Address 7 | ON | ON | ON | OFF | OFF | | | |
| Address 8 | OFF | OFF | OFF | ON | OFF | | | |
| Address 9 | ON | OFF | OFF | ON | OFF | | | |
| Address 10 | OFF | ON | OFF | ON | OFF | | | |
| Address 11 | ON | ON | OFF | ON | OFF | | | |
| Address 12 | OFF | OFF | ON | ON | OFF | | | |
| Address 13 | ON | OFF | ON | ON | OFF | | | |
| Address 14 | OFF | ON | ON | ON | OFF | | | |
| Address 15 | ON | ON | ON | ON | OFF | | | |
| Address 16 | OFF | OFF | OFF | OFF | ON | | | |
| Address 17 | ON | OFF | OFF | OFF | ON | | | |
| Address 18 | OFF | ON | OFF | OFF | ON | | | |
| Address 19 | ON | ON | OFF | OFF | ON | | | |
| Address 20 | OFF | OFF | ON | OFF | ON | | | |
| Address 21 | ON | OFF | ON | OFF | ON | | | |
| Address 22 | OFF | ON | ON | OFF | ON | | | |
| Address 23 | ON | ON | ON | OFF | ON | | | |
| Address 24 | OFF | OFF | OFF | ON | ON | | | |
| Address 25 | ON | OFF | OFF | ON | ON | | | |
| Address 26 | OFF | ON | OFF | ON | ON | | | |
| Address 27 | ON | ON | OFF | ON | ON | | | |
| Address 28 | OFF | OFF | ON | ON | ON | | | |
| Address 29 | ON | OFF | ON | ON | ON | | | |
| Address 30 | OFF | ON | ON | ON | ON | | | |
| Address 31 | ON | ON | ON | ON | ON | | | |
| Full Duplex | | | | | | | | OFF |
| Half Duplex | | | | | | | | ON |
| 9600 Baud | | | | | | OFF | OFF | |
| 19,200 Baud | | | | | | ON | OFF | |
| 38,400 Baud | | | | | | OFF | ON | |
| 115,200 Baud | | | | | | ON | ON | |

US Robotics Modem Rear Panel



Set switches 1 - 8 as follows:

- 1 & 2 = Down 3 = Up 4 = Down
- 5, 6 & 7 = Up 8 = Down