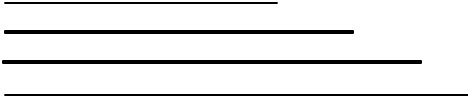


***CONTROLINC***<sup>®</sup>

**QUICK** 

***STARTUP***

***GUIDE***

**DCM 320A**



**EIM CONTROLS**

## Preface

This handy reference is a guide to help you get your system up and running quickly. Refer to the EIM wiring diagram supplied with the actuator for detailed wiring information. The first section of this guide will help you get your Controlinc actuators hooked-up and set-up correctly. If you need to change configuration of the unit, we recommend using our Windows based Configuration and Control Utility (CCU) rather than setting configuration DIP switches shown in this guide. Setting network station address DIP switches is required. The second section of this manual is the Modbus memory map reference to help configure your host database. If you are using EIM Controlinc Network Master, then refer to the manual supplied with that unit for memory maps. Section three of this manual is a brief system startup guide to help you do things in the proper order to achieve a successful system startup. The fourth section covers optional phase monitor module and optional Network Interface Unit (NIU).

## Warning

**Failure to follow instructions for proper electrical wiring, storage, setup, and maintenance may cause serious injury, damage equipment, or void the warranty. Refer to Manual E796 for instructions on storage, electrical hook-up, and maintenance.**

Revision G

Copyright © 1998  
All rights reserved.

EIM Controls  
13840 Pike Road  
Missouri City, Texas 77489

1-800-679-1561  
(281) 499-1561 FAX (281) 499-8445

EIM Controls UK Ltd.  
Suite 34, Liberty House,  
New Greenham Park,  
Newbury, Berkshire,  
RG19 6HW, England

44 (0) 1635 817 315 FAX 44 (0) 1635 817 460

[www.eim-co.com](http://www.eim-co.com)

## Step 1 Select network topology

Select desired network topology from Figures 1 and 2. Combination bus and E>Net connections may be used with all topologies. Note the ports being used (A,B,C,D).

## Step 2 Set network jumpers and switches

If selected network topology is multidrop bus, then remove network termination and bias by turning OFF S5 and S6 on the DCM 320A card. Remove jumpers JP1 and JP2 on the CAM05, if installed. Terminations must be left in the last (most distant) unit on the network. If baud rate is less than 9600, then select LOW baudrate range by turning OFF S1 thru S4 on both DCM 320A and CAM05 cards, if installed. If baud rate is greater than 28.8K baud, then turn ON S3 and S4 to select the HIGH baudrate range. S1 and S2 ON selects the normal medium baudrate range. Refer to Figure 4 for jumper and DIP switch locations.

## Step 3 Connect network wiring

Wire network ports selected in Step 1. Refer to Figure 3 when wiring Ports A and B on TBM 320A module. Refer to Figure 4 when wiring Ports C and D on the CAM05 module.

## Step 4 Connect auxiliary I/O wiring

Refer to Figure 3 when connecting discrete auxiliary I/O wiring. Note that some functions must be jumpered between screw terminals if not wired to external contacts. Some functions are selected by inserting jumpers between screw terminals. Analog I/O wiring is connected to the DCM 320A module as shown in Figure 4.

## Step 5 Set network station address

Each node (valve actuator) on the network must have a unique station address. Locate DIP switch SW1 on the DCM 320A card shown in Figure 4. Locate the desired station address on pages 1-4 and 1-5. Set the DIP switches of SW1 to the corresponding pattern shown beside the selected address. Leave address DIP switches set to this pattern.

### Notice:

We highly recommend using EIM's Windows based Configuration and Control Utility (CCU) to configure the actuators. CCU is available at [www.eim-co.com](http://www.eim-co.com) or your local EIM valve actuator distributor.

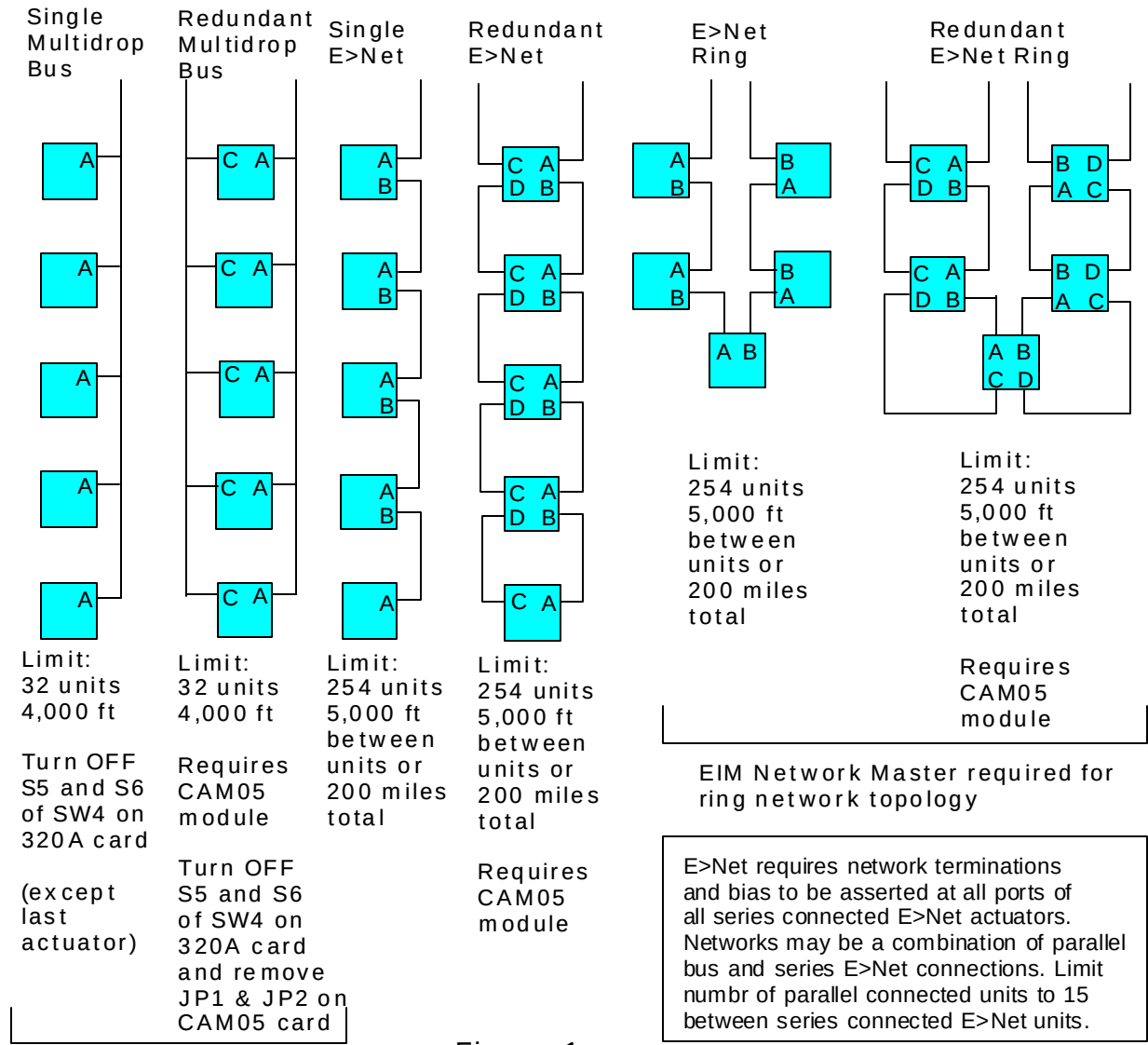
If using CCU, you may skip step 6 below.



## Step 6 Select configuration parameters

If CCU is not available, you may configure the actuator using the 10 DIP switches of SW2. This is a back-up means of configuring the unit and is not required if EIM's CCU is available. The actuator is normally shipped with factory default settings. These settings may be changed by the following procedure. Locate DIP switches SW2 and Setup Execute Button on the DCM 320A module shown in Figure 4. Select the feature or configuration parameter from the configuration tables. Set the DIP switches per the corresponding switch pattern and then press the execute button. If the configuration parameter is valid, the green (setup data good) LED will flash. If error data is entered, the red (setup data error) LED will light until the error is corrected. Repeat this procedure for each parameter to be revised. Return all DIP switches to the off position when configuration is complete.

Controlinc Model 320A  
RS485 Network Topology Options



Limits based on EIA standard for RS-485 bus networks

Figure 1

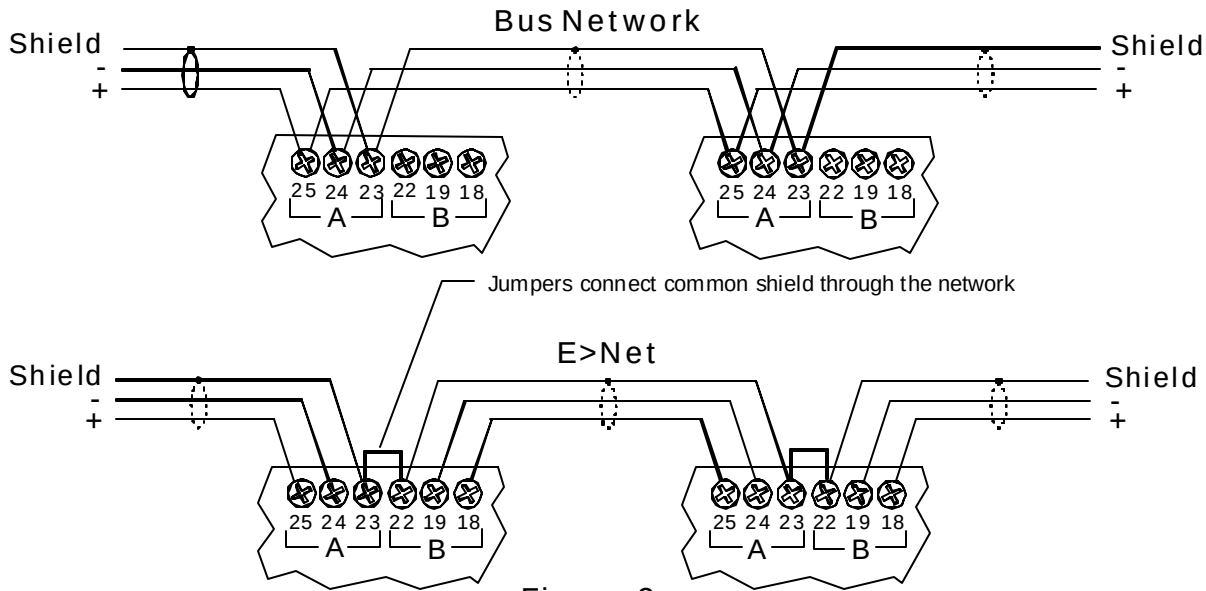


Figure 2

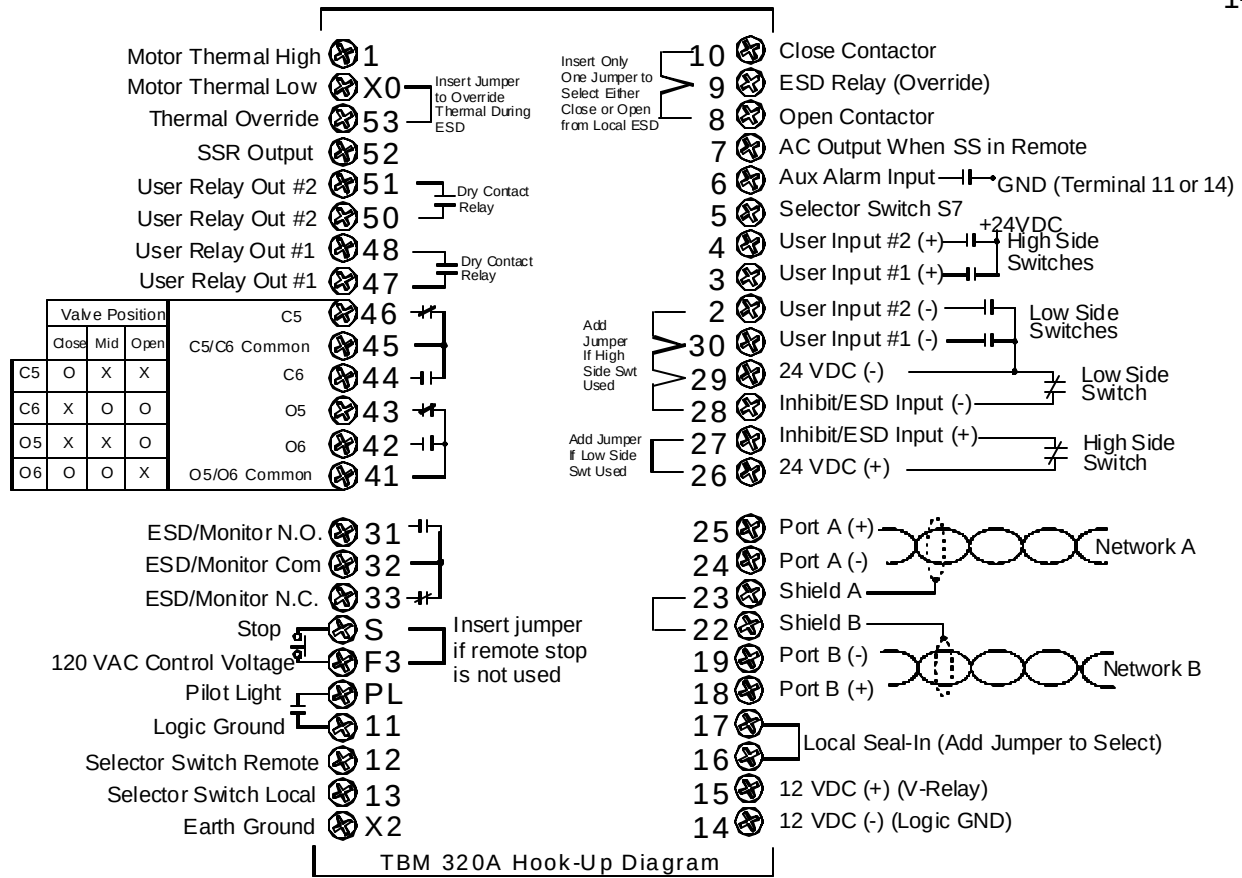


Figure 3

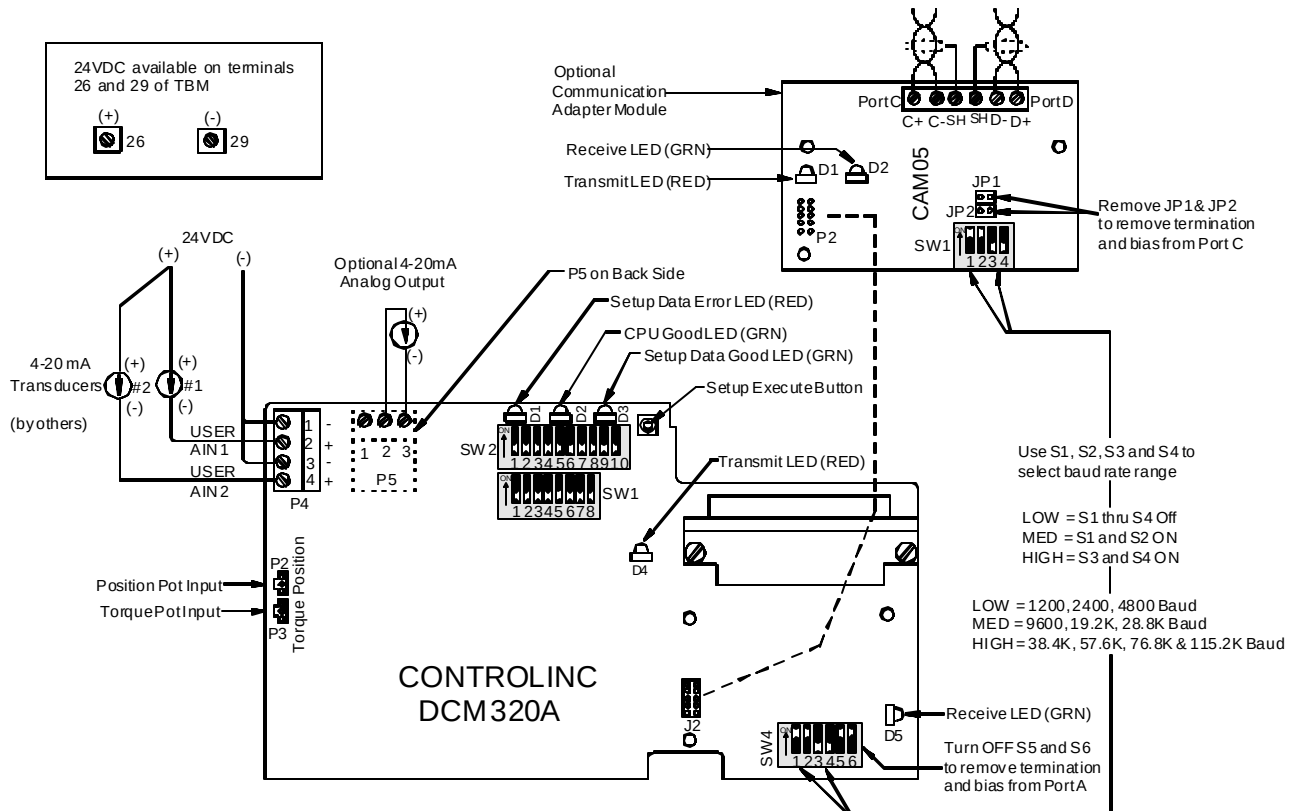
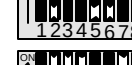
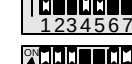
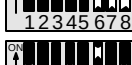
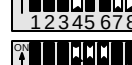
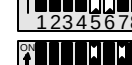
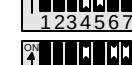
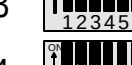
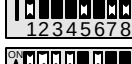
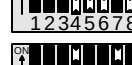
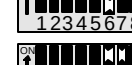
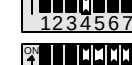
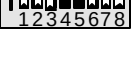
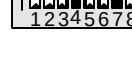
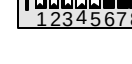
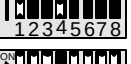
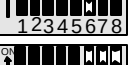
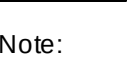
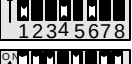
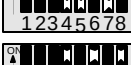
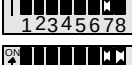
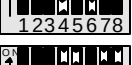
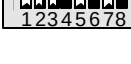
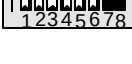
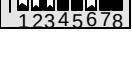
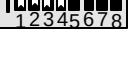


Figure 4

|                                                                                     |    |                                                                                     |    |                                                                                     |    |                                                                                     |    |                                                                                      |     |                                                                                       |     |
|-------------------------------------------------------------------------------------|----|-------------------------------------------------------------------------------------|----|-------------------------------------------------------------------------------------|----|-------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------|-----|
|    | 1  |    | 25 |    | 49 |    | 73 |    | 97  |    | 121 |
|    | 2  |    | 26 |    | 50 |    | 74 |    | 98  |    | 122 |
|    | 3  |    | 27 |    | 51 |    | 75 |    | 99  |    | 123 |
|    | 4  |    | 28 |    | 52 |    | 76 |    | 100 |    | 124 |
|    | 5  |    | 29 |    | 53 |    | 77 |    | 101 |    | 125 |
|    | 6  |    | 30 |    | 54 |    | 78 |    | 102 |    | 126 |
|    | 7  |    | 31 |    | 55 |    | 79 |    | 103 |    | 127 |
|    | 8  |    | 32 |    | 56 |    | 80 |    | 104 |    | 128 |
|    | 9  |    | 33 |    | 57 |    | 81 |    | 105 |    | 129 |
|    | 10 |    | 34 |    | 58 |    | 82 |    | 106 |    | 130 |
|   | 11 |   | 35 |   | 59 |   | 83 |   | 107 |   | 131 |
|  | 12 |  | 36 |  | 60 |  | 84 |  | 108 |  | 132 |
|  | 13 |  | 37 |  | 61 |  | 85 |  | 109 |  | 133 |
|  | 14 |  | 38 |  | 62 |  | 86 |  | 110 |  | 134 |
|  | 15 |  | 39 |  | 63 |  | 87 |  | 111 |  | 135 |
|  | 16 |  | 40 |  | 64 |  | 88 |  | 112 |  | 136 |
|  | 17 |  | 41 |  | 65 |  | 89 |  | 113 |  | 137 |
|  | 18 |  | 42 |  | 66 |  | 90 |  | 114 |  | 138 |
|  | 19 |  | 43 |  | 67 |  | 91 |  | 115 |  | 139 |
|  | 20 |  | 44 |  | 68 |  | 92 |  | 116 |  | 140 |
|  | 21 |  | 45 |  | 69 |  | 93 |  | 117 |  | 141 |
|  | 22 |  | 46 |  | 70 |  | 94 |  | 118 |  | 142 |
|  | 23 |  | 47 |  | 71 |  | 95 |  | 119 |  | 143 |
|  | 24 |  | 48 |  | 72 |  | 96 |  | 120 |  | 144 |

|                                                                                         |                                                                                         |                                                                                         |                                                                                          |                                                                                                                                 |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|  145   |  169   |  193   |  217   |  241                                         |
|  146   |  170   |  194   |  218   |  242                                         |
|  147   |  171   |  195   |  219   |  243                                         |
|  148   |  172   |  196   |  220   |  244                                         |
|  149   |  173   |  197   |  221   |  245                                         |
|  150   |  174   |  198   |  222   |  246                                         |
|  151   |  175   |  199   |  223   |  247                                         |
|  152   |  176   |  200   |  224   |  248                                         |
|  153   |  177   |  201   |  225   |  249                                         |
|  154   |  178   |  202   |  226   |  250                                         |
|  155  |  179  |  203  |  227  |  251                                        |
|  156 |  180 |  204 |  228 |  252                                       |
|  157 |  181 |  205 |  229 |  253                                       |
|  158 |  182 |  206 |  230 |  254                                       |
|  159 |  183 |  207 |  231 | <p>Note:</p> <p>Addresses<br/>0 and 255<br/>are reserved<br/>for broadcast.<br/>Address 254<br/>reserved on<br/>COM port 2.</p> |
|  160 |  184 |  208 |  232 |                                                                                                                                 |
|  161 |  185 |  209 |  233 |                                                                                                                                 |
|  162 |  186 |  210 |  234 |                                                                                                                                 |
|  163 |  187 |  211 |  235 |                                                                                                                                 |
|  164 |  188 |  212 |  236 |                                                                                                                                 |
|  165 |  189 |  213 |  237 |                                                                                                                                 |
|  166 |  190 |  214 |  238 |                                                                                                                                 |
|  167 |  191 |  215 |  239 |                                                                                                                                 |
|  168 |  192 |  216 |  240 |                                                                                                                                 |

## Setup Instructions

The DCM 320A is configured at the factory as specified on the order. If setup revisions are necessary, follow the instructions below.

Locate DIP switches SW2 and Setup Execute Button on the DCM 320A (See Figure 4 on Page 1-3). When any one of the SW2 switches are turned ON, the module enters the setup mode. When all SW2 switches are turned OFF, the module returns to the normal run mode. Remember to turn OFF all SW2 switches when setup is complete.

The first five switches (S1 - S5) of SW2 select the parameter/mode to be configured. The last five switches (S6-S10) are used to enter data or select a parameter.

Locate the desired setup parameter to be revised on Pages 1-6 through 1-13 of this manual. Set switches per the corresponding switch pattern shown and then press the execute button. If the setup parameter is valid, the green (setup data good) LED will flash. If an invalid enter is made, the red (setup data error) LED will light until the error is corrected.

If uncertain about setup of the module, known factory default settings may be reloaded as shown below. When executed, the module loads known setup parameters from program memory to EEPROM configuration memory. Factory default parameters are highlighted in this manual by a box around the default setting.

### Reload Factory Default Settings



S1,S2,S3,S4,S5,S6,S8,S10 ON  
Loads default settings as designated by rectangle around description under each setup category in this manual.

### Archive Torque Profile



S2,S3,S4 ON, Stores torque profile to EEPROM for later retrieval by host computer.  
Note: Torque trending is always enabled when optional torque pot assembly is installed.

## Operating Modes



All switches OFF. Normal run mode. Return all switches to this position after setup.



S1 ON, Block valve mode. Open, Stop, Close commands.



S1,S6 ON, Modulating/Analog control mode. Requires configuration of source of setpoint and bandwidth. Default mode.



S1,S7 ON, Precision positioner/analog control mode. Requires VFC motor starter.



S1,S8 ON, Pulse input modulating control mode. Positioning by discrete inputs, User Input #1 (OPEN) and User Input #2 (CLOSE).

### Feature Selection



S2 ON, Position (close limit) valve seating. Default mode.



S2,S6 ON, Enable close valve torque seat.



S2,S7 ON, Enable torque backseat.



S2,S6,S7 ON, Enable anti-torque switch hammer/logjam function.



S2,S8 ON, Enable 4-20mA position feedback at optional analog output.



S2,S9 ON, Enable monitor relay.



S2,S10 ON, Disable passcode protection.

### Motor Starter Type



S1,S3 ON, Electro-mechanical reversing contactor motor starter. Default selection.



S1,S3,S6 ON, Solid-state reversing motor starter.



S1,S3,S7 ON, Variable frequency controller (VFC). Required for precision mode.

## ESD Function



S2,S3 ON, Do nothing. ESD is disabled.  
Factory default.



S2,S3,S6 ON, Go closed on ESD and  
do not operate ESD relay.



S2,S3,S7 ON, Go open on ESD and  
do not operate ESD relay.



S2,S3,S8 ON, Go closed on ESD and  
operate ESD relay.



S2,S3,S9 ON, Go open on ESD and  
operate ESD relay.



S2,S3,S10 ON, Operate ESD relay only.  
Do not operate close or open outputs.

## ESD Trigger Sources

Note: At least one source must be selected, else ESD is disabled.



S1,S2,S3 ON, Disable ESD.  
Factory default.



S1,S2,S3,S6 ON, Enable ESD on command  
from network master (host computer).



S1,S2,S3,S7 ON, Enable ESD/Monitor relay  
control on local ESD discrete input.



S1,S2,S3,S8 ON, Enable ESD on loss of  
communications from host.

## ESD Delay Time



S4  
0 sec



S4,10  
32 sec



S4,6  
2 sec



S4,6,10  
34 sec



S4,7  
4 sec



S4,7,10  
36 sec



S4,6,7  
6 sec



S4,6,7,10  
38 sec



S4,8  
8 sec



S4,8,10  
40 sec



S4,6,8  
10 sec



S4,6,8,10  
42 sec



S4,7,8  
12 sec



S4,7,8,10  
44 sec



S4,6,7,8  
14 sec



S4,6,7,8,10  
46 sec



S4,9  
16 sec



S4,9,10  
48 sec



S4,6,9  
18 sec



S4,6,9,10  
50 sec



S4,7,9  
20 sec



S4,7,9,10  
52 sec



S4,6,7,9  
22 sec



S4,6,7,9,10  
54 sec



S4,8,9  
24 sec



S4,8,9,10  
56 sec



S4,6,8,9  
26 sec



S4,6,8,9,10  
58 sec



S4,7,8,9  
28 sec



S4,7,8,9,10  
60 sec



S4,6,7,8,9  
30 sec



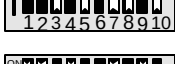
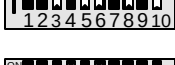
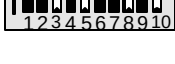
S4,6,7,8,9,10  
62 sec

Note: ESD Delay Time applies only to software generated ESD  
and not to hardwired local ESD.

## Notes on Local Inhibit/ESD:

- 1) Local ESD is a hardwired closed loop circuit wired to TBM terminals 27 (+) and 28 (-) using either an external 24VDC power supply or the internal 24VDC power available at terminals 26(+) and 29(-). See Figure 3.
- 2) Local ESD will inhibit control from the Controlinc 320A module, local push buttons and selector switch. To force valve closed on local ESD, insert jumper between terminals 9 and 10. To force valve open on local ESD, insert jumper between terminals 8 and 9.
- 3) To override motor thermal contacts during local ESD, insert jumper between terminals X0 and 53. Warning: Do not override thermals in a hazardous area.
- 4) Software activated ESD can activate Local ESD by wiring N.C. contacts of ESD/Monitor relay (terminals 32 & 33) in series with Local Inhibit/ESD inputs at terminals 27 and 28.

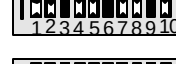
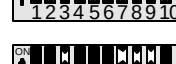
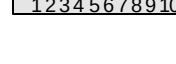
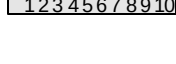
## Position Control Bandwidth

|                                                                                     |                       |                                                                                     |                         |
|-------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------|-------------------------|
|    | S1,2,4<br>1% default  |    | S1,2,4,8,9<br>0.80%     |
|    | S1,2,4,6<br>0.10%     |    | S1,2,4,6,8,9<br>0.90%   |
|    | S1,2,4,7<br>0.15%     |    | S1,2,4,7,8,9<br>1.00%   |
|    | S1,2,4,6,7<br>0.20%   |    | S1,2,4,6,7,8,9<br>1.50% |
|    | S1,2,4,8<br>0.25%     |    | S1,2,4,10<br>2.00%      |
|    | S1,2,4,6,8<br>0.30%   |    | S1,2,4,6,10<br>2.50%    |
|    | S1,2,4,7,8<br>0.35%   |    | S1,2,4,7,10<br>3.00%    |
|    | S1,2,4,6,7,8<br>0.40% |    | S1,2,4,6,7,10<br>3.50%  |
|    | S1,2,4,9<br>0.45%     |    | S1,2,4,8,10<br>4.00%    |
|    | S1,2,4,6,9<br>0.50%   |    | S1,2,4,6,8,10<br>4.50%  |
|  | S1,2,4,7,9<br>0.60%   |  | S1,2,4,7,8,10<br>5.00%  |
|  | S1,2,4,6,7,9<br>0.70% |                                                                                     |                         |

## Setpoint Source

|                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  | S1, S4 ON, Enable setpoint from network master (host computer).<br>Factory default. |
|  | S1, S4, S6 ON, Enable setpoint from torque potentiometer analog input.              |
|  | S1, S4, S7 ON, Enable setpoint from User analog input #1 (4-20mA input).            |
|  | S1, S4, S6, S7 ON, Enable setpoint from User analog input #2 (4-20mA input).        |

## Modulation Delay Time

|                                                                                     |                      |                                                                                       |                         |
|-------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------|-------------------------|
|    | S3<br>0.1 sec        |    | S3,10<br>12 sec         |
|    | S3,6<br>0.2 sec      |    | S3,6,10<br>13 sec       |
|    | S3,7<br>0.3 sec      |    | S3,7,10<br>14 sec       |
|    | S3,6,7<br>0.4 sec    |    | S3,6,7,10<br>15 sec     |
|    | S3,8<br>0.5 sec      |    | S3,8,10<br>16 sec       |
|    | S3,6,8<br>1.0 sec    |    | S3,6,8,10<br>17 sec     |
|    | S3,7,8<br>2.0 sec    |    | S3,7,8,10<br>18 sec     |
|    | S3,6,7,8<br>3.0 sec  |    | S3,6,7,8,10<br>19 sec   |
|    | S3,9<br>4.0 sec      |    | S3,9,10<br>20 sec       |
|    | S3,6,9<br>5.0 sec    |    | S3,6,9,10<br>21 sec     |
|  | S3,7,9<br>6.0 sec    |  | S3,7,9,10<br>22 sec     |
|  | S3,6,7,9<br>7.0 sec  |  | S3,6,7,9,10<br>23 sec   |
|  | S3,8,9<br>8.0 sec    |  | S3,8,9,10<br>24 sec     |
|  | S3,6,8,9<br>9.0 sec  |  | S3,6,8,9,10<br>25 sec   |
|  | S3,7,8,9<br>10 sec   |  | S3,7,8,9,10<br>26 sec   |
|  | S3,6,7,8,9<br>11 sec |  | S3,6,7,8,9,10<br>27 sec |

## Speed Control Bandwidth

|                                                                                   |                    |                                                                                   |                      |
|-----------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------|----------------------|
|  | S3,4<br>3% default |  | S3,4,7,9<br>5.5%     |
|  | S3,4,6<br>0.5%     |  | S3,4,6,7,9<br>6.0%   |
|  | S3,4,7<br>1.5%     |  | S3,4,8,9<br>6.5%     |
|  | S3,4,6,7<br>2.0%   |  | S3,4,6,8,9<br>7.0%   |
|  | S3,4,8<br>2.5%     |  | S3,4,7,8,9<br>7.5%   |
|  | S3,4,6,8<br>3.0%   |  | S3,4,6,7,8,9<br>8.0% |
|  | S3,4,7,8<br>3.5%   |  | S3,4,10<br>8.5%      |
|  | S3,4,6,7,8<br>4.0% |  | S3,4,6,10<br>9.0%    |
|  | S3,4,9<br>4.5%     |  | S3,4,7,10<br>9.5%    |
|  | S3,4,6,9<br>5.0%   |  | S3,4,6,7,10<br>10.0% |

Note: Speed control bandwidth is meaningful only when a VFC motor starter is used. Speed control bandwidth must be greater than position control bandwidth.

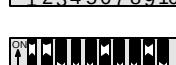
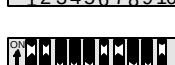
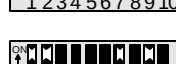
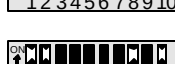
## Calibrate Analog Output

|                                                                                     |                                                                                                                         |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  | S1,2,3,4,6,8 ON, Output zero (4mA) current at analog output #1 (AO#1).                                                  |
|  | S1,2,3,4,6,7,8 ON, Decrease zero analog output at AO#1 by 0.025mA each time Execute button is pressed and released.     |
|  | S1,2,3,4,7,8 ON, Increase analog output at AO#1 by 0.025mA each time the Execute button is pressed and released.        |
|  | S1,2,3,4,9 ON, Output full scale (20mA) at analog output #1 (AO#1).                                                     |
|  | S1,2,3,4,7,9 ON, Decrease full scale analog output at AO#1 by 0.025mA each time Execute button is pressed and released. |
|  | S1,2,3,4,6,9 ON, Increase full scale analog output at AO#1 by 0.025mA each time Execute button is pressed and released. |

## Anti-water Hammer

S1,S2 ON, Disable anti-water hammer. Default mode.

Note: With S1 and S2 ON, switches S6 through S10 select valve closing position at which anti-water hammer takes effect.

|                                                                                      |                |                                                                                       |                    |
|--------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------|--------------------|
|    | S6<br>1%       |    | S6,S7,S9<br>11%    |
|    | S7<br>2%       |    | S8,S9<br>12%       |
|    | S6,S7<br>3%    |    | S6,S8,S9<br>13%    |
|    | S8<br>4%       |    | S7,S8,S9<br>14%    |
|    | S6,S8<br>5%    |    | S6,S7,S8,S9<br>15% |
|    | S7,S8<br>6%    |    | S10<br>16%         |
|    | S6,S7,S8<br>7% |    | S6,S10<br>17%      |
|   | S9<br>8%       |   | S7,S10<br>18%      |
|  | S6,S9<br>9%    |  | S6,S7,S10<br>19%   |
|  | S7,S9<br>10%   |  | S8,S10<br>20%      |

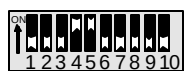
## Calibrate Analog Inputs

|                                                                                      |                                                                              |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
|  | S1,2,3,4,6 ON, Set analog input User #1 Zero. Input 4mA offset current.      |
|  | S1,2,3,4,7 ON, Set analog input User #1 Span. Input 20mA full scale current. |
|  | S1,2,3,4,6,7 ON, Set analog input User #2 Zero. Input 4mA offset current.    |
|  | S1,2,3,4,8 ON, Set analog input User #2 Span. Input 20mA full scale current. |

Note: Press execute button while calibration current is being applied.

## Network Baud Rate

### Primary Ports A and B



S4,5  
9600  
(default)



S4,5,6  
1200



S4,5,7  
2400



S4,5,6,7  
4800



S4,5,8  
9600



S4,5,6,8  
19200



S4,5,6,7,8  
38400

### Secondary Ports C and D



S1,2,4,5,6,8  
19200  
(default)



S1,2,4,5,6  
1200



S1,2,4,5,7  
2400



S1,2,4,5,6,7  
4800



S1,2,4,5,8  
9600



S1,2,4,5,6,8  
19200



S1,2,4,5,6,7,8  
38400

## Network Parity

### Primary Ports A and B



S1,4,5  
No parity



S1,4,5,6  
Odd parity



S1,4,5,7  
Even parity

### Secondary Ports C and D



S3,4,5  
No parity



S3,4,5,6  
Odd parity



S3,4,5,7  
Even parity

## Response Delay Time

### Primary Ports A and B



S2,4,5,8,9  
8mS  
(default)



S2,4,5,6,8,9  
9mS



S2,4,5,7,8,9  
10mS



S2,4,5,6,7,8,9  
15mS



S2,4,5,10  
20mS



S2,4,5,6,10  
25mS



S2,4,5,7,10  
30mS

### Secondary Ports C and D



S1,3,4,5,8,9  
8mS  
(default)



S1,3,4,5,6,8,9  
9mS



S1,3,4,5,7,8,9  
10mS



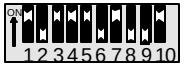
S1,3,4,5,6,7,8,9  
15mS



S1,3,4,5,10  
20mS



S1,3,4,5,6,10  
25mS



S1,2,4,5,7,10  
30mS

## User Relay #1 Application



S5 ON, Direct control of N.O. relay from network master. Factory default.



S5,S6 ON, Select normally closed (N.C.) else contacts are normally open (N.O.)



S5,S7 ON, Override relay, operates at the same time as the ESD relay.



S5,S8 ON, Activate relay when selector switch is in Remote position.



S5,S9 ON, Activate relay when selector switch is in Local position.



S5,S10 ON, Activate relay at LSA limit setpoint (requires LSA position to be configured)

## User Relay #2 Application



S1,S5 ON, Direct control of N.O. relay from network master. Factory default.



S1,S5,S6 ON, Select normally closed (N.C.) else contacts are normally open (N.O.)



S1,S5,S7 ON, Override relay, operates at the same time as the ESD relay.



S1,S5,S8 ON, Activate relay when selector switch is in Remote position.

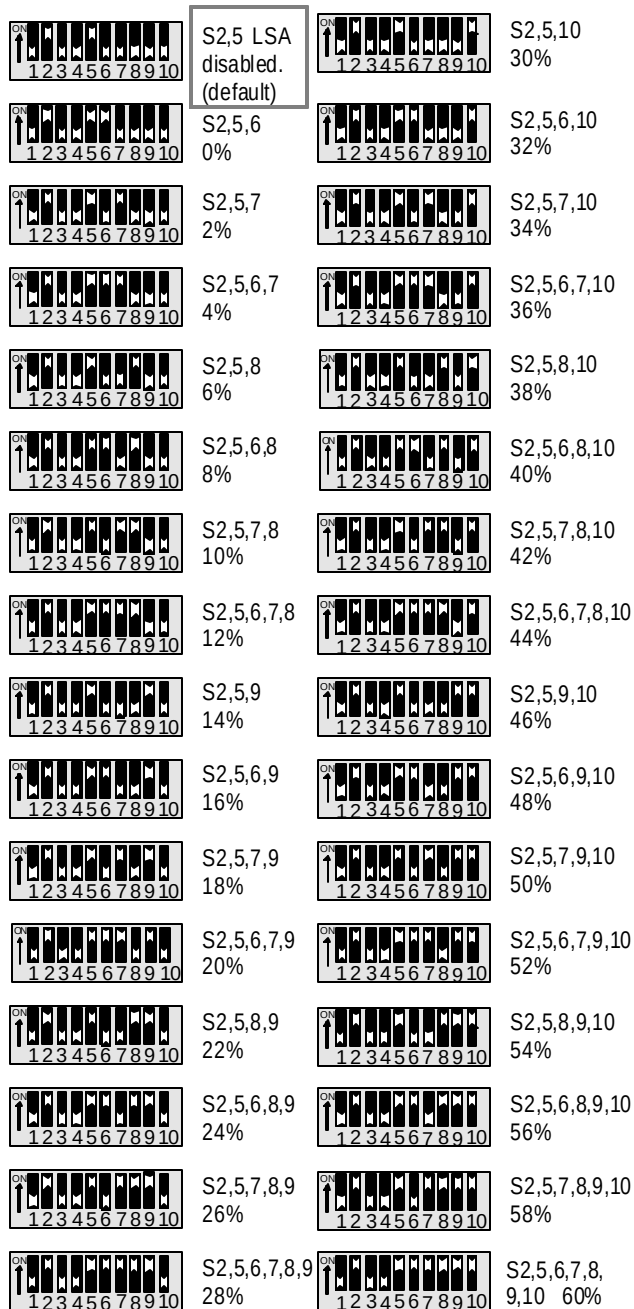


S1,S5,S9 ON, Activate relay when selector switch is in Local position.

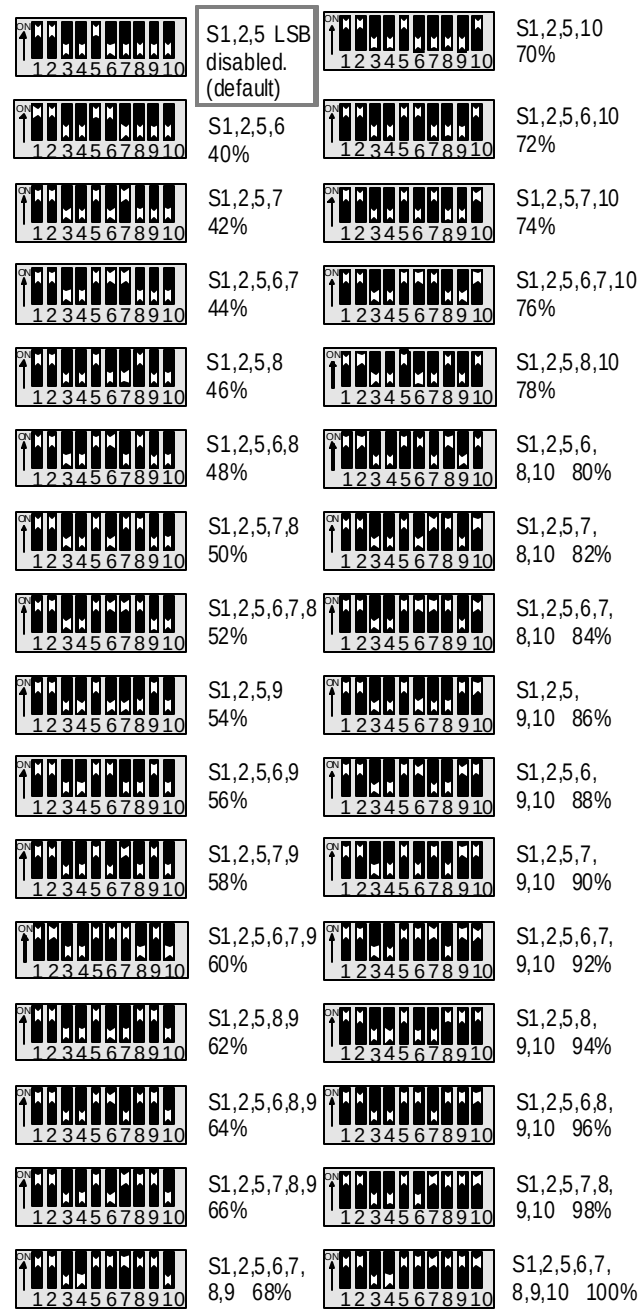


S1,S5,S10 ON Activate relay at LSB limit setpoint. (requires LSB position to be configured)

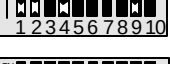
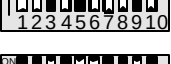
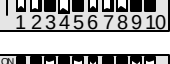
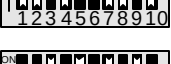
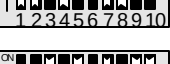
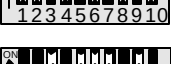
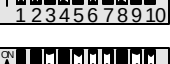
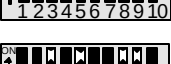
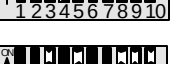
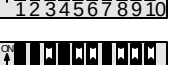
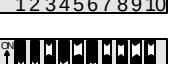
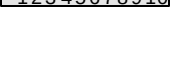
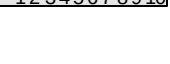
## LSA Position Setpoint



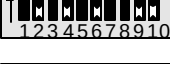
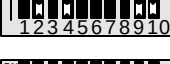
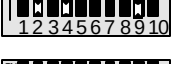
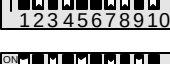
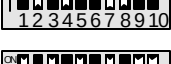
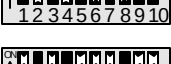
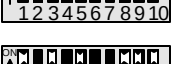
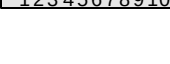
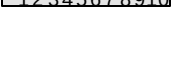
## LSB Position Setpoint



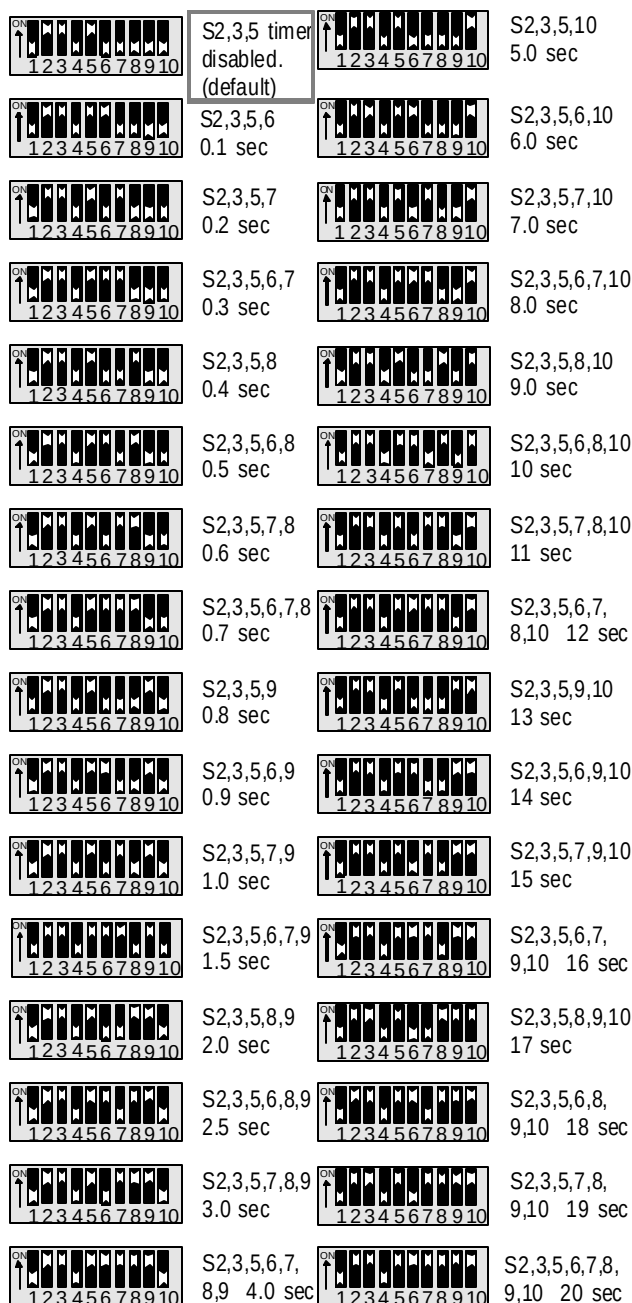
## Closing Duty Cycle ON Timer

|                                                                                     |                                   |                                                                                     |                           |
|-------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|---------------------------|
|    | S3,5 timer disabled.<br>(default) |    | S3,5,10<br>5.0 sec        |
|    | S3,5,6<br>0.1 sec                 |    | S3,5,6,10<br>6.0 sec      |
|    | S3,5,7<br>0.2 sec                 |    | S3,5,7,10<br>7.0 sec      |
|    | S3,5,6,7<br>0.3 sec               |    | S3,5,6,7,10<br>8.0 sec    |
|    | S3,5,8<br>0.4 sec                 |    | S3,5,8,10<br>9.0 sec      |
|    | S3,5,6,8<br>0.5 sec               |    | S3,5,6,8,10<br>10 sec     |
|    | S3,5,7,8<br>0.6 sec               |    | S3,5,7,8,10<br>11 sec     |
|    | S3,5,6,7,8<br>0.7 sec             |    | S3,5,6,7,8,10<br>12 sec   |
|    | S3,5,9<br>0.8 sec                 |    | S3,5,9,10<br>13 sec       |
|   | S3,5,6,9<br>0.9 sec               |   | S3,5,6,9,10<br>14 sec     |
|  | S3,5,7,9<br>1.0 sec               |  | S3,5,7,9,10<br>15 sec     |
|  | S3,5,6,7,9<br>1.5 sec             |  | S3,5,6,7,9,10<br>16 sec   |
|  | S3,5,8,9<br>2.0 sec               |  | S3,5,8,9,10<br>17 sec     |
|  | S3,5,6,8,9<br>2.5 sec             |  | S3,5,6,8,9,10<br>18 sec   |
|  | S3,5,7,8,9<br>3.0 sec             |  | S3,5,7,8,9,10<br>19 sec   |
|  | S3,5,6,7,8,9<br>4.0 sec           |  | S3,5,6,7,8,9,10<br>20 sec |

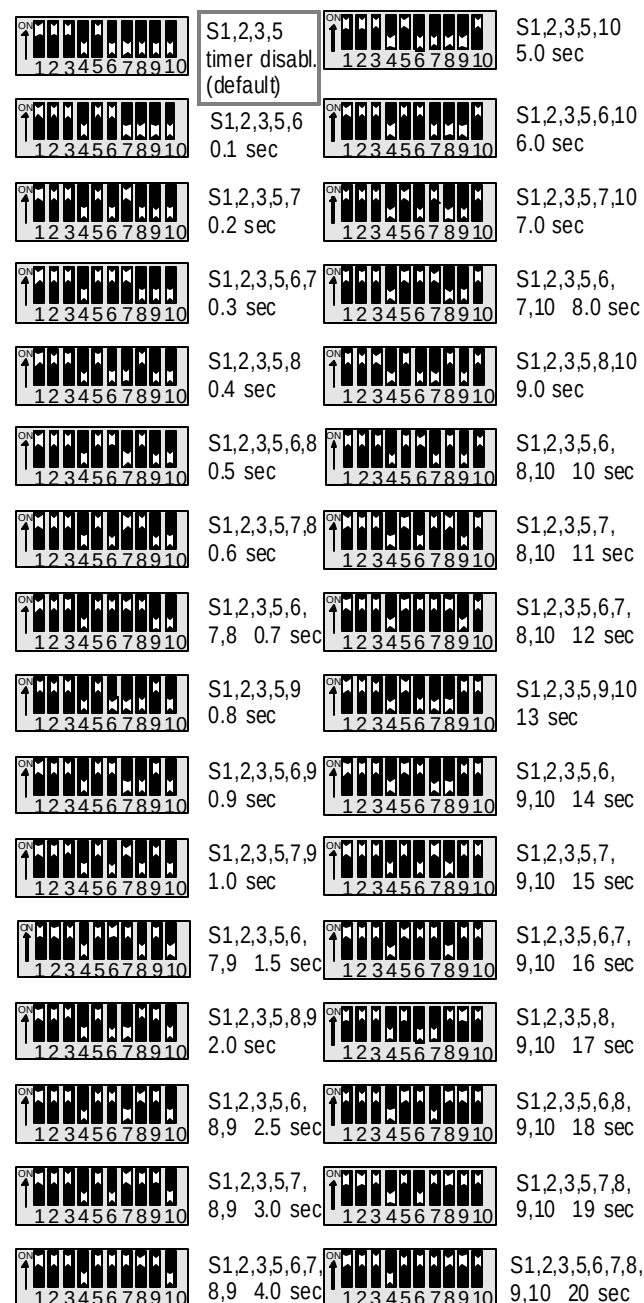
## Closing Duty Cycle OFF Timer

|                                                                                     |                                     |                                                                                       |                             |
|-------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|-----------------------------|
|    | S1,3,5 timer disabled.<br>(default) |    | S1,3,5,10<br>5.0 sec        |
|    | S1,3,5,6<br>0.1 sec                 |    | S1,3,5,6,10<br>6.0 sec      |
|    | S1,3,5,7<br>0.2 sec                 |    | S1,3,5,7,10<br>7.0 sec      |
|    | S1,3,5,6,7<br>0.3 sec               |    | S1,3,5,6,7,10<br>8.0 sec    |
|    | S1,3,5,8<br>0.4 sec                 |    | S1,3,5,8,10<br>9.0 sec      |
|    | S1,3,5,6,8<br>0.5 sec               |    | S1,3,5,6,8,10<br>10 sec     |
|    | S1,3,5,7,8<br>0.6 sec               |    | S1,3,5,7,8,10<br>11 sec     |
|    | S1,3,5,6,7,8<br>0.7 sec             |    | S1,3,5,6,7,8,10<br>12 sec   |
|    | S1,3,5,9<br>0.8 sec                 |    | S1,3,5,9,10<br>13 sec       |
|   | S1,3,5,6,9<br>0.9 sec               |   | S1,3,5,6,9,10<br>14 sec     |
|  | S1,3,5,7,9<br>1.0 sec               |  | S1,3,5,7,9,10<br>15 sec     |
|  | S1,3,5,6,7,9<br>1.5 sec             |  | S1,3,5,6,7,9,10<br>16 sec   |
|  | S1,3,5,8,9<br>2.0 sec               |  | S1,3,5,8,9,10<br>17 sec     |
|  | S1,3,5,6,8,9<br>2.5 sec             |  | S1,3,5,6,8,9,10<br>18 sec   |
|  | S1,3,5,7,8,9<br>3.0 sec             |  | S1,3,5,7,8,9,10<br>19 sec   |
|  | S1,3,5,6,7,8,9<br>4.0 sec           |  | S1,3,5,6,7,8,9,10<br>20 sec |

## Opening Duty Cycle ON Timer



## Opening Duty Cycle OFF Timer



## Modbus Function Codes

|                              | Host<br>begining<br>register |
|------------------------------|------------------------------|
| 01 Read Coil Status          | 00001                        |
| 02 Read Input Status         | 10001                        |
| 03 Read Holding Register     | 40001                        |
| 04 Read Input Register       | 30001                        |
| 05 Force Single Coil         | 00001                        |
| 06 Preset Single Register    | 40001                        |
| 07 Read Exception Status     |                              |
| 08 Loopback Diagnostic Test  |                              |
| 15 Force Multiple Coils      | 00001                        |
| 16 Preset Multiple Registers | 40001                        |
| 17 Report Slave I.D.         |                              |

## Input Register Map

(Use function code 04)

- 00 Live discrete inputs (Inputs 0-15)
- 01 Standard valve status (Inputs 16-31)
- 02 C320 valve status (Inputs 32-47)

## Note:

All registers are zero based. Add one to inputs, coils or holding registers when configuring host database.  
See host beginning registers above.

## Discrete Input Map

(Inputs 0 through 15 are hardware inputs)  
(Use function code 02)

- 00 Open limit switch
- 01 Close limit switch
- 02 Aux. open contact
- 03 Aux. close contact
- 04 Selector switch Local/Manual
- 05 Selector switch Remote/Auto
- 06 Open torque switch
- 07 Close torque switch
- 08 Power monitor alarm
- 09 Motor thermal overload
- 10 Phase monitor
- 11 Local ESD alarm
- 12 VFC fault alarm
- 13 User discrete input #1
- 14 User discrete input #2
- 15 On-board execute button
- 16 Open limit switch
- 17 Close limit switch
- 18 Opening (valve moving open)
- 19 Closing (valve moving close)
- 20 Selector switch Local/Manual
- 21 Selector switch Remote/Auto
- 22 Open torque switch
- 23 Close torque switch
- 24 Valve stall alarm (valve not moving)
- 25 Power monitor alarm
- 26 Motor thermal overload alarm
- 27 Phase monitor alarm
- 28 Local ESD alarm
- 29 Actuator fail alarm
- 30 No input (always zero)
- 31 Unit alarm (above alarms OR'ed)
- 32 Open limit switch
- 33 Close limit switch
- 34 Stopped (valve stopped in mid travel)
- 35 Opening (valve moving open)
- 36 Closing (valve moving close)
- 37 Valve stall alarm (valve not moving)
- 38 Selector switch in Local/Manual
- 39 Unit alarm (alarms OR'ed)
- 40 Motor overload alarm
- 41 Power monitor alarm
- 42 Primary network Com alarm
- 43 Secondary network Com alarm
- 44 Open torque alarm
- 45 Close torque alarm
- 46 Local ESD input alarm
- 47 Phase monitor alarm

## Coil Map

(Coils 0 through 7 are hardware outputs)

(Use function codes 01,05 and15)

- 00 Close motor starter output
- 01 Open motor starter output
- 02 Solid-state relay/VFC speed control
- 03 ESD control relay
- 04 User relay #1/Override relay
- 05 User relay #2
- 06 Network channel 1 enable
- 07 Network channel 2 enable
- 08 Open valve command
- 09 Stop command (open and close inhibit)
- 10 Close valve command
- 11 ESD command
- 12 Analog control mode configuration
- 13 reserved
- 14 Precision positioner mode configuration
- 15 Pulse mode configuration
- 16 Open limit switch status
- 17 Close limit switch status
- 18 Opening status (valve moving open)
- 19 Closing status (valve moving close)
- 20 Selector switch Local/Manual
- 21 Selector switch Remote/Auto
- 22 Open torque alarm
- 23 Close torque alarm
- 24 Valve stall alarm (valve not moving)
- 25 Power monitor alarm
- 26 Motor overload alarm
- 27 Phase monitor alarm
- 28 Local ESD alarm
- 29 Actuator fail alarm
- 30 No coil (reserved for host)
- 31 Unit alarm (all alarms OR'ed)
- 32 Enable torque seat mode
- 33 Enable logjam retry mode
- 34 Enable 4-20mA feedback at AO#1
- 35 Enable monitor relay, else ESD relay
- 36 Disable passcode protection
- 37 Enable solid-state motor starter mode
- 38 Enable VFC motor starter mode
- 39 Enable Close on ESD w/o ESD relay
- 40 Enable Open on ESD w/o ESD relay
- 41 Enable Close on ESD with ESD relay
- 42 Enable Open on ESD with ESD relay
- 43 Enable ESD relay only
- 44 Enable ESD trigger from host
- 45 Enable ESD trigger from local input
- 46 Enable ESD trigger from loss of com.
- 47 Configuration error detected

## Coil Map (continued)

(Use function codes 01,05 and15)

- 48 Select AIN1 as setpoint source
- 49 Select AIN2 as setpoint source
- 50 Select AIN3 as setpoint source
- 51 AIN1 calibrated
- 52 AIN2 calibrated
- 53 AIN3 calibrated
- 54 AO1 calibrated
- 55 reserved
- 56 reserved
- 57 Select N.C. contacts for Relay #1
- 58 Enable Relay #1 as Override
- 59 Activate Relay #1 in Remote/Auto
- 60 Activate Relay #1 in Local/Manual
- 61 Activate Relay #1 at LSA setpoint
- 62 Select N.C. contacts for Relay #2
- 63 Enable Relay #2 as Override
- 64 Activate Relay #2 in Remote/Auto
- 65 Activate Relay #2 in Local/Manual
- 66 Activate Relay #2 at LSB setpoint
- 67 Set primary network to odd parity
- 68 Set primary network to even parity
- 69 Set secondary net to odd parity
- 70 Set secondary net to even parity
- 71 Enable primary network alarm
- 72 Enable secondary network alarm
- 73 reserved
- 74 reserved
- 75 reserved
- 76 Enable torque backseat
- 77 Save torque profile to EEPROM
- 78 reserved
- 79 Load default configuration
- 100 Open command
- 101 Close command
- 102 Stop command
- 103 ESD command

**Holding Register Map**

(RO = Read Only    RW = Read/Write)  
(Use function codes 03,06 and 16)

00 RW Coils 0-15  
01 RO Coils 16-31  
02 RW Coils 32-47  
03 RW Coils 48-63  
04 RW Coils 64-79  
05 RO Inputs 0-15  
06 RO Inputs 16-31  
07 RO Valve Position 1.0% increments  
08 RO Valve Status inputs 32-47  
09 RO Valve Status inputs 16-31  
10 RW Analog Output (0-4095)  
11 RW Valve Position Setpoint (0-4095)  
12 reserved  
13 RO Valve Position (0.1% increments)  
14 RO Position Analog Input (0-4095)  
15 RO Torque Analog Input (0-4095)  
16 RO User Analog Input #1 (0-4095)  
17 RO User Analog Input #2 (0-4095)  
18 RW Water Hammer setpoint (1-20%)  
19 RW Modulation delay (0.1-28 sec)  
20 RW ESD Delay timer (0-62 sec)  
21 RW Position Bandwidth (0.1-5.0%)  
22 RW Speed Bandwidth (0.5-10%)  
23 reserved  
24 RW Torque AIN Zero offset, raw cnts  
25 RW Torque AIN Span, raw A/D counts  
26 RW User AIN1 Zero offset, raw counts  
27 RW User AIN1 Span, raw A/D counts  
28 RW User AIN2 Zero offset, raw counts  
29 RW User AIN2 Span, raw A/D counts  
30 RW AO#1 Zero offset, raw counts  
31 RW AO#1 Span, raw D/A counts  
32 RW LSA Setpoint (0-60%)  
33 RW LSB Setpoint (40-100%)  
34 RW Close ON duty cycle (0-20 sec)  
35 RW Close OFF duty cycle (0-20 sec)  
36 RW Open ON duty cycle (0-20 sec)  
37 RW Open OFF duty cycle (0-20 sec)  
38 RW Primary network baudrate  
39 RW Primary network response delay  
40 RW Secondary network baudrate  
41 RW Secondary network response delay  
42 RW Passcode char 1(LSB) & 2(MSB)  
43 RW Passcode char 3(LSB) & 4(MSB)  
44 RO Firmware version  
45 reserved  
46 reserved  
47 reserved

**Register Map (continued)**

(Use function codes 03,06 and 16)

48 RO Torque @ 10% valve position  
49 RO Torque @ 20% valve position  
50 RO Torque @ 30% valve position  
51 RO Torque @ 40% valve position  
52 RO Torque @ 50% valve position  
53 RO Torque @ 60% valve position  
54 RO Torque @ 70% valve position  
55 RO Torque @ 80% valve position  
56 RO Torque @ 90% valve position  
57 RO Torque profile @ 10%  
58 RO Torque profile @ 20%  
59 RO Torque profile @ 30%  
60 RO Torque profile @ 40%  
61 RO Torque profile @ 50%  
62 RO Torque profile @ 60%  
63 RO Torque profile @ 70%  
64 RO Torque profile @ 80%  
65 RO Torque profile @ 90%  
66 RW Accumulator #1 (DI 13)  
67 RW Accumulator #2 (DI 14)  
68 RW Lost COM ESD delay  
69 RW Stall time delay  
100 RO Unit I.D.

**Note:**

- 1) Unless otherwise specified,  
analog I/O is unsigned integer  
in range of 0-4095.
- 2) Torque readings are raw A/D counts.
- 3) Torque profile values are read  
from EEPROM.
- 4) Do not write to reserved registers.

## Network Installation

### Plan the network topology

Before connecting actuators, the entire network layout should be planned. Topologies may be bus or E>Net or a combination of bus and E>Net. All networks may be redundant or ring or redundant rings. Limit the number of parallel connected bus units to 15 between E>Net units. Planning should include node addressing, wire routing, terminations, and grounding.

### Select network cable

Ensure correct cable is being used. Networks require twisted pair and shielded cable with a characteristic impedance between 50 and 120 Ohms. Capacitance between conductors must be less than 30pF/ft (98 pF/m); 10-15pF/ft is ideal. Shielding may be aluminum foil with drain wire. Only cables with stranded conductors are recommended. Insulating and outer jacket materials must be selected for the application environment. Following are acceptable Belden or equivalent cables for most network applications.

|                 |               |               |               |               |               |
|-----------------|---------------|---------------|---------------|---------------|---------------|
| 24AWG           | 22AWG         | 20AWG         | 18AWG         | 16AWG         | 14AWG         |
| 9841, 12.8pF/ft | 8761, 24pF/ft | 8762, 27pF/ft | 8760, 24pF/ft | 8719, 23pF/ft | 8720, 24pF/ft |

8162, 9729, and 9842 are 24AWG, 2-pair cables with <13pF/ft

### Route cable away from electrical interference

Network cables should enter the electrical enclosure at the bottom or lowest point near the transformer end. Route cable around the transformer end, normally in a counter clockwise direction to the top side of the TBM. Never install network cable in the same conduit with power conductors. Never route network cable through the high voltage contactor area. The cable should never lie across the TBM or hinder the protective cover of the TBM. Always use the shortest distance and keep excess cable to a minimum; 6" typical.

### Observe polarity and network grounding

Each network connection is polarized + and - on wiring diagrams. Always use consistency in wiring and the use of wire colors to track polarity. The cable shield or drain wire must be connected to the designated (SH) terminal at each port of each actuator. The shield must be connected to earth ground at only one point. Some networks may require a jumper between shield connections at each actuator to carry the shield through the network. One port of E>Net networks may be earth grounded at each actuator if desired. The shield connection of each actuator is isolated from earth. Do not allow the shield to touch circuits on the TBM or the metal enclosure. Use plastic electrical tape or heat shrink tubing to isolate the shield or drain wire.

### Wire preparation and connections

Screw terminals of the TBM have wire clamps which will accept conductors without terminals. Wire terminals may be applied if desired but are not required. Strip conductor insulation back 3/8" when connecting directly to the TBM screw terminals. Do not allow wire clippings to fall on the TBM or into the actuator enclosure. Protect conductors and the shield or drain wire to prevent contact with the TBM. Use plastic electrical tape or heat shrink tubing to prevent bare conductors from contacting other circuits or earth ground.

### Test network

Use EIM's Configuration and Control Utility (CCU) to test the network prior to connecting to a host or network master. The CCU is a Windows application which will run on a laptop using an RS232 to RS485 adapter or EIM's Network Interface Unit (NIU) for connecting to the network. After all actuators are verified to operate in Local mode, test each actuator to verify all network connections and each actuator operates via the network in Remote mode.

Seven  
Simple  
Sequential  
Steps to  
Successful  
System  
Startup

## **Step 1**      Set limit and torque switches

Set open and close limits and open and close torque switches while operating valve with local push buttons. Refer to Manual E796 for instructions on setting switches.

## **Step 2**      Set DIP switches

Set address DIP switches to unique address as shown in the first section of this guide. Refer to Figure 4 on Page 1-3 for location of DIP switches. Refer to network station address switch settings on Pages 1-4 and 1-5. Also remember to check baud rate of each actuator to ensure it matches the host system.

## **Step 3**      Check network wiring

Check polarity of each network connection per wiring connections shown in Figure 3 of this guide. Ensure shield is connected at each actuator and is earth grounded at only one point. Refer to Page 3-1 for additional instructions on network installation.

## **Step 4**      Check network terminations

Bus networks require termination resistance and bias at each end of the network. Remove termination and bias on all modules except the last, most distance unit at the end of the network. Always leave termination and bias on every unit when using E>Net. See Figure 4 for location of DIP switches and jumpers for termination and bias selection. Verify quiescent line bias is 250mV minimum during no communication activity.

## **Step 5**      Test network

Use EIM's Configuration and Control Utility (CCU) software to test each actuator. Ensure each station address is tested and verify received data. View communication signals with oscilloscope to ensure good signal strength and clean waveforms. Repeat test for each actuator on redundant network if installed.

## **Step 6**      Verify network master configuration

If using EIM Controlinc Network Master, refer to the User Manual supplied with the system for setup details. If direct connecting to your DCS, SCADA, or PLC system, refer to the manufacturer's supplied documentation. Verify network baud rate and parity match the settings of the actuators. Verify the master is configured for the total number of actuators and database matches network address assignments per actuator location on network. Take system out of test or diagnostic mode when finished.

## **Step 7**      Test host interface

If using EIM Controlinc Network Master, use Modbus host test software supplied with the system to test slave port(s) of the network master. If direct connect to other host equipment, use software supplied with that equipment to test actuators. Verify database for each node and I/O point by tag name and mapping of each point to operator's screen. Operate each valve open and close or to setpoint. Test each auxilliary I/O point.

- |              |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tools</b> | <ol style="list-style-type: none"> <li>1) Speed handle or 3/8" battery drill with 1/2" thin wall socket</li> <li>2) Common screwdriver</li> <li>3) Multimeter (VOM)</li> <li>4) Portable oscilloscope (optional)</li> <li>5) Laptop computer with Windows</li> </ol> | <ol style="list-style-type: none"> <li>6) EIM Configuration and Control Utility (CCU) w/ RS485 adapter</li> <li>7) Other system test software supplied with host system</li> <li>8) Programming cables</li> <li>9) 4-20mA calibrator for analog I/O</li> </ol> |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

If your actuator contains the optional phase monitor, then this section applies.

The phase monitor module shown in Figure 5 is mounted on the back side of the DCM 320A module facing the motor starter.

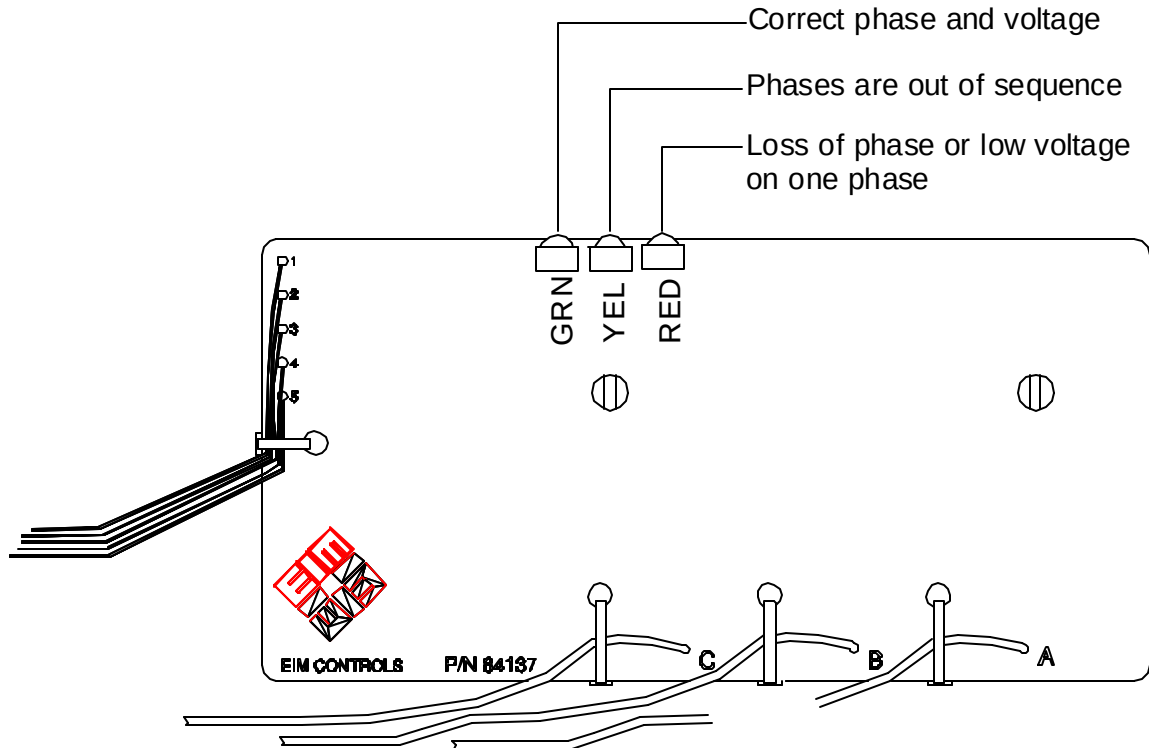


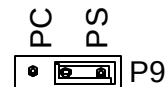
Figure 5

Notice: We advise using phase sentry mode rather than phase correction.

Phase sentry mode will cause the actuator to shut down if phases are out of sequence or a loss of phase is detected. Phase correction mode will cause the actuator to correct the phase sequence and continue to operate when phases are out of sequence. Either will cause the actuator to shut down if a loss of phase is detected.

To select modes, do the following:

- 1) Remove TBM 320A termination panel.
- 2) Locate 3-pin jumper P9 marked PC and PS.  
PC means Phase Correction.  
PS means Phase Sentry.



- 3) Move the shorting strap to the desired mode selection (PC or PS).

## Optional Network Interface Unit (NIU)

If your network host system contains the optional NIU, then you must select the same baud rate range as the Controlinc cards in the actuator. Select baud rate range by setting DIP switches S3, S4, or S5 as shown in Figure 6 below.

Observe (+) and (-) polarity connections of the network when connecting to the NIU. Also connect shield of the network cable to the NIU. Insure that only one earth ground point is connected to the shield. This earth ground point does not have to be at the NIU. It may be at any point in the network.

Unless the NIU is connected at a point other than the end of the network, termination DIP switches S7 and S8 must be ON. These switches assert network bias and termination resistors.

EIM Network Masters contain NIUs for network interface. The NIU is compatible with Controlinc, RS-485 and E>Net networks. It provides isolation and transient protection for your DCS, PLC or SCADA system network connection to protect your equipment. It also provides improved hardware driver and receiver with added noise immunity.

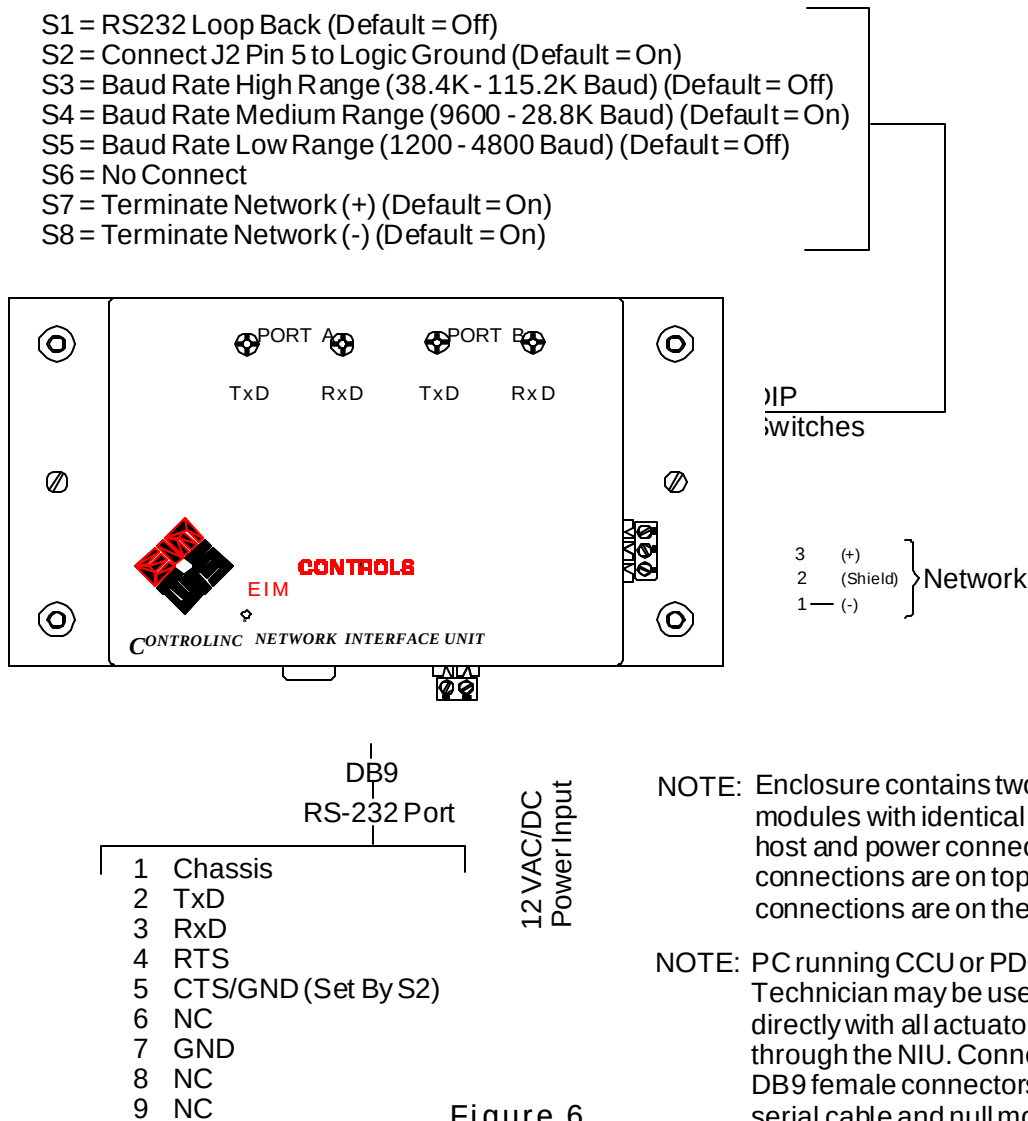


Figure 6



Symbol of Intelligence,  
Performance, Quality  
and Reliability

EIM Controls  
1340 Pike Road  
Missouri City, Texas 77489

1-800-679-1516  
(281) 499-1516 • FAX (281) 499-8445

EIM Controls UK Ltd.  
Suite 34, Liberty House,  
New Greenham Park,  
Newbury, Berkshire,  
RG19 6HW, England

44 (0) 1635 817 315 • FAX 44 (0) 1635 817 460

[www.eim-co.com](http://www.eim-co.com)

ECL-400-1003

Copyright©1998 EIM Company, Inc.