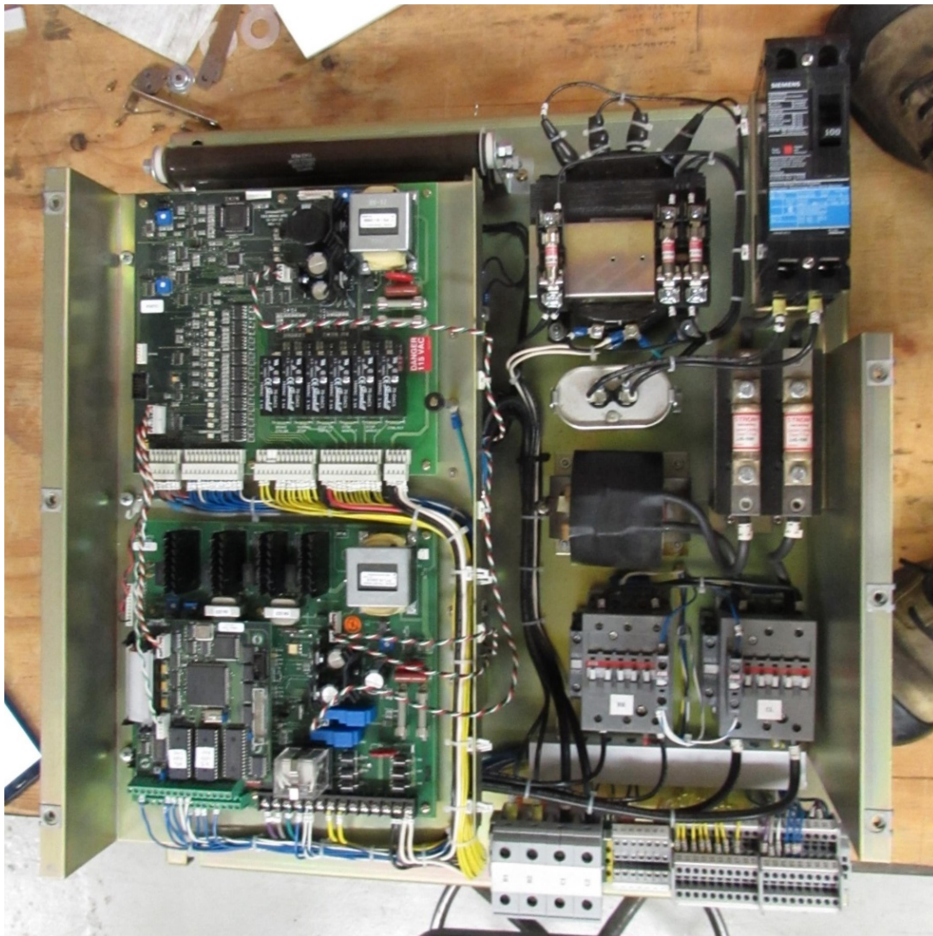




EC 2000 – CES

Stamping Press Position Controller

Instruction Manual



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Table of Contents

SECTION 1 - THEORY OF OPERATION	6
SECTION 2 – MODELS AND PART NUMBERS.....	9
SECTION 3– SPECIFICATIONS	10
3.1 Features	10
3.2 Power and Load Ratings.....	10
3.3 Electrical Protection	10
3.4 Environmental Ratings	11
3.5 Electrical Noise.....	11
3.6 Enclosures	11
3.7 Weight.....	11
3.8 Dimensions (see Figure 3&4)	11
3.9 Reliability.....	11
3.10 Codes and Standards.....	11
SECTION 4 – CONTROL OPERATION MODES.....	13
4.1 Control Modes	13
4.2 Mode of Operation	13
SECTION 5 – Inputs/Outputs.....	14
5.1 Analog Inputs	14
5.2 Digital Inputs	14
5.3 Analog Outputs	14
5.4 Digital Outputs	14
SECTION 6 – INSTALLATION	15
6.1 Panel & Keypad Layouts.....	15
6.2 Mounting Hardware.....	18
6.3 Wiring.....	18
6.4 Hardware Jumper & Potentiometer Setup	19
SECTION 7 – KEYPAD	22
SECTION 8 – PROGRAMMING	23
8.1 Menu A: Control Setup	23
8.2 Menu B: CLCH PERFORMANCE	26
8.4 Menu C: ACCEL/DECEL SETUP	27
8.4 Menu D: BRAKE PERFORMANCE	27

8.5	Menu F: PROCESS.....	29
8.6	Menu G: FAULT	30
8.7	Menu H: FAULT TIMER SETUP.....	31
8.8	Menu I POSITION ERROR SETUP	34
8.9	Menu J: METER SETUP	35
8.10	Menu K: SERIAL OPTIONS	35
SECTION 9 – PRESS CONTROL OPERATION -- WIRED INTERFACE		36
9.1	CONTROL INPUT SIGNALS	36
9.2	CONTROL - OUTPUT SIGNALS	37
9.3	PRESS CONTROL INTERFACE - SERIAL PORT.....	38
9.4	SIGNALS FOR CUSTOMER’S RECORDER	39
9.5	BRAKE CONTACTOR.....	39
9.6	CONTROL OPERATING MODES.....	39
SECTION 10 – STARTUP & ADJUSTMENT		43
10.1	POWER CONVERSION	43
10.2	PRESS SPEED CONTROL.....	43
10.3	BRAKE CONTROL BOARD.....	43
10.4	CLUTCH CONTROL BOARD	44
10.5	PRE-START-UP PROCEDURE	44
10.6	START-UP PROCEDURE.....	46
SECTION 11 – FAULT LISTING & DESCRIPTIONS.....		48
11.00	FAULT LIST	48
11.01	LEVEL 100 FAULTS	48
11.02	LEVEL 200 FAULTS	48
11.03	LEVEL 300 FAULTS.....	50
SECTION 12 PRESS CONTROL INTERFACE - SERIAL PORT		52
12.0	SERIAL PORT PRESS CONTROL INSTRUCTIONS	52
12.1	SERIAL PORT PARAMETER DATA PACKET INSTRUCTIONS	53
12.2	SERIAL PORT PARAMETER DATA PACKET INSTRUCTIONS (ALTERNATE METHOD).....	54
12.3	SERIAL PORT EXECUTE PARAMETER INSTRUCTION	54
12.4	SERIAL PORT FAULT REPORT INSTRUCTION.....	54
12.5	SERIAL PORT FAULT REPORT DATA PACKET CONTENT	55
12.6	SERIAL PORT MONITOR DATA INSTRUCTION	55

12.7 SERIAL PORT MONITOR DATA PACKET CONTENT	55
12.8 SERIAL PORT CONNECTIONS	56
SECTION 13 – TROUBLESHOOTING	57
13.1 TROUBLE SHOOTING 100 LEVEL STOP MOTOR FAULTS	58
13.2 TROUBLE SHOOTING 200 LEVEL STOP NOW FAULTS	58
13.3 TROUBLE SHOOTING 300 LEVEL STOP ON TOP FAULTS	62
13.4 TROUBLE SHOOTING. NO FAULT DISPLAYED:	64
13.41 Blank Display:	64
13.42 Keypad Does Not Respond. Display works:	65
13.43 Control does not engage. No faults:	65
13.44 Unit runs at top speed only - No control:	65
13.45 The speed range is limited—doesn't reach maximum speed:.....	65
13.46 High Voltages Fuses blow on power up:	66
13.47 High Voltages Fuses blow while running:	66
13.48 Low Voltages Fuses on clutch control board blow:	66
13.49 Low Voltages Fuses on brake control board blow:	66
13.50 Unstable Speed Running:	66
13.51 Unstable Speed Slowing or Braking:	67

Table of Figures

Figure 1: Eddy Current Drive Block Diagram	7
Figure 2: EC 2000-CES Keypad Display.....	8
Figure 3: Standard Panel Dimensions (Not to scale)	15
Figure 4: Keypad Cutout Template (to Scale, Inches).....	16
Figure 5: Keypad Dimensions (to Scale)	17
Figure 6: Clutch Control Board Layout	20
Figure 7: Brake Control Board Layout	21
Figure 8: Keypad Layout.....	22

Listing of Tables

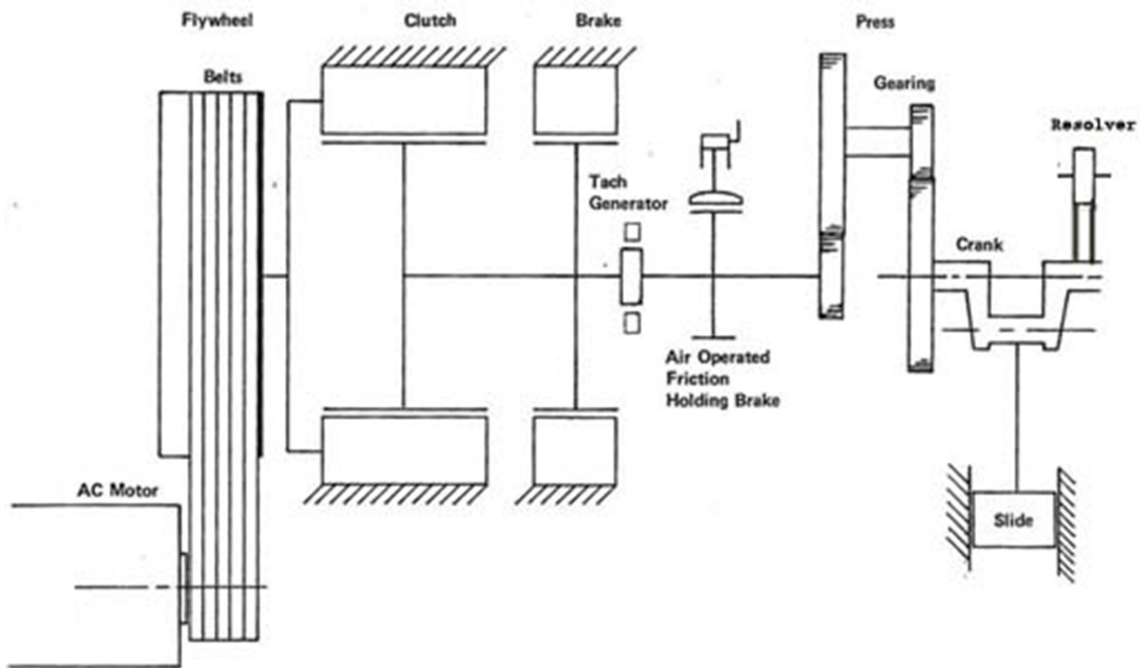
Table 1: Models and Part Numbers	9
Table 2: Clutch Control Board Programmable Jumpers Default Settings in Green	19
Table 3: Follower Set Point Jumper Settings	19
Table 4: Brake Control Board Programmable Jumpers	21
Table 5: Keypad Button Descriptions	22
Table 6: Mechanical Unit Tach Pulses/REV Setting	24
Table 7: Parameter Locations	40
Table 8: Press Run Data Format	53
Table 9: Control Fault Data Format	55
Table 10: Control Monitor Data Format	56

SECTION 1 - THEORY OF OPERATION

The Dynamatic® Eddy Current CES press drive system consists of a prime mover (AC induction motor), an AC motor starter (optional and not provided), the Eddy Current coupling, Eddy Current Brake a speed feedback device (tachometer generator), a resolver (position measurement) and a controller with an operator interface.

The AC motor is started under no load and runs at full speed before the controller is energized. The output of the control is determined by reference setting (based on press position) and feedback magnitude with drive speed and torque being based on the operational mode and load requirements. Speed control mode with tachometer or resolver feedback will regulate within 0.5% of set speed. Preset speeds, and external reference inputs are available as standard parameter selections with the EC 2000-CES control.

The EC 2000-CES uses digital technology to provide a flexible, low noise control for today's high tech industrial environment. It provides setup and programming via a keypad with a user friendly alphanumeric display; drive parameters may be programmed and displayed by the customer to activate the many built-in features. Below is a schematic of a typical press drive.



C.E.S. Press Drive System

Figure 1

Figure 1: Eddy Current Drive Block Diagram

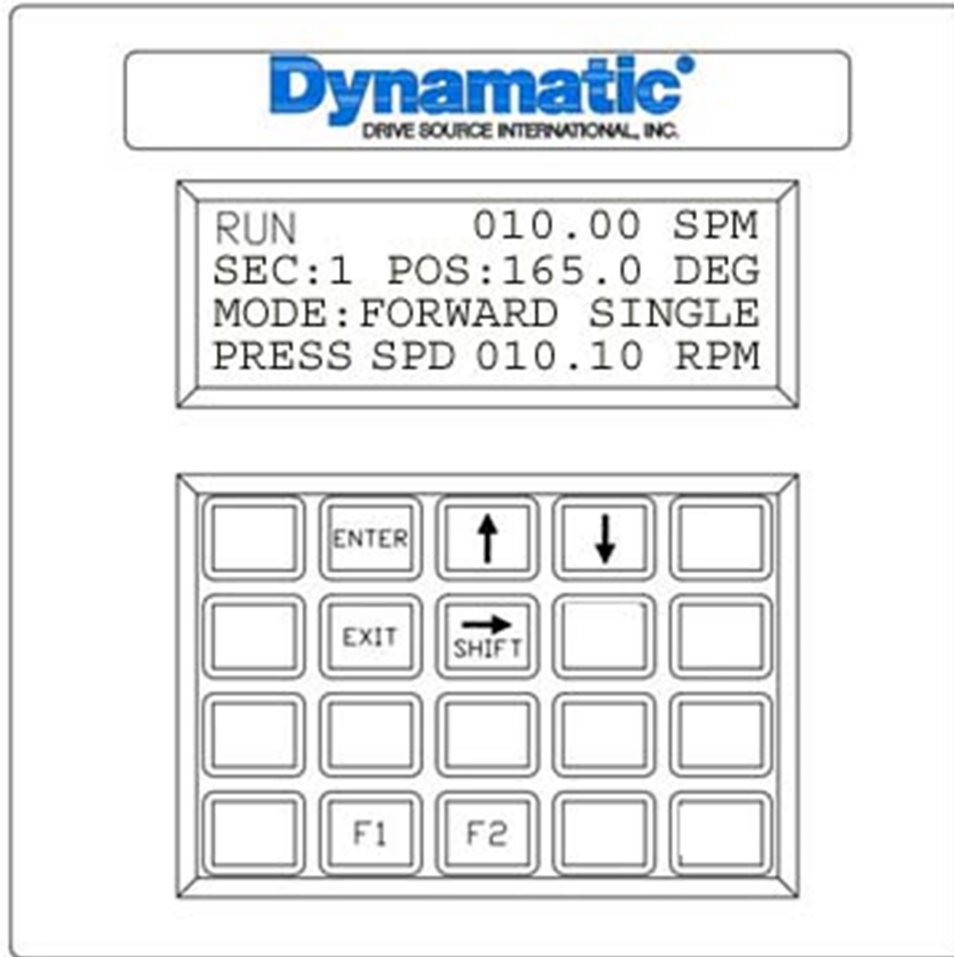


Figure 2: EC 2000-CES Keypad Display

SECTION 2 – MODELS AND PART NUMBERS

Table 1: Models and Part Numbers

Dynamatic Part Number	Output Voltage	Maximum Current	Required Input Voltage (50/60 Hz)	Notes
015-000248-2002	300VDC *	135A	600V 1ph **	SCRs in F.W. bridge rectification
015-000248-2003	300VDC *	80A	600V 1ph **	SCRs in F.W. bridge rectification
015-000248-2004	300VDC *	32A	600V 1ph **	SCRs in F.W. bridge rectification

* (Field Forcing to 600V -- Transformer sold separately)

** (Input Voltage with step up Isolation Transformer)

SECTION 3– SPECIFICATIONS

3.1 Features

- Direct Drop in Replacement for Dynamatic Digital CES Controls, Galco or Control Techniques
- Voltage ranges available from 45 – 300VDC
- Up to 135 amps output (see Table 1 for model list)
- Control Modes (3) Speed (AC tachometer generator or pulse pickup), torque (clutch current) feedback. Position Control with Resolver Feedback. Tach-less Speed control when Resolver is used.
- Six selectable angles and speeds. Programmable Creep Angle, Creep Speed and Stop Angle
- Adjustable brake & clutch current output
- Controllable via potentiometer, follower signal (0-10V, 4-20mA), or Programmed angles and speeds
- Digital, noise free operation
- Fuse and MOV protected
- Back-lit LCD with keypad user interface
- Recorded and displayed faults
- RS422 / 485 Com port. Remotely programmable speeds and angles.
- Ethernet IP add-on to be available

3.2 Power and Load Ratings

- Input voltage: 200, 230, 460, 575V AC
- Output Currents: 24 to 135 Amp (See Table #1)
- Output: Voltage 300VDC Field Forcing to 750 VDC with Inversion
- Solid State Relay Outputs (5) Normal Stop Stop on Top, Stop Now, Stop Motor, & Control Fault
- Load Regulation: -0.25% load change from 25% to full load
- Line Regulation: +/- 1% of rated speed for +/-10% change in line voltage
- Thermal Drift: +/- 0.05% of rated speed per °C
- Linearity: +/- 2% of maximum rated speed
- Minimum Regulated Speed: 25 RPM
- Linear Acceleration/Deceleration Range: 1% - 199% of top speed/sec or Instantaneous.

3.3 Electrical Protection

- Fuses: Class T, 600V, 125 A
- Circuit Breaker 125 Amp 2P
- Metal Oxide Varistor on Clutch & Brake Output
 - 1800V/m 10kA
- Metal Oxide Varistor on power board line input
 - 240V, 6.5kA

3.4 Environmental Ratings

- Operating temperature range: 0°C to 40°C (enclosed or panel mount)
- Storage temperature: -10°C to 75°C maximum
- Humidity: 95% non-condensing
- Elevation: to 1500 meters without derating

3.5 Electrical Noise

- The control is immune to showering arc noise as specified by NEMA 519 test procedures. Operation will not be affected by a 5 watt, 2-way radio transmission with the enclosure door closed.
- Noise Immunity and Radiation
- The controller complies with FCC, part 15B, of federal regulation #47 as a Class A digital device when operated in a defined enclosure and installed in accordance with our instructions; third party verification is required.
- EMI Susceptibility: Complies with IEC 801(1984)-3, class 2. It operates without fault or disturbance under the specified level of radiated EMI (Performance Criteria 1).

3.6 Enclosures

- Enclosures available upon request (lead times may vary)
- Enclosures available with cooling and proper NEMA standards

3.7 Weight

-

3.8 Dimensions (see Figure 3&4)

- Panel Mounted (Standard):
- Keypad: 4.875"H x 4.875"W x 1.375"D

3.9 Reliability

- Mean Time Between Failures: 50,000 hours

3.10 Codes and Standards

- National Electrical Code (NEC) compliant

SECTION 4 – CONTROL OPERATION MODES

4.1 Control Modes

- Speed (AC Tachometer Generator or Speed Pickup)
- Torque (Current Feedback)
- Position & Speed (Resolver Feedback)

4.2 Mode of Operation

- Manual/Auto
 - Allows the use to switch between an automatic signal (i.e. 4-20mA or 0-10V) and the control potentiometer in Speed Mode
- Start Stop – Utilizes Enable-High, Enable Low & Clutch Contactor
- Six Preset Angles and Speeds
 - Programmable through the keypad
- Top Stop – Utilizes Creep angle Creep Speed & Stop Angle
- Adjustable Braking
- Ramp Control
- Loss of Follower
- User Process Units – Programmable SPM and Gear Ratio & Tach Pulses
- Forward/Reverse Speed Control
- ESTOP (TB2-31 and 32 are not closed)

SECTION 5 – Inputs/Outputs

5.1 Analog Inputs

- Potentiometer/Reference Voltage
 - Used for setpoints

5.2 Digital Inputs

- Clutch On
- Enable High
- Enable Low
- Inch High
- Inch Low
- Reverse
- Continuous Mode
- Fault Reset

5.3 Analog Outputs

- Tach Pulses

5.4 Digital Outputs

- Clutch Contactor On Relay NO
 - 2A, 115VAC
- Solid State Relays 120VAC
 - Normal Stop
 - Stop on Top
 - Stop Now
 - Stop Motor
 - Control Fault

SECTION 6 – INSTALLATION

6.1 Panel & Keypad Layouts

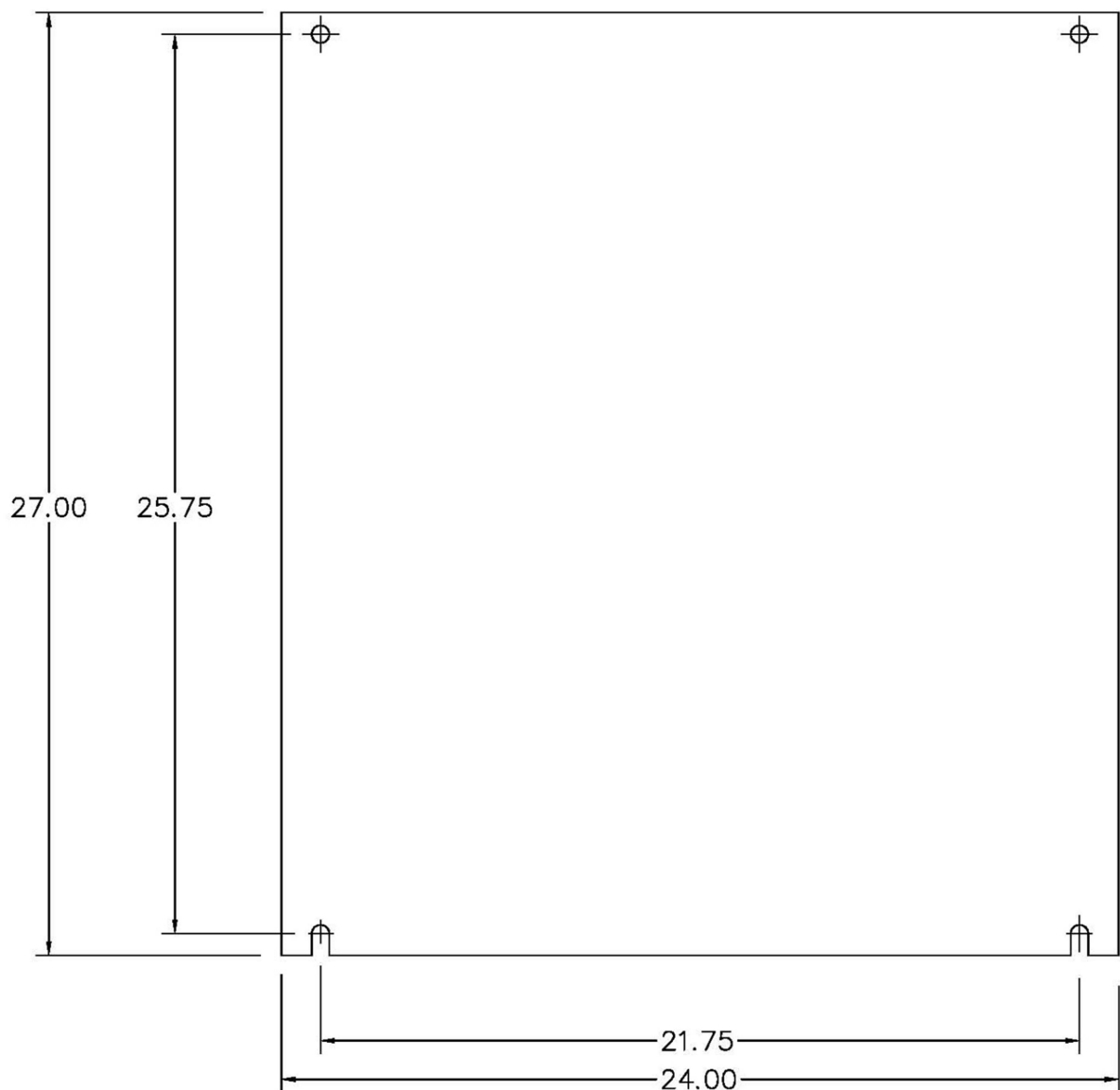


Figure 3: Standard Panel Dimensions (Not to scale)

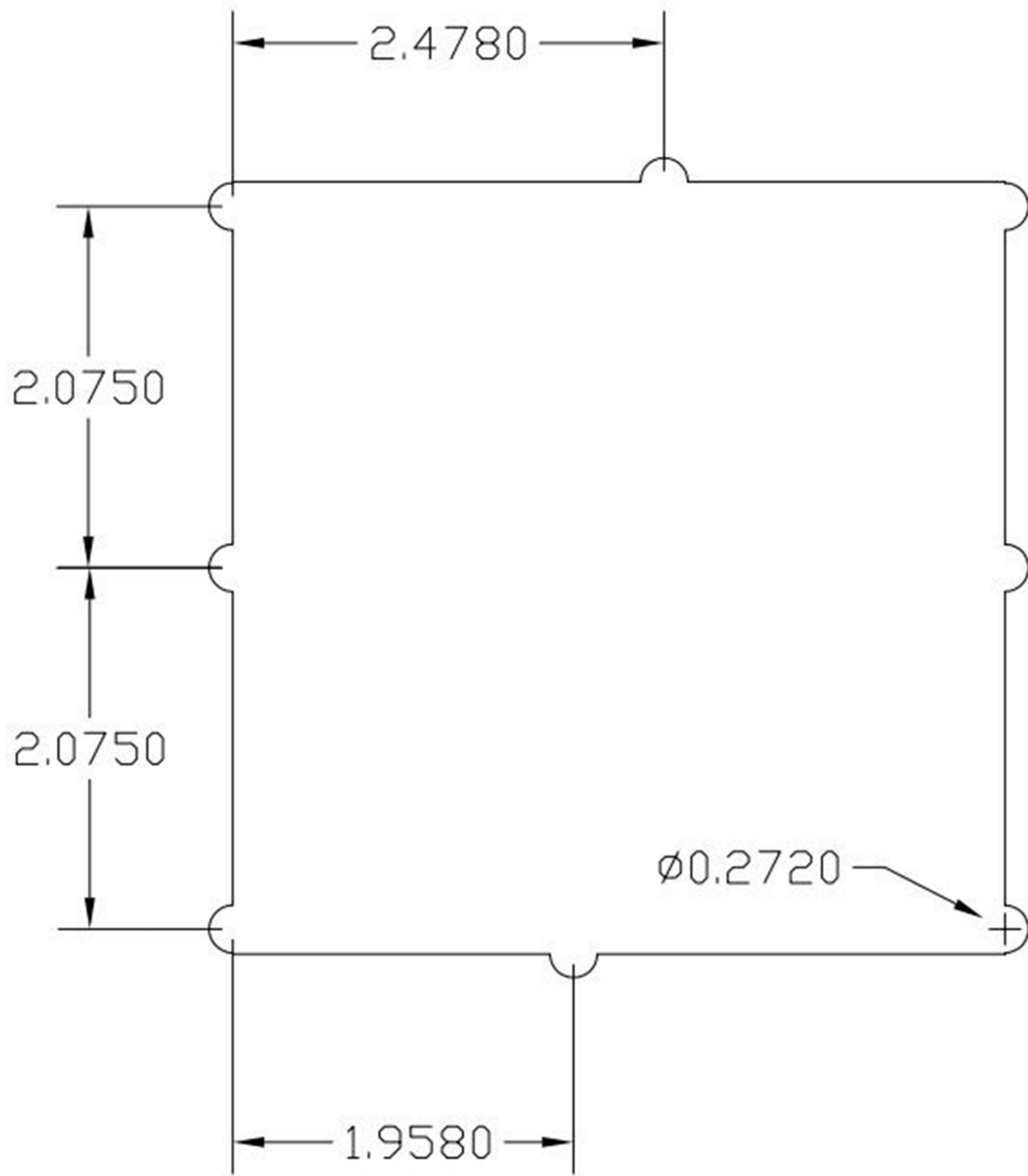


Figure 4: Keypad Cutout Template (to Scale, Inches)

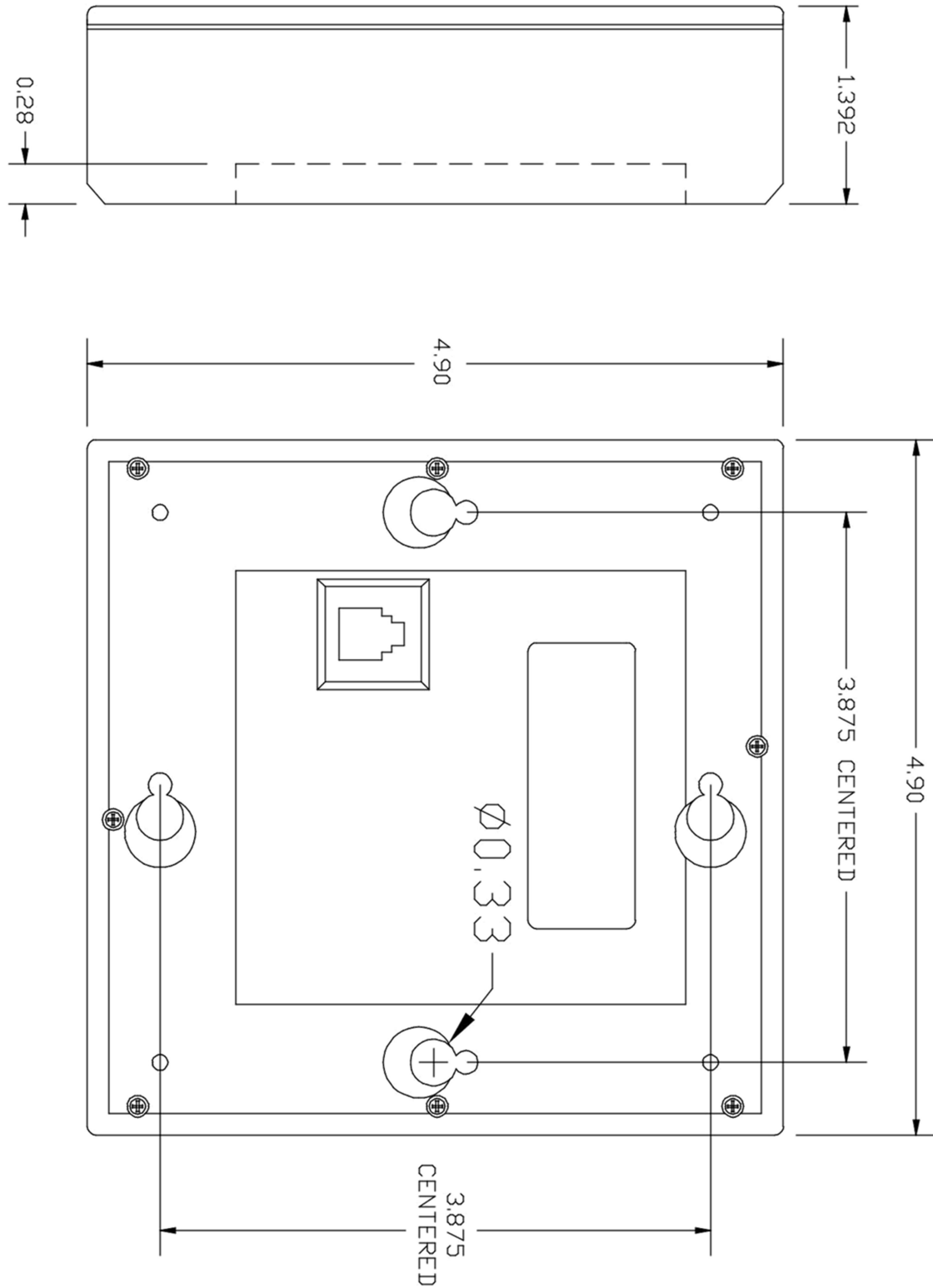


Figure 5: Keypad Dimensions (to Scale)

6.2 Mounting Hardware

- Standard Panel
 - ¼" - 20 Bolts, Flat Washers, Lock Washers (Not included)
- Keypad
 - Included

6.3 Wiring

- Dynamatic recommends adhering to the National Fire Protection Association's "NFPA 70: National Electrical Code" codes and standards for proper branch protection, SCCR ratings, and ampacity ratings.
 - <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>
- Terminal Block Tightening Torque
 - "TB" : 25 lb-in.
 - "TB1" : 8.8 lb-in.
 - "TB2" : 6 lb-in.

6.4 Hardware Jumper & Potentiometer Setup

a. Jumpers and Potentiometers on Clutch Driver Board 015-001201-0012

Table 2: Clutch Control Board Programmable Jumpers

Default Settings in Green

JUMPER	PARAMETER	POSITION "A"	POSITION "B"
J2	Follower Operation (Not Used on CES Control)	Pulse Pickup (TB2-17)	Tach. Generator (TB2-18 & 19)
J3	Process Feedback (Not Used on CES Control)	0 TO ±20VDC	0 TO ± 5, ±10V
J4	Speed Control Feedback	From Resolver (TB2-2)	Tach. Generator (TB1, G1 & G2)
J5	Clutch Current Feedback Scaling**	72 AMP (or less) Output	100 Amp Output
J6	Brake Current Feedback Scaling**	36 AMP (or less) Output	50 Amp Output
J7*	Gating Pulse Train	Standard and High Power Controls	CES Press Drive Control Only
J8*	Sync Bias	Standard and High Power Controls	CES Press Drive Control Only
J11	Clutch Gating Circuit	Standard Control On Board Pulse Xfmr	CES & High Power Control Off Board Pulse Xfmr
J13	Clutch Current Feedback Circuit	Standard Control On-Board LEM's	CES & High Power Control Off-Board LEM's
J14	Brake Current Feedback Circuit	Standard Control On-Board LEM's	CES & High Power Control Off-Board LEM's
J15*	Sync Bandwidth	Standard and High Power Controls	CES Press Drive Control Only
J16*	Sync Bandwidth	Standard and High Power Controls	CES Press Drive Control Only

Notes: **Remove Jumper J5 for 135 Amp Clutch Rating

**Remove Jumper J6 for 67 Amp Brake Rating

* Jumpers J7, J8, J15, J16 must all be in "A" or "B" Position

Table 3: Follower Set Point Jumper Settings

(**Set Point For CES Control)

SIGNAL	JUMPER	
	J9	J10
0 –10 VDC**	A	A
0 -5 VDC	A	B
4 – 20 MADC	B	B
8 – 40 MADC	B	A

Wire Jumpers W1 & W2 connect internal SCR's. Cut for H.P. & CES controls
W3 connects fly back diode disabling Inversion. Cut if inversion is required.

Potentiometers:

R4 -- Measure TP1(-) to TP4(+) -- Adjust R4 for 5Volts +- .1

R29 -- SCR Pulse Position

R100 --Torque Limit – Not Used on CES Controller

Clutch Control Board Layout

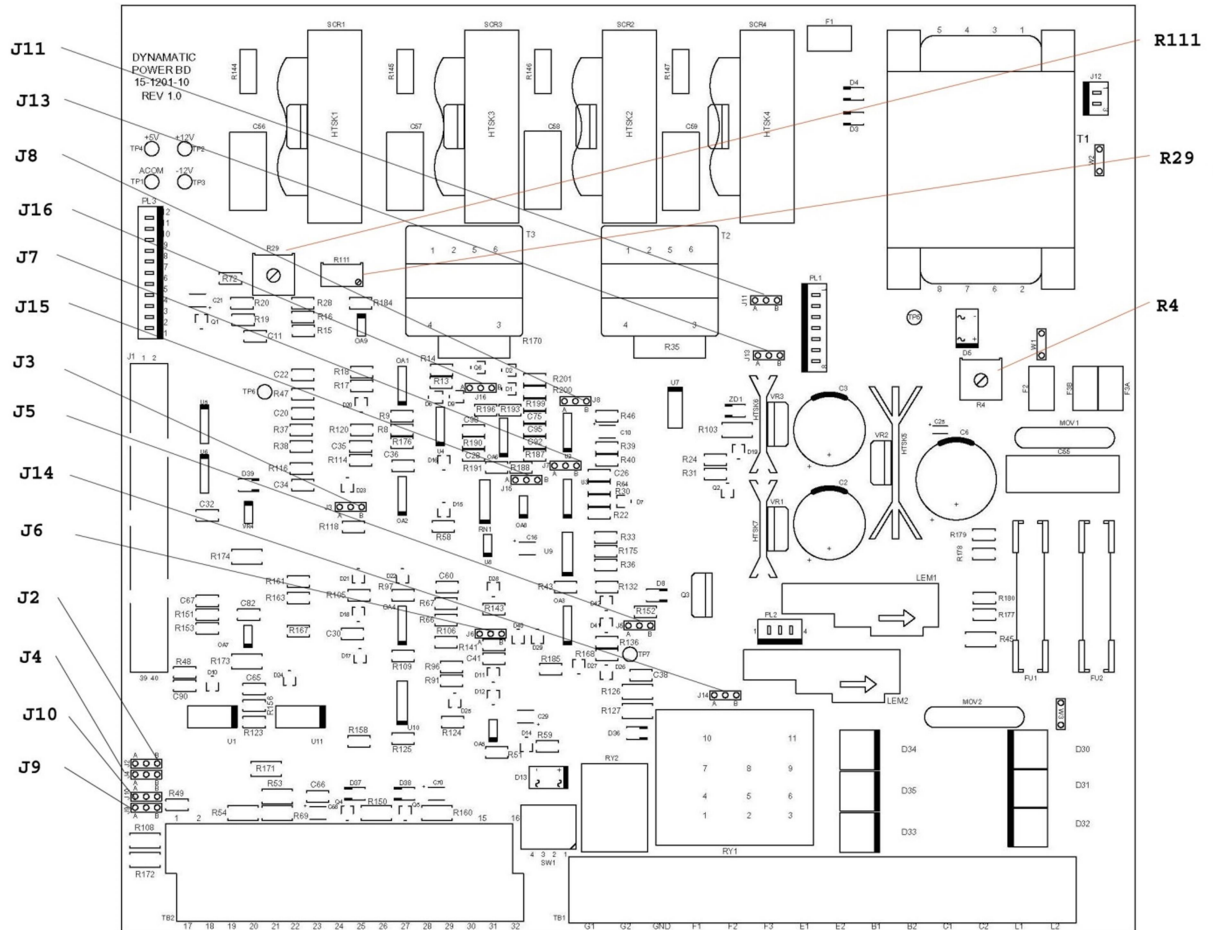


Figure 6: Clutch Control Board Layout

Location of Jumpers on the Clutch power Board
Note that Jumpers J3 and J6 are located under the logic circuit board, if it is installed.

Table 4: Brake Control Board Programmable Jumpers

JUMPER	PARAMETER	POSITION “A”	POSITION “B”
J1	Resolver Reference	Internal Power Supply	External Power Supply
J2	Resolver Reference	Internal Power Supply	External Power Supply
J3	Resolver Reference	Internal Power Supply	External Power Supply
J4	Clock Reference	Internal Oscillator	External Oscillator
J5	Processor Mode	Run	Test
J6	Tachometer Pulse Divisor	Low Divisor	High Divisor
J7	Programmable Switch	Open	Closed

R1 -- Measure TP1(-) to TP4(+) -- Adjust R1 for 5Volts +- .1
R35 -- SCR Pulse Position
R174 -- Analog Input Scale -- Not currently used

Figure 7: Brake Control Board Layout

SECTION 7 – KEYPAD

- Initial programming must be done with the keypad.
- The keypad is plugged into the RS-235 port mounted on the control side plate.
- Dynumatic® part number: 037-000544-01 (Keypad)

Table 5: Keypad Button Descriptions

Key	Function	Notes
ENTER	Allows user into a menu or submenu; confirms value change	
EXIT	Allows user to back out of a menu or submenu.	
F1/F2	Turns Display light on and off	"
↑	Allows user to cycle through menus or values in ascending order	
→ Shift	Allows user to change between individual digits	
↓	Allows user to cycle through menus or values in descending order	

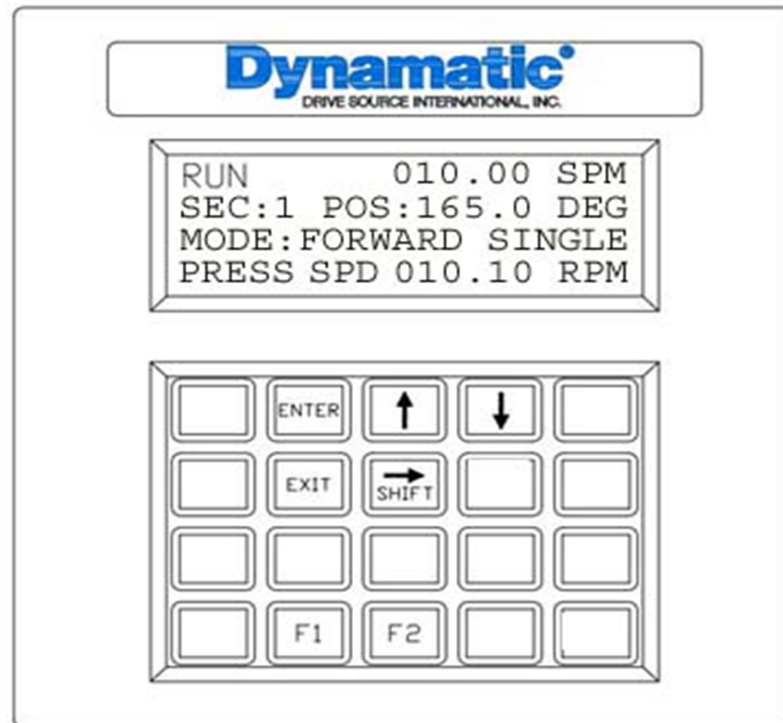


Figure 8: Keypad Layout

SECTION 8 – PROGRAMMING

8.1 Menu A: Control Setup

1. CONTROL TYPE

- Position (Default)
 - *Uses the Resolver for Position Control*
- Speed
 - *Uses the AC Tachometer Feedback for speed feedback and control depending on Jumper J4*
- Torque
 - *Clutch coil voltage is regulated. This is used in applications where torque is used to very loosely control speed or when maximum speed is all that is required.*

2. CONTRLR CURRENT

Select the output range of the controller. Choose the closest value to the coil rating for scaling purposes.

- 5.5 Amps
- 8 Amps
- 16 Amps
- 24 Amps
- 36 Amps
- 54 Amps
- 72 Amps
- 80 Amps
- 100 amps (Default)
- 135 amps

3. CLUT COIL RATING

Locate the clutch coil rating on the nameplate of the mechanical unit and enter it. The value should be equal or less than the previous parameter (2. Controller Current).

Default = 100 Amp

4. CLUTCH CURNT LIM

Enter the coil current limit, which is equal to or less than the clutch coil rating. Note, limiting the coil current to less than its rated value will reduce the amount of torque.

Default = 100 Amp

5. TACH PULSES/REV

The control tachometer feedback comes from a mechanical unit tachometer or press resolver depending on the position of Jumper J4 on the clutch driver board. Set the speed feedback frequency for the AC tachometer generator based on the resolver or mechanical unit you have. See the table, below. For finer tuning, see Menu A, Parameter 20.

Table 6: Mechanical Unit Tach Pulses/REV Setting

DRIVE	PPR
Obsolete Drives ACM's	10
AS-14 / 25 – Fractional "FD"	12
AS-27 / AT-320	16(Default)
CES DRIVES	28
VT-320 P-base, AT-360, AT-440	30
Pulse Pickup, Gear	30, 60, 120, 180
Tach From Resolver**	See Notes Below

****Tachometer From Resolver.** Place clutch driver board jumper J4 in the A position. The resolver outputs a pulse 4096 times per revolution. This output is connected to the pulse input (term 1 & 2) on the clutch driver board after being scaled by jumper J6 with a divisor of 2 (low) or 8 (high). The default is 8 (high).

$$\text{HZ} = 4096 / (\text{Divisor} * 60) \quad (\text{at one stroke per minute})$$

$$4096 \text{ pulse} / 8 * 60 \text{ sec} = 8.533 \text{ HZ} \quad (\text{for a divisor of 8})$$

To calculate PPR: $\text{PPR} = \text{HZ} * 60 / \text{Gear Ratio}$

For a ratio of 25 $\text{PPR} = 8.533 * 60 / 25 = 20.48 \text{ PPR}$

Since this is not a preprogrammed PPR, a PPR of 16 would be used along with a scale factor of $20.48 / 16 = 1.28$ (Parameter A-15)

6. CLUTCH MIN RPM

The minimum speed for the clutch. (DEFAULT = 0)

7. CLUTCH MAX RPM

The maximum speed of the clutch. DEFAULT = (1000 For CES Drives)

8. CLUT CNTRL OFFSET

A programmable offset for the clutch output. This compensates for electrical dead band in the control, as well as mechanical unit response. 0–10000. This value should be increased to the highest value that will not cause motion at command signal = 0. Lower values for low current controls. Higher values for high current controls. Typical 8 amp control is “0”. Typical 100 amp control = “500”

9. BRAK CNTRL OFFSET

A programmable offset for the brake output. This compensates for electrical dead band in the control, as well as mechanical unit response. 0–10000. This value should be increased to the highest value that will not cause significant braking at command signal = 0. Lower values for low current controls. Higher values for high current controls. Typical 8 amp control is “0”. Typical 100 amp control = “500”

10. CUR FILTER

Filter for the current feedback loop. 1 – 64 Each Increment = 8.3 ms . Has no effect if current loop disabled. Otherwise current response is dampened (Default = 16)

11. SPD FILTER AVER

Allows for taking an average of the speed feedback readings. This is primarily used for non-standard speed feedback configurations, noise affected configurations, or light loads that are difficult to control (Default: 0).

12. SPEED FILTER CLAMP

Limits the speed of change allowed from velocity feedback. Used on noise affected configurations such as pulse pickups. (Default: 0).

13. MEMORY RESET EN

Allows the user to reset the stored parameters back to the factory defaults upon cycling power to the controller).

- YES
- NO (default)

14. CLUTCH CUR SCALE

Used to adjust the difference between the actual clutch current (measured with a DC clamp on meter) and the current reading of the EC 2000-HP. If the keypad displayed

clutch current is less than measured, increase the percentage, and vice-versa (Default: 100%).

15. CLUTCH PPR SCALE

Used to fine tune the Menu A, Parameter 5 (TACH PULSES/REV) speed feedback rate (Default: 100%). This is typically used for nonstandard or pulse pickup units or with resolver provided pulses.

16. CLUTCH DEADBAND

Offset Between the actual set point and the beginning of clutch action for the PID loops.
Rarely used (Default = 0 RPM)

17. BOOT START DELAY

Delays the boot up sequence of the EC 2000-CES. This is used for large more unstable power supplies that disrupt the controllers boot up sequence when switching on (Default: 0 sec).

8.2 Menu B: CLCH PERFORMANCE

This is for adjusting the clutch performance using an internal proportional-integral-derivative feedback loop (PID). It is recommended to only adjusting the speed feedback parameters 4, 5, and 6. And try to keep parameter 6 as low as possible (as high DIFF values can cause a control speed to run away over time) and adjust parameters 4 and 5 until stable results are achieved.

1. CURR PROP GAIN

Current Proportional Gain is the amount of response (times a constant) to the current and is proportional to the amount of that error. Default = 100%

2. CURR INTGRL GAIN

Current Integral Gain is the amount of response to the current error repeated per period of time the error exists and is proportional to the amount of that error times the time. Default = 50%

3. CURRENT DIFF GAIN

Current Differential Gain is a dampening to the control response that is calculated based on the rate at which the current value is approaching the set point value. This slows the response to avoid over shoot. Normally only needed in systems with a very slow response.
Default = 0%

4. SPEED PROP GAIN

Speed Proportional Gain is the amount of response (times a constant) to the current and is proportional to the amount of that error. Default = 100%

Default = 80%

5. SPED INTGRL GAIN

Speed Integral Gain is the amount of response to the current error repeated per period of time the error exists and is proportional to the amount of that error times the time.

Default = 40%

6. SPEED DIFF GAIN

Speed Differential Gain is a dampening to the control response that is calculated based on the rate at which the speed value is approaching the set point value. This slows the response to avoid over shoot. Normally only needed in systems with a very slow response.

Default = 0%

7. ENABLE CURRENT LOOP

The EC 2000-CES has two PID loops (as seen in the previous parameters), speed and current, where the speed PID loop is fed into the current PID loop. This parameter allows the user to disable the current PID loop. This is typically is used in Systems with fast changing outputs that require very quick response. While a bit of speed accuracy is given up, control response and stability is improved considerably.

- ENABLE
- DISABLE (default)

8.4 Menu C: ACCEL/DECEL SETUP

1. Auto Accel Rate (Default: 100%)
2. Auto Decel Rate (Default: 200%*)
3. Inch Accel Rate (Default: 100%)
4. Inch Decel Rate (Default: 200%*)
5. Stop Decel Rate (Default: 200%*)

*Note 200% = Instant Change to New Setting

8.4 Menu D: BRAKE PERFORMANCE

1. *Locate the brake coil rating on the nameplate of the mechanical unit and enter it. The value should be equal to or less than the (Menu A Parameter 2. Controller Current). Default = 50 Amp*

2. Brake Current Limit

Enter the coil current limit, which is equal to or less than the clutch coil rating. Note, limiting the coil current to less than its rated value will reduce the amount of torque.

Default = 100 Amp

3. BRAKE PROP GAIN

Brake Current Proportional Gain is the amount of response (times a constant) to the current and is proportional to the amount of that error. Default = 100%

4. BRAKE INTGRL GAIN

Brake Current Integral Gain is the amount of response to the current error repeated per period of time the error exists and is proportional to the amount of that error times the time.

Default = 50%

5. BRAKE DIFF GAIN

Brake Current Differential Gain is a dampening to the control response that is calculated based on the rate at which the current value is approaching the set point value. This slows the response to avoid over shoot. Normally only needed in systems with a very slow response.

Default = 0%

6. BRK SPD PROP GAIN

Speed Proportional Gain is the amount of response (times a constant) to the current and is proportional to the amount of that error. Default = 100%

Default = 80%

7. BRK SPD INTGRL GAIN

Brake Speed Integral Gain is the amount of response to the current error repeated per period of time the error exists and is proportional to the amount of that error times the time.

Default = 45%

8. BRK SPD DIFF GAIN

Brake Speed Differential Gain is a dampening to the control response that is calculated based on the rate at which the speed value is approaching the set point value. This slows the response to avoid over shoot. Normally only needed in systems with a very slow response.

Default = 0%

9. BRAKE DEADBAND

Offset Between the actual set point and the beginning of clutch action for the PID loops. Used to prevent oscillation between clutch and brake when running at steady speed (Default = 50 RPM)

10. BRK OFF DLY

This is a programmable delay from issuance of the stop command to release of the clutch contactor by the control. Note that this timer is overridden by the contactor on input from the press control.
Default = 0.50 Seconds

8.5 Menu F: PROCESS

The EC-2000-CES Control operates in strokes per minute. It uses RPM X gear ratio to establish a operating speed in strokes per minute. All of the speeds set in process are multiplied by the gear ratio to establish an operating speed. Note the control can also display an output speed in strokes per minute from the resolver. This can be used to correct the gear ratio if the proper value is not known to obtain the proper output speed. $\text{Max RPM} / \text{Gear Ratio} = \text{Max SPM}$

1. INCH SPEED 0 to Max SPM
2. MICRO INCH SPEED 0 to Max SPM
3. ANGLE #1

The control has six programmable angle and speeds. For example, when the control sees Angle #1 as the last position it has passed, it will run at Speed #1
Range: 0 to 360 Degree (Note 360 DEG is ignored)

4. SPEED #1

Programmed Speed for Angle #1
0 to Max SPM

5. ANGLE #2

Angle and Speed #2 thru 6 work the same as Angle #1 and Speed #1

6. SPEED #2
7. ANGLE #3
8. SPEED #3
9. ANGLE #4
10. SPEED #4
11. ANGLE #5
12. SPEED #5

13. ANGLE #6

14. SPEED #6

15. CREEP ANGLE

16. CREEP SPEED

If the control is in single stroke mode when it passes the creep angle, it will run at the creep speed

Programmed Speed for Creep Speed:

0 to Max SPM

17. STOP ANGLE

If the control is in single stroke mode when it passes the stop angle, it will conduct a normal stop

18. RESOLVER OFFSET

Enter degrees to correct resolver reading to actual press position

0 – 360 degrees

19. RESOLVER DIR REV

- ENABLE
- DISABLE (default)

20. GEAR RATIO

Enter Gear Ratio from Press Drive to Press

Default = 25

8.6 Menu G: FAULT

1. CURRENT FAULT

Allows the user to see the current fault (read only).

2. PRIOR FAULT #1

Allows the user to see the previous fault (read only).

3. PRIOR FAULT #2

Allows the user to see the second previous fault (read only).

4. PRIOR FAULT #3

Allows the user to see the third previous fault (read only).

5. PRIOR FAULT #4

Allows the user to see the fourth previous fault (read only).

6. CLEAR FAULT

If enabled, the control will clear the fault.

Note: If enabled when there is no fault, fault history will be cleared.

- ENABLE
- DISABLE (default)

8.7 Menu H: FAULT TIMER SETUP

1. BRAKE CONT TIME

Time allowed after losing brake contactor till controller faults

Fault 229.

Default = 2000 MS

2. ENA & CONT START

(2) Enables and Clutch On Signal must be on together within the programmed time.

Missing Enable Low - Fault 210

Missing Enable High – Fault 213

Missing Clutch On – Fault 208

Default = 500 MS

3. ENA & CONT MISSING

Once controller accepts a run command if one of the enables or clutch on or clutch contactor is missing for the programmed time a fault will be generated.

Missing Clutch on Fault 208

Missing Clutch Contactor Fault 218

Clutch Contactor on without Clutch On Input on Fault 209

Default = 500 MS

4. CL CONT ON TOO LG

When stopping the clutch contactor is delayed. If the delay is longer than this parameter a fault is generated

Fault 223

Default = 2000 MS

5. CL CONT ON TOO SHT

When stopping the clutch contactor is delayed. If the delay is longer than This parameter a fault is generated

Fault 225

Default 300 MS

6. INCH REV CHG TIM

Inch – Micro-Inch – Rev signals cannot be changed while engaged. Additionally reverse must have inch enabled. Inch & Micro inch cannot be on together. This timer applies to all of these faults.

Fault 211 Inch & Micro Inch On Together

Fault 212 Reverse command without Inch command

Fault 317 Inch Command Change

Fault 318 Micro Inch Command Change

Fault 319 Reverse Command Change

Default = 300 MS

7. CL OVER CUR TIME

Timer for clutch overcurrent above current rating

Fault 315

Default = 2500 MS

8. BR OVER CUR TIME

Timer for brake overcurrent above current rating

Fault 316

Default = 2500 MS

9. CL-BR OVERLAP TIME

Timer for clutch and brake current overlap when both are greater than 20% of current ratings

Fault 314

Default = 2500 MS

10. CL CUR ON TO LONG

Timer for clutch current on too long

Fault 320

Default = 5000 MS

11. CL CUR ON % LONG

Percentage of Clutch current for on too long timer

Fault 320

Default = 30%

12. BR CUR ON TO LONG

Timer for brake current on too long

Fault 321

Default = 5000 MS

13. BR CUR ON % LONG

Percentage of max brake current for on too long timer

Fault 321

Default = 30%

14. CL COOL DOWN

Timer for brake current on too long

Fault 227

Default = 30 SEC

15. BR COOL DOWN

Percentage of max brake current for on too long timer

Fault 228

Default = 30 SEC

16. OVR SPD TRIP TIME

Over Speed Trip Timer

Fault 101

Default = 2000 MS

17. OVR SPD TRIP %

Over Speed Trip %

Fault 101

Default = 30%

18. UND SPD TRIP TIME

Under Speed Trip Timer

Fault 313

Default = 2000 MS

19. UND SPD TRIP %

Percentage of max brake current for on too long timer

Fault 313

Default = 30 %

20. FDBK FLT TIME

Tachometer Feedback Fault Timer

Fault 205

Default = 2000 MS

21. FDBK FLT CL CUR %

Tachometer Feedback Fault % FL Amps

Fault 205

Default = 30 %

22. RESOLV-TACH-UPD

Update Time for Resolver Speed Update

Default = 100 MS

23. SERIAL COMM FAULT

Timer For EC-2000 Communication Fault

Fault 231

Default = 5000 MS

24. MISSING STPT TIME

Timer For EC-2000 to acknowledge a set point. If the control fails to receive a set point after a run or inch command is issued this fault will be issued.

Fault 204

Default = 2000 MS

8.8 Menu I POSITION ERROR SETUP

1. TOP STOP ERROR

If the error in stopping at the programmed stop angle exceeds this value +/- Fault will be set

Fault 224

Default = 30 degrees

2. Apply Brake Advance

*Advances the braking action ahead of the stop angle programmed.
Default = 0 Degrees*

3. Wrong Direction Error

Amount of motion allowed in the reverse direction from the programmed direction in degrees before a fault is set.

Fault 206

Default = 36 Degrees

8.9 Menu J: METER SETUP

1. Select Meter 1

Select the Meter for Display Line Number 1

*Choices Are: Status – Set Point - Drive Status (Run Stop Etc.) & Set point
Sector – Position - Current Sector & Current Position (Degrees)
Drive Mode – Direction – Forward-Reverse & Inch Single etc.
Drive Speed SPM
Clutch Amps
Brake Amps
EC- RPM Feedback - (Resolver or Tachometer in RPM)
EC- Set Point in RPM - Set point seen by the control RPM
EC Ramp In RPM - Acceleration Ramp in RPM*

8.10 Menu K: SERIAL OPTIONS

1. EC-2000 MENUS (Speed Controller Menu Access. Consult Factory)
Allows Direct Access to Speed Controller Menus. Need Item 2 Enabled as well for this to work. Use only for trouble shooting.

*Choices Are: ENABLE
DISABLE*

Default: Disable (Reverts to Disable when power is cycled to the control.)

2. EC-2000 Output (Speed Controller Menu Output. Consult Factory)
Allows Direct Access to Speed Controller Menus. Need Item 1 Enabled as well for this to work. Use only for trouble shooting.

*Choices Are: ENABLE
DISABLE*

Default: Disable (Reverts to Disable when power is cycled to the control.)

3. Access All Menus (Allows Access to Menus not normally used. Consult Factory)

Choices Are: *ENABLE*
DISABLE

Default: *Disable* (Reverts to Disable when power is cycled to the control.)

4. Display Timeout -- Disables the display after 30 seconds. Display will return if enter or exit buttons are pressed. Useful for trouble shooting serial port.

Choices Are: *Enable*
Disable
Default = *Disable*

SECTION 9 – PRESS CONTROL OPERATION -- WIRED INTERFACE

9.1 CONTROL INPUT SIGNALS

The EC-2000-CES controller will accept nine different input command signals from the press controller that are available for the operator to make, they are as follows: two Enables, Clutch Contactor ON, Inch, Micro Inch, Reverse, Control Power ON, Stop-On-Top and Fault Reset. Some controls also have a Stop-on-bottom command.

- **ENABLES:**

The enable signals are required to start the drive. These contacts are the last contact closures in the start sequence. The clutch contactor ON signal and the two enable signals must all be given within the time set in parameter H.2 of one another or a fault will be created. The enable contacts must be closed in order to run. Upon opening either of these contacts, the press control signals the controller to stop the drive immediately with a command to zero speed and to open the clutch contactor in the programmed time delay in parameter D.10. The controller responds to this removal of enable with a normal stop signal output signal. The enable contact closures must be given only after all safety features of press operation have been determined to be in a "GO" status by the press control. Redundant +/- inputs are provided to ensure that the enable signal is present and that the receiver is not shorted. The enable signals consist of two press control contact closures that put the 115 VAC of the press control into the I/O board. Enable High places 120VAC on the brake control board input and Enable Low ties the input to AC common.

- **CLUTCH ON (INPUT):**

In addition to the enables, the press control provides 115 VAC to energize the clutch contactor. This ensures that the press control has absolute control over the ability of the CES controller to energize the clutch. This input signal monitors the 115 VAC signal. The clutch contactor ON signal is one of the signals that activate the control command which closes the clutch contactor and sends a speed command to the controller .

- **INCH:**

The inch signal indicates that the controller is directed to operate at inch speed. The two enables and clutch on signal are need as well. The inch command can only be changed when the enable command is not present; otherwise, a fault will be generated. The inch signal consists of a press control contact closure that puts the 115 VAC of the press control into the brake control board.

- **MICRO INCH:**
The micro inch signal indicates that the controller is directed to operate at the micro inch speed. The two enables and clutch on signal are need as well. The micro inch command can only be changed when enable is not present; otherwise, a fault condition will be generated. The micro inch signal consists of a press control contact closure that puts the 115 VAC of the press control into the.
- **REVERSE:**
The reverse command is sent to the press control to indicate that the press is to operate in the inch or micro inch mode in the reverse direction. The two enables and an inch command are needed as well. The controller uses this information to establish either the inch-reverse or micro inch-reverse mode. If the reverse command is issued with any command other than the inch or micro inch, a fault will be generated. The reverse command cannot be changed when enable is present; otherwise, a fault will be generated. The reverse signal consists of a press control contact closure that puts the 115 VAC of the press control into the brake control board.
- **CONTROL POWER ON:**
The control power on signal is provided by the press control to activate the 115 VAC control power to the controller. This will close a contact in the secondary of the controller transformer.
- **STOP-ON-TOP – CONTINUOUS MODE:**
The continuous mode signal is issued by the press control to indicate that the controller should run continuously without stopping on top. If the signal is removed execute a normal stop-on-top. If the continuous command is not present when the creep angle is reached a stop on top is performed. The control will command creep speed at the creep angle and stop at when the stop angle is reached.
- **FAULT RESET:**
The fault reset command is a signal from the press control to reset any fault condition in the controller, allowing for continuation of operation. If the condition is a result of a clutch current fault or a brake current fault, it will be necessary to wait the on the setting of parameters H.14 for the clutch and H.15 for the brake before resetting; otherwise another fault will be generated. This delay is necessary to allow time for the coil to cool down. The fault reset signal consists of a press control contact closure that puts the 115 VAC of the controller into the brake control board.

9.2 CONTROL - OUTPUT SIGNALS

The CES controller provides seven different solid-state output signals that function as contact closures and contact openings, according to the conditions called for. The output signals that occur during different phases of operation are as follows: Normal Stop, Stop Main Motor Fault, Stop Now Fault, Stop-on-Top Fault, Control Failure Fault, Clutch ON and E-Relay. The first five items (up to control fault) are protected by miniature fuses on the brake control board. The others come from the press control and are not protected.

- **NORMAL STOP (OUTPUT):**
The normal stop signal input from, controller indicates that the control is about a normal stop (due to reaching the stop angle in stop on top mode) or in the case of a commanded stop input (enable release) from the press control. Receipt of the normal stop output (led on output low) signal from the CES controller indicates that the CES controller has commanded the press drive to be at zero speed. Upon receipt of this normal stop signal, the press control is directed to remove the enable signals and set the friction brake and remove the clutch on signal after an appropriate delay. The normal stop output will be cleared (led off output high) by the press control giving the enable signal the next time it is desired to run. This signal is programmable. See hidden parameters I.4

through I.11. The brake control board of the controller opens a solid-state relay contact for the normal stop signal to the press control.

- **STOP MAIN MOTOR FAULT (OUTPUT):**

The stop main motor fault signal from the controller to the press control requests an emergency stop condition. The press control then stops the main motor, sets the flywheel brake, sets the friction brake and removes the enable signal. The controller is placed in the fault mode and sets the eddy current brake to help stop the press. The brake control board of the CES controller opens a solid-state relay contact (LED On) for the stop motor fault signal to the press control. This signifies a 100 Level Fault.

- **STOP NOW FAULT (OUTPUT):**

The stop now fault signal is an output from the controller. It indicates a second level of emergency stop in which the press control is to immediately remove the enable and set the friction brake the software programs the reference to zero which applies the eddy current brake to help stop the press. The brake control board of the controller opens a solid-state relay contact (LED On) for the stop now fault signal to the press control. This signifies a 200 Level Fault.

- **STOP-ON-TOP FAULT:**

The stop-on-top fault signal directs the control to complete the present cycle, and then execute a normal stop-on-top, after which the controller is in the fault mode. The brake control board of the CES controller opens a solid-state relay contact (LED On) for the stop-on-top fault signal to the press control. This signifies a 300 Level Fault.

- **CONTROL FAILURE FAULT (OUTPUT):**

The control failure fault is generated by either of two conditions. One is when the main microprocessor watchdog timer senses a microprocessor failure. The other is when the secondary clutch brake controller faults. The brake control board of the controller opens a solid-state relay contact (LED On) for the control failure fault signal to the press control. Either failure means loss of control, so this is treated as a stop now 200 Level fault.

- **CLUTCH ON (OUTPUT SIGNAL):**

The clutch on output is a 115-volt output (voltage provided by the press control). This signal allows the press control to monitor the run state of the controller.

The contactor is activated by the following conditions:

Brake contactor is ON

Enables are present

No fault is present

Clutch contactor ON signal is present

Note: if the brake contactor drops out or clutch ON is removed, The clutch contactor will drop out after the timed brake delay timer or if the press control drops the control clutch on signal. .

9.3 PRESS CONTROL INTERFACE - SERIAL PORT

The serial interface assembly makes it possible for the controller to communicate with another microprocessor or a main computer. This communication link is an RS-422 assembly that is connected to Terminals 91 through 94. It can be utilized to set references (i.e., speeds and angles) and to communicate diagnostic information, faults, etc. See next section for detailed Information.

9.4 SIGNALS FOR CUSTOMER'S RECORDER

The controller provides two addition signals:

- Pulse Output Seen by Control feedback system (Logic Board TB2-1,2)
- Analog Output 0 to 10V (Set point used by control TB2-20,21)

9.5 BRAKE CONTACTOR

A brake contactor is provided which will be closed under simultaneous conditions of control power ON being available and brake current fault not being present. The brake contactor is opened by programmable parameter H.1 seconds after a brake current fault is present.

9.6 CONTROL OPERATING MODES

The controller includes 9 operating modes, as described in detail below. Among these are the four basic modes, employed in various combinations, as follows: Run, Fault, Test and Ready.

- **RUN MODE (NORMAL)**

The controller is in the run mode if the following conditions exist:

1. Enable signals are present
2. NO fault is present
3. Reverse is not present
4. Inch is not present
5. Micro inch is not present
6. Clutch contactor ON is present
7. Brake contactor is closed

When in the run mode, the CES controller functions in the following manner:

A clutch ON command closes the clutch contactor. Upon initiation of the run mode, the drive reference signal ramps up from an initial value of zero that is adjustable from 0 to 200% of span in strokes per minute, until the drive reference equals the programmed reference. When in the run mode, the speed reference follows the profile set by the angles and speeds stored in the parameter locations as listed in Table 7. Every angle and every speed must have an assigned value. A setting of 360 degrees on any angle will cause the control to skip the speed setting that immediately follows.

Table 7: Parameter Locations

Parameter Number	Data
F.3	Angle No. 1
F.4	Speed No. 1 (manual)*
F.5	Angle No. 2
F.6	Speed No. 2
F.7	Angle No. 3
F.8	Speed No. 3
F.9	Angle No. 4
F.10	Speed No. 4
F.11	Angle No. 5
F.13	Speed No. 5
F.14	Angle No. 6
F.15	Speed No. 6
42	Creep Angle ($\alpha 7$)
43	Stop Angle ($\alpha 8$)

While in the run mode, when the press control sends a stop-on-top command input low, the control controller will wait for the creep angle. Upon reaching the creep angle, the drive reference will decelerate to the creep speed and remain at creep speed until the stopping angle is reached. Upon reaching the stopping angle, the controller will set the reference at 0 and issue a normal stop signal to the press control. At the same time, the CES controller will initiate a timer (parameter D.10 at the end, of which the clutch contactor signal will be dropped, dropping out the clutch contactor. Upon receipt of the normal stop signal, the press control will enable the friction brake and remove the enable signal. The press control will remove the enable within the time set in parameter H.4, but not before the parameter set in H.2 milliseconds; otherwise a stop now fault will be generated. The run mode will be indicated by the "Run" display on the keypad. Some controls have a full range manual Run Speed pot, Others function without any speed pot..

- **INCH FORWARD MODE (SET UP)**

The controller will be in the inch forward mode if the following conditions exist:

1. Enable signals are present
2. No fault is present
3. Reverse is not present
4. Inch is present
5. Micro inch is not present
6. Clutch contactor ON signal is present
7. Brake contactor is closed

When in the inch forward mode, the controller functions in the following manner:

A clutch ON command with enables closes the clutch contactor. Upon initiation of the run mode, the control reference signal ramps up from zero at the inch acceleration rate parameter C.3, until the drive reference equals programmed reference parameter F.1). When the enables are released the control reference ramps down according to the stop deceleration rate Parameter C.4 to zero set point is reached. At the time the enable is removed, the clutch timer is initiated. After the delay time is reached, the clutch contactor is dropped out by control removing clutch on or the internal brake delay timing out (parameter D.10).

The inch mode will be indicated by display of the "Inch H" on the keypad display.

- **INCH REVERSE MODE (SET UP)**

The controller will be in the inch reverse mode if the following conditions exist:

1. Enable signals are present
2. No fault is present
3. Reverse is not present
4. Inch is present
5. Micro inch is not present
6. Clutch contactor ON signal is present
7. Brake contactor is closed
8. The main motor is programmed to run in the reverse direction

When in the inch reverse mode, the controller functions in the following manner.

A clutch ON command with enables closes the clutch contactor. Upon initiation of the run mode, the control reference signal ramps up from zero at the inch acceleration rate parameter C.3, until the drive reference equals programmed reference parameter F.1). When the enables are released the control reference ramps down according to the stop deceleration rate Parameter C.4 to zero set point is reached. At the time the enable is removed, the clutch timer is initiated. After the delay time is reached, the clutch contactor is dropped out by control removing clutch on or the internal brake delay timing out (parameter D.10).

The inch reverse mode will be indicated by simultaneous display of the "Inch H" and "Reverse" on the keypad display.

- **MICRO INCH FORWARD MODE (SET UP)**

The controller will be in the micro inch forward mode if the following conditions exist:

1. Enable signals are present
2. No fault is present
3. Reverse is not present
4. Micro Inch is present
5. Inch is not present
6. Clutch contactor ON signal is present
7. Brake contactor is closed

When in the micro inch forward mode, the controller functions in the following manner:

A clutch ON command with enables closes the clutch contactor. Upon initiation of the run mode, the control reference signal ramps up from zero at the inch acceleration rate parameter C.3, until the drive reference equals programmed reference parameter F.2). When the enables are released the control reference ramps down according to the stop deceleration rate Parameter C.4 to zero set point is reached. At the time the enable is removed, the clutch timer is initiated. After the delay time is reached, the clutch contactor is dropped out by control removing clutch on or the internal brake delay timing out (parameter D.10).

The micro inch mode will be indicated by display of the "Inch L" on the keypad display.

- **MICRO INCH REVERSE MODE (SET UP)**

The controller will be in the micro inch reverse mode if the following conditions exist:

1. Enable signals are present
2. No fault is present
3. Reverse is not present
4. Micro Inch is present
5. Inch is not present
6. Clutch contactor ON signal is present
7. Brake contactor is closed
8. The main motor is programmed to run in the reverse direction

When in the micro inch reverse mode, the controller functions in the following manner.

A clutch ON command with enables closes the clutch contactor. Upon initiation of the run mode, the control reference signal ramps up from zero at the inch acceleration rate parameter C.3, until the drive reference equals programmed reference parameter F.1). When the enables are released the control reference ramps down according to the stop deceleration rate Parameter C.4 to zero set point is reached. At the time the enable is removed, the clutch timer is initiated. After the delay time is reached, the clutch contactor is dropped out by control removing clutch on or the internal brake delay timing out (parameter D.10).

The micro inch reverse mode will be indicated by simultaneous display of the "Inch L" and "Reverse" on the keypad display.

- **FAULT MODE**

Two fault indicators designed into the controller are the Fault display and Fault LED's. While in the fault mode, the fault is displayed on the top line of the display regardless of the display assignment for that line, The fault can also be read at parameter G.1.

The fault mode is entered if any fault is generated. Once the fault mode has been entered by the initiation of a fault, the controller remains in the fault mode until the fault mode is remotely reset by the press control issuing a fault reset command. The fault mode can be reset locally from the controller keypad. Call up Parameter G.6, Clear Faults, and using the Down Arrow (↓) change to enable. Press enter and faults are cleared. The last four prior faults are stored at parameters G.2 through G.5. These are read only.

Note: If you clear faults with the keypad when there is no fault, fault history is cleared.

This function does not occur with the reset input allowing the clear fault button to be pressed with no fault without clearing fault history.

In the fault mode, the current fault and last four faults are stored, indicated and can be transmitted to the press control by the controller on request. (see serial port section) In the case of all faults, the press is stopped. There are various levels of faults; and the urgency with which the press is stopped differs with the different levels of faults. The four faults that the CES controller will diagnose are as follows: Stop Main Motor Fault, Stop Now Fault, Stop-On-Top-Fault and Control Fault. These are fully in sections 10 & 12.

SECTION 10 – STARTUP & ADJUSTMENT

This controller replaces the present Dynamatic Digital CES Press Control in all aspects and adds numerous diagnostic features. This design replaces discrete analog and digital control circuitry with all microprocessor-based operation.

10.1 POWER CONVERSION

The CES Press Control provides control for the full range of Dynamatic press drives the power conversion circuitry operates from 480 volts (+10%, -15 %) input and provides a maximum of 600 volts dc coil excitation voltage. The following maximum current levels are available:

- Clutch Excitation - provides 135 amps at 70% duty cycle.
- Brake Excitation - provides 65 amps at 70% duty cycle.

Refer to the power schematic for your press drive (76203) for the following discussion. Both the clutch and the brake power-sections consist of rectifier circuits to convert the ac line power to dc power. Each circuit employs a full wave bridge rectifier consisting of four SCRs and resistor-capacitor networks for suppression. There is a clutch contactor and a brake contactor for electromechanically disconnecting the clutch and brake respectively. There are two-line fuses and a circuit breaker for over-current protection. An autotransformer steps the 480-volt line voltage up to 600 volts for the required forcing voltage. The clutch suppressor and brake suppressor printed circuit boards provide isolation and amplification of the SCR firing pulses.

10.2 PRESS SPEED CONTROL

The press control provides closed loop speed control operation with inner speed loops on both the clutch and brake. It provides adjustable acceleration and deceleration. The reference data is modified by a press angle measuring and control circuit function that will change the reference at adjustable angles.

10.3 BRAKE CONTROL BOARD

The logic circuitry is handled by two processors. The main processor located on the brake control board part# 15-1201-002x. The control processor is located on the clutch control board part# 15-1201-0013. This brake control board has circuitry that performs the following functions:

- Serial Communications including keypad / display along with serial port to remote computer. It also communicates to clutch board receiving data on clutch – brake amps and speed and other data from the clutch control board.
- Inputs and outputs to and from the press control (enables, clutch on, clutch contactor, normal stop, faults, etc.)
- Sends “run”, “inch”, “micro inch” command to clutch control board when enable conditions are satisfied over wired connections.

- Reads resolver. Converts data to press angle and calculates the desired speed in RPM based on the current angle. The speed command is then sent to the clutch control board via an analog output.
- Stores all parameters and sends control parameters to clutch control board via serial port.
- Calculates resolver speed and sends that signal to the clutch control board via a wired pulse output.
- Monitors speed, position, currents, inputs & outputs and creates faults based on conditions.

10.4 CLUTCH CONTROL BOARD

The clutch control board has circuitry that performs the following functions:

- Enables or disables clutch and brake outputs based on wired input from brake control board.
- Reads the analog speed command from the brake control board. Using the PID control loops calculates an appropriate clutch or brake SCR firing angle to control the press speed based on speed and current feedback.
- Reads clutch & brake currents from DC LEM transducer.
- Reads speed feedback from tachometer or resolver.
- Sends clutch, brake, speed, set point and various other items to the brake board via serial port.

10.5 PRE-START-UP PROCEDURE

Use a digital multi-meter (such as a Fluke 87) with 1% or better accuracy for all measurements required during start-up.

- Turn the circuit breaker to the OFF position. Turn all incoming signals OFF.
- Make sure the press motor is off.
- Check all terminal screws for tightness.
- Make certain that All plugs are properly seated.
- Check for loose connections.
- Install a jumper from term 27 to 24 on the clutch control board. This will allow the clutch control to be operated independently of the I/O safety system.
- Turn the circuit breaker to the ON position.
- Check for the presence of 115 volts on the secondary of the control transformer.
- Check the power supplies for their voltages (+/- 0.5%) of 5V DC on the clutch and brake control board. Use the pin TP1 on the clutch board as common. Measure to the heatsink on VR2 on the clutch control board and VR3 on the brake control board. Adjust R4 on the clutch control board or R1 on the brake control board as need for 5V DC.
- Check the line voltages L1 & L2 for the presence of 600 volts, +/- 10%.
- Program the control to test the clutch & brake output.
- Padlock the main motor of the press in the OFF position.
- Turn the Press Control OFF.

- On the control keypad, enter the test (local control) mode as follows:
 1. Press the "enter" key.
 2. Use the "down" arrow until you reach "SERIAL OPTIONS"
 3. Press the "enter" key.
 4. Use the ""up" arrow key until you reach "EC-2000 MENUS"
 5. Press the "enter" key
 6. Use the "up" arrow to change from disabled to enabled.
 7. Press the "enter" key
 8. Press the "exit" key
 9. Use the ""up" arrow key until you reach "EC-2000 OUTPUT ON"
 10. Press the "enter" key
 11. Use the "up" arrow to change from disabled to enabled.
 12. Press the "enter" key
 13. Press the "exit" key 3 times
 14. Press the "p1" key -- This allows you to directly program the clutch control board.
 15. Press the "enter" key
 16. Use the "up" arrow key until you reach "CONTROL SETUP"
 17. Press the "enter" key
 18. Use the "up" arrow until you reach "LOCAL\REM ENABLE"
 19. Press the "enter" key
 20. Use the "up" arrow to change from disabled to enabled.
 21. Press the "enter" key
 22. Press the "exit" key 3 times
 23. Press the "local-remote" key. The control can now be operated from the keypad.
 24. Press the "set point" key.
 25. Use the "up" arrow to set the set point to 1000.
 26. Press the "set point" key
 27. Connect a clip on DC Ammeter to one of the clutch leads.
 28. Press the "run" key to energize the clutch. Press the "stop" key to de-energize the clutch. The current should ramp up and limit at the set current limit of the control.
 29. Press the "stop" key. The brake will energize for the period set under D. BRAK PERFORMANCE" 10. BRK OFF DEL SEC.
 30. If the currents limit properly the test is complete. Go to Step 36. If not then you will need to calibrate the meter readings to match the actual currents.
 31. To calibrate the currents make a note of the value reached during the test.
 32. Press "p1" to return to the brake programing mode.
 33. To calibrate the clutch amps go to Menu A CONTROL SETUP Item 16 CLUT CURR SCALE. The default value is 100% raise this value to lower the actual amps or lower the value to increase the actual amps. Example:
 34. Current Limit 100A.
 35. Actual Current 120A
 36. $100\% \times 120 / 100 = 120\%$ Is the correct Setting

37. To calibrate the brake go to Menu D BRAK PERFORMANCE - Item 11 BRAK CUR SCALE and follow the same procedure as for the clutch.
38. Press “p1” to return to clutch control mode to test the clutch and brake. If the brake doesn’t engage long enough to get a good reading then you can increase the brake delay time. Go to D. BRAK PERFORMANCE - Item 10 BRAK OFF DEL SEC. and increase the delay time. Just remember to return that value to the original setting when complete.
39. Turn the Circuit Breaker OFF
40. Remove the jumper placed earlier between terminal 27 & 24 on the brake control board

10.6 START-UP PROCEDURE

- Power the control on. This will return all the parameters changed earlier to the operational settings with the exception of BRAK OFF DEL SEC. It will also remove the clutch control process from local mode.
- Send the following signals from the press control to the CES controller. Remove the signal after making the prescribed check. When faults are simulated, send the fault reset signal from the press control to reset the CES controller.
 - 1) Inch - Check for presence of LED on brake control board and on the keypad / display. .
 - 2) Micro Inch - Check for presence of LED on brake control board and on the keypad / display.
 - 3) Reverse – Check for presence of LED on brake control board and on the keypad / display.
 - 4) Stop-On-Top - Check for presence of LED on the brake control board.
 - 5) Clutch Contactor ON and Enable - Check for presence of LEDs on the brake control board. Since the motor is not running, an under-speed fault (313) will result, and a stop-on-top fault will be generated. Check this LED on the brake control board. Since the press is not rotating, it will not get to the creep angle or the stop angle; therefore, a stop now fault will be generated. Check this LED on the brake control board.
 - 6) Send the clutch contactor ON signal without the enable signal. A stop now fault (213) will be generated.
 - 7) Send the enable signal without the clutch contactor ON signal. A stop now fault (208) will be generated.
- Run the Press in the Inch Mode.
 1. Go to Menu F PROCESS Item 1 INCH SPEED. .
 2. Enter five strokes per minutes
 3. Go to Menu C. ACCEL/DECEL STUP Item 3. Set to 100% Item 4 Set to 100%
 4. Enable the control using the (2) enables, clutch on and inch signal checking clearances, mechanical interference, etc.
 5. Note the speed control. If control is unstable reduce speed gains.
 6. If the control displays Fault 206 (Wrong Direction Fault) Go to Menu F PROCESS Item 19 RESOLVER DIR REV and change setting to REV if in FOR or FOR if in REV.

- Resolver Adjustment
 1. Enter program mode and go to Menu F PROCESS Item 18 RESOLVER OFFSET.
 2. Inch the press to top "0" Degrees. Adjust Item 18 using "up" or "down" arrows until the POS reading on the display equals the press angle "0" degrees.
 3. This completes the setup of the resolver.
- Operate the Press in the Run Mode.
 - Enter a simple profile of run speeds. One speed throughout the cycle. Stop on top:
 1. Go to Menu F PROCESS Item 3 ANGLE #1. Set to 340 DEG
 2. Go to Item 4 Speed # 1. Set to 10 Strokes Per Minute.
 3. Set Items 5,7,9,11,13 to 360 DEG. These Speeds will be skipped.
 4. Set Item 15 CREEP ANGLE to 300 DEG
 5. Set Item 16 CREEP SPEED to 4.0 Strokes Per Minute
 6. Set Item 17 STOP ANGLE to 355 DEG
 - Run the press through several cycles.
 - Use the stop-on-top function to stop the press. Readjust the creep speed, creep angle, and stop angle, if necessary, to attain the proper stopping on top.
- Run the Press in the Micro Inch Mode.
 1. Go to Menu F PROCESS Item 2 MICRO INCH SPEED. .
 2. Enter four strokes per minutes
 3. Enable the control using the (2) enables, clutch on and micro inch signal checking clearances, mechanical interference, etc.
- Check the Remaining Faults.

SECTION 11 – FAULT LISTING & DESCRIPTIONS

11.00 FAULT LIST

11.01 LEVEL 100 FAULTS

Stop Motor Faults

- **FAULT 101 Over Speed**
 - Over Speed Fault occurs when drive speed is over the set point by the % of span set in over speed trip % for the time set in over speed trip time.
 - Time-% Parameters- Group H, Items 16 & 17.

11.02 LEVEL 200 FAULTS

Stop Now Faults

- **FAULT 204 Missing Set Point**
 - This fault occurs if the control engages and the set point reported back from the speed controller does not equal the set point command. This fault has a 1 second delay.
- **FAULT 205 Tachometer Feedback**
 - If the control fails to see tachometer motion when the current reaches a programmed % of full load amps and a programmed time the feedback fault is set
 - Time-% Parameters- Group H, Items 20 & 21
- **FAULT 206 Resolver Motion in the Wrong Direction**
 - If the resolver rotates in the reverse direction past the degree amount programmed this fault is set.
 - Degrees - Parameter- Group I, Item 3
- **FAULT 207 Low or Lost AC Voltage**
 - This fault is set if the control supply voltage becomes unstable or is reduced to less than 80% of 120 VAC.
- **FAULT 208 Missing Clutch On Signal**
 - If the two enables are closed during starting or running and the clutch on input is opened or remains open for the programmed time this fault is set.
 - Time = Parameter Group H Item 2 (Starting) Item 3 (Running)
- **FAULT 209 Clutch Contactor on without Clutch On Input**
 - If the clutch contactor is on and the clutch on signal is off for the programmed time this fault is generated
 - Time - Parameter Group H Item 3
- **FAULT 210 Missing Low Enable**
 - During Starting if the low enable is not closed within the programmed amount of time this fault will be set.
 - Time - Parameter Group H Item 2
- **FAULT 211 Inch and Micro Inch Inputs On Together**
 - If Inch and Micro Inch are closed while the clutch is engaged for the programmed time this fault is set.
 - Time- Parameter Group H, Item 6

- **FAULT 212 Reverse Command without Inch or Micro Inch**
 - If Reverse is enabled and neither inch or Micro Inch are enabled and the clutch is engaged, after a programed time the control will fault
 - Time Parameter Group H Item 6
- **FAULT 213 Missing High Enable**
 - During Starting if the high enable is not closed within the programed amount of time this fault will be set.
 - Time - Parameter Group H Item 2
- **FAULT 218 Clutch On Input without Clutch Contactor**
 - If the two enables are closed and clutch on enabled during starting or running and the clutch contactor is opened or remains open for the programmed time this fault is set.
 - Time = Parameter Group H Item 2 (Starting) Item 3 (Running)
- **FAULT 219 Inputs Present on Startup or at Fault Reset**
 - If any enable inputs are closed at control startup or on fault reset this fault is set. Not Programmable
- **FAULT 223 Clutch Contactor Removed Late**
 - The clutch contactor needs a time delay on stopping to dissipate clutch current. This delay is programmable, but usually controlled by the clutch controller. If the contactor remains closed after the programmed setting, this fault will be set.
 - This control has a setting for clutch delay under brake performance.
 - Time = Parameter Group H Item 4
- **FAULT 224 Top Stop Out Of Range**
 - When operating in single stroke mode, if the control fails to perform a top stop within the programmable degree range +_ degrees, this fault is set.
 - Degree error = Parameter Group I Item 1
 - Top Stop Degrees = Parameter Group F, Item 17
- **FAULT 225 Clutch Contactor Removed Early**
 - The clutch contactor needs a time delay on stopping to dissipate clutch current. This delay is programmable, but usually controlled by the clutch controller. If the contactor opens before the programmed setting, this fault will be set.
 - This control has a setting for clutch delay under brake performance.
 - Time = Parameter Group H Item 5
- **FAULT 226 Stop Angle Reached before Creep Speed Attained**
 - If the control is in single stroke mode it will reduce speed to the creep speed when it passes the creep angle. If it doesn't get to creep speed prior to reaching the stop angle this fault is set.
 - Creep Angle = Parameter Group F, Item 15, Creep Speed = Parameter Group F, Item 16, Stop Angle = Parameter Group F, Item 17.
- **FAULT 227 Enable Before Clutch Cool Down Expired**
 - If the control faults out on clutch over current or clutch current on too long, control operation is not possible until the cool down time expires
 - Time = Parameter Group H, Item 14
- **FAULT 228 Enable Before Brake Cool Down Expired**
 - If the control faults out on brake over current or brake current on too long, control operation is not possible until the cool down time expires

- Time = Parameter Group H, Item 15
- **FAULT 229 Brake Contactor Open**
 - In normal operation the brake contactor is closed. If it opens for the programmed time a fault is set.
 - Parameter Group H, Item 1
- **FAULT 231 Controller Internal Communication Error**
 - The controller has two microprocessors. The master processor handles everything except for speed and current control. The control processor handles speed and current control. It accepts speed and run commands from the master control and reports current and speed values to the main processor several times per second. If no data is received by the master processor for the programmed time, a control fault is set.
 - Time = Parameter Group H, Item 23.

11.03 LEVEL 300 FAULTS

Stop On Top Faults

- **FAULT 313 Under Speed Fault**
 - Over Speed Fault occurs when drive speed is under the set point by the % of span set in under speed trip % for the time set in over speed trip time.
 - Time-% Parameters- Group H, Items 18 & 19.
- **FAULT 314 Clutch and Brake Current Overlap**
 - If both the clutch and brake values exceed 20% of max current at the same time for the time set in the programmed parameter a fault is set.
 - Time = Parameter Group H, Item 9.
- **FAULT 315 Clutch Over Current**
 - If the clutch current exceeds the maximum limit value for the programmed period of time this fault is set.
 - Time = Parameter Group H, Item 7
- **FAULT 316 Brake Over Current**
 - If the brake current exceeds the maximum limit value for the programmed period of time this fault is set.
 - Time = Parameter Group H, Item 8
- **FAULT 317 Inch Command Change**
 - If the Inch command is changed while the drive is run mode and the programmed period of time has passed this fault is set.
 - Time = Parameter Group H, Item 6
- **FAULT 318 Micro Inch Command Change**
 - If the Micro Inch command is changed while the drive is run mode and the programmed period of time has passed this fault is set.
 - Time = Parameter Group H, Item 6
- **FAULT 319 Reverse Command Change**
 - If the Reverse command is changed while the drive is run mode and the programmed period of time has passed this fault is set.
 - Time = Parameter Group H, Item 6
- **FAULT 320 Clutch Current On Too Long**

- If the control clutch current is above the programmed % of max current for the programmed time limit a fault is generated.
 - Time = Parameter Group H, Item 10, % = Parameter Group H, Item 11
- **FAULT 321 Brake Current On Too Long**
 - If the control brake current is above the programmed % of max current for the programmed time limit a fault is generated.
 - Time = Parameter Group H, Item 12, % = Parameter Group H, Item 13

SECTION 12 PRESS CONTROL INTERFACE - SERIAL PORT

The serial interface assembly makes it possible for the CES-EC-2000 control to communicate with another microprocessor, main computer or logic controller. This communication link is an RS-422 converter and a 232 data splitter module that is mounted on the control side panel. These modules then plug in to the controller back board and multiplex with the keypad to communicate. The port can be utilized to set references (i.e., speeds and angles) and to communicate diagnostic information, faults, etc. Note, when the press control is communicating with the CES control, the keypad is momentarily disabled. This is to avoid the issue of both keypad and port trying to program the control at the same time.

12.0 SERIAL PORT PRESS CONTROL INSTRUCTIONS

A resume of serial interface commands from the press control to the DMR is as follows:

- AA Accept downloaded parameters that follow.
- BB Send fault codes
- CC Send monitor data.
- DD Begin using parameters down loaded with last AA commands
- EE Echo back last AA parameters.

The press control may have constraints on changing of speeds and press drive parameters while the press is running. The CES controller will change parameters as directed by the press control. Press control parameters are sent by the press control in a packet of bits representing ASCII characters. The first two ASCII characters will be AA. The packet length is 68 characters. ASCII "0" characters are used to complete the 68-character packet. Upon receiving an EE command, the AA packet will be transmitted back to the press control by the DMR for comparison to ensure its accuracy. The AA will be changed to EE when sent back.

A typical program to run a press with a Single Speed and use the slowdown function to get good parts would be set up as follows:

1. Angle No. 1 = 340 degrees
2. Speed No. 1 = 16 SPM
3. Angle No. 2 = 160 degrees
4. Speed No. 2 = 10 SPM
5. Angle No. 3 = 185 degrees
6. Speed No. 3 = 16
7. Angle No. 4 = 360 degrees
8. Speed No. 4 = 10
9. Angle No. 5 = 360 degrees
10. Speed No. 5 = 10
11. Angle No. 6 = 360 degrees
12. Speed No. 6 = 10
13. Creep Angle = 305 degrees

14. Stop Angle = 356.5 degrees
15. On the keypad, enter:
Creep Speed = 4 SPM

12.1 SERIAL PORT PARAMETER DATA PACKET INSTRUCTIONS

The press run data packet should contain the following information, and in the order given:

1. ASCII characters AA.
2. Six independent angles and speeds defined in pairs. The angles are in degrees and are defined in a clockwise (CW) rotation with zero degrees at top dead center. The speeds are in strokes per minute. If it is desired to skip an angle, it may be programmed to be 360.0 degrees and, since the press will only accept angles from 0 to 359.9 degrees, it will skip the angle programmed for 360.0 degrees.
3. The seventh angle will be the angle that starts slowing the press down to the creep speed after the CES controller has received the stop-on-top contact closure.
4. The eighth angle will be the angle to initiate the contact that will allow the press control to set the friction brake after the press has been at creep speed and reaches this stop angle.
5. The angles will be four digits with an implied decimal point, in tenths of a degree ranging from 0 to 359.9 degrees.
6. The speeds will be four digits, with an implied decimal point, in hundredths of a stroke per minute.
- 7.- The press run data should have the format indicated in Table 2-5.
8. Note: The Controller will not accept "0"s for angle or speed settings from the serial port. .

Table 8: Press Run Data Format

Packet Number	Data	Par No.
1 through 2	AA	
3 through 6	Angle No. 1	F.3
7 through 10	Speed No. 1	F.4
11 through 14	Angle No. 2	F.5
15 through 18	Speed No. 2	F.6
19 through 22	Angle No. 3	F.7
23 through 26	Speed No. 3	F.8
27 through 30	Angle No. 4	F.9
31 through 34	Speed No. 4	F.10
35 through 38	Angle No. 5	F.11
39 through 42	Speed No. 5	F.12
43 through 46	Angle No. 6	F.13
47 through 50	Speed No. 6	F.14
51 through 54	Creep Angle	F.15
55 through 58	Stop Angle	F.17
59 through 68	Zeros	

12.2 SERIAL PORT PARAMETER DATA PACKET INSTRUCTIONS (ALTERNATE METHOD)

It is also possible to write less than a complete data packet. Use the following method.

1. ASCII characters AA in positions 1 & 2.
2. Place the data you want to write in the proper location. For example if you wanted to change Speed No. 4 to 17.00 SPM, you would place ASCII "1700" in positions 31 through 34.
3. Place ASCII "0" in the 10 spaces following the data (positions 35 through 44)
4. Place ASCII characters that do not represent numbers or letters in spaces 3 through 30. For example, you could use "@" or "%".
5. Send the data packet to the control. The control will discard the meaningless data and write the correct data to the correct location. This technique can be used to write any amount of angle or speed changes. Just place the data you want to write in the proper packet locations. Complete the packet with (10) "0"s and fill the areas you are not changing with ASCII characters that are not letters or numbers.
6. Note the control will not accept "0"s as data.

12.3 SERIAL PORT EXECUTE PARAMETER INSTRUCTION

When ready, the press control will send a two-character packet to the CES controller instructing the DMR to execute the new parameters. The two ASCII characters in this packet of bits will be DD. All characters in the packet will be 8 bit ASCII (the most significant bit being zero) with one start, one stop and no parity.

In the run mode the new parameters will take effect immediately after the receipt of the "DD" command, unless the control is in creep mode or is stopping on stop. In that case the command will be ignored and another "DD" command is required. If the press is stopped, or is operating in the inch or micro inch mode then the DD command to execute the new parameters is given, the new parameters will take effect immediately. There are no termination characters for the packets.

12.4 SERIAL PORT FAULT REPORT INSTRUCTION

Fault data is sent by the CES controller upon request of the press control. The two ASCII characters of the "Request to Send Fault Data" will be BB. The packet length of the request will be two characters. The DMR will send the fault data in a packet of bits representing ASCII characters. The first two ASCII characters will be BB. The remaining characters will be four digit numbers, which will represent faults corresponding to these numbers. Zeros are used to complete the 68-character packet.

12.5 SERIAL PORT FAULT REPORT DATA PACKET CONTENT

Table 9: Control Fault Data Format

Packet Number	Data
1 through 2	BB
3 through 6	Current Fault
7 through 10	Prior Fault #1
11 through 14	Prior Fault #2
15 through 18	Prior Fault #3
19 through 22	Prior Fault #4
23 through 68	Zeros

12.6 SERIAL PORT MONITOR DATA INSTRUCTION

Monitor data will be sent by the DMR on request of the press control. The two ASCII characters of the "Request to Send Monitor Data" will be CC. The packet length of the request will be two characters. The DMR will then send the monitor data in a packet of bits representing ASCII characters. The first two ASCII characters will be CC. The remaining characters will contain the monitor data. Zeros are used to complete the 68-character packet. Numbers in the monitor data will be four digits with an implied decimal point.

12.7 SERIAL PORT MONITOR DATA PACKET CONTENT

The CES monitor data packet will contain the following information:

1. ASCII characters CC.
2. Acceleration and deceleration rates will be four digits, with an implied decimal point, in tenths of a stroke.
3. The speeds will be four digits, with an implied decimal point, in hundredths of a stroke per minute.
4. The CES monitor data will have the format indicated in Table 10 (Next Page) per minute per second.

Table 10: Control Monitor Data Format

Packet Number	Data
1 through 2	CC
3 through 6	Inch Speed
7 through 10	Micro Inch Speed
11 through 14	Creep Speed
15 through 18	Auto acceleration rate
19 through 22	Auto deceleration rate
23 through 26	Manual acceleration rate
27 through 30	Manual deceleration rate
31 through 34	Stop Deceleration Rate
35 through 68	Zeros

12.8 SERIAL PORT CONNECTIONS

Note: The Serial Port Connections on the CES Controller are as follows:

TX+ = 91 Old(322)
TX- = 92 Old(323)
RX- = 93 Old(324)
RX+ = 94 Old(325)

The Proper baud rate must also be set. It is 9600.

SECTION 13 – TROUBLESHOOTING

13.0 EC-2000-CES Press Drive Control – Troubleshooting

Caution: these instructions should be read and clearly understood before working on the CES press control.

Warning: Equipment is at or above line voltage extreme care must be observed when working on energized equipment.

Troubleshooting- equipment

1. VOM (Multimeter)
2. Clamp-on ammeter

Additional useful equipment:

1. Scope
2. Digital Recorder

Record keeping

A logical and effective maintenance program requires keeping a log of any problems and any corrective action taken even if that action was not successful in solving the problem.

Normal indications

In order to be more effective in troubleshooting requires knowledge of normal conditions. Normal conditions would include but not be limited to:

1. Line voltage
2. Brake current levels
3. Clutch current levels
4. Normal input signals in all operating modes
5. Normal operating speeds

Trouble Shoot if:

- A. Drive will not run
- B. Drive runs then faults
- C. Drive runs but does not control well.
- D. Drive runs does not stop consistently
- E. Faults occur
- F. Fuses Blow

13.1 TROUBLE SHOOTING 100 LEVEL STOP MOTOR FAULTS

100 Level: This fault results in the press stopping and signals the stopping of the main motor:

- 101 Over speed fault.** An over speed condition exists when the tach feedback exceeds the speed reference by a value determined in parameters H.16 & H.17.

Possible causes:

- Mechanical binding between flywheel and rotor.
- Loss of brake coils and excessive counterbalance pressure.
- Incorrect J9 & J10 on clutch control board
- Shorted SCR on Clutch
- Check parameters H.16 & H.17
-

13.2 TROUBLE SHOOTING 200 LEVEL STOP NOW FAULTS

200 Level: These faults result in immediately stopping the press, but not the main motor:

- 204 Missing Set point fault.** Loss of set point after run command issued.

Possible causes:

- Programming error speed set point Programed at "0"
- Connection Problem between clutch control and brake control boards. Check "PL2" plug on clutch control logic board and EC-PL plug on brake board.
- Cycle power to the control
- Serial port failure on clutch control board or brake control board. Replace as needed.

- 205 Loss of tach fault.** Loss of tach pulses with as determined by parameters H.21 & H.22.

Possible causes:

- Failure of tach. Connect spare tach or switch to resolver tach.
- Failure of Resolver (If used as a tach) – Check J4 jumper on clutch control board
- Mechanical binding of press.
- Failure of clutch coil. Check coils.
- Improperly set current limit. Check setting and adjust as necessary.
- Bad SCR's on Clutch
- Defective Clutch control board not firing SCR's

- 206 **Press movement in wrong direction fault.** Press movement in wrong direction contrary as set by parameter I.3 (wrong direction degrees)

Possible causes:

- Improper or loose wiring of resolver check and repair.
- Incorrect setting of parameter F.19 (For-Rev Resolver).
- Loose plug in resolver chip on brake board – re-seat.
- At top, falling back, holding brake not adjusted properly.
- Motor is running in wrong direction.
- Defective Brake control board.

- 207 **Loss of line fault.** Loss of one phase or greater than 20% drop in voltage for greater than 100 milliseconds.

Possible causes:

- Input line fuse blown.
- Brake control board fuse blown.
- Loss of a single phase.
- Defective brake control board
- Low voltage – check incoming line.

- 208 **Enables without clutch contactor on fault.** “clutch on” (wire 10) signal is not present within time set in H.2 of receiving enables.

Possible causes:

- Press control not sending signal. Check clutch on LED on brake control board.
- Bad clutch brake board
- Parameter H.2. Time set too short.

- 209 **Clutch contactor on after clutch on is a de-energized fault.** Clutch on signal (10) is present longer than tie set in H.3

Possible causes:

- Clutch contactor welded
- Clutch contactor auxiliary contact stuck on.
- Defective brake board input.
- Parameter H.3. Time set too short.

- 210 **Missing enable low fault.** The two enable signals are not coincident for more than time listed in parameter H.2.

Possible causes:

- Press control not sending signal. Check clutch on LED on brake control board.
- Bad clutch brake control board.
- Parameter H.2. Time set too short.

- 211 Inch or micro inch enable fault.** Presences of both inch and micro inch commands with an enable.

Possible causes:

- Press control is sending both signals
- Defective brake control board input.

- 212 Reverse command fault.** The presence of a reverse command without either an inch or micro inch command.

Possible causes:

- Press control is not sending the signal.
- Defective brake control board input.

- 213 Missing enable high fault.** The two enable signals are not coincident for more than time listed in parameter H.2.

Possible causes:

- Press control not sending signal. Check clutch on LED on brake control board.
- Bad clutch brake control board.
- Parameter H.2. Time set too short.

- 218 Enables & Clutch on without clutch contactor fault.** Clutch contactor not on in time set in H.3

Possible causes:

- Connections on clutch contactor coil
- Clutch contactor auxiliary contacts.
- CE relay contacts
- E-relay on clutch control board
- Bad clutch on output on brake control board. Check operation of terminal 22 & 24 on clutch control board. Should go from +12vdc to 0v when control engages.
-

- 219 Enables or Clutch on closed on start up or after fault reset.**

Possible causes:

- Press control is sending the signals
- Operator error
- Bad input or inputs on brake board

223 Clutch contactor on too long. Delay longer than setting in parameter H.4

Possible causes:

- Press control delay is too long
- Brake off delay is too long. Check parameter D.10. Contactor stays on till brake delay ends.
- Clutch Contactor sticking
- Clutch auxiliary contact sticking.

224 Stop-on-top not performed fault. The stop-on-top function failed to stop the press in the degree span allowed in parameter I.1.

Possible causes:

- Mechanical binding of press.
- Clutch speed is not tuned properly. Check parameter B.4, B.5, & B.6.
- Press in continuous mode too long. Check continuous input.
- Brake SCR's not working properly.
- Auto or stop deceleration set too low. Try setting to 200% parameters C.2 & C.5.
- Too much brake dead band. Try setting to "0" RPM. Parameter D.9.
- Brake gains are too low.
- Creep angle is set too late.
- Creep speed is too high.
- Defective Brake control board not firing SCR's properly

225 Clutch contactor on or clutch contactor removed too soon fault. Clutch on signal removed without removing the enable signal or removing clutch on signal during the delay required by the parameter in H.5 before de-energizing clutch contactor.

Possible causes:

- Press control is dropping the signal too soon.
- Clutch control board E-relay releases too soon. Check parameter D.10 Brake delay.
- Clutch contactor loose connection.
- Clutch contactor aux-contacts.
- Defective clutch control board.

226 Stop angle reached before creep speed attained.

Possible causes:

- Brake gains set too low
- SCR's not firing properly
- Auto or stop deceleration set too low. Try setting to 200% parameters C.2 & C.5.
- Too much brake dead band. Try setting to "0" RPM. Parameter D.9.
- Creep angle set too late
- Defective brake board not firing SCR's
- Unstable clutch control.

- 227 Enable before clutch cool down expired fault.** Enabling the CES controller before the cooldown period has expired following a clutch current fault.

Possible causes:

- Operator error following a clutch current fault.
- Defective brake control board.

- 228 Enable before clutch cool down expired fault.** Enabling the CES controller before the cooldown period has expired following a clutch current fault.

Possible causes:

- Operator error following a brake current fault.
- Defective brake control board.

- 231 Communication Fault between the clutch and brake control boards.**

The controller has two microprocessors. The master processor handles everything except for speed and current control. The control processor handles speed and current control. It accepts speed and run commands from the master control and reports current and speed values to the main processor several times per second. If no data is received by the master processor for the programmed time, a control fault is set.

Time = Parameter Group H, Item 23.

Possible causes:

- Connections between clutch control board "PL2 and brake control board PL-EC
- Clutch control processor crashed. Cycle power to the control.
- Defective clutch control logic board.
- Defective brake control board.

13.3 TROUBLE SHOOTING 300 LEVEL STOP ON TOP FAULTS

300 level: these faults will cause the CES controller to execute a normal stop upon reaching the top of the press stroke.

- 313 Under speed fault.** An under speed fault exists when the tach signal is less than speed reference for a time and % as determined by parameters H.18 & H.19.

Possible causes:

- Insufficient torque caused by damaged or reduced capacity of clutch coils.
- Mechanical binding of press.
- Clutch current limit set too low.
- Failed SCR's
- Clutch control board not firing SCR's
- Loose belts on mechanical CES Drive.

- 314 Clutch and brake current overlap fault.** Overlap fault occurs when clutch and brake current are present at the same time. Allowable limits are 20% and time as set in parameter H.9.

Possible causes:

- Clutch or Brake SCR's not firing properly
- Clutch or brake LEM's are not working
- Clutch control or brake control boards not firing SCR's properly.
- Defective clutch or brake suppressor boards.
- Unstable tuning of clutch or brake PID loops.

- 315 Clutch current fault.** If clutch current is above the current limit programmed in A.4 for a time determined by parameter H.7, a clutch current fault will occur. The CES press controller cannot be run until the cool down time set in parameter H.14 has expired.

Possible causes:

- Mechanical binding or overloading of press.
- Increase value of parameter H.7.
- Insufficient torque due to damaged clutch coils.
- Miss- adjustment of tuning parameters.
- Defective clutch control board
- Defective clutch SCR's
- Loose belts.

- 316 Brake current fault.** If brake current is above the current limit set in parameter B.4 for a time determined by parameter H.8 a brake current fault will occur. The press cannot be run until the cooldown time set in parameter H.15 has expired.

Possible Causes:

- Insufficient braking torque due to damaged brake coils.
- Increase parameter H.8
- Miss-adjustment tuning parameters
- Defective brake control board.
- Defective SCR's

- 317 Inch change fault.** If the inch command signal is changed while enable is present this fault will occur.

Possible Causes:

- Check operator error or interface problem. Check LED
- Input module for inch command.
- Defective brake control board

- 318 Micro inch change fault.** If the micro inch command is changed while the enable is present this fault will occur.

Possible Causes:

- Check operator error or interface problem. Check LED
- Input module for micro inch command.
- Defective brake control board

- 319 Reverse change fault.** If the reverse command is changed while the enable is present this fault will occur.

Possible Causes:

- Check operator error or interface problem. Check LED
- Input module for reverse command.
- Defective brake board.

- 329 Parameter out of limit fault.** If a parameter downloaded via the serial interface is out of the established limits, this fault will occur.

Possible causes:

- Operator or interface error .
- Defective brake control board

Control fault: a microprocessor watchdog timer monitors the microprocessor and the power supply for proper operation. This fault requires turning power to the control off to reset.

Possible causes:

- Power supply 5V Adjustment clutch control board.
- Power supply 5V Adjustment brake control board.
- Defective clutch control board
- Defective brake control board.

13.4 TROUBLE SHOOTING. NO FAULT DISPLAYED:

13.41 Blank Display:

Possible causes:

- Processor Crashed. Cycle control Power
- Power supply 5V Adjustment brake control board. Adjust to 5.000 v +-1%
- Defective RS-232 Data Splitter
- Defective RS-422 Data Converter
- Defective Keypad Display.
- Bad cable connections
- Defective brake control board
- Blown Fuses on brake control board

13.42 Keypad Does Not Respond. Display works:

Possible causes:

- Press Control RS-422 Serial Connections are Incorrect.
- Defective RS-232 Data Splitter
- Defective RS-422 Data Converter
- Defective Keypad Display.
- Bad cable connections
- Defective brake control board

13.43 Control does not engage. No faults:

Possible causes:

- Press control is not sending signals. Check control LED's
- Missing AC voltage Check Term 1 & 6 for 120VAC
- Defective brake control board

13.44 Unit runs at top speed only - No control:

Possible causes:

- Check parameters. SPM or (F.3 – F.14) gear ratio (F.20) may be too high.
- Check J9 & J10 on clutch control board. Set to "A" position.
- Check parameters H.16, H.17, H.20 & H.21. These may be set so high that over speed and tach loss faults are disabled.
- Missing Tachometer feedback . Check display
- Check j4 jumper on clutch control board. Position "A" for resolver tach. Position "B" for mechanical unit tach.
- Binding in mechanical unit.

13.45 The speed range is limited—doesn't reach maximum speed:

Possible causes:

- Check parameters. SPM or (F.3 – F.14) gear ratio (F.20) may be too low.
- Check parameters H.18 & H.19. These may be set so high that under speed fault is disabled.
- Wrong tachometer PPR (parameter A.5). Check display SPM
- Binding in press or mechanical unit.

13.46 High Voltages Fuses blow on power up:

Possible causes:

- If the fuses blow on startup or while stopping the problem is likely with the brake circuit
- Fault or ground in brake coil circuit. Meg and Ohm coils to check.
- Defective SCR's . Ohm SCR's. Check SCR gates. Should be about 18 ohm.
- Try powering up with coil disconnected. If fuses blow, problem is in the control. If not problem is in the mechanical unit.
- Defective brake control board.

13.47 High Voltages Fuses blow while running:

Possible causes:

- If the fuses blow while running the problem is likely with the clutch circuit
- Fault or ground in clutch coil circuit. Meg and Ohm coils to check.
- Defective SCR's . Ohm SCR's. Check SCR gates. Should be about 18 ohm.
- Try engaging clutch with coil disconnected. If fuses blow, problem is in the control. If not problem is in the mechanical unit.
- Check for press binding causing excess clutch amps.
- Defective clutch control board.

13.48 Low Voltages Fuses on clutch control board blow:

Possible causes:

- Too much load on 120VAC circuit. Change 1 amp fuse to 5 amp
- Defective clutch control board or logic board.

13.49 Low Voltages Fuses on brake control board blow:

Possible causes:

- Defective brake control board.

13.50 Unstable Speed Running:

Possible causes

- Tuning Parameters. Check if current loop is disabled. Try disabling it if not. (parameter B.7)
- Tuning Parameters. Try increasing speed proportional gain parameter B.4
- Tuning Parameters. Try adding speed differential gain. Parameter B.6
- Press Counterbalance not set or working properly. Check to see if control is working harder on the down stroke vs the upstroke or visa versa.

13.51 Unstable Speed Slowing or Braking:

Possible causes

- Tuning Parameters. Check if current loop is disabled. Try disabling it if not. (parameter B.7)
- Too much brake dead band. Try setting to "0" RPM. Parameter D.9.
- Tuning Parameters. Try increasing speed brake proportional gain parameter D.6
- Tuning Parameters. Try reducing Brake Speed Integral gain. D.7
- Tuning Parameters. Try adding Brake speed differential gain. Parameter B.8
- Press Counterbalance not set or working properly. Check to see if control is working harder on the down stroke vs the upstroke or visa versa.

Note: The fault menu and conditions are merely troubleshooting aids. Drive stops due to automatic Fault detection may be eliminated by changing times or settings in Menu H.

CAUTION: Changing fault times or percentages can cause safety issue. Proceed cautiously and return settings to reasonable values once fault cause is determined.

If there are questions or additional assistance is required, please contact the factory.

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