Modbus Plus
Expansion Board

Catalog No. EXB015A01

Installation and Operating Manual

8/03 MN1322

Table of Contents

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

Group 1 Board Name	**Catalog No.**	**Manual No.**
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
Profibus	EXB014A0X	MN1323
Modbus Plus	EXB015A0X	MN1322

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

The Modbus Plus expansion board is a Group 2 expansion board. It allows a Series H control to communicate as a node on the Modbus Plus network. It has a DB9 connector to make connection to the network simple.

Group 2 board
Modbus Plus Expansion Board
Catalog No. EXB015A01

A good resource document is the “Modicon Plus Network Planning and Installation Guide”. Refer to that guide for planning your network and details such as cable specifications etc.

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).

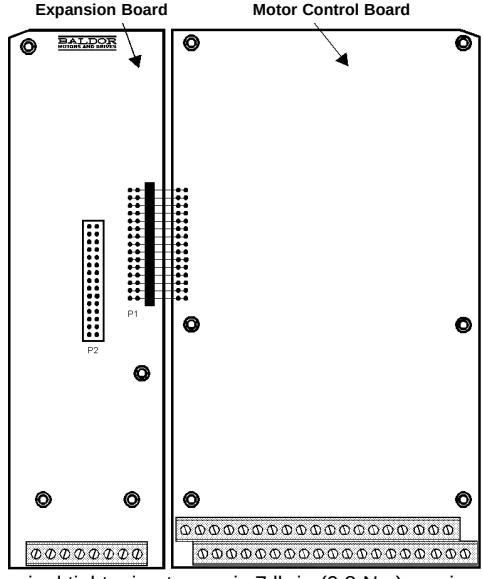
Single Expansion Board Installation

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.

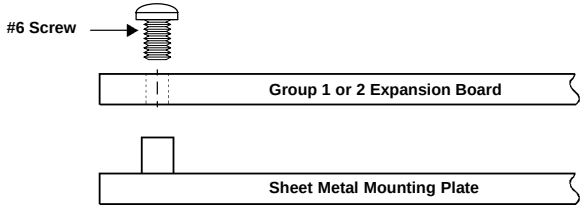
Single Expansion Board Installation (Continued)

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:

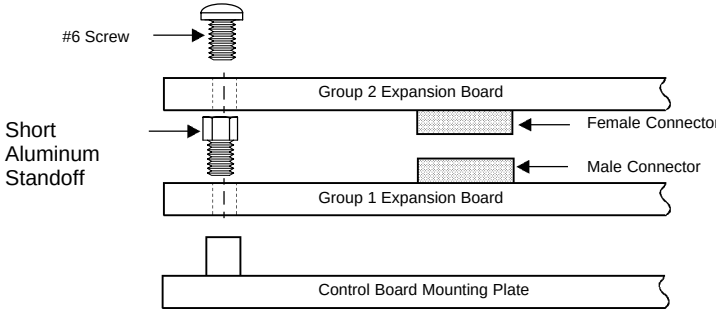
1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control.
3. Wait at least 5 minutes for internal capacitors to discharge.
4. Remove the four (4) Phillips head screws ($^1/_4$ turn) that secure the control cover. (For A & B size, remove four screws that secure 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)

12. 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).
13. Restore all power sources to the control.
14. Restore drive operation.

Figure 3-3 Dual Expansion Board Installation



Section 4
Hardware Setup

A good resource document is the “Modicon Plus Network Planning and Installation Guide”. Refer to that guide for planning your network and details such as cable specifications etc.

DIP Switch Settings

This procedure will configure the Modbus Plus Expansion Board for communication with a computer or terminal. Reference Figure 4-1 and Table 4-1 for the following procedure.

1. Set DIP switches 1 through 6 for the desired board address.
2. Switches 7 and 8 are not used and may be left in either position.
3. Be sure a jumper is installed at J1.
4. Be sure no jumper is installed at J3 or J4.
5. Install the expansion board in the Series H control as instructed in Section 3 of this manual.

Note: The switch settings can be changed after the board is powered up. However, switch changes will not take effect until the board is reset (by turning power off then on).

Cable Connection

Connect the Modbus cable to the DB 9 connector on the expansion board (shown in Figure 4-1).

Powerup

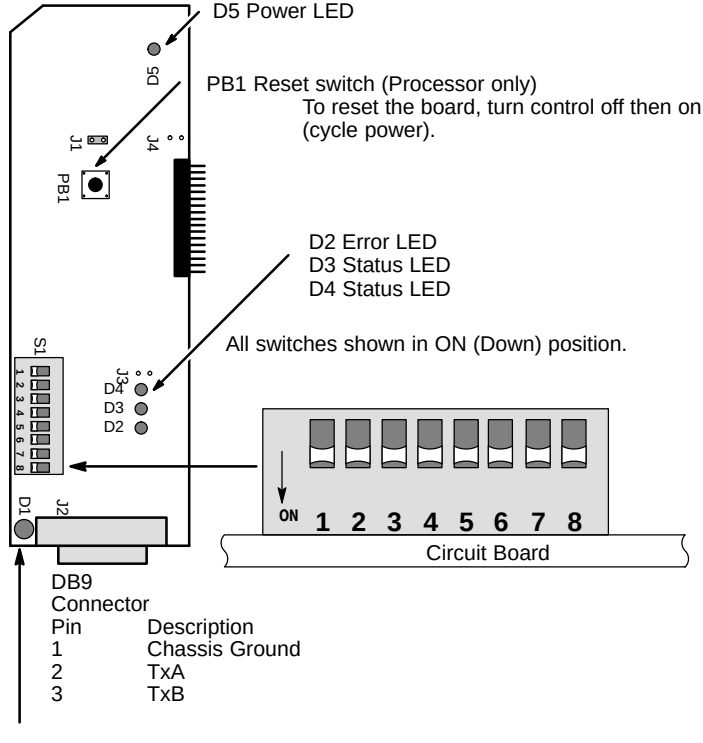
When the Modbus Plus expansion board is powered up it will do the following:

1. Perform a self test.
2. Check the switch settings for configuration information.
3. Verify communications with the Series H control board.
4. Check for power from the Series H control.
5. Perform a duplicate ID (address) check to determine if any other devices on the network have the same ID number.
6. Go online.

Refer to the LED description in this section of the manual.

Figure 4-1 Board Configuration

Modbus Plus Expansion Board Catalog No. EXB015A01



DB9 Connector

Pin	Description
1	Chassis Ground
2	TxA
3	TxB

D1 Modbus Plus Status LED

Table 4-1 Switch Settings

Modbus Plus Address	S1 Switch Position					
	1	**2**	**3**	**4**	**5**	**6**
1	0	0	0	0	0	0
2	1	0	0	0	0	0
3	0	1	0	0	0	0
4	1	1	0	0	0	0
5	0	0	1	0	0	0
6	1	0	1	0	0	0
7	0	1	1	0	0	0
8	1	1	1	0	0	0
9	0	0	0	1	0	0
10	1	0	0	1	0	0
11	0	1	0	1	0	0
12	1	1	0	1	0	0
13	0	0	1	1	0	0
14	1	0	1	1	0	0
15	0	1	1	1	0	0
16	1	1	1	1	0	0
17	0	0	0	0	1	0
18	1	0	0	0	1	0
19	0	1	0	0	1	0
20	1	1	0	0	1	0
21	0	0	1	0	1	0
22	1	0	1	0	1	0
23	0	1	1	0	1	0
24	1	1	1	0	1	0
25	0	0	0	1	1	0
26	1	0	0	1	1	0
27	0	1	0	1	1	0
28	1	1	0	1	1	0
29	0	0	1	1	1	0
30	1	0	1	1	1	0
31	0	1	1	1	1	0
32	1	1	1	1	1	0
33	0	0	0	0	0	1
. . .	. . .	. . .	. . .	. . .	. . .	. . .
63	1	1	1	1	1	1

LED Indicators

Five LED's are located on the Modbus Plus expansion board (see Figure 4-1 for their locations).

D1 Modbus Plus Status LED

D1 displays the operational status of the Modbus Plus Interface expansion board (EXB). When power is first applied, the LED will pause, then flash slowly 8 times while it checks the network. If a valid Modbus Plus connection is established, D1 will flash continuously. Otherwise, it flash an error code as shown in Table 4-2.

Table 4-2

LED State	Status Description
OFF	No power is applied to the EXB.
2 Flashes then pause	The network is active, but the token is never passed to this node. The node may have a bad transmitter.
3 flashes then pause	No other nodes on the network.
4 flashes then pause	Duplicate node numbers on the network.

D2 Error LED

D2 will flash 4 times then pause if any errors are encountered that would prevent correct operation of the board. If this error occurs, turn the control off, then on (cycle power). If error continues, the trouble could be the expansion board, motor control board, or software version. Correct the problem as required, and if the error remains, contact Baldor.

D3 and D4 Status LED

D3 will flash to indicate that firmware is correctly loaded and running. D4 will flash to indicate that the interface circuits between Modbus Plus expansion board and the Series H control is running correctly. These LEDs flash at different rates and, if flashing, indicate proper operation.

D5 Power LED

D5 indicates that the expansion board is receiving power from the Series H control.

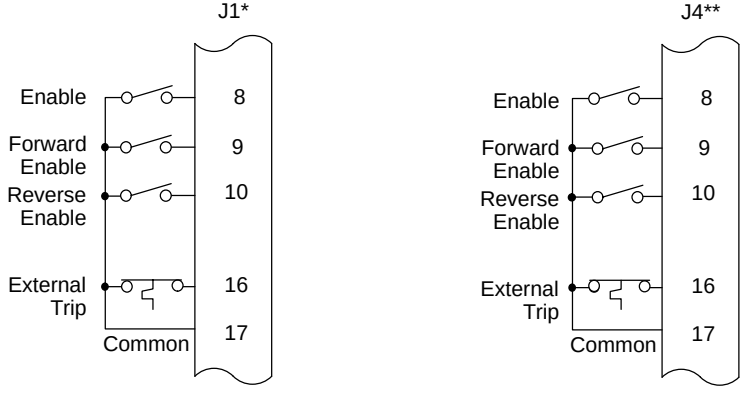
Control Terminal Strip Connections

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 4-2. 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 4-2 Serial Opto Input Connections



* Series 18H, 22H and 23H controls.
** Series 15H and 21H controls.

Section 5
Register Map for Modbus Plus

Configure Control Software for Modbus Plus Mode

The Series H control operating mode must be set to Serial to use the Modbus Plus expansion board. There is no selection for Modbus Plus on the Level 1 Input block Operating mode parameter list. However, selecting Serial with the Modbus Plus expansion board installed will allow operation of the Modbus Plus board.

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

Note: The firmware version of the Series H control must support the Baldor Binary Protocol (BBP). To confirm that BBP is supported, perform the following:
Scroll to the Level 2 Communications block, and view the selections. If RS485BBP is available, the software version is compatible with the Modbus Plus expansion board. Otherwise, contact Baldor to obtain a software update.

During power up, the control checks if the communication board is installed. If an RS485 board is installed, the RS485BBP protocol is automatically selected during power up.

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	

Action	Description	Display	Comments
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 ▲ or ▼ key	Scroll to Level 2 blocks	PRESS ENTER FOR LEVEL 2 BLOCKS	
Press ENTER key	Select Level 2 blocks.	PRESS ENTER FOR OUTPUT LIMITS	First screen in Level 2 block
Press ▲ or ▼ key	Scroll to Communications block	PRESS ENTER FOR COMMUNICATIONS	
Press ENTER key	Select Level 2 Communications block.	PROTOCOL p: RS232 ASCII	
Press Enter key	Flashing cursor indicates mode can be changed	PROTOCOL ⇳□ RS232ASCII	
Press ▲ or ▼ key	Scroll to RS 485 BBP (Baldor Binary Protocol)	PROTOCOL ⇳□ RS485BBP	
Press ENTER key	Select RS 485 BBP mode.	PROTOCOL p: RS485BBP	
Press ▲ or ▼ key	Scroll to Exit Menu	PRESS ENTER FOR MENU EXIT	
Press DISP key	Returns to Display mode.	STP MOTOR SPEED LOCAL 0RPM	Display mode.
Press LOCAL key	Changes to Serial Operation.	STP MOTOR SPEED SERIAL 0RPM	Ready for Modbus Plus operation.

Note: The 15H control does not have a Command Select “Serial”, this is not needed for this control.

The control is now configured for Modbus Plus mode and the Host software can now be setup.

Data Exchange with the Modbus Plus Expansion Board

This section describes the register interface used for data exchange with the Series H control. Motor drive parameters are mapped to Modbus Plus "Data/Holding" registers (4xxxx). Parameters can be read from or written to the Series H control by reading from or writing to the appropriate Modbus Plus registers.

Common Area Register Mapping (All Series H Controls)

Register Address	T#	Read/Write	Description
40001	–	Read/Write	Watchdog polling flag (see Note 4)
41000	0	Write Only	Null Transaction (see Note 3)
41001–43999	61	Read/Write	Baldor Control Parameters 1001–3999 (see Baldor Drive Installation & Operating Manual)
44000–46999		–	Reserved for additions.
49012	41	Read/Write	Watchdog Time (0=disable) (10 ms minimum for vector) (1 sec. minimum for inverter) (see Note 3)

For 15Hand 21H Inverter controls, use the following registers for communication. For all other H controls, use the Standard Series H Area Register Mapping.

Series 15H Specific Area Register Mapping

Register Address	T#	Read/Write	Description
47000	31	Read Only	Terminal Strip (see NOTE 1)
47001	45	Read Only	Fault Status (0=no fault present)
47002	17	Read Only	Current Actual (100mA RMS)
47003	18	Read Only	Speed Actual (RPM)
47004	19	Read Only	Frequency Actual (.1 Hz)
47005	33	Read Only	Software Revision (ex S15–4.03 is returned as 403)
47006	34	Read Only	Product Series (ex Series 15H returns 15)
47007	35	Read Only	Product Class (5=H)
47008 [1]	1	Read/Write	Run Cmd (0=stop, 1=fwd, 2=rev, 3=bipolar)
47009	5	Read/Write	Command Mode (see NOTE 2)
47010	6	Read/Write	Hz Speed Ref
47011	3	Read/Write	Control Source (0=keypad, 1=terminal strip, 2=network)
47012			Reserved
47013	75	Write Only	Digital Output
47014	46	Write Only	Fault Reset (1=execute fault reset)

Notes:

After the fault is cleared (1=execute fault reset), you must send a stop (run cmd=0) followed by the direction for the run command again. Otherwise, the motor will not run.

[1] To use register 47008, you must jumper terminals J4–8, J4–9, J4–10 and J4–17 together to allow the motor to run.

Standard Series H Area Register Mapping (except 15H and 21H controls)

Register Address	T#	Read/Write	Description
48000	17	Read Only	Current Actual (100mA RMS)
48001	18	Read Only	Speed Actual (RPM)
48002	19	Read Only	Frequency Actual (.1 Hz)
48003	20	Read Only	Power Actual (Watts)
48004	21	Read Only	Input Voltage (Volts RMS)
48005	22	Read Only	Output Voltage (Volts RMS)
48006	24	Read Only	Motor Direction (0=fwd,1=rev)
48007	25	Read Only	Zero Speed (1=at zero)
48008	26	Read Only	At Speed (1=at commanded speed)
48009	27	Read Only	Warning (1=warning)
48010	28	Read Only	At Position (1=at position)
48011	29	Read Only	At Setpoint (1=at setpoint)
48012	30	Read Only	At Set Speed (1=at set speed)
48013	31	Read Only	Terminal Strip (see NOTE 1)
48014	71	Read Only	Analog Input 1
48015	72	Read Only	Analog Input 2
48016	73	Write Only	Analog Output 1
48017	74	Write Only	Analog Output 2
48018	75	Write Only	Digital Output
48019	33	Read Only	Software Revision (ex S15–4.03 is returned as 403)
48020	34	Read Only	Product Series (ex Series 15H returns 15)
48021	35	Read Only	Product Class (5=H)
48022	36	Read Only	Option Id 1
48023	37	Read Only	Option Id 2
48024	38	Read Only	Run Time (low order)
48025	38	Read Only	Run Time (high order)

Standard Series H Area Register Mapping Continued

Register Address	T#	Read/Write	Description
48100	6	Read/Write	Hz Speed Ref
48101	7	Read/Write	Speed Ref (RPM)
48102	8	Read/Write	Speed Ref (High resolution – 1/256 RPM) (low order)
48103	8	Read/Write	Speed Ref (High resolution – 1/256 RPM) (high order)
48104	9	Read/Write	Torque Ref (±15 bits = programmed current limit)
48105	10	Read/Write	Process Ref (±14 bits = full scale)
48106	11	Read/Write	Process Feedback (±14 bits = full scale)
48107	12	Read/Write	Position Ref (scaling=quadrature counts) (low order)
48108	12	Read/Write	Position Ref (scaling=quadrature counts) (high order)
48109	13	Read/Write	Position Speed (RPM)
48110	14	Read/Write	Position Feed Fwd
48111	15	Read/Write	Position (scaling=quadrature counts) (low order)
48112	15	Read/Write	Position (scaling=quadrature counts) (high order)
48113	16	Read/Write	Home Offset (low order)
48114	16	Read/Write	Home Offset (high order)
48120	52	Write Only	Calc Presets (1=execute preset calculation)
48121	53	Read/Write	Auto Tune Mode (0=no test/cancel test)
48122	54	Read Only	Auto Tune Data
48123	55	Read Only	Auto Tune Status (0=failed, 1=pass, 2=running)

Standard Series H Area Register Mapping Continued

Register Address	T#	Read/Write	Description
49000 [1]	1	Read/Write	Run Cmd (0=stop, 1=fwd, 2=rev, 3=bipolar)
49001	2	Write Only	Run Inhibit (1=stop, regardless of Control Source)
49002	3	Read/Write	Control Source (0=keypad,1=terminal strip,2=network)
49003	5	Read/Write	Command Mode (see NOTE 2)
49004	4	Read Only	Control State (0=not ready, 1=ready, 2=enabled, 3=stopping, 4=faulted
49005	45	Read Only	Fault Status (0=no fault present)
49006	46	Write Only	Fault Reset (1=execute fault reset)
49007	49	Write Only	Force Fault (0–1=force network fault)
49008	50	Read Only	Security Status (0=disabled, 1=unlocked, 2=locked)
49009	51	Write Only	Security Lock (valid code unlocks, any other locks)
49010	39	Read/Write	Table Select (parameter table select 0–3)
49011	40	Read/Write	Acc/Dec Group (1–2)
49012	41	Read/Write	Watchdog Time (0=disable) (10 ms minimum for vector) (1 sec. minimum for inverter) (see NOTE 3)

Note:

[1] To use register 49000, you must jumper terminals J1–8, J1–9, J1–10 and J1–17 together to allow the motor to run.

Note 1: Terminal Strip

Bit	Series 18H, 22H and 23H Controls		Series 15H and 21H Controls	
	Name	Terminal Number	Name	Terminal Number
15		Not Used		Not Used
14		Not Used		Not Used
13		Not Used		Not Used
12	Input 1	J1–8	Input 1	J4–8
11	Input 2	J1–9	Input 2	J4–9
10	Input 3	J1–10	Input 3	J4–10
9	Input 4	J1–11	Input 4	J4–11
8	Input 5	J1–12	Input 5	J4–12
7	Input 6	J1–13	Input 6	J4–13
6	Input 7	J1–14	Input 7	J4–14
5	Input 8	J1–15	Input 8	J4–15
4	Input 9	J1–16	Input 9	J4–16
3	Output 1	J1–19	Output 1	J4–19
2	Output 2	J1–20	Output 2	J4–20
1	Output 3	J1–21	Output 3	J4–21
0	Output 4	J1–22	Output 4	J4–22

Note 2: Command Mode Table

Cmd	Mode	Class	Description
0	None	All	No mode selected. Output stage of control remains off or disabled (voltage and current removed from the motor), regardless of Run Cmd condition.
1	Torque CMD selected source	S, V	Closes the current loop with command input from the source selected in the COMMAND SELECT parameter.
2	Torque CMD network	S, V	Closes the current loop with command input from the Torque Ref. register.
3	Speed CMD selected source	All	Closes the velocity loop with command input from the source selected in the COMMAND SELECT parameter.
4	Speed CMD network	All	Closes the velocity loop with command input from the Speed Ref. register.
5	Orient	S, V*	C or Index channel orient. The motor will be commanded in the Fwd direction at the predefined homing speed until the index pulse is detected. The motor will then be commanded to hold position at the predefined home offset.
6	Position CMD ABS	S,V*	Closes the position loop with an absolute position command from the Position Ref. register.
7	Position CMD INC	S, V*	Closes the position loop with an incremental position command from the Position Ref. register.
8			Reserved for future use.
9	Position CMD external	S, V*	Closes the position loop with command input from external option source (e.g. pulse follower exb).
10			Reserved for future use.
11	Process Torque	All	Closes the torque process control loop. Commands come from the appropriate command input parameters.
12	Process Velocity	All	Closes the velocity process control loop. Commands come from the appropriate command input parameters.
13	Auto Tune	E,S,V	Changes command mode to Auto Tune. Test conditions are controlled by Auto Tune Mode.

Class

The class field indicates the product classes that support the transaction. The product codes are as follows:

E = Encoderless Vector
I = Inverter
S = Servo
V = Vector
V* = Vector with custom software for positioning

Note 3: Network Watchdog Timer

The network watchdog timer is used by the drive to detect a communications loss. Normally, this functions as follows: On initialization/power up, the Watchdog Time = 0 (disabled). If any value other than 0 is written to the Watchdog Time, the timer activates. Thereafter, every time a network command is received, the internal timer is reset. When the time between network commands exceeds the value stored in this register, the control faults and disables the motor. The host must continuously send commands to keep the timer reset (a NULL command – a write to register 41000 – can be sent, if desired). Writing the watchdog time back to 0 disables the timer.

Note 4: Watchdog Polling Flag

If the Watchdog Polling Flag is set to 0, no automatic polling will take place. The Network Watchdog will function normally. If the Watchdog Polling Flag is set to 1, automatic polling will take place. This means that the Modbus Plus card will send NULL transactions to the Motor Drive every 20ms or so, as long as there is valid Modbus Plus communications (which means that there is at least one other Modbus Plus device on the network to pass the token to, and communications with that device are valid). This will keep the Network Watchdog timer from expiring unless the Modbus Plus network itself goes down.

H Series – Fault Message Description

Fault Message	Fault Code		Fault Description
	15H	18H	
Line Regen	1	1	Fault in Line REGEN converter unit - Series 21H Line REGEN Inverter control.
Feedback Fault		2	Loss of encoder feedback.
Invalid Base ID	3	3	Failed to read configuration from the Power Base ID value in software.
Low INIT Bus V	4	4	Low bus voltage detected on start–up.
Regen Res Power	5	5	Excessive power dissipation required by Dynamic Brake Hardware.
Current SENS FLT	6	6	Failure to sense phase current.
HW Desaturation	7	7	High output current condition detected (greater than 400% of rated output current).
HW Ground Fault	8	8	Ground Fault detected (output current leakage to ground).
Resolver Fault		9	Loss of resolver feedback.
HW Power Supply	10	10	Control Board power supply failure detected.
Overcurrent	11	11	Continuous current limit exceeded.
Bus Overvoltage	12	12	High DC Bus voltage.
Following ERR		13	Motor speed/position does not follow command.
Torque Prove		14	Unbalanced current between all 3 phases.
Bus Undervoltage	15	15	Low DC Bus voltage condition detected.
3 Sec Overload	16	16	Peak output current exceeded the 3 second rating value.
Over Speed		17	Motor RPM exceeded 110% of MAX Speed.
Motor Temp		18	Motor over temperature
Heatsink Temp	19	19	Control heatsink exceeded temperature limit.
External Trip	18	20	Connection at J1/J4 pin 16 and 17 is open.
Param Checksum	51	21	Parameter checksum error.

H Series – Fault Message Description Continued

Fault Message	Fault Code		Fault Description
	15H	18H	
µp Reset	22	22	A software watchdog timer has reset the processor because a process has timed out.
ROM Fault		23	ROM checksum error.
1 Min Overload	24	24	Peak output current exceeded the 1 minute rating value.
No I Feedback		25	Loss of current feedback
New Base ID	26	26	Control board detected a change in the Power Base ID value in software.
EXB Selection	27	27	Expansion board not installed to support the Level 1 Input Block, Command Select parameter.
Power module		28	Power module failure.
Co–processor		29	Co–processor error (i.e. DSP board).
Software Version		30	Wrong control software version detected.
Feedback Module		31	Feedback HW module failure.
Serial watchdog		32	Serial port transmit/receive error
FLT Network	33	33	Lost network communications.
Hardware Protect	54		A general hardware fault was detected but cannot be isolated.
Unknown FLT Code	55	34	Microprocessor detected a fault that is not identified in the fault code table.
Bus Current SENS	56		Failure to sense bus current.

Note These faults may be different for custom software.

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