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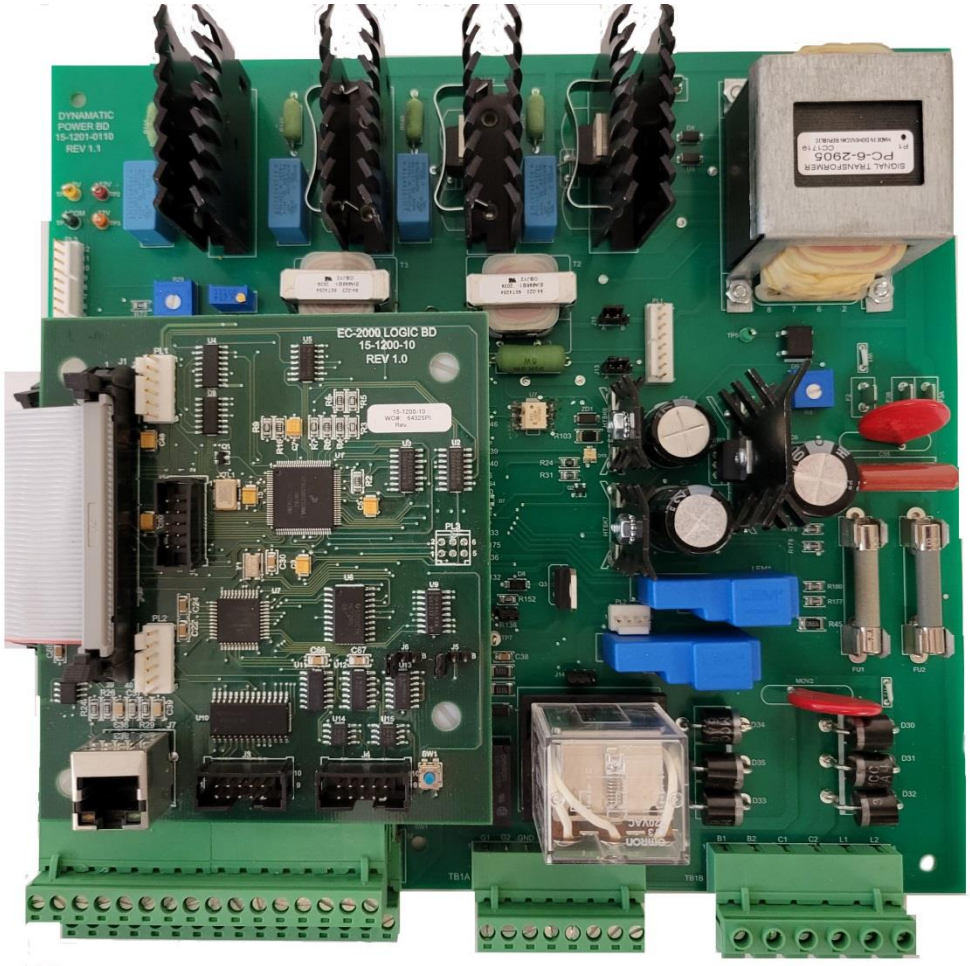
EC 2000

Instruction Manual

Software Version 2.17
Hardware Version 110-1.1



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SECTION 1 - THEORY OF OPERATION

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

The AC motor is started under no load and allowed to reach full speed before the controller is energized (motor starter not included). The output of the control is determined by reference setting and feedback magnitude with drive speed and torque being based on the operational mode and load requirements. Speed control mode with tachometer feedback will regulate within 0.5% of set speed, while approximately 5% regulation is possible in torque mode using the internal clutch current loop as feedback. Preset speeds, jog, thread, and external reference inputs are available as standard parameter selections with the EC 2000 control.

EC 2000 uses digital technology to provide 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.

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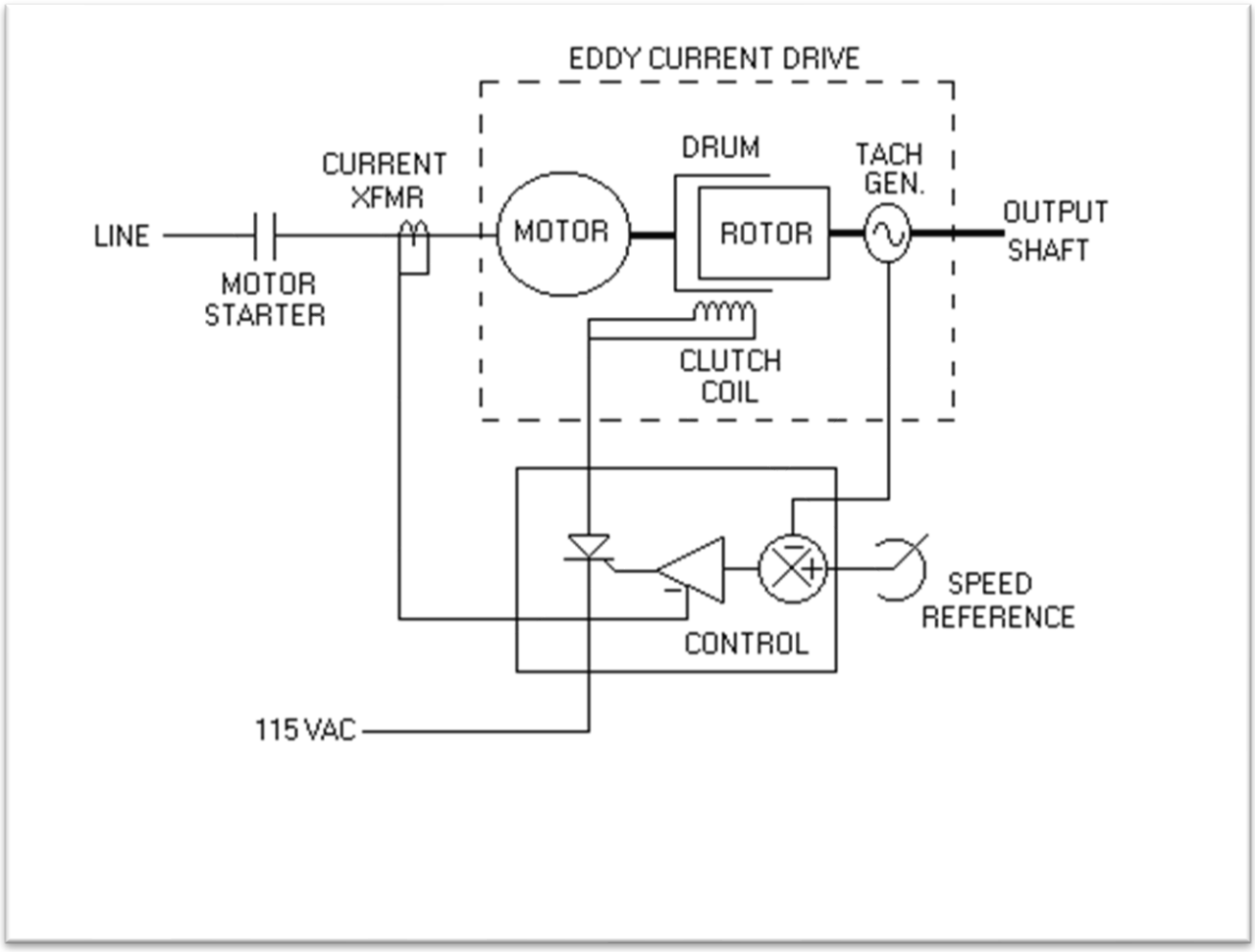

Figure 1: Eddy Current Drive & Control Block Diagram

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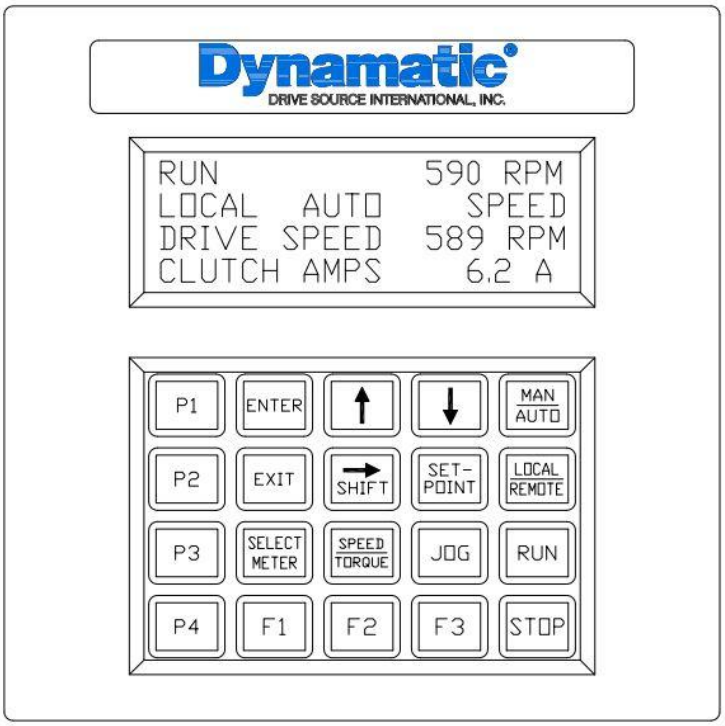

Figure 2: EC 2000 Keypad Display

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SECTION 2 – SPECIFICATIONS

2.1 Features

- Eddy current drive digital controller
- Available in panel and NEMA enclosed configurations
- Adjustable output voltage from 0 – 90VDC
- Up to 11 amps output (see **EC 2000 – HP** models for higher voltage or current outputs)
- Ethernet IP add-on available
- Speed (AC tachometer generator or speed pickup) or torque (clutch current) feedback permissible
- Adjustable brake current output
- Controllable via potentiometer, follower signal (0-10V, 4-20mA), or the keypad
- 115VAC standard power input
- Digital, noise free operation
- Fuse and MOV protected
- Back-lit LCD with keypad user interface
- Programmable analog and relay outputs for different speeds/states and monitoring.
- Recorded and displayed faults

2.2 Power and Load Ratings

- Input voltage: 115VAC, 50/60Hz
- Input Line Current: 11.0A RMS
- Output: 11.0A DC Output at 90VDC MAX
- Inversion and field forcing available to 90VDC
- “Run” Relay (SPST): 115 VAC or 24 VDC at 5A (Resistive); 150VA Pilot Duty
- Programmable “F” Relay (SPDT): 2A @ 115 VAC
- 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: 15 RPM
- Linear Acceleration/Deceleration Range: 1% - 200% of top speed/sec

2.3 Electrical Protection

- Fuses: 10A, 250VAC, Type ABC
- Metal Oxide Varistors
  - 240V, 10kA
  - Used on both input and output

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2.4 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

2.5 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).

2.6 Enclosures

- Available in NEMA Type 1 (Dynamatic Part Number: 015-002000-0300)
- Other enclosures available upon request (lead times may vary)

2.7 Weight

- Panel Mounted Controller: 8.3 lbs. (base unit)
- 460/230VAC : 120VAC transformer: 24 lbs. (panel mounted)

2.8 Dimensions (see Figures 3-6)

- Main Board: Main Board - 8.5"H x 9.25"W x 2.25"D
- Panel Mounted (Standard):
- Keypad: 4.875"H x 4.875"W x 1.375"D

2.9 Reliability

- Mean Time Between Failures: 50,000 hours

2.10 Codes and Standards

- National Electrical Code (NEC) Compliant

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SECTION 3 – CONTROL OPERATION MODES

3.1 Control Modes

- Speed (AC Tachometer Generator or Pulse Pickup)
- Torque (Current Feedback)
- Speed/Torque (switchable)
- External (Uses Analog Input as Feedback)

3.2 Other Modes of Operation

- Local/Remote
  - Allows the user to switch between keypad use and externally wired devices
- Jog
- Manual/Auto
  - Allows the use to switch between an automatic signal (i.e. 4-20mA or 0-10V) and the control potentiometer
- 2 or 3 wire start/stop
- Four Preset Set Points
  - Programmable through the keypad
- Skip RPM (Frequencies)
  - Four Setpoint Skips with programable deadband
- PLC Run
- Auto Start on Power
- Auto Restart after fault
- Adjustable Braking
- Mutuatrol Braking
  - Requires Additional Hardware
- Coast to Stop
- Ramp Control
- Loss of Follower
- Torque Limit
  - Requires motor current transformer
- User Process Units
- Forward/Reverse Speed Control
- Tachometer Follower
- ESTOP (TB2-31 and 32 are not closed)

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SECTION 4 – Inputs/Outputs

4.1 Analog Inputs

- Potentiometer/Reference Voltage
  - Used for set points
- Automatic Signal
  - 0-10V, 0-5V, 4-20mA, 8-40mA
  - Used for set points
- Motor Current Feedback (AC)
- Speed Feedback
- Analog Feedback
  - Used for External Control

4.2 Digital Inputs

- E-Stop (Normally closed)
- Stop (Normally closed)
- Start (Normally open)
- Jog (Normally open)
- PLC Run (Normally open)
- Preset 1 or 2
- Preset 3 or 4
- Manual/Auto
- Speed/Torque

4.3 Analog Outputs

- 2 x Programmable 0-10V/4-20mA Outputs
  - None
  - Drive Speed
  - Reference
  - Set Point
  - Motor Amps
  - Clutch Amps
  - Brake Amps
  - Controller Feedback
  - Tach Follower Speed
  - Process Feedback
  - Controller Output
  - Brake Output

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4.4 Digital Outputs

- Run Relay (Normally open)
  - 2A, 115VAC

- Programmable “F” Relay (SPDT)
  - Speed Mode
  - Torque Mode
  - External Mode
  - Local Mode
  - Remote Mode
  - Manual Mode
  - Auto Mode
  - Stopped
  - Stopping
  - E-Stop
  - Run
  - Run 0
  - Coasting
  - Jogging
  - Fault
  - Restart
  - Torque Limit
  - At Set Point
  - Loss of Follower
  - Loss of Feedback
  - Reverse Mode

- 4 x Programmable +12VDC Relays (Logic) R1, R2, R3 & R4.
  - Female pin header needed (6 position, 2.54 mm pitch)
  - Same programming functions as “F” relay

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SECTION 5 – INSTALLATION

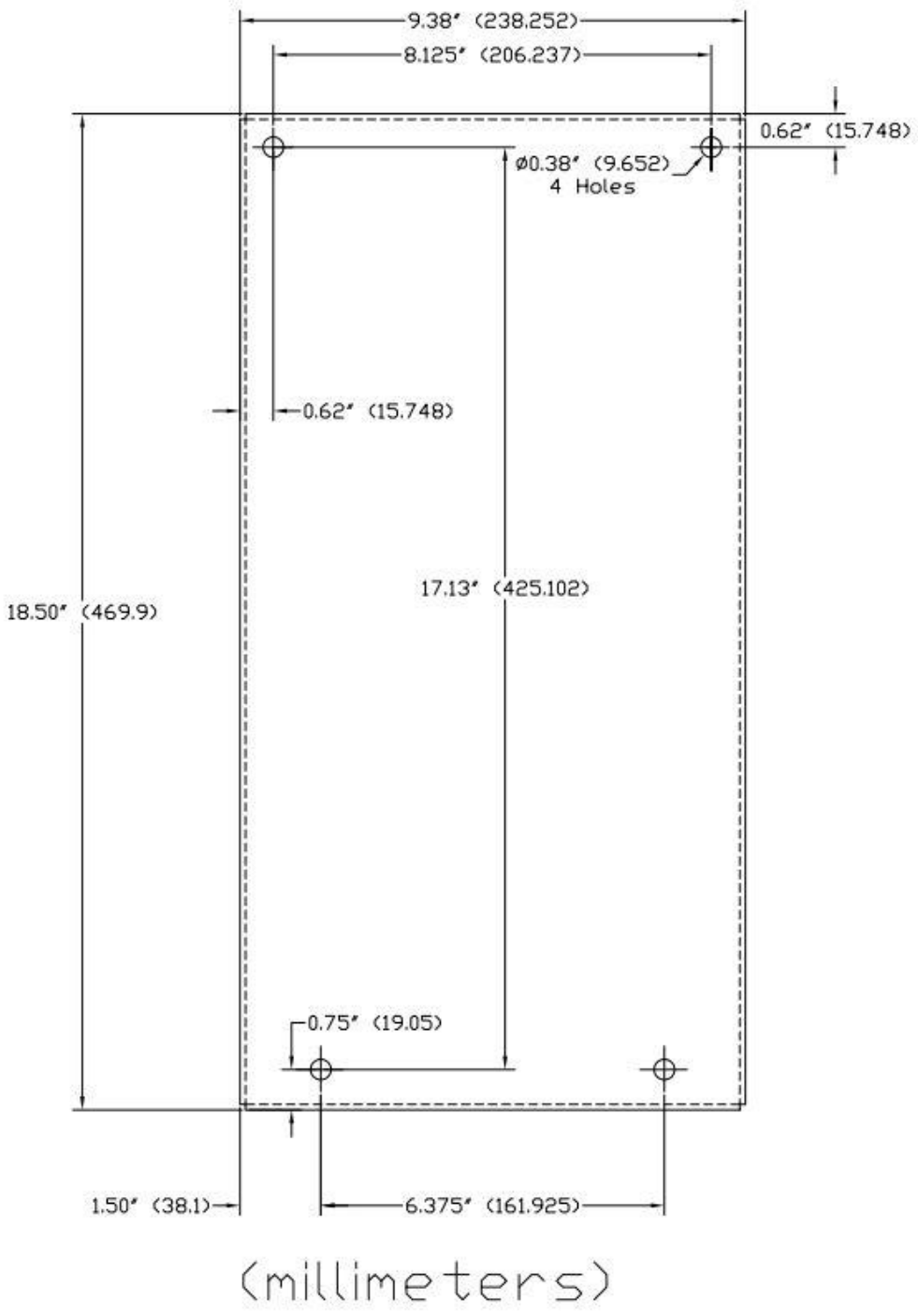

Figure 3: Standard Panel Dimensions (Not to scale)

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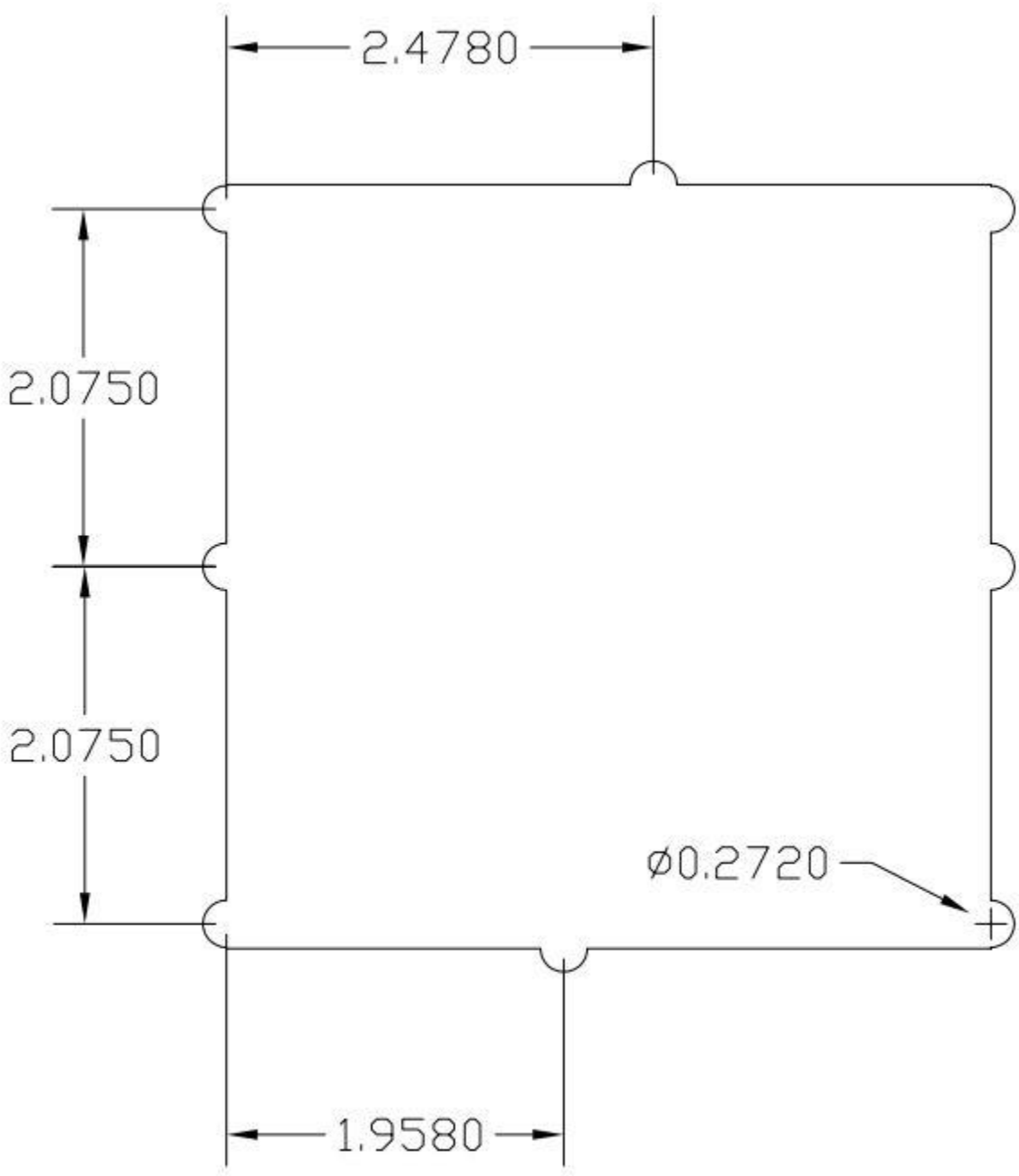

Figure 4: Keypad Cutout Template (to Scale, Inches)

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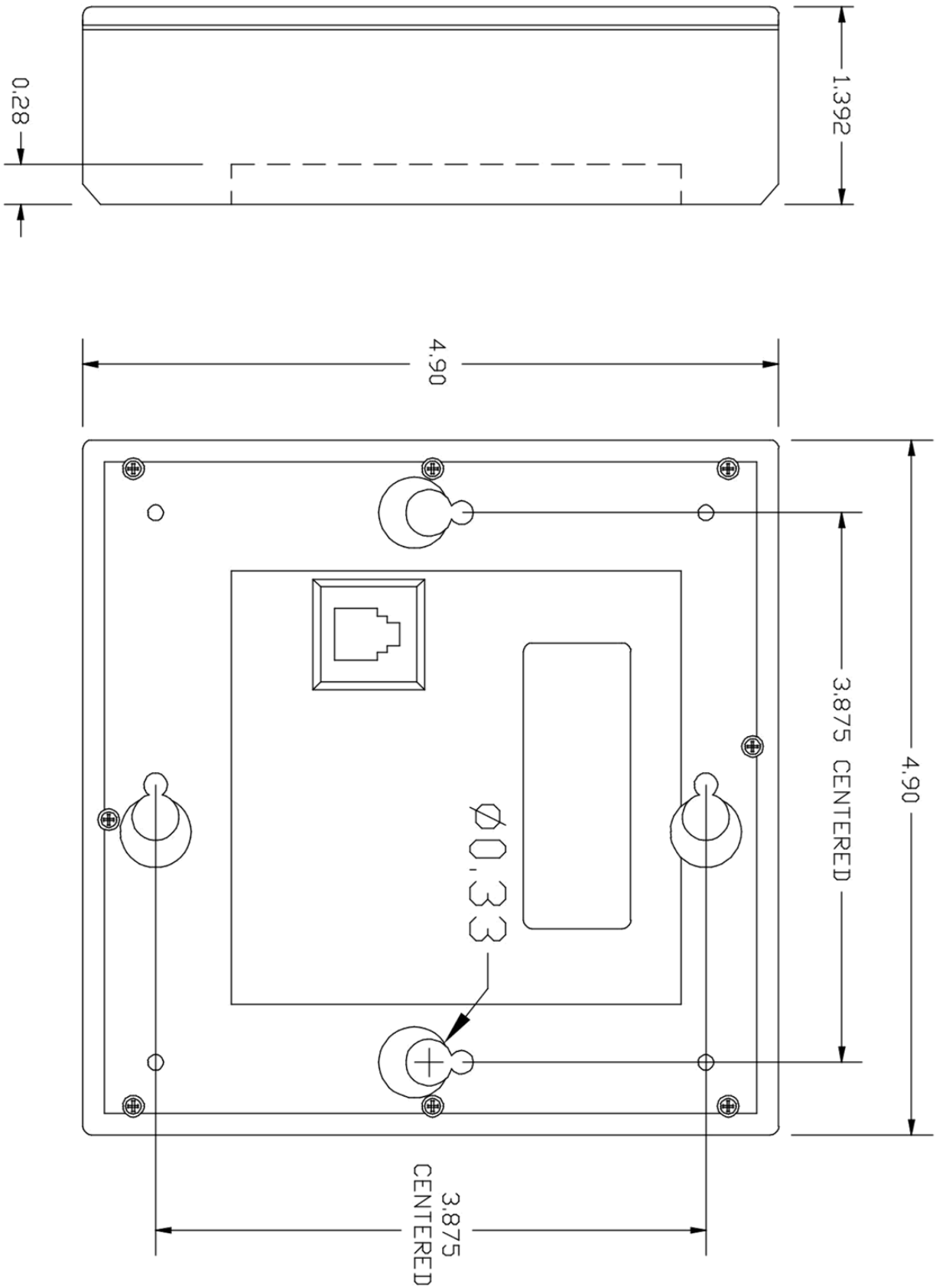

Figure 5: Keypad Dimensions (to Scale)

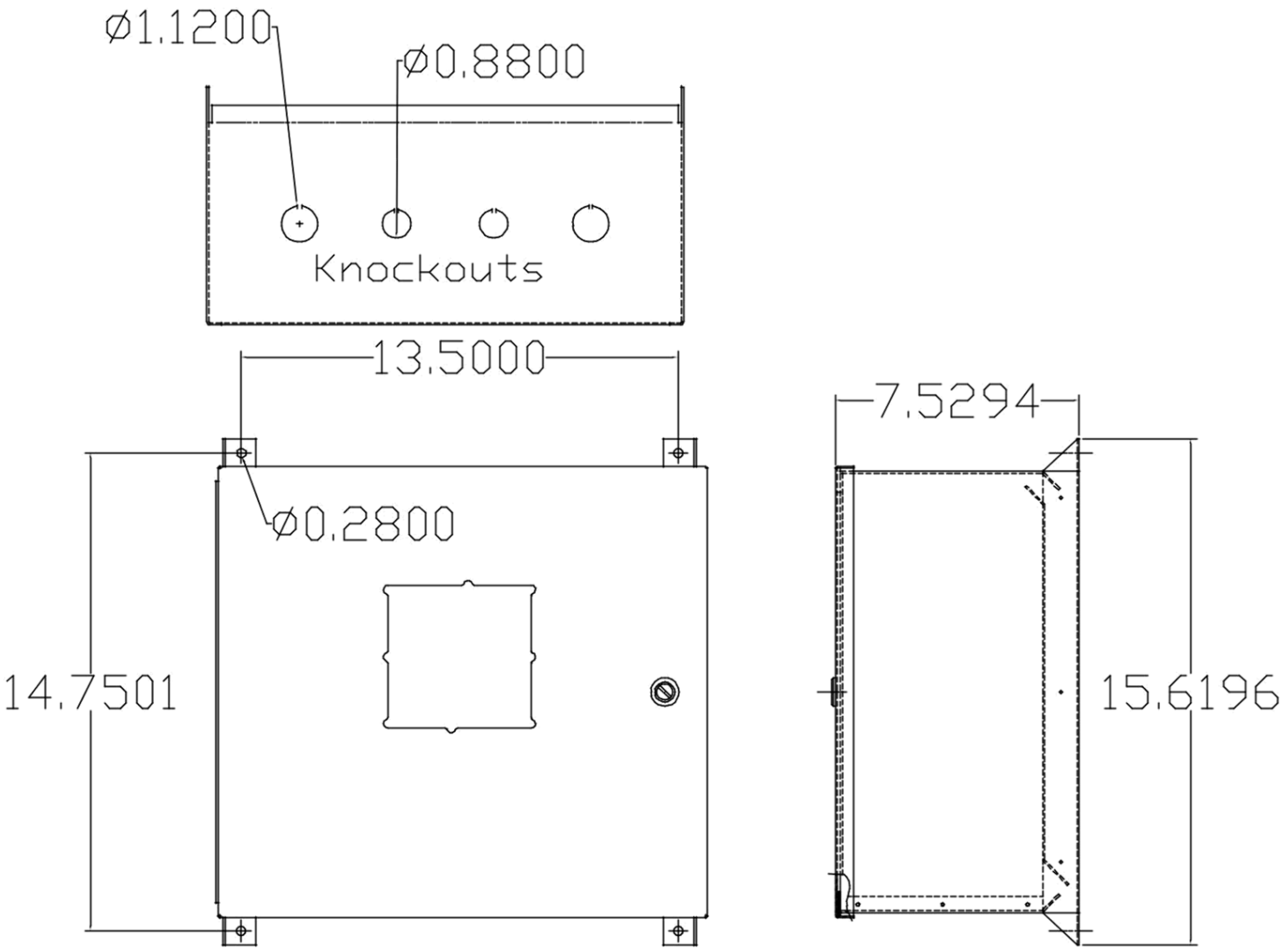

Figure 6: Standard NEMA Rated Enclosure Dimensions (Not to Scale)

5.1 Mounting Hardware

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

5.2 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.

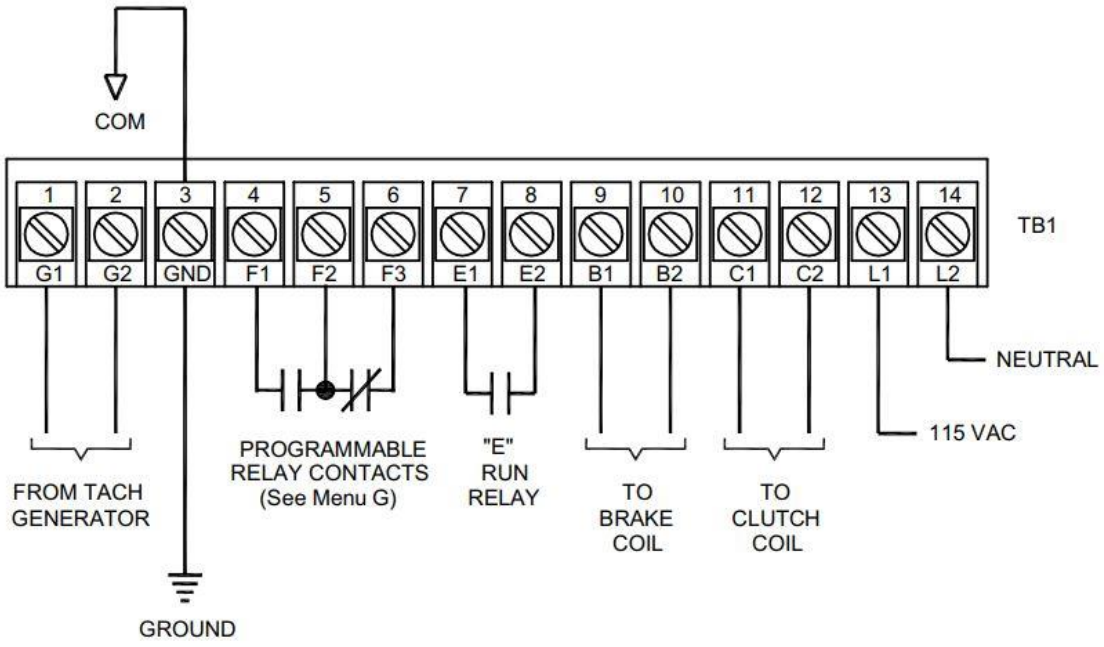

Figure 7: "TB1" Terminal Block

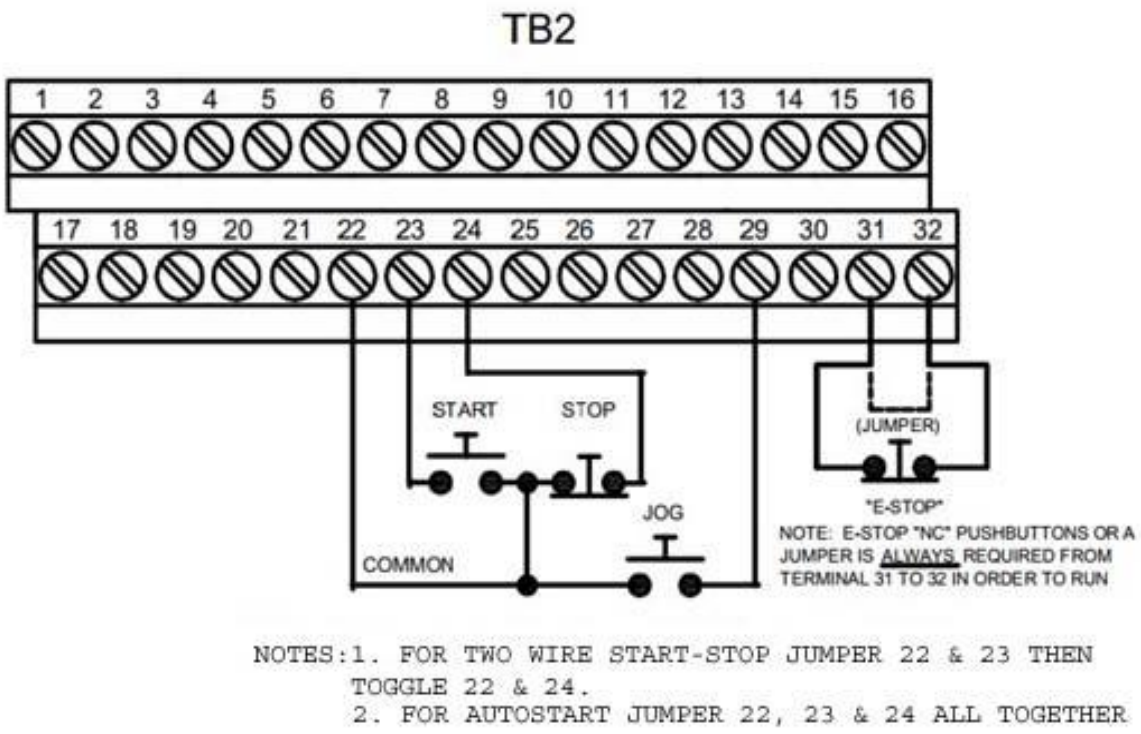

Figure 8: Start/Stop/Jog & E-STOP Wiring

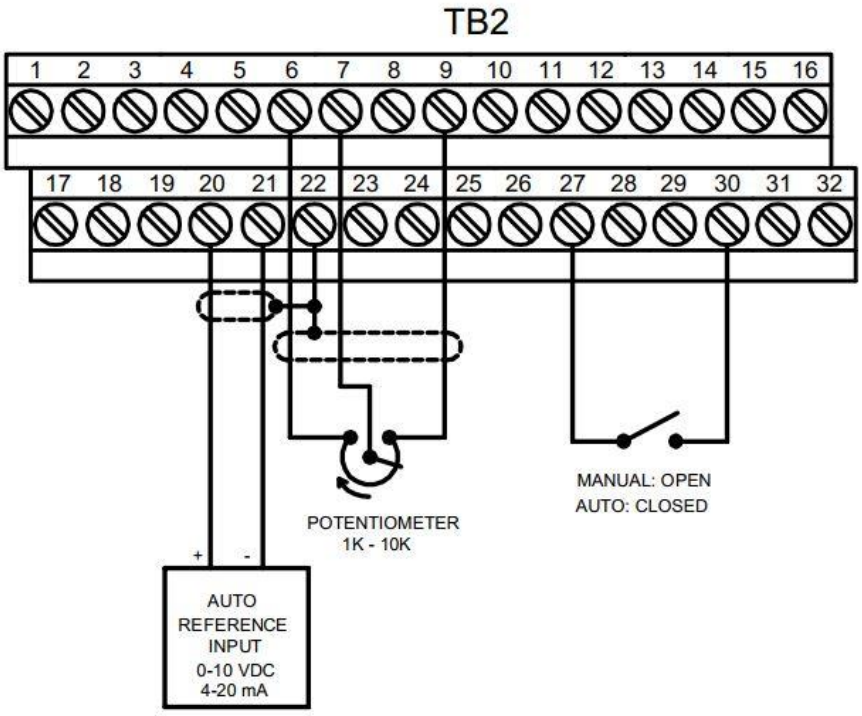

Figure 9: Set Point Reference and Auto/Manual Mode Wiring.

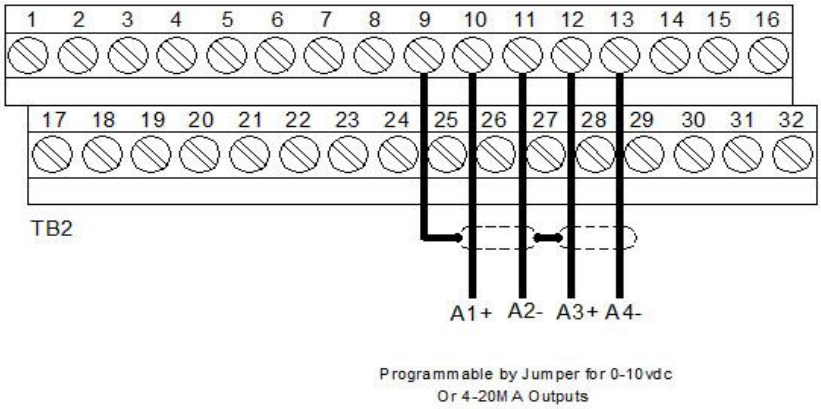

Figure 10: Programmable Analog Outputs Wiring

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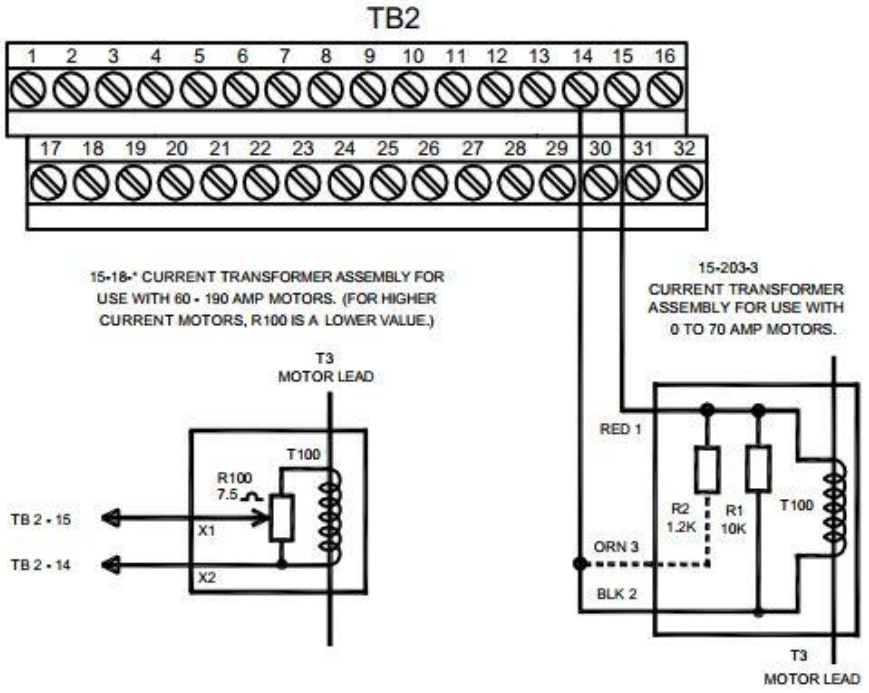
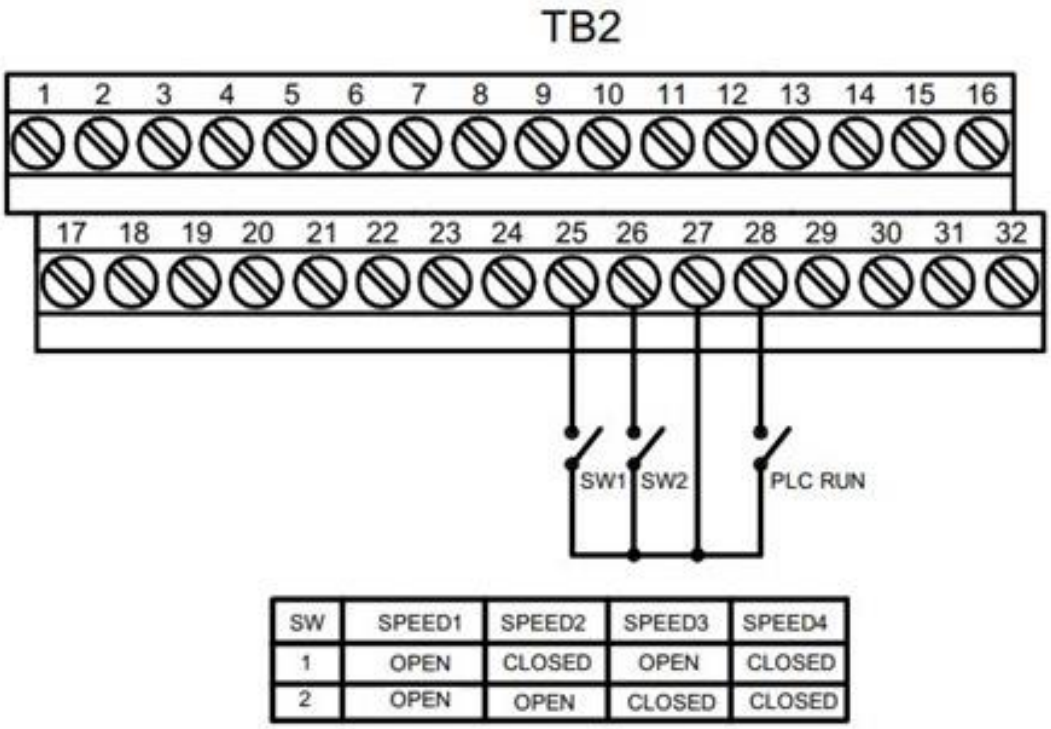


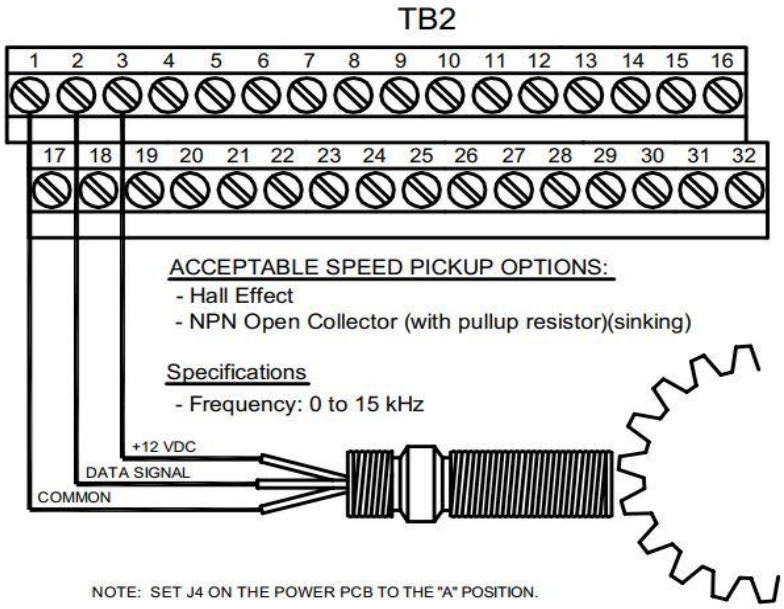
Figure 11: Current Transformer Wiring for Torque Limiting



SW	SPEED1	SPEED2	SPEED3	SPEED4
1	OPEN	CLOSED	OPEN	CLOSED
2	OPEN	OPEN	CLOSED	CLOSED

Figure 12: Preset Speeds & PLC Run Wiring

Figure 13: Speed Pickup Wiring



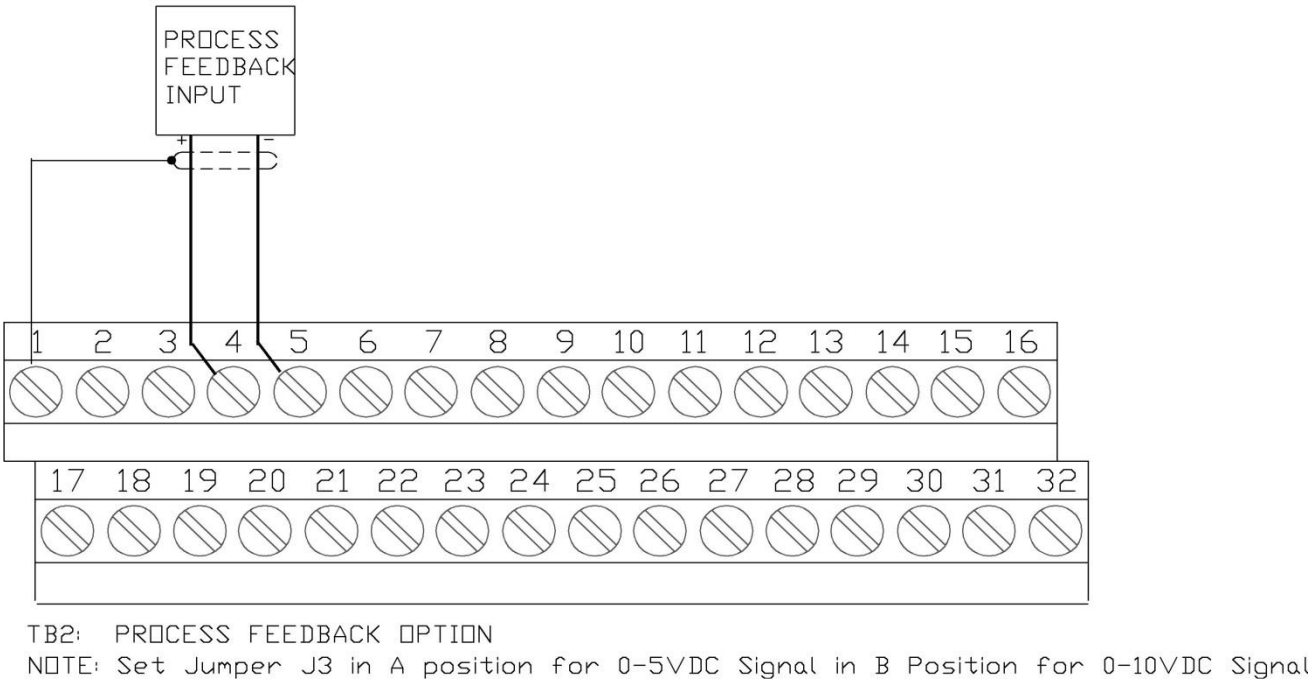


Figure 14: Process Feedback Connection Diagram

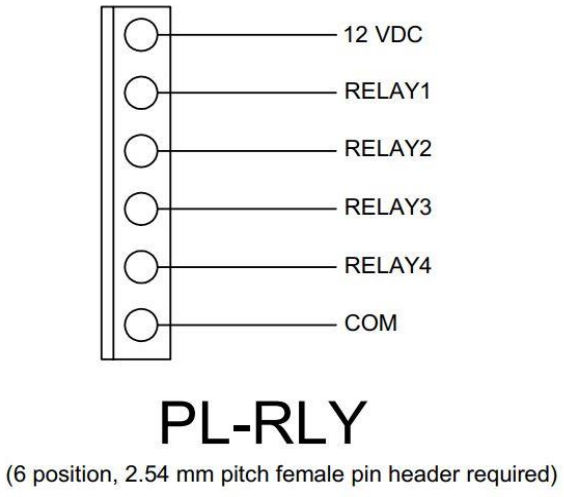


Figure 15: Relay 1 – 4 Connection Diagram

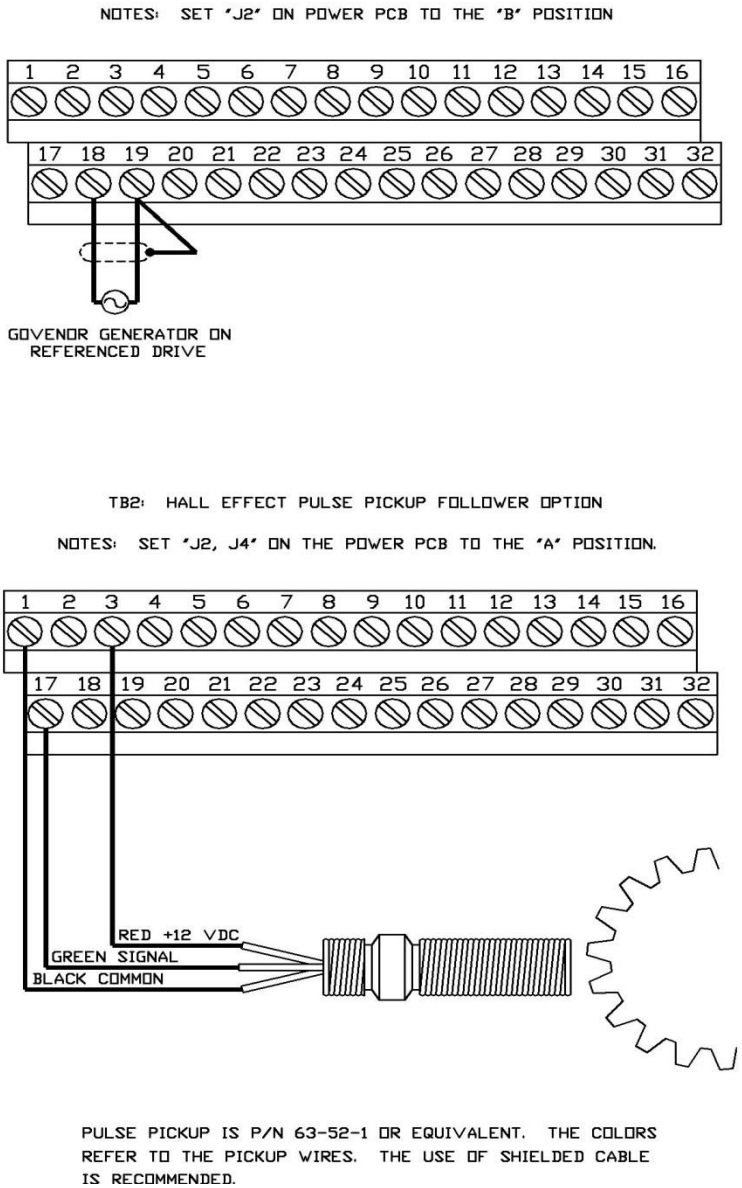


Figure 16: Tach & Pulse Follower Connections

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5.3 Hardware Setup

- Below is a list of jumper settings for the EC 2000. All jumpers not listed should be left in the default position. **Table 1: EC 2000 Jumper Settings**

Jumper	Parameter	Position A	Position B	No Jumper
J2	Follower Operation	Pulse Pickup	Tachometer Generator	DNA
J3	External Analog Feedback	10V	5v	DNA
J4	Speed Control Feedback	Pulse Pickup (TB2: 1,2,3)	Tachometer Generator (TB1: G1/G2)	DNA
J5	Clutch Current Scaling	5.5A Max	8A Max	11A Max
J6	Brake Current Scaling	5.5A Max	8A Max	11A Max
J11	Clutch SCR Location	On Board (STD)	Off Board (High Power)	DNA
J13	Clutch LEM Location	On Board (STD)	Off Board (High Power)	DNA
J14	Brake LEM Location	On Board(STD)	Off board (High Power)	DNA
J17	Analog Output #1	0-10VDC	4-20MA	DNA
J18	Analog Output #2	0-10VDC	4-20MA	DNA

Table 2: Follower Set Point Jumper Settings

Signal	Jumper	
	J9	J10
0 – 10 VDC	A	A
0 – 5 VDC	A	B
4 – 20 mA (DC)	B	B
8 – 40 mA (DC)	B	A

- To properly utilize motor torque limiting with the EC 2000, the red dip switch “SW1” must be set in conjunction with a current transformer. Below is a table with “SW1” contact configurations with Dynamatic® approved current transformers.
- To fine tune the scaling of the motor amps for torque limiting, adjust R111.

3:Torque Limiting SW1 Settings

Current Transformer Assembly	Rated Motor Current	SW1 Contacts				Transformer Lead Connections
		1	2	3	4	
15-203-3	0 – 3A	X	X	X	X	Orange Lead NOT Used
	3 – 4A	X	O	O	O	
	4 – 5A	O	O	X	O	
	5 – 10A	O	O	O	X	
	10 – 20A	X	X	X	X	Connect Orange and Black Leads
	20 – 35A	X	O	O	O	
	35 – 50A	O	O	X	O	
	50 – 70A	O	O	O	X	
15-203-*	55 – 500A	X	X	X	X	

X = Indicates closed contact; O = Open

* Use 15-203-125 for 55-125A, 15-203-250 for 110-250A, and 15-203-500 for 220-500A

* Trim Pots – Next Page

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- Adjust Trim pot R111 to scale motor amps
- Adjust Trim pot R4 to scale CPU voltage to 5.000 +- 1VDC
- Adjust Trim Pot R29 To Zero SCR firing at 0.6 to 0.7 VDC on B1 & B2 while control is not engaged.

SECTION 6 – KEYPAD

- The EC 2000 can be either controlled via the keypad or from an external pilot device, but initial programming must be done with the keypad.
- The keypad is plugged into the "PL2-KEYPAD" male pin header on 15-1200-1.
- Dynamatic® part number: 037-000544-0100 (Keypad with 10ft cable)
    - Other cable sizes available upon request

Table 4: Keypad Button Descriptions

Key	Function	Notes
P1	Preset 1	Set in Menu L, "Process"
P2	Preset 2	Set in Menu L, "Process"
P3	Preset 3	Set in Menu L, "Process"
P4	Preset 4	Set in Menu L, "Process"
ENTER	Allows user into a menu or submenu; confirms value change	
EXIT	Allows user to back out of a menu or submenu.	
SELECT METER	User changes displayed meters (Meter 1 or Meter 2) on the bottom two lines of the keypad.	Meter options include: Reference, Motor Amps, Clutch Amps, Brake Amps, Feedback, and Drive Speed.
F1/F2/F3	Successive pushing locks or unlocks the keypad	"Locked" does not allow changing of parameters
↑	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	
SET-POINT	Reference point for speed or torque control	
SPEED TORQUE	Switches between speed or torque control	
JOG	Momentary run function at a preset reference	
MAN AUTO	Switches between "Manual" and "Automatic" mode	"Manual" refers to the use of a potentiometer for speed/torque reference, while "Automatic" refers to the use of a follower input such as 0-10V or 4-20mA .
LOCAL REMOTE	Switches between "Local" and "Remote" mode	"Local" mode is for operation from the keypad, while "Remote" mode is for operation from external pilot devices. Only available to toggle if enabled in Menu A, Parameter 12.
RUN	Starts the control	Will only work in "Local" mode
STOP	Stops the control	The control can either be programmed to stop the control via the keypad or external push button (See Menu K).

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SECTION 7 – PROGRAMMING

7.1 Menu A: Control Setup

1. CONTROL TYPE

- Speed (default)
  - *Uses the AC Tachometer Feedback for speed feedback and control.*
- Torque
  - *Clutch coil current is regulated. This is frequently used for take-up or spooler applications where torque is proportional to tension and speed varies with the diameter of the roll.*
- Spd/Trq
  - *The control type is selected via the terminal block input or the "Speed/Torque" keypad button*.
- External
  - The control utilizes feedback from a 0-5V or 0-10V Analog Input. This is normally used for process control

2. CONTRLR CURRENT

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

Standard Power Controls	High Power Controls	
ò 5.5 Amps	ò 16.0 Amps	ò 64.0 Amps
ò 8 Amps (Default)	ò 24.0 Amps	ò 80.0 Amps
ò 11.0 Amps	ò 32.0 Amps	ò 100.0 Amps
	ò 48.0 Amps	ò 135.0 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).

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.

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5. TACH PULSES/REV

Set the speed feedback frequency for the AC tachometer generator based on what mechanical unit you have. See the table below. For finer tuning, see Menu A, Parameter 20.

Table 5: Mechanical Unit Tach Pulses/REV Setting

DRIVE	PPR
Obsolete Drives ACM's	10
AS-14 / 25 – Fractional "FD"	12 (Default)
AS-27 / AT-320	16
Salient Pole Drives	24
VT-320 P-base, AT-360, AT-440	30
Pulse Pickup, Gear	30, 60, 120, 180

6. TACH FOLLOWER PULSES/REV

Sets a pulses per revolution rate for applications that use a pulse or tach input to create a set point. To use this input PRESET 1 SOURCE needs to be set to PULSE.

7. CLUTCH MIN RPM

The minimum speed for the clutch.

8. CLUTCH MAX RPM

The maximum speed of the clutch. Please note that proper minimum and maximum values are necessary for safe and proper use of the drive.

11. MTR NO LOAD AMPS

The no load amp setting for the motor for proper scaling and torque limiting. Consult the nameplate on the drive for the correct value. Only used if a current transformer is being used to measure the motor amps.

12. MTR FL. LOAD AMP

The full load amp setting for the motor for proper scaling and torque limiting. Consult the nameplate on the drive for the correct value. Only used if a current transformer is being used to measure the motor amps.

13. COAST ENABLE

Allows for the deceleration rate by dropping out the output and allowing the shaft to coast to a stop.

- ENABLE
- DISABLE (default)

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14. LOCAL/REM ENABLE

Allows user to switch between local and remote mode on the keypad. Local corresponds to functions done on the keypad, while remote corresponds to functions done external to the keypad (TB2).

- ENABLE
- DISABLE (default)

15. CURRENT FILTER

Adjusts the inner current loop feedback signal (clutch amps) (Default: 16).

16. SPEED FILTER AVER

Allows for taking an average of the speed feedback readings. This is primarily used for non-standard speed feedback configurations or noise affected configurations (Default: 0).

17. SPEED FILTER CLAMP

Limits the amount of speed feedback change allowed by the EC 2000. If the clamp value (Item 16 below) is exceeded, the value will be ignored for this parameter X 32ms after which the value will be accepted. This is primarily used for non-standard speed feedback configurations or noise affected configurations. (Default: 0).

18. SPEED FILTER CLAMP VALUE

The value for item 15 above that will be used to limit the feedback change accepted by the control in set point span (0 -10000) where 10000 = max speed (for example 1660 RPM).
This is primarily used for non-standard speed feedback configurations or noise affected configurations. (Default:5000).

19. TACH FOLLOWER FILTER AVER

Allows for taking an average of the Tach follower feedback readings. This is primarily used for non-standard speed feedback configurations or noise affected configurations (Default: 0).

20. TACH FOLLOWER FILTER CLAMP

Limits the amount of set point change allowed by the EC 2000. If the clamp value (Item 19 below) is exceeded, the value will be ignored for this parameter X 32ms after which the value will be accepted. This is primarily used for non-standard speed feedback configurations or noise affected configurations. (Default: 0).

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21. TACH FOLLOWER CLAMP VALUE

The value for item 15 above that will be used to limit the Set Point change accepted by the control in set point span (0 -10000) where 10000 = max speed (for example 1660 RPM).
This is primarily used for non-standard speed feedback configurations or noise affected configurations. (Default:5000).

22. REVERSE CONTROL

Sometimes used in centrifuge applications, this allows the user to control the drive to control "down"(braking) instead of "up."(motoring)

- ENABLE
- DISABLE (default)

23. REV CONTRL REM

Allows the user to switch the controller from forward to reverse in conjunction with TB2-25 being closed to common and "REVERSE CONTROL" being enabled.

- ENABLE
- DISABLE (default)

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

25. 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.

26. TACH FOLLOWER PPR SCALE

Used to fine tune the Menu A, Parameter 6 (TACH FOLLOWER PULSES/REV) set point rate (Default: 100%). This is typically used for nonstandard or pulse pickup units.

27. MEMORY RESET EN

Allows the user to reset the stored parameters back to the factory defaults upon powering or resetting the device (pressing the SW1 button on the 15-1200-1 logic board).

- Enable
- Disable (default)

Note: Parameters can also be reset back to factory defaults by placing a jumper between terminals 32 and 29 on TB2, while also removing all other connections on TB2.

28. BOOT START DELAY

Delays the boot up sequence of the EC 2000. This is used for more unstable power supplies where the control does not boot up properly usually resulting in missing auto set point. (Default: 0 sec).

29. CLUTCH DEAD BAND

A deadband below setpoint that can be programed where the control will not operate until the deadband value has been exceeded. This is rarely used by may be required when control oscillates between clutch and braking action when mutuatrol braking is used. (Default = 0 RPM)

30. REVERSE POT SETPOINT

Allows the user to use a set point reference signal in reverse. For example, if a potentiometer normally gives a full voltage signal to give a maximum speed reference, enabling this parameter would tell the control to give a minimum speed reference with a full voltage signal from that potentiometer.

- ENABLE
- DISABLE (default)

31. REVERSE FOLLOWER ANALOG SETPOINT

Allows the user to use a set point reference signal in reverse. For example, if an analog signal 0-10V normally gives a full voltage signal to give a maximum speed reference, enabling this parameter would tell the control to give a minimum speed reference with a full voltage signal from that potentiometer.

- ENABLE
- DISABLE (default)

32. REVERSE PROCESS ANALOG SETPOINT

Allows the user to use the external process feedback set point signal in reverse. For example, if an analog signal 0-10V normally gives a full voltage signal to give a maximum speed reference, enabling this parameter would tell the control to give a minimum speed reference with a full voltage signal from that potentiometer.

- ENABLE
- DISABLE (default)

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7.2 Menu B: CLCH PERFORMANCE

This is for adjusting the clutch performance using an internal proportional-integral-derivative feedback loop (PID). Dynamatic recommends only adjusting the speed feedback parameters 4, 5, and 6. Dynamatic recommends trying 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

   Proportional control is the amount of response to an incorrect current and is proportional to the amount of error. Note that the current loop is fed by the speed loop. Default 20%

2. CURR INTGRL GAIN

   Integral control is the amount of response to an incorrect current as time passes. Default: 20%

3. CURRENT DIFF GAIN

   Differential Control reduces or increases the output based the output based on the speed at which the process is approaching or moving away from set point. Default 0%

4. SPEED PROP GAIN

   Proportional control is the amount of response to an incorrect speed and is proportional to the amount of error. This allows the control to correct the error, but only to the point where the error is great enough to create an output. Without integral gain, setpoint will never be reached. Default: 30%

5. SPEED INTGRL GAIN

   *Integral control is a constant summation of error from the set point and provides feedback proportional to the total error * time. While proportional control deals with a large difference in target and actual speed, integral control deals with small errors. Default 2%*

6. SPEED DIFF GAIN

   Derivative control compensates for setpoint overshoot. It measures the speed at which the process is approaching or leaving setpoint. This tends to slow the approach or departure of the process variable from setpoint Default: 0%

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7. ENABLE CURRENT LOOP

   The EC 2000 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 used as a last resort in performance stabilization. Particularly in processes that require a very fast response time.

   - ENABLE (default)
   - DISABLE

8. TORQUE LIMIT

   The percentage of motor amps (set under Menu A Control Setup) allowed until the torque limit fault is enabled. Default: 100%

9. TRQL PROP GAIN

   The proportional gain control of the torque limit. Default: 10%

10. *TRQL INTGRL GAIN*

    The integral gain control torque limit. Default 10%

7.3 Menu C: ACCEL/DECEL SETUP

Note: % = % of Span Total RPM Per Second

1. NORMAL ACCELERATION RATE (Default: 10%) (Normal rates are used in Manual Mode and Local Mode))
2. NORMAL DECELERATION RATE (Default: 10%)
3. AUTO ACCELERATION RATE (Default: 10%) (Auto rates are used in Auto Mode)
4. AUTO DECELERATION RATE (Default: 10%)
5. JOG ACCELERATION RATE (Default: 100%) (Jog rates are used in Jog Mode)
6. JOG DECELERATION RATE (Default: 200%)
7. STOP DECELERATION RATE (Default 200%) Stop Rate is used when stopping except in Jog mode then Jog decal rate is used.

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7.4 Menu D: BRAKE PERFORMANCE

Allows to user to adjust the brake output (TB1 – B1/B2). Note, the brake will enable when the clutch drops out. For simultaneous clutch and brake output, a "Mutuatrol" modification is required (please consult Dynamatic).

1. Braking Enable

   Enable Braking while Stopping

   - ENABLE
   - DISABLE - default

2. Mutuatrol Braking Enable

   Enable Braking while running (Requires Brake Control Board)

   - ENABLE
   - DISABLE - default

3. Brake Coil Rating Amps

   Set the amount of brake amps to apply. Note, the higher the current, the quicker the braking.

4. Brake Current Limit Amps

   Set the amount of brake amps to apply. Note, the higher the current, the quicker the braking.

*******Items 5 -11 Are Only used when Mutuatrol braking is enabled **********

5. BRAKE CURR PROP GAIN

   Proportional control is the amount of response to an incorrect current and is proportional to the amount of error. Note that the current loop is fed by the speed loop. Default 50%

6. BRAKE CURR INTGRL GAIN

   Integral control is the amount of response to an incorrect current as time passes. Default: 25%

7. BRAKE CURRENT DIFF GAIN

   Differential Control reduces or increases the output based the output based on the speed at which the process is approaching or moving away from set point. Default 0%

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8. BRAKE SPEED PROP GAIN

Proportional control is the amount of response to an incorrect speed and is proportional to the amount of error. For example, if you are driving a car, and you want to be going 40 mph, but you drop below that, you hit the gas pedal to accelerate until you hit 40 mph again. Default: 300%

9. BRAKE SPEED INTGRL GAIN

Integral control is a constant summation of error from the set point and provides feedback proportional to the total rather than the error. While proportional control deals with a large difference in target and actual speed, and derivative control deals with sudden changes, integral control deals with small errors. Default 2%

10. BRAKE SPEED DIFF GAIN

Derivative control compensates for sudden changes in speed. For example, if you are driving at 40 mph, but now you are on a hilly road. If you hit a large hill, the speed will drop fairly quickly, but you press the gas pedal again to bring it back up. But you probably applied a lot more gas than was needed to counteract that sudden and drastic drop in speed. Default: 0%

11. *BRAKE DEADBAND*

The amount of RPM over set point the process must be before the braking is applied. Useful for preventing oscillation between clutch& brake. Default: 50 rpm

12. *BRAKE OFF DELAY (Seconds)*

Amount of Time in seconds the brake remains energized after control has stopped

13. *BRAKE CURRENT SCALE*

Used to adjust the difference between the actual brake current (measured with a DC clamp on meter) and the current reading of the EC 2000. If the keypad displayed brake current is less than measured, increase the percentage, and vice-versa (Default: 100%).

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7.5 Menu E: FOLLOWER SETUP

The follower is the automatic signal (Auto Mode) that acts as a setpoint reference instead of a potentiometer. Typically, this signal comes from a SCADA or PLC system. The EC 2000 accepts 0-10V, 0-5V, 4-20mA, or 8-40mA signals.

1. FOLLOWER MINIMUM

   Number that represents the minimum process value (Default 0 RPM)
2. FOLLOWER MAXIMUM

   Number that represents the maximum process value (Default 1660 RPM)

3. FOLLOWER MIN REF

   The minimum reference point. For example, a 4-20mA signal would set the minimum reference at 20% for 4mA at zero output (20% of 20mA is 4mA). Default 0%

4. FOLLOWER MAX REF

   The minimum reference point. For example, a 4-20mA signal would set the maximum reference at100% for 20mA at 100% output Default 100%

7.6 Menu F: ANALOG OUTPUTS

EC 2000 can output two different analog values based on a variety of statuses or set points. Note that for a 4-20mA or 8-40mA output, proper programming must be used.

1. ANALOG 1 SELECT

   Select which status, range, or set point will have an analog output. For example, selecting DRIVE SPD will output an analog range (0-10V, 0-5V, 4-20mA, 8-40mA) based on the drive speed of the unit. For example, if you have set the control to output a 0-10V signal, your maximum speed setting is 1600 RPM, and your drive is running at 800 RPM, you will see an output of 5V. Default = Drive Speed

   - NONE
   - DRIVE SPD
   - REFERENCE
   - SETPOINT
   - MTR AMPS
   - CLUT AMPS
   - BRAK AMPS
   - CONTROLLER FEEDBACK
   - TACH FOLLWER SPEED
   - PROCESS FEEDBACK
   - CONTROLLER OUTPUT
   - BRAKE OUTPUT

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2. ANA 1 MIN SIGNAL

   Signal that represents the minimum value. If desiring to output a 4-20mA signal, set this value to 20% (20% of 20 is 4). Also Set Jumper 18 to B Position Default 0 %

3. ANA 1 MAX SIGNAL

   Signal that represents the maximum value. If desiring to output a 4-20mA signal, set this value to 100% (100% of 20 is 20). Default 100 %

4. ANA 1 MIN OUTPUT

   Value Represented by Minimum Signal (Default = 0 RPM)

5. ANA 1 MAX OUTPUT

   Value Represented by Maximum Signal (Default = 1660 RPM)

6. ANALOG 2 SELECT

   Same Options as ANALOG 1 SELECT
   Default = Reference

7. ANA 2 MIN SIGNAL

   Signal that represents the minimum value. (Default = 0 %)

8. ANA 2 MAX SIGNAL

   Signal that represents the maximum value.(Default = 100.0%)

9. ANA 2 MIN OUTPUT

   Value Represented by Minimum Signal (Default = 0 RPM)

10. ANA 2 MAX OUTPT

    Value Represented by Maximum Signal (Default = 1660 RPM)

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7.7 Menu G: RELAY OUTPUT

1. F RELAY

The F Relay corresponds to TB1- F1/F2/F3 (see Figure 7). Trip ON means the relay is normally deenergized, TRIP OFF means the relay is normally energized. TRIP ON and TRIP OFF have the same options.

- NONE
- STATUS
  - SPD MODE (control is in speed mode)
  - TRQ MODE (control is in torque mode)
  - EXTERNAL MODE (control is in external mode)
  - LOCAL (local mode is selected)
  - REMOTE (remote mode is selected)
  - MANUAL (manual mode is selected)
  - AUTO (auto mode is selected)
  - STOPPED (drive is stopped)
  - STOPPING drive is stopping)
  - ESTOP (estop contact is open)
  - RUN (drive is running)
  - RUN0 (drive is running, but there is no set point reference)
  - COASTING (drive is coasting)
  - JOGGING (drive is in jog mode)
  - FAULT (fault condition exists) (default)
  - RESTART (drive is in restart mode)
  - TRQ LIM (torque limit reached)
  - AT SET POINT +- 2% (within 2% of set point)
  - FOLLOWER LOST
  - FEEDBACK LOST
  - REVERSE MODE (reverse mode is selected)
- TRIP ON
  - MTR AMPS
  - CLUT AMPS
  - BRAK AMPS
  - SETPOINT
  - DEV+ (deviation above the set point)
  - DEV- (deviation below the set point)
  - SPEED
- TRIP OFF
  - Same Choices as Trip On

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2. RELAY1

   "RELAY1" – "RELAY4" are 12VDC logic output relays. See Figure 13. They have identical parameters to Relay F (Shown Above)

3. RELAY2
4. RELAY3
5. RELAY4

7.8 Menu H: UNITS

1. PROCESS UNITS

   - RPM (default)
   - USER

   USER can be selected to display speed in something other than RPM. If chosen, Parameters 2-4 are opened for changing. If not, Parameter 1 is the only one that is open.

2. USER UNITS

   - RPM (revolutions per minute)
   - RPS (revolutions per second)
   - RPH (revolutions per hour)
   - CPM (cycles per minute)
   - CPS (cycles per second)
   - CPH (cycles per hour)
   - FPM (feet per minute)
   - FPS (feet per second)
   - FPH (feet per hour)
   - SPM (strokes per minute)
   - SPS (strokes per second)
   - SPH (strokes per hour)
   - XPM (x per minute)
   - XPS (x per second)
   - XPH (x per hour)

3. USER DECIMAL PNT

   - 0 (no decimal) (Default)
   - 1 (one decimal)
   - 2 (two decimals)
   - 3 (three decimal)

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4. MAX USER VALUE

   Enter the number of user units that corresponds with the top process speed. For example, if the maximum press speed is 40 SPM, the MAX USER VALUE will be 40.0 (USER DECIMAL PNT will be 1).

7.9 Menu I: POTENTIOMTR SETUP

The setup menu if an external potentiometer is used for a set point reference.

1. POT MINIMUM Default = 0 RPM

   The minimum value for the potentiometer input

2. POT MAXIMUM Default = 1660 RPM

   The maximum value for the potentiometer input

3. POT MINIMUM REF Default = 0 %

   The minimum signal level that corresponds to the minimum value listed above in #1.

4. POT MAXIMUM REF Default = 100%

   The maximum signal level that corresponds to the maximum value listed above in #2

7.10 Menu J: TORQUE POTENTIOMTR SETUP (Used in Torque Mode)

The setup menu if an external potentiometer is used for a set point torque reference.

1. TORQUE POT MINIMUM Default = 0 %

   The minimum value for the potentiometer input

2. TORQUE POT MAXIMUM Default = 100 %

   The maximum value for the potentiometer input

3. TORQUE POT MINIMUM REF Default = 0 %

   The minimum signal level that corresponds to the minimum value listed above in #1.

4. TORQUE POT MAXIMUM REF Default = 100%

   The maximum signal level that corresponds to the maximum value listed above in #2

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7.11 Menu K: SOURCE SELECT

The setup menu for run, jog, presets, stop, start, and set point reference modes. "TERM" refers to devices attached to TB2, "KEYPAD" refers to operation from the Keypad. Remember, for external devices to be functional, the control must be in "REMOTE."

1. AUTO/MAN SOURCE

    - TERM
    - KEYPAD (Default)

2. JOG SOURCE

    - TERM (Default)
    - KEYPAD

3. PLC AUTOSTART

    Allows the user to automatically start the control using the PLC start input terminals (TB2-28 and TB2-27) instead of the normal start terminal of TB2-23. By enabling and closing TB2-28 and TB2-27, the drive will automatically start upon power up. Note: the next parameter, "PLC RUN ENABLE", must be enabled as well.

    - ENABLE
    - DISABLE (default)

4. PLC RUN ENABLE

    Allows the user to start or stop the drive based on the PLC start input terminals of TB2-28 and TB2-27.

    - ENABLE
    - DISABLE (default)

5. PRESET SOURCE

    Allows the user to change between P1,P2,P3, and P4 on the keypad or through TB2 (see Figure 12). Note: the user changes the programmed presets in "Menu L: PROCESS". Default=TERM

    - TERM
    - KEYPAD

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6. CONTROL TYPE SOURCE

   Allows user to determine when in Speed / Torque Mode, to use the keypad or a terminal to change from Speed mode to Torque mode. This parameter is only seen when Speed / Torque mode is selected under Control Setup.

   - TERM
   - KEYPAD

7. PRESET 1 SOURCE

   Allow the user to change what "P1" corresponds to. For example, "P1" can be set to "POT", but by being in "LOCAL" and "MANUAL" mode, one can use P2, P2, and P3 from the keypad, but have the external potentiometer be enabled when "P1" is selected. "PULSE" corresponds to "TB2-17", which is the Follower Pulse Pickup Input. Default=POT

   - TERM
   - KEYPAD
   - POT (Default)
   - PULSE
   - SET POINT

8. MAN START SOURCE
   Allows the user to change how the control starts in "MANUAL" mode.

   - TERM (Default)
   - KEYPAD

9. AUTO START SOURCE

   Allows the user to change how the control starts in "AUTO" mode.

   - SERIAL (for use with the Ethernet IP add on)
   - TERM (default)

10. AUTO SETPNT SOURCE

    Allows the user to change which setpoint reference is used.

    - SERIAL (for use with the Ethernet IP add on)
    - TERM (default)

11. STOP SOURCE

    Allows the user to change how to stop the control.

    - TERM (external stop button via TB2)
    - TERM&KPD (external stop button and keypad) (Default)

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7.12 Menu L: PROCESS

Match minimum and maximum values to previously set values for minimum/maximum speed.

1. MINIMUM PROCESS
2. MAXIMUM PROCESS
3. JOG SETPOINT Default=100 RPM
   The set point for "JOG".
4. PRESET 1 Default = 400 RPM
   The set point for "P1".
5. PRESET 2 Default = 800 RPM
6. PRESET 3 Default = 1000 RPM
7. PRESET 4 Default = 1600 RPM

7.13 Menu M: TORQUE PROCESS

Match minimum and maximum values to previously set values for minimum/maximum torque

1. MINIMUM PROCESS Default = 0%
2. MAXIMUM PROCESS Default = 100%
3. JOG SETPOINT % Default=10 %
   The set point for "JOG".
4. PRESET 1 Default = 20%
   The set point for "P1".
5. PRESET 2 Default = 40%
6. PRESET 3 Default = 60%
7. PRESET 4 Default = 100%

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7.14 Menu N: EXTERNAL PROCESS

External Process uses the analog process input for feedback. This menu provides the scaling and the units when the Control Type is set to external.

1. EXTERNAL FEEDBACK PROCESS UNITS
   - USR (user defined units)
   - RPM (revolutions per minute) Default
   - RPS (revolutions per second)
   - RPH (revolutions per hour)
   - CPM (cycles per minute)
   - CPS (cycles per second)
   - CPH (cycles per hour)
   - FPM (feet per minute)
   - FPS (feet per second)
   - FPH (feet per hour)
   - SPM (strokes per minute)
   - SPS (strokes per second)
   - SPH (strokes per hour)
   - XPM (x per minute)
   - XPS (x per second)
   - XPH (x per hour)

2. EXTERNAL FEEDBACK DECIMAL POINT
   - 0 (No Decimal Point) Default = 0
   - 1 (One Decimal Point)
   - 2 (Two Decimal Points)
   - 3 (Three Decimal Points)

3. EXTERNAL FEEDBACK VALUE MINIMUM
   Value 0 to Process Maximum Default 0

4. EXTERNAL FEEDBACK VALUE MAXIMUM
   Value 1 to Process Maximum Default = 1000

5. EXTERNAL FEEDBACK REFERENCE MINIMUM
   Value 0 to 100% Default = 0

6. EXTERNAL FEEDBACK VALUE MAXIMUM
   Value 0.1% to 100% Default = 100%

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7.15 Menu O 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

   Clears the current fault. If there is no fault, it will clear the fault history

   - ENABLE
   - DISABLE (default)

7.16 Menu P: FAULT TIMER SETUP

1. CLUTCH OVERCURRENT %

   When exceeded the control will see a fault condition but will not trip until the time listed in #2 is exceeded. 0 to 1000% Default 30% over Clutch Current limit value

2. CLUTCH OVERCURRENT TIME MILLISECONDS

   If the value designated in #1 above is exceeded, the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2500 or 2.5 Seconds

3. BRAKE OVERCURRENT %

   When exceeded the control will see a fault condition but will not trip until the time listed in #4 is exceeded. 0 to 1000% Default 30% over Brake Current limit value

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4. BRAKE OVERCURRENT TIME MILLISECONDS

   If the value designated in #3 above is exceeded, the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2500 or 2.5 Seconds

5. CLUTCH BRAKE OVERLAP TIME MILLISECONDS

   If the clutch and brake are both energized at a value above 10% of the current limit for the time set here the control will fault. 0 to 50000 MS Default = 5000 or 5 Seconds.

   The delay timer for auto start on power up (default: 10 sec)

6. CLUTCH COIL FAULT %

   If the control output command is at 25% and the clutch current has not reached the % value programmed here the control will see a fault. However, the control will not fault until the time designated in parameter 7 has passed. Default = 0.1%

7. CLUTCH COIL FAULT TIME MILLISECONDS

   If the value designated in #6 above is not reached , the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2500 or 2.5 Seconds

8. BRAKE COIL FAULT %

   If the control output command is at 25% and the brake current has not reached the % value programmed here the control will see a fault. However, the control will not fault until the time designated in parameter 9 has passed. Default = 0.1%

9. BRAKE COIL FAULT TIME MILLISECONDS
   If the value designated in #8 above is not reached , the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 5000 or 5 Seconds

10. *N/A*

11. *N/A*

12. OVERSPEED TRIP %

    If the controller speed is over speed by the percentage of span as programed in this parameter, the control will see a fault. However, the control will not trip out until the time designated in #11 has passed Default = 100%

13. OVERSPEED TRIP TIME MILLISECONDS

    If the value designated in #10 is exceeded , the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2000 or 2.0 Seconds

14. UNDERSPEED TRIP %

If the controller speed is under speed by the percentage of span as programed in this parameter, the control will see a fault. However, the control will not trip out until the time designated in #13 has passed. Default = 100%

15. UNDERSPEED TRIP TIME MILLISECONDS

If the value for under speed designated in #12 is exceeded , the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2000 or 2.0 Seconds

16. FEED BACK FAULT CLUTCH CURRENT %

If the controller sees no feedback and the clutch current reaches the value in this parameter, the controller will see a fault. However, the control will not trip out until the time designated in #15 has passed. Default = 100%

17. OVERSPEED TRIP TIME MILLISECONDS

If the current value as designated in #14 is exceeded and no feedback is detected, the control will trip out after the time set has passed 0 to 50000 Milliseconds Default = 2000 or 2.0 Seconds

18. CURRENT OVERLOAD PROPORTIONAL GAIN

If the clutch brake current exceeds the current limit value, the control will attempt to phase back the current. This parameter adjusts the phase back response proportionally. Default =40%

19. CURRENT OVERLOAD INTEGRAL GAIN

If the clutch brake current exceeds the current limit value, the control will attempt to phase back the current. This parameter adjusts the phase back response in proportion to error and time. Default = 00%

7.17 Menu Q SKIP RPM SETUP

1. SKIP RPM 1

Enter RPM to be skipped – This will not allow setpoints maintained with Skip RPM 1 +/- Deadband as listed in parameter # 5 Default = 0 RPM

2. SKIP RPM 2

Enter RPM to be skipped – This will not allow setpoints maintained with Skip RPM 2 +/- Deadband as listed in parameter # 5 Default = 0 rpm

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3. SKIP RPM 3

   Enter RPM to be skipped – This will not allow setpoints maintained with Skip RPM 3 +/- Deadband as listed in parameter # 5

4. SKIP RPM 4

   Enter RPM to be skipped – This will not allow setpoints maintained with Skip RPM 4 +/- Deadband as listed in parameter

5. SKIP RPM BAND

   Enter RPM Band for Items 1 thru 4 to be skipped – This will not allow setpoints maintained with Skip RPM 1-4 +/- Deadband as listed in parameter.

7.18 Menu R: METER SELECT - Four Meters. One on each display line

1. SELECT METER 1

   Choices: Default = STATUS-SET POINT

   - STATUS-SET POINT
   - MODE-TYPE
   - SPEED (RPM)
   - CLUTCH (AMPS)
   - BRAKE (AMPS)
   - MOTOR (AMPS)
   - PROCESS FEEDBACK(EXTERNAL)
   - REFERENCE RAMP
   - TACH FOLLOWER(RPM)
   - FEEDBACK ERROR
   - SPEED PROPORTIONAL GAIN
   - SPEED INTEGRAL GAIN
   - SPEED DIFFERENTIAL GAIN
   - CONTROL OUTPUT
   - CONTROL FEEDBACK
   - BRAKE SPEED PROPORTIONAL GAIN
   - BRAKE SPEED INTEGRAL GAIN
   - BRAKE DIFFERENTIAL GAIN

2. SELECT METER 2

   Choices: Default=MODE-TYPE

   - SAME SELECTIONS AS METER 1

3. SELECT METER 3

   Choices: Default = SPEED (RPM)

   - SAME SELECTIONS AS METER 1

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4. SELECT METER 4
   Choices: Default: Clutch (AMPS)
   - SAME SELECTIONS AS METER 1

7.19 Menu S: SERIAL OPTIONS

1. EC-2000 MENUS

   If disabled, the EC-2000 menus are not accessible. Used only by CES Control Communications

   - ENABLE (Default)
   - DISABLE

2. EC-2000 DATA

   If disabled, the control will not transmit any menu data Used only by CES control communicator.

   - ENABLE (Default)
   - DISABLE

3. ACCESS ALL MENUS
   If enabled all menus are accessible at all times. Special use only.

   - ENABLE
   - DISABLE (Default)

4. DISPLAY TIME OUT
   If enabled, after 90 seconds without a key press the control keypad display will stop displaying data. Useful for port sharing.

   - ENABLE
   - DISABLE (Default)

5. SELECT KEYPAD PORT
   Selects which port the keypad will use.

   - PORT 1
   - PORT 2

6. SELECT REMOTE PORT
   Selects which port data transfer will use.

   - PORT 1
   - PORT 2

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7. LEGACY 10K UNITS
   When enabled data transfer uses 10,000 type units which is comparable with older EC-2000 Software

   - ENABLE
   - DISABLE (Default)

8. DATA TRANSMIT ENABLE
   When enabled control sends operating data out remote serial port.

   - ENABLE
   - DISABLE (Default)

9. PARAMETER TRANSMIT ENABLE
   When enabled controller sends changing parameter data out remote serial port

   - ENABLE
   - DISABLE (Default)

10. CES DATA INTERFACE
    When enabled control uses CES Menu interface for data and parameter communication. Otherwise, the native format is used.

    - ENABLE
    - DISABLE (Default)

7.20 Menu T: AUTO START MENU

1. RESTART POWER EN

   If enabled, the control will start and enter run mode right after power is applied. If the start circuit or PLC run circuit is properly closed and enabled.

   - ENABLE
   - DISABLE (default)

2. RESTART FAULT EN

   If enabled, the control will restart and enter run mode again after a fault.

   - ENABLE
   - DISABLE (default)

3. START DELAY- PWR

   The delay timer for auto start on power up (default: 10 sec)

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4. START DELAY- FLT

   The delay timer for auto start after a fault (default: 10 sec).

5. MAX FAULT RETRYS

   The number of attempts allowed to restart after a fault. (Default 3)

6. RESTART TIMER

   The determines when to clear the start attempts counter. For example, if the parameter was set to 60 sec, then the drive will have to run for 60 seconds before the start attempts are cleared. (Default= 60 sec)

7.21 Menu U: FIRMWARE MENU

1. FIRMWARE REVISION

   Lists firmware revision of control program.

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SECTION 8– TROUBLESHOOTING

8.1 CONTROL WILL NOT "RUN" or "START"

- Verify there is a normally closed button or jumper between TB2-22 and TB2-24.
- Double check your control modes such as "LOCAL" and "REMOTE".
- Check the "MENU K: SOURCE SELECT" to make sure the proper start sources are programmed.

8.2 NO OUTPUT

- Verify you have a setpoint programmed. The setpoint is the top right line of the display.
- Verify the control says "RUN" on the top left line of the keypad. If it says "RUN0", then there is no setpoint reference.
- Disconnect the clutch coil leads from the EC 2000 (C1 and C2). Try to run the control with a setpoint and measure the DC voltage on the TB1-C1 and C2 (where the clutch coil leads were just connected). A high DC voltage should be obtained (over 90VDC). If not, contact Dynamatic for a replacement board. If there is a voltage on those terminals, measure the resistance of the clutch coil and compare it to the value on the drive nameplate as it could be a defective clutch coil.
- Check if Jumpers 11 and 13 are in the "A" position on the circuit board.

8.3 DRIVE RUNS AT FULL SPEED

- Measure the AC Tachometer Voltage on TB1-G1 and G2. One should see a voltage anywhere from 30VAC to 60VAC. If no voltage is measured, verify the control is in the proper feedback mode (speed, torque, etc.) or replace the AC Tachometer Generator inside the drive. If an AC voltage is indeed measured, check the mechanical unit to see if there is a lockup between the drum and rotor. If your clutch rotates at full speed without the control being in "RUN" mode, then there is a lockup between the motor and the clutch.
- Verify the "TACH PULSES/REV" setting in MENU A is correct.

8.4 FUSES BLOW

- Verify the EC 2000 is not underrated for the mechanical unit.
- Verify the right voltage is being applied at TB1-L1 and L2 (115VAC).
- Check to see if the clutch coil or brake coil is shorted.
- Verify incoming power is properly grounded.
- Disconnect the clutch and brake leads and try to power the control, if the fuses blow again, the EC 2000 needs to be replaced if incoming power is assumed to be proper.

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8.5 CANNOT CHANGE ANY SETTINGS

- Press F1,F2, and F3 on the keypad successively to unlock the keypad for access.
- Try resetting the EC 2000 by pressing "SW1" on the 15-1200-1 board or by removing all TB2 wires and placing a jumper between TB2-32 and TB2-29, then applying power.

8.6 FOLLOWER OR POTENTIOMETER SIGNAL NOT CHANGING SETPOINT

- Verify the control is in the right mode. "AUTO" mode corresponds to an automatic follower signal. "REMOTE" mode corresponds to a signal that is external to the keypad.
- Check to see if any external connections into TB2 are improperly grounded. Recheck the wiring diagrams seen in Figures 8 through 13. If multiple signals are wired into TB2, try disconnecting signals one by one to eliminate possible issues.
- Verify the signals are present at TB2.

8.7 UNSTABLE SPEED

- Adjust the PID loop parameters in Menu B.

8.8 SPEED ON DISPLAY IS DIFFERENT THAN ACTUAL SPEED

- Verify that the Tach Pulses/REV setting in Menu A, Parameter 5 matches your mechanical unit. If it is unknown, try another setting and see if the displayed speed is closer to the actual speed.

8.9 SCREEN IS FROZEN AND/OR HAS UNFAMILIAR CONTENT

- Try resetting the EC 2000 either by pushing "SW1" on the 15-1200-1 board or by removing all TB2 connections and placing a jumper between TB2-32 and TB2-29.

8.10 SCREEN IS LIT, BUT NOTHING IS DISPLAYED

- Try resetting the EC 2000. If the issues persist, check to see if the keypad cable is inserted correctly or not damaged.

8.11 LOCAL/REMOTE KEY DOES NOT WORK

- Check to see if "LOCAL/REM ENABLE" is enabled in Menu A, Parameter 12.

8.12 DRIVE SLOWER THAN DESIRED

- Check to see if the clutch current limits are properly set in Menu A, Parameter 4.

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SECTION 9 – SERIAL COMMUNICATIONS

The latest major change to the EC 2000 is the implementation of serial communications on the EC 2000 control. The capabilities offered allow complete control of the EC 2000 through its serial port along with data acquisition. The system can read and write all 105 of the parameters, read and monitor data from the control such as speed, clutch current, feedback, and communicate with any device that can transmit and receive data over a serial port.

9.1 DATA TRANSCEIVING ORGANIZATION

NOTE: ASCII(0) = 30, ASCII(1) = 31, ASCII(8) = 38

- One Byte Hex Header Block
  - 7e "~" Command Follows
- One Byte ASCII Command
  - 30 "0" 30 = read, 31 = write
- Two Byte ASCII Menu Number
  - 3031 "01" Menu Number 1 = A, 2 = B, etc.
- Two Byte ASCII Item Number
  - 3038 "08" Menu Item Number
- Five Byte ASCII Parameter
  - 3030303031 "00001"

9.2 READ AND WRITE REQUESTS

- 7e30303130383030303031 (reads data in Menu A, Parameter 8)
- 7e30303130383031363630 (controller response indicating the speed is 1660 RPM)
- 7e31303130383031303030 (writes data "1000" to Menu A, Parameter 8).
- 7e31303130383031303030 (controller response indicating the speed is 1000 RPM)

9.3 NOTES

- When reading values, the 5-byte parameter values do not matter, but five bytes must be sent.
- When writing data, the five bytes are written to the parameter menu and item specified.
- When writing parameters the data is reread and returned.
- If the parameter doesn't exist "20000" will be returned as the parameter. The highest normal value is "10000".
- If something else goes wrong on reading, "20001" will be returned. On writing: "20002".
- The controller will enforce parameter limits, so values higher or lower than the limits will not be allowed. However, the parameter will switch to the closest value possible and that value will be reported back and set.
- Additional items may be added.

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9.4 DATA ACQUISITION

Table 6: Serial Data Acquisition

Item #1	Drive Speed in %	0 to 10000	
Item #2	Drive Speed In RPM	0 to Max RPM	
Item #3	Reference	0 to 10000	
Item #4	Set Point	0 to 10000	
Item #5	Motor Amps (XFMR)	0 to 250	
Item #6	Clutch Amps (LEM)	0 to 250	
Item #7	Brake Amps (LEM)	0 to 250	
Item #8	Analog Input Pot or 4-20 mA	0 to 250	
Item #9	Drive Status “tb_in_a”	16 bit	Jog; PLC RUN; PRESET 1/2; Auto/Man; E-Stop
Item #10	Drive Status “key_in_a”	16 bit	Keypad Button Status
Item #11	Drive Status “db_in_a”	16 bit	Program Status; Source Selects; etc.
Item #12	Drive Status “db_in_b”	16 bit	Faults; Presets; Status
Item #13	Drive Status “state_a”	16 bit	Drive State On Off; Local / Remote; Etc.
Item #14	Drive Status “state_b	16 bit	Drive Commands: Stop Run Jog Fault, etc.
Item #15	Drive Status “state_c”	16 bit	Keypad Run & Stop Presets; Pot.
Item #16	Drive Status “misc_in_a”	16 bit	Fault Listing
Item #17	Software Version	5 byte	

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SECTION 10 – INDEX

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