Quick Startup Guide Part Number: DCM 320B, Rev. C Release: Mar 2013

CONTROLINC® Quick Startup Guide





Preface

DCM320B is an upgrade of DCM320A. It is a fit, form, and function replacement for the DCM320A. The DCM320B may be used as a direct replacement of the DCM320A in existing installations. The primary difference is the DIP switch configuration method. The DCM320B provides more range and resolution of most configuration parameters. This handy reference is a guide to help you get your system up and running quickly. Refer to the Bettis 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 Bettis 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. This last section also covers optional phase monitor module.

A 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 C

for Revision F and later revision boards

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Section 1: Quick Start Guide

Step 1: Identify network topology

Identify network topology from Figures 2 and 3 on page 5 and note the ports being used (Ports A,B,C,D). Refer to page 23 for guidance on network planning and installation.

Step 2: Set network jumpers and switches

If network topology is parallel bus, then remove network termination and bias by turning OFF S1 and S2 of SW4 on the DCM 320B card. Remove jumpers JP1 and JP2 on the CAM05, if installed. Terminations must be left in the most distant unit on the network. If E>Net is selected, all ports must be terminated. Baudrate range selection is not required on DCM 320B but is required on CAM05. Refer to Figure 5 on page 5 for jumper and DIP switch locations.

Step 3: Connect network wiring (Refer to page 23 for guidance)

Wire network ports selected in Step 1. Refer to Figure 4 when wiring Ports A and B on TBM 320A module. Refer to Figure 5 when wiring Ports C and D on the CAM05 module.

Step 4: Connect auxiliary I/O wiring

Refer to Figure 4 on page 6 when connecting discrete auxiliary I/O wiring. Note that some functions must be jumpered between screw terminals if not wired to external contacts. Analog I/O wiring is connected to the DCM 320B module as shown in Figure 5.

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 320B card shown in Figure 5. Locate the desired station address on pages 6 and 7. Set the DIP switches of SW1 to the corresponding pattern shown beside the selected address. Press execute button to store address.

Notice:

We highly recommend using Bettis's Windows based Configuration and Control Utility (CCU) to configure the actuators. CCU is available at www.Bettis.com or your local Bettis valve actuator Distributor.

If using CCU, you may skip step 6 below.

Figure 1 Configuration and Control Utility (CCU)

Connect Setting Actuator C	Control 3	20 B Config	320 B Calibration	1	
ESD Triggers T Lost Comm T Local IV Host Delay Action for 0 Second ESD Action	Modulation Modulation Delay Position Deadbar Speed Deadbard	0.1 Second +	Duty Cycle Speed O Open On Time Open Off Time Close On Time	Control Off Off Off	नन नन नन
C Open C Close C Stop ESD/Monitor Relay C Monitor C ESD C Network Control Method Block C Pulse C Network Modulating	Relay #1 C SS Locel C SS Remote C LSA 0% C ESD C Network F NC contact	Relay #2 C SS Local C SS Remote C LSB 0% C ESD C Network F NC contact	Close Off Time Anti Water Hammer Primary and Secon Comm1 Baud IT Enable Comm 1 Comm2 Baud IT Enable Comm 2	Ott 0% dary Netwo 9600 Alarm 19200 Alarm	स स कूं स स
C 0-5 Analog C Network C 4-20mA #1 C 4-20mA #2 Torque Settings C Torque Seat C Log Jam C Torque Back Seat	Contactor Type Contactor SSR With Contactor Variable Frequency	Discort Chinges Save Changes Save Detaults	Alarm after Comm 1 Parity © None © Odd © Even	60.0 Secon Comm 2 F None Odd Even	d 🕂

Step 6: Select configuration parameters

The actuator may be configured using the 5 DIP switches of SW2 and 8 DIP switches of SW1. This is a back-up means of configuring the unit if CCU is not available. The actuator is normally shipped with factory default settings. These settings may be changed by the following procedure. Locate DIP switches SW1, SW2, and Setup Execute Button on the DCM 320B module shown in Figure 5. Place the Selector Switch in the "OFF" position. Select the feature or configuration parameter from the configuration tables in this manual. 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 5 DIP switches of SW2 to the OFF position and return the 8 DIP switches of SW1 to the network station address when configuration is complete. With all SW2 switches OFF and the address switches set, press the execute button to store the network address to nonvolatile configuration memory.



Figure 2 Controlinc Model 320B RS485 Network Topology Options

for RS-485 bus networks







NOTE:

TBM320A is used with both DCM320A and DCM320B.

Figure 5



Figure 6	Configuration	n Data and Net	work Station	Address (SW1)	
12345678	12345678 25	12345678 49	12345678 73	12345678 97	12345678 121
12345578 2	12345678 26	Î. 101 50	12345678 74	12345678 98	12345678 122
12345678 3	12345678 27	12345678 51	12345678 75	12345678	12345678 123
12345678 4	12345678 28	12345678 52	12345678 76	12345678 100	12345678
	12345678 29	12345678 53	12345678 77	12345678	12345678 125
	12345678 30	12345678 54	12345678 78	12345678 102	12345678 126
12345678 7	12345678 31	12345678 55	12345678 79	12345678 103	12345678 127
12345678 8	112345678 32	Tunn 12345678 56	12345678 80	12345678 104	12345678 128
12345678 9	12345678 33	11111111111111111111111111111111111111	12345678 81	1 ₁₂₃₄₅₆₇₈ 105	1 12345678 129
12345678 10	1 <u>12345678</u> 34	12345678 58	1 12345678 82	12345678 106	12345678 130
12345678 11	1 12345678 35	1 12345678 59	1 12345678 83	12345678 107	1 <u>111111111</u> 12345678 131
12345678 12	1 <u>11 111 111</u> 12345678 36	Tuu 101 00	Î un u nu 84	12345678 108	132 12345678
12345678 12345678	1 12345678 37	1 <u>11345678</u> 61	12345678 85	12345678 12345678	133 12345678
12345678 12345678	1 <u>12345678</u> 38	1 <u>12345678</u> 62	1 <u>1111111</u> 86	12345678 12345678	134 12345678
1 12345678 12	1 12345678 39	1 <u>12345678</u> 63	1 <u>12345678</u> 87	111 12345678	1 ₁₂₃₄₅₆₇₈ 135
12345678 12345678	1 <u>12345678</u> 40	12345678 64	12345678 88	12345678 12345678	136 12345678
1 111 111 111 12345678 17	1 12345678 41	1 000000 05 12345678	1 12345678 89	113 12345678	112345678 12345678
12345678 12345678	1 <u>12345678</u> 42	14 4444 4 12345678 66	10 10 10 10 90	112345678 12345678	12345678 12345678
12345678 12345678	12345678 43	1 <u>11111111</u> 67	1 <u>12345678</u> 91	1 ₁₂₃₄₅₆₇₈ 115	139 12345678
12345678 12345678	12345678 44	10000000 12345678 68	1 <u>11345678</u> 92	12345678 12345678	140
12345678 21	1 12345678 45	12345678 69	12345678 93	12345678 117	12345678 12345678
12345678 12345678	1 <u>12345678</u> 46	1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:	12345678 94	12345678 12345678	142
1 <u>12345678</u> 23	1 12345678 47	12345678 71	12345678 95	12345678 12345678	12345678 12345678
11111111111111111111111111111111111111		12345678 72	12345678 96	12345678 120	144 12345678

Figure 6

Configuration Data and Network Station Address (SW1) continued.....

12345678	145	12345678 169
5 H H H H H H H H H 1232355748	146	12345678 170
12345678	147	12345678
12345678	148	12345678 172
12345678	149	12345678
12345678	150	12345678
12345678	151	12345678 175
12345678	152	12345678 176
12345678	153	12345678
12345678	154	12345678
	155	12345678 179
12345678	156	12345678 180
12345678	157	12345678 181
12345578	158	12345678 182
12345678	159	12345678 183
	160	12345678 184
12345678	161	12345678 185
12345678	162	12345678
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12345678	239
12345678	240



station address memory, set all SW2 switches to OFF, set SW1 switches to the desired address, place selector switch in OFF position and then press execute button.

Addresses 0 and 255 are reserved for broadcast, Address 254 is reserved on secondary port.

1.1 Setup Instructions

The DCM 320B is factory configured as specified by the customer purchase order. If field setup changes are required, follow setup instructions below. If unsure about setup of a module, known factory default settings may be reloaded as shown under "Direct Command Mode". When executed, the module loads known parameters from program memory to EEPROM configuration memory. Default parameters are highlighted in this manual by a box around the default or the value is listed

1.2 Entering Setup Mode

Locate DIP switches SW1, SW2, Setup Execute Button and LED indicators on the DCM 320B (See Figure 5 on page 5). SW2 switches select mode and SW1 switches select setup parameters and network station address.

- 1) Record network station address of SW1. These switches must be returned to the same setting before exiting setup.
- 2) Place selector switch in the OFF position.
- 3) Select desired setup mode by setting SW2 as indicated on this and following pages.
- 4) Verify the DCM320B has entered setup mode by a rapid flashing CPU GOOD light.

1.3 Changing Setup Parameters

The five switches (S1 - S5) of SW2 select the parameter/mode to be configured. The eight switches of SW1 (S1-SB) are used to select desired setup data.

- 1) Locate the desired setup parameter to be revised on pages 9 through 22.
- 2) Set the five switches of SW2 per the switch pattern shown for desired mode.
- 3) Set SW1 switches as shown or refer to the switches on pages 6 and 7 for desired value. Selected values are multiples of the stated resolution for each parameter.
- 4) When both SW2 and SW1 switches are set, press the execute button to store the setup parameter to nonvolatile memory.
- 5) Verify the green LED (setup data good) light flashes. If an invalid enter is made, the red LED (setup data error) light will turn on until the error is corrected.

1.4 Exiting Setup Mode

- 1) Tum off all five SW2 switches.
- 2) Place selector switch in the OFF position.
- 3) Return SW1 switches to the Network Station Address recorded in Step 1 under "Entering Setup Mode" above.
- 4) Press the Execute Button.
- 5) Verify the DCM320B has returned to the normal run mode by a slow flashing CPU GOOD light.

1.5 Direct Command Mode



All SW2 switches OFF. Normal run mode. Return all SW2 switches to this position after setup.

S1 ON = Direct Command Mode. Select the desired command by setting SW1 switches as follows.

S1 ON = Reload Factory Defaults, Loads default settings as listed or designated by rectangle around description under each setup mode parameter in this manual.

S2 ON = Reset passcode protection.

S1,S2 ON = Archive Torque Profile. Stores torque profile to EEPROM for later retrieval by host computer.

1.6 Valve Control Mode

(Setpoint Source)

SW2	
S2	ON = Valve Control Modes, Select the desired ntrol mode by setting SW1 switches as follows,
SW1	All SW1 switches OFF = Remote Host Control. Host may write Setpoint or Open, Stop, Close. Required by F.Fieldbus for modulating control.
12345678 SW1	S1 ON = Control from AIN1 (Torque Analog Input), Position control with Potentiometer or 0-5V signal connected to P3.
↑ 12345678	S2 ON = Control from AIN2 (User Analog Input #1). Position control with 4-20mA signal connected to P4-2,
SW1	S1,S2 ON = Control from AIN3 (User Analog Input #2). Position control with 4-20mA signal connected to P4-4,
5WI 12345678	S3 ON = Block Valve Control Mode, Required by Foundation Fieldbus for discrete control mode,
SW1	S1,S3 ON = Pulse Input Control Mode, 24VDC discrete control wired to User Input #1 (OPEN) and User Input #2 (CLOSE),

1.7 Valve Travel Limits



S1,S2 ON = Valve Travel Limits Mode.

All switches OFF = Open and Close Position Limits. Open to LSO and Close to LSC.

S1 ON = Enable close valve torque seat. Open to LSO and Close to TSC.

S2 ON = Enable torque backseat. Open to TSO and Close to LSC.

S1,S2 ON = Enable close torque seat and torque backseat, Open to TSO and Close to TSC,

1.8 ESD Function



1.9 ESD/Monitor Relay Function



S2,S3 ON, Select ESD/Monitor Relay Function,

All SW1 switches OFF, Deactivate relay when an alarm is detected.

S1 ON, Activate relay when software based ESD is detected.

S2 ON, Activate relay on command from remote network host. Factory default

1.10 ESD Trigger Sources

Note:

At least one source must be selected, or ESD is disabled.



1.11 ESD Delay Time



S1,S2,S4 ON, Select ESD delay setup mode.

Select delay time by setting SW1 switches as shown on Pages 7 and 8. (See example below)

Range = 0 to 60 Seconds Resolution = 1 Seconds Default = 0

Example: Set ESD delay time to 30 seconds.



Locate the DIP switch pattern for 30 on Page 7.

Note:

ESD Delay Time applies only to software generated ESD and not to the hardwired local ESD input.

Notes on hardwired Local Inhibit/ESD:

- Local ESD is a hardwired closed loop circuit wired to TBM tenninals 27 (+)and 28
 (-) using either an external 24VDC power supply or the internal 24VDC power available at tenninals 26(+) and 29(-). See Figure 4.
- 2) Local ESD will inhibit control from the DCM320B 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. Actuator will Stop (Stay-Put) if no jumpers are inserted between terminals 8-9 or 9-10.
- 3) To override motor thermal contacts during local ESD, insert jumper between terminals XO and 53.

A 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.

1.12 Position Control Bandwidth



S3,S4 ON, Select position control bandwidth (Deadband) setup mode.

Select bandwidth by setting SW1 switches as shown on Pages 7 and 8. (See example below)

Range = 0.1 to 5.0% (0-50) Resolution = 0.1% Default = 1.0%

Example: Set control bandwidth to 2.5%.



Locate the DIP switch pattern for 25 on Page 7, i.e. $25 \times 0.1\%$ resolution = 2.5%.

1.13





S1,S3,S4 ON, Select speed control bandwidth setup mode.

Select bandwidth by setting SW1 switches as shown on Pages 7 and 8 . (See example below)

Range = 0.3 to 10.0% (3-100) Resolution = 0.1% Default = 3.0%

Example: Set speed control bandwidth to 5%.



Locate the DIP switch pattern for 50 on Page 7, i.e. $50 \times 0.1\%$ resolution = 5.0%.

Note:

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

1.14 Motor Starter Type



3456

S1,S2,S3 ON, Select type of motor starter installed, Select motor starter type by setting SW1 switches.

All SW1 switches OFF, Enable Electro-mechanical motor starter, Factory default,

S1 ON, Enable Solid-State Relay (SSR) motor starter type,

S2 ON, Enable Variable Frequency Drive (VDF) motor starter type,

1.15 Analog Output Control



S3 ON, Select source for analog output, Select AO#1 source by setting SW1 switches.

All SW1 switches OFF, Enable Network Host control of analog output AO#1. Factory default.

S1 ON, Enable Position Feedback control of analog output AO#1.

1.16 Modulation Delay Time



S2,S3,S4 ON = Modulation Delay Timer Mode,

Select delay time by setting SW1 switches as shown on Pages 7 and 8. (See example below)

Range = 0 to 25,5 Seconds, (0-255) Resolution = 0,1 Second, Default = 0,1 Second.

Example: Set modulation delay time to 6 seconds.



Locate the DIP switch pattern for 60 on Page 7, i.e. 60 x 0,1 Sec resolution = 6,0 seconds,

1.17 Network Response Delay Time

1.17.1 Primary Network Ports A and B



S1,S2,S3,S4 ON, Select Ports A & B response delay mode.

Select delay time by setting SW1 switches as shown on Pages 7 and 8.

Range = 8 to 60mS (8-60) Resolution = 1mS Default = 8mS

Example: Set response delay to 15mS



Locate the DIP switch pattern for 15 on Page 7.

1.17.2 Secondary Network Ports C and D



S5 ON, Select Ports C & D response delay mode,

Select delay time by setting SW1 switches as shown on Pages 7 and 8, (See example above)

Range = 8 to 60mS (8-60) Resolution = 1mS Default = 8mS

1.18

Torque Retry (Log-Jam) Control



S1,S3 ON, Select Close Torque (Log-Jam) function.

All SW1 switches OFF, Disable close torque retry (Log-jam) function. Factory default.

S1 ON, Enable close torque retry (Log-jam) function,

1.19 Network Baud Rate

1.19.1 Primary Network Ports A and B



S1,S5 ON Select baudrate for primary network ports A and B.

Select baud rate by setting SW1 switches as shown below, Default = 9600

1.19.2 Secondary Network Ports C and D



S2,S5 ON Select baudrate for secondary network ports C and D.

Select baud rate by setting SW1 switches as shown below. Default = 19200



1.20 Network Parity

1.20.1 Primary Network Ports A and B



S1,2,5 ON, Select parity for primary network. Select parity by setting SW1 switches as shown below.

1.20.2 Secondary Network Ports C and D



S3,5 ON, Select parity for secondary network, Select parity by setting SW1 switches as shown below.



All SW1 switches OFF = No parity

S1 = Even parity



S2 = Odd parity

1.21 Calibrate Analog I/O



S1,3,5 ON, Select analog input and output calibration mode,

Set SW1 to select the desired analog input or output calibration, apply calibration current to input or connect 4-20mA meter to output and then press execute button.

1.22 Calibrate Analog Inputs



S2 ON, Set Torque analog input Zero, Input zero offset resistance/voltage,

S1,2 ON, Set Torque analog input Span. Input full scale resistance/voltage.

S2,3 ON, Set User #1 analog input Zero. Input 4mA offset current.

S1,2,3 ON, Set User #1 analog input Span. Input 20mA full scale current,

S2,4 ON, Set User #2 analog input Zero. Input 4mA offset current.

S1,2,4 ON, Set User#2 analog input Span. Input 20mA full scale current.

1.23 Calibrate Analog Output



S2,3,4 ON, Increase zero analog output at AO#1 while the Execute button is pressed.

S1,2,3,4 ON, Decrease zero analog output at AO#1 while the Execute button is pressed.

S5 ON, Increase full scale analog output at AO#1 while the Execute button is pressed.

S1,5 ON, Decrease full scale analog output at AO#1 while the Execute button is pressed.

1.24

Load Factory Default Calibrate Values





S2,5 ON, Load factory default calibration values for all analog inputs and outputs for both Zero and Span.

1.25

SW2

S2,S3,S5 ON, Select User Relay#1 setup mode,

Select user relay#1 function by setting SW1 switches as shown below,

User Relay #1 Application



SW1 34567

SW1

SW1

SW1

W1

SW1

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S1 ON, Activate normally open (N.O.) relay when Selector Switch in Remote position,

All SW1 switches OFF, Direct control of N,O, relay from network master, Factory default,

S2 ON, Activate normally open (N.O.) relay when Selector Switch in Local position.

S1,S2 ON, Activate normally open (N.O.) relay at LSA limit setpoint, if LSA position configured.

S3 ON, Activate normally open (N.O.) relay when any ESD is active.

S1,S3 ON, Direct control of normally closed (N.C.) contact from network master.

S2,S3 ON, Activate normally closed (N.C.) relay when Selector Switch in Remote position.

S1,S2,S3 ON, Activate normally closed (N.C.) relay when Selector Switch in Local position.

S4 ON, Activate normally closed (N.C.) relay at LSA limit setpoint, if LSA position configured.

S3 ON, Activate normally closed (N.C.) relay when any ESD is active.

1.26 User Relay #2 Application



Notice:

User Relay #1 and User Relay #2 are non-latching SPST type. When power to the actuator is lost, both relays are de-energized and the contacts will open. Do not apply these relays to critical control applications where closed contacts are required during loss of power.

1.27

LSA Position Setpoint



S4,5 ON, Select LSA position setup mode. Select LSA position by setting SW1 switches as shown on Page 7.

Range = 0 to 100% Resolution = 1% Default = 0 (LSA disabled)

Example: Set LSA position to 30%



Locate the DIP switch pattern for 30 on Page $\ {\bf 7}$

1.28 LSB Position Setpoint



S2,5 ON, Select LSA position setup mode.

Select LSB position by setting SW1 switches as shown on Page 7, Range = 0 to 100%

Resolution = 1% Default = 0 (LSB disabled)

Example: Set LSB position to 60%

Anti-water Hammer



Locate the DIP switch pattern for 60 on Page 7.

1.29



S2,4,5 ON, Select anti-water hammer setup mode.

Select anti-water hammer position by setting SW1 switches as shown on Page 7. This is the position that anti-water hammer is activated while the valve is closing.

Range = 0 to 100% Resolution = 1% Default = 0 (Anti-water hammer disabled)

Example: Set Anti-water hammer position to 10%



Locate the DIP switch pattern for 10 on Page 7',

1.30



S1,3,4,5 ON, Select opening duty cycle ON timer.

Select opening ON time by setting SW1 switches,

Range = 0 to 65 Seconds, Resolution = 1 Second, Default = 0 (Timer disabled)

Opening Duty Cycle ON Timer

Example: Set opening ON timer to 6 seconds.



Locate the DIP switch pattern for 6 on Page 7.

1.31 Opening Duty Cycle OFF Timer



S2,3,4,5 ON, Select opening duty cycle OFF timer. Select opening OFF time by setting SW1 switches.

Range = 0 to 65 Seconds, Resolution = 1 Second, Default = 0 (Timer disabled)

Closing Duty Cycle ON Timer

Example: Set opening OFF timer to 9 seconds.



Locate the DIP switch pattern for 9 on Page 7.

1.32



S1,2,4,5 ON, Select closing duty cycle ON timer,

Select closing ON time by setting SW1 switches, Range = 0 to 65 Seconds. Resolution = 1 Second. Default = 0 (Timer disabled)

Example: Set closing ON timer to 6 seconds.



Locate the DIP switch pattern for 6 on Page 7.

1.33

Closing Duty Cycle OFF Timer



S3,4,5 ON, Select closing duty cycle OFF timer.

Select closing OFF time by setting SW1 switches,

Range = 0 to 65 Seconds, Resolution = 1 Second, Default = 0 (Timer disabled)

Example: Set closing OFF timer to 9 seconds.



Locate the DIP switch pattern for 9 on Page 7,

Notice:

Duty cycle timers are active only when selector switch is in REMOTE position. Opening and closing speed of the valve may be adjusted (slowed) by enabling the opening or closing duty cycle timers. Duty cycle timers are available only with a solid-state or VFD starter. Anti-water hammer duty cycle is is fixed at 50% duty with one second ON time and one second OFF time for SSR and VFD starters and two seconds ON time and two seconds OFF time for electro-mechanical starter. When activated, the Anti-water hammer function overrides the closing duty cycle timer. If duty cycle or Anti-water hammer functions are used in any Anti water hammer scheme, EIM must be advised of system parameters and conditions.

Section 2: Modbus Memory Map Reference

2.1 Modbus Function Codes

		Host
		beginning
		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.	

Note;

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

2.2 Input Register Map

(Use function code 04)

- 00 Inputs 0-15 (Live discrete inputs)
- 01 Inputs 16-31 (Standard valve status)
- 02 Inputs 32-47 (DCM320 valve status)
- 03 Inputs 48-63 (Specific to DCM320B)

2.3 Input Register 03 (DCM320B only)

- 48 DCM is in Setup Mode
- 49 AIN1 Signal fault
- 50 AIN2 Signal fault
- 51 AIN3 Signal fault
- 52 Software triggered ESD active
- 53-63 Reserved inputs (always zero)

2.5 Discrete Input Map

(Inputs 0 through 15 are hardware inputs)

- (use function code 02)
- 00 Open limit switch (LSO)
- 01 Close limit switch (LSC)
- 02 Contactor Aux. open contact
- 03 Contactor Aux. close contact
- 04 Selector switch Local/Manual
- 05 Selector switch Remote/Auto
- 06 Open torque switch (TSO)
- 07 Close torque switch (TSC)
- 08 Power monitor alarm
- 09 Motor thermal overload
- 10 Phase monitor
- 11 Local ESD alarm
- 12 Aux. alarm input (VFD fault)
- 13 User discrete input #1
- 14 User discrete input #2
- 15 Reserved
- 16 Open limit switch (LSO)
- 17 Close limit switch (LSC)
- 18 Opening (valve moving open)
- 19 Closing (valve moving close)
- 20 Selector switch Local/Manual
- 21 Selector switch Remote/Auto
- 22 Open torque switch (TSO)
- 23 Close torque switch (TSC)
- 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 (LSO)
- 33 Close limit switch (LSC)
- 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 thermal overload alarm
- 41 Power monitor alarm
- 42 Primary network alarm
- 43 Secondary network alarm
- 44 Open torque alarm (TSO)
- 45 Close torque alarm (TSC)
- 46 Local ESD input alarm
- 47 Phase monitor alarm

2.6 Coil Map

(Coils 0 through 7 are hardware outputs)

- (use function code 01, 05 and 15)
- 00 Close motor starter output
- 01 Open motor starter output
- 02 Solid-state relay NFC speed control
- 03 ESD/Monitor relay output
- 04 User relay #I/Override relay
- 05 User relay #2
- 06 Primary network channel 1 enable
- 07 Secondary network channel 2 enable
- 08 Host OPEN valve command
- 09 Host STOP command
- 10 Host CLOSE valve command
- 11 Host ESD command
- 12 Enable normal modulating mode
- 13 reserved
- 14 Enable VFD starter control mode
- 15 Enable pulse control mode
- 16 Open limit switch status (LSO)
- 17 Close limit switch status (LSC)
- 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 (TSO)
- 23 Close torque alarm (TSC)
- 24 Valve stall alarm (valve not moving)
- 25 Power monitor alarm
- 26 Motor overload alarm (Motor thermal)
- 27 Phase monitor alarm
- 28 Local ESD alarm
- 29 Actuator fail alarm
- 30 reserved for host (always zero)
- 31 Unit alarm (all alarms OR'ed)
- 32 Enable torque seat mode
- 33 Enable logjam retry mode
- 34 Enable 4-20mA feedback at A0#1
- 35 Enable monitor relay, else ESD relay
- 36 Enable passcode protection
- 37 Enable solid-state starter contol mode
- 38 reserved
- 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 Stop on ESD with ESD relay
- 44 Enable ESD trigger from host
- 45 Enable ESD trigger on local ESD input
- 46 Enable ESD trigger from loss of com.
- 47 Configuration conflict error detected
- 48 Select AIN1 as setpoint source
- 49 Select AIN2 as setpoint source
- 50 Select AIN3 as setpoint source
- 51 Move to Default on AIN1 fault
- 52 Move to Default on AIN2 fault
- 53 Move to Default on AIN3 fault
- 54 reserved
- 55 reserved
- 56 reserved
- 57 Select N.C. contacts for Relay #1
- 58 Enable Relay #1 as Override on ESD
- 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 on ESD
- 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 Enable MRTU operating mode
- 76 Enable torque backseat
- 77 Save torque profile to EEPROM
- 78 CPU has reset
- 79 Load factory default configuration
- 100 Host OPEN valve command
- 101 Host CLOSE valve command
- 102 Host STOP command
- 103 Host ESD command

2.7 Holding Register Map

(RO	= Rea	ad Only RW = Read/Write)	
	(Use	function 03, 06 and 16)	
00	RW	Coils 0-15	42
01	RO	Coils 16-31	43
02	RW	Coils 32-47	44
03	RW	Coils 48-63	45
04	RW	Coils 64-79	46
05	RO	Inputs 0-15	47
06	RO	Inputs 16-31	48
07	RO	Valve Position 1.0% increments	49
08	RO	Valve Status inputs 32-47	50
09	RO	Valve Status inputs 16-31	51
10	RW	Analog Output (0-4095)	52
11	RW	Valve Position Setpoint (0-4095)	53
12	RO	Inputs 48-63	54
13	RO	Valve Position (0.1% increments)	55
14	RO	Position Analog Input (0-4095)	56
15	RO	Torque Analog Input (0-4095)	57
16	RO	User Analog Input #1 (0-4095)	58
17	RO	User Analog Input #2 (0-4095	59
18	RW	Water Hammer setpoint (1-20%)	60
19	RW	Modulation delay (0.1-25.5 sec)	61
20	RW	ESD Delay timer (0-65.5 sec)	62
21	RW	Position Bandwidth (0.1-5.0%)	63
22	RW	Speed Bandwidth (0.5-10%)	64
23	RW	Default Position Setpoint (0-4095)	65
24	RW	Torque AIN Zero offset, raw cnts	66
25	RW	Torque AIN Span, raw AID counts	67
26	RW	User AIN1 Zero offset, raw counts	68
27	RW	User AIN1 Span, raw AID counts	69
28	RW	User AIN2 Zero offset, raw counts	70
29	RW	User AIN2 Span, raw AID counts	100
30	RW	A0#1 Zero offset, raw counts	No
31	RW	A0#1 Span, raw D/A counts	1\1
32	RVV	LSA Setpoint (0-4095)	1)(
33	RVV	LSB Setpoint (0-4095)	,
34	RVV	Close ON duty cycle (0-65.5 sec)	2) <i>A</i>
35	RVV	Close OFF duty cycle (0-65.5 sec)	,
36	RVV	Open ON duty cycle (0-65.5 sec)	3)1
3/	RVV	Open OFF duty cycle (0-65.5 sec)	4) 7
<u>کر</u>			4)
39	KVV	Primary network response delay	I
40 41			5) [
41	KVV	secondary network response dela	-,-

2	RW	Passcode char 1(LSB) & 2(MSB)
3	RW	Passcode char 3(LSB) & 4(MSB)
4	RO	Firmware version
5	rese	rved
6	rese	rved
7	rese	rved
8	RO	Torque@ 10% valve position
9	RO	Torque@ 20% valve position
0	RO	Torque@ 30% valve position
1	RO	Torque@ 40% valve position
2	RO	Torque@ 50% valve position
3	RO	Torque@ 60% valve position
4	RO	Torque@ 70% valve position
5	RO	Torque@ 80% valve position
6	RO	Torque@ 90% valve position
7	RO	Torque profile @ 10%
8	RO	Torque profile @ 20%
9	RO	Torque profile @ 30%
0	RO	Torque profile @ 40%
1	RO	Torque profile @ 50%
2	RO	Torque profile @ 60%
3	RO	Torque profile @ 70%
4	RO	Torque profile @ 80%
5	RO	Torque profile @ 90%
6	RW	Accumulator #1 (User Input #1)
7	RW	Accumulator #1 (User Input #2)
8	RW	Lost COM ESD delay (mS)
9	RW	Stall time delay (mS)
0	RW	RW Valve Travel Time/1% (mS)
00	RO	RO Unit I.D.
Vot	e:	
I)U	nless	otherwise specified, analog I/O is
u	nsigi	ned integer in range of 0-4095.

- 2) All time parameters are in mS.
- 3) Torque readings are raw AID counts.
- 4) Torque profile values are read from EEPROM.
- 5) Do not write to reserved registers.

Section 3: Network Installation Guide

Step 1: Plan the network topology

Before connecting actuators, the entire network layout should be planned. Select desired network topology from Figures 2 and 3 on page 5. 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. Network planning should include node addressing, wire routing, terminations, and grounding.

Step 2: 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						

Step 3: 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.

Step 4: 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 (Terminals 22 and 23) of each actuator to carry the shield through the network. 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.

Step 5: Wire preparation and connections

Screw terminals of the TBM have wire clamps that accept wires without terminals but may be applied if desired. Strip 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.

Step 6: Wire preparation and connections

Use BETTIS's Configuration and Control Utility (CCU) or Controlinc Pocket Technician to test the network prior to connecting to a host or network master. The CCU is a Windows application that will run on a laptop using an RS232 to RS485 adapter or BETTIS'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.

Section 4: System Startup Guide

Step 1: Set position and torque limit switches

Set open and close position and torque switches while operating valve full open and close with local push buttons. Refer to Manual E796 for limit switch setting instructions.

Step 2: Set DIP switches

Set address DIP switches to unique address as shown in the first section of this guide. Refer to Figure 5 on page 5 for location of DIP switches. Refer to network station address switch settings on pages 6 and 7. 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 26 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 distant 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 Bettis'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 BETTIS 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 BETTIS 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.

Tools:

- 1) Speed handle or 3/8" battery drill with 1/2" thin wall socket
- 2) Common screwdriver
- 3) Multimeter (VOM)
- 4) Portable oscilloscope (optional)
- 5) Laptop computer with Windows
- 6) Bettis Configuration and Control Utility (CCU) w/ RS485 adapter
- 7) Other system test software supplied with host system
- 8) Programming cables
- 9) 4-20mA calibrator for analog I/O

Section 5: Optional Phase Monitor

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

The phase monitor module shown in Figure 7 is mounted on the back side of the DCM 320B module facing the motor starter.

Figure 7



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 for proper electric motor rotation 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 mode will cause the actuator to shut down if a loss of phase [single-phasing] is detected.

To select modes, do the following:

- 1) Remove TBM 320A termination panel.
- 2) Locate 3-pin jumper P9 on bottom of board 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}.

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