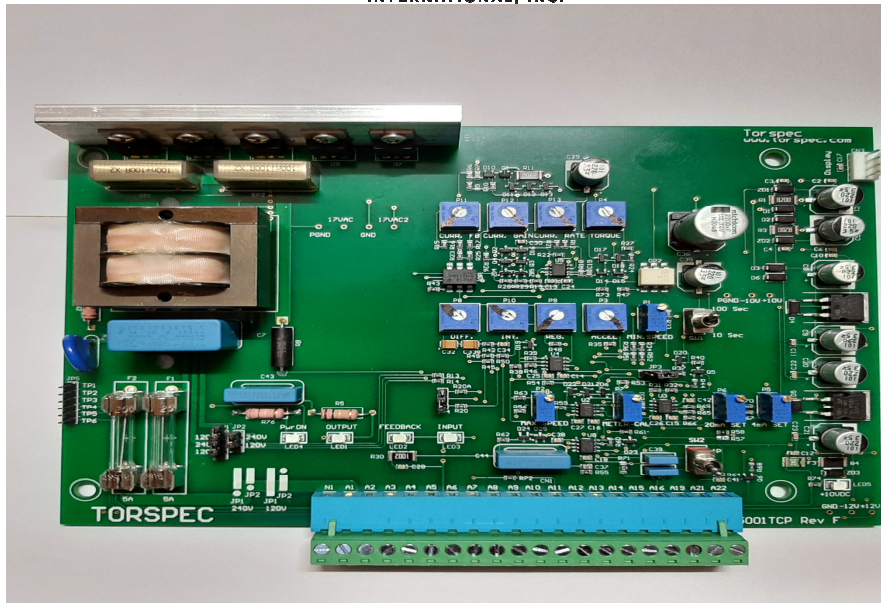




**INSTALLATION AND SETTING UP MANUAL
S5702TCP – Rev F- CONTROLLED
BRAKING SYSTEM-CENTRIFUGE DECANTERS (pages 3 to 6)
&**

**INSTALLATION AND SETTING UP MANUAL
5001TCP - Rev F SPEED CONTROLLER (pages 7 to 17)**

WARNING

*Disconnect all incoming power before working on this equipment.
Follow power lockout procedures.
Use extreme caution around electrical equipment.
Do not touch the circuit board while power is applied.*

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Manufacturers & Suppliers of World Class Quality Variable Speed Drives & Controls

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INSTALLATION AND SETTING UP MANUAL

S5702TCP CONTROLLED BRAKING SYSTEM- CENTRIFUGE DECANTERS

SETTING UP INSTRUCTIONS FOR SPEED CONTROLLED BRAKING SYSTEM USING CONTROLLER TYPE S5702TCP (CENTRIFUGE DECANTERS).

The controller model S5702TCP is modified from the controller model 5001TCP.

SETTING UP

Ensure that the controller is mounted vertically with the terminal block in the bottom when viewed from terminal block side.

Switch SW2 should be placed in 2P position if used on Torspec eddy current brakes (100TCD 305TCD).

Jumper JP4 should be placed in R20A position if used on Torspec eddy brakes.

1. Connect the system using the interconnection diagram.
2. The potentiometers on the board have been factory set to give a nominal performance as detailed below. Instructions for fine-tuning the system are described in items #6, onwards.
 - a.) P1- Set Minimum Speed- 300 rpm at no load when RV1 (main speed pot) is fully counter-clockwise-CCW.
 - b.) P2- Set Maximum Speed- 3200 rpm at full load when RV1 (main speed pot) is fully clockwise-CW and the switch SW2 (2P/4P) is in 2P position.
 - c.) P4 – **Internal Brake/ Torque Limit** – This has been set at maximum to allow maximum brake torque to be available. Depending on the ECB model it should be adjusted to allow max VDC rating per each ecb coil rating (ecb name plate rating).
 - d.) P8- **Stability**—set to 1/3 clockwise rotation
 - e.) P9 – **Regulation** – This control sets the change of speed which will result from a change of load and has been set to 1/3 clockwise
 - f.) P10 – **Stability** – Set to 1/3 clockwise rotation
 - g.) P11 – **Current Feedback** – factory set fully anti-clockwise. Range is from 1 to 5 amps. For 1 amp coil set fully clockwise, for 2 amp set midway, for 5 amps set fully anti-clockwise

The controls P8 and P9 determine the dynamic performance of the system and have been adjusted for average conditions.

3. Isolate the drive motor and apply power to the controller S5702TCP only. Zero the speed indicator by means of the zero adjuster on the meter.

Note: To avoid overheating the Torspec unit, do not leave power to the controller for an extended period.

4. Apply power to the whole system.

The system is now ready for operation. Speed variation is obtained by means of the Speed Control Potentiometer RV1.

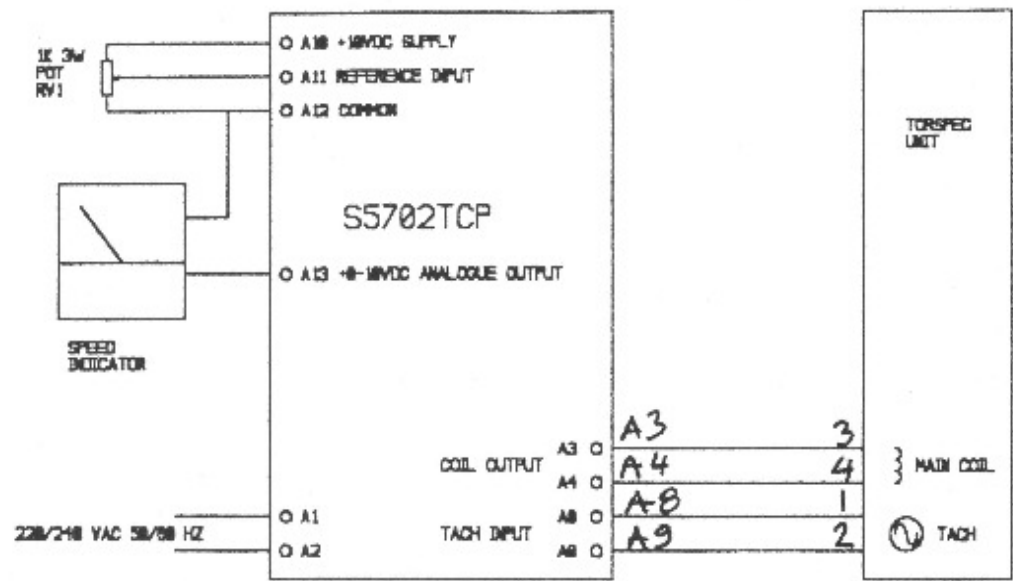
5. Maximum brake may be limited by turning P4 anti-clockwise. (this should be adjuster per ecb nameplate coil VDC rating).
6. Acceleration time may be limited by turning P3 anti-clockwise.

Better control may be possible with further adjustment, which should be made with the driven machine working under normal operating conditions. Proceed as follows:

7. Adjustment of P3 and P4 is described in instruction 5 and 6 above.
8. P1 and P2 adjust the speed range available from the speed control potentiometer RV1. For adjustment proceed as follows:
9. Apply power to the whole system and run the centrifuge drive motor.
10. Set **speed control** potentiometer to minimum.
11. Adjust the Minimum Speed P1 until the required minimum speed is set.
12. Turn the speed control potentiometer to maximum.
13. Adjust the Maximum Speed P2 until the required maximum speed is achieved. At this point the speed indicator may be calibrated by means of the meter calibration potentiometer.
14. Repeat instructions 10, 11, 12 and 13 until the maximum and minimum speeds are correctly set.
15. The functions of potentiometers P8, P9, P10 are as follows:
 - a. **P8 – Differential Control** – This increases the response of the system to transient speed changes. Clockwise rotation improves stability and minimizes overshoot and undershoot when speed changes are made, but may cause an increase in regulation at low speeds.
 - b. **P9 – Regulation** – This control adjusts the gain of the system. Clockwise rotation reduces regulation but may promote instability. Anti-clockwise rotation increases regulation and improves stability.
 - c. **P10 – Integral Control** – this decreases the response of the system to transient speed changes. Clockwise rotation reduces the response but improves stability.

If P8, P9 and P10 are adjusted, it may be necessary to recalibrate the minimum (P1) and maximum speeds (P2) as indicated in the instruction numbers 9, 10, 11, 12, and 13

S5702TCP CONNECTION DIAGRAM



TORSPEC INTERNATIONAL INC		
SAMPLE TORSPEC DRIVE INTERCONNECTION FOR PERMVALT		
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POF		
DRAWING NO.	REFERENCE NO.	DATE
S5702TCP		AUG. 88

CENTRIFUGE DECANTER APPLICATION

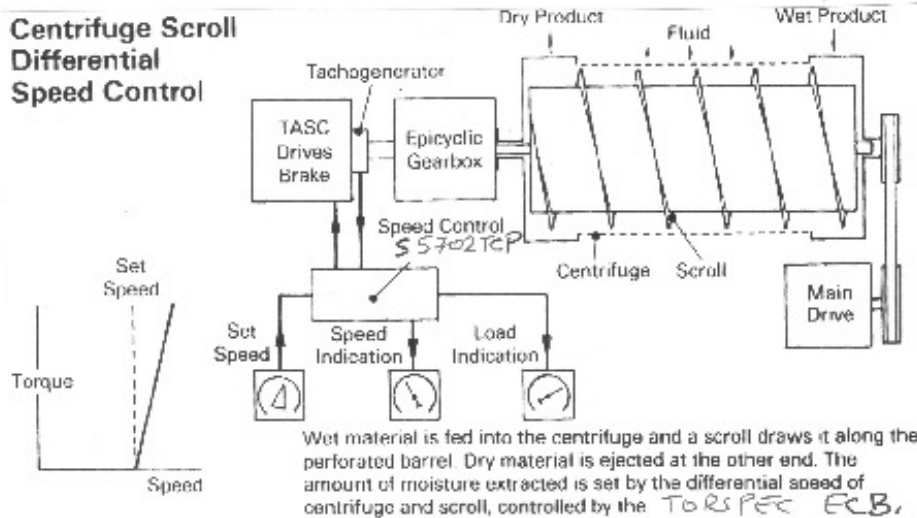
Eddy Current Brake (ECB) Application #1: Decaners Centrifuges

The centrifuge is used to separate liquids from solids and this requirement exists in many industries especially in chemical processes. The horizontal centrifuge consists from a main barrel (bowl) which rotates at high speed and inner screw conveyor (scroll) which rotates in the same direction but at lower speed. Wide ranges of slurries can be treated by varying the relative speed of the barrel and the screw.

Material is fed in at one end the scroll moves it along to other end at a rate, which extracts the required amount of liquid. Dry material is ejected at the other end. Usually the material in the barrel tends to drag the screw round at the barrel speed. The screw must therefore be braked in order to maintain its set speed. The amount of moisture extracted is set by the differential speed centrifuge and scroll, controlled by the Torspec eddy current brake (ECB) or back drive.

The braking action must be a non friction type to avoid maintenance problems and the brake must be capable of providing the maximum required braking torque continuously without overheating. Torspec Eddy Current Brake (ECB) perfectly matches these braking criteria and is utilized on decanter centrifuge applications, especially on Alfa Laval Decanter Centrifuges worldwide. They are referred as back drives. This back drive system utilizes Torspec ECB and Controller S5702TCP.

When the load drives the ECB (back drive) beyond set speed, it is detected by this controller and d.c. current is applied to the ECB (back drive) to bring the brake to the set speed (differential speed setting). If the reference voltage is used to select a desired screw speed, the ECB (back drive) will remain switched off until the screw is dragged round beyond the set speed. At this point, the feedback voltage and frequency will be bigger than reference, the Torspec ECB (back drive) unit will be switched on and the screw will be braked until the correct speed is reached.



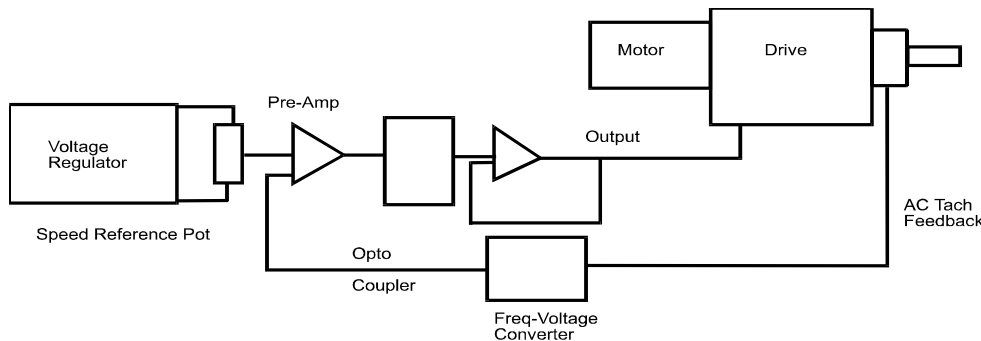
INSTALLATION AND SETTING UP MANUAL

5001TCP - Rev F SPEED CONTROLLER

SYSTEM DESCRIPTION

The 5001TCP drive panel is a solid-state controller, which has been well proven in the industry and is used to control speed on the TORSPEC drive. The 13 pre-set controls have been factory adjusted to give a nominal performance so the system may operate satisfactory without adjustment. However, instructions are provided so the optimum performance may be obtained with further fine-tuning. The function of these controls will be described later.

SCHEMATIC SYSTEM DESCRIPTION



The TORSPEC drive coil is driven from a full wave thyristor output stage, which incorporates current feedback. This output stage is driven from an error voltage via a pre-amplifier employing operational amplifiers, which as variable gain, integral and differential action. In addition, there are two optical couplers between the power, output stage and the control circuitry to provide isolation.

The error voltage is the difference between a reference voltage and a feedback voltage, which is proportional to the TORSPEC drives output shaft speed. Thus, variable speed control is achieved by varying the reference voltage. To minimize errors the reference is derived from a voltage regulator, while the feedback voltage is produced from the frequency developed by a sinusoidal tachogenerator and via a digital-to-analog converter.

CONSTRUCTION

All of the components are mounted on the front of a double-sided epoxy glass printed circuit card, each component identified by a component code. The board is a hybrid construction of through hole and surface mount components for high reliability and serviceability. Termination is through a quick connect terminal strip with captive screws and retractable wire pressure plates.

CONTROLLER PHYSICAL DETAILS

Size 8.06" long x 6.19" high x 1.42": deep

Permissible temperature is 1-160°F (71 deg C) local ambient around the controller providing the 160°F local ambient is equivalent to 122°F (50 deg C) outside ambient when the controller is mounted in a small NEMA 12 enclosure.

SPECIFICATIONS

Inputs

Supply Voltage:	110 - 120VAC, 220 - 240VAC $\pm$ 6%
Supply Frequency:	50 to 60 HZ
Tach Signal Frequency:	12 to 720 HZ
Tach Signal Voltage:	Proportional to tach frequency
	30 to 60V at 700 HZ
Torque Limit:	Is controlled by P4 on the board or by an external 2K pot across terminals A5, A6, and A7

Outputs

Maximum Nominal Output:	90 VDC (45 to 160 VDC optional)
Maximum Current:	5 ADC (8 ADC optional/ 5-10 ADC optional)
Reference Signal Load:	16 MADC (625 ohm)
Speed Output Signal:	0-10 VDC
Speed Output Frequency:	0.2 HZ/RPM square wave, 12 VDC Amplitude
Speed Output Signal:	4 to 20 MA

Abbreviations

ADC = Amps direct current	AAC = Amps alternating current
HZ = Hertz	MADC = Milli-amps direct current
VAC = Volts alternating current	VDC = Volts direct current

PERFORMANCE

1. Speed control range is down to 60 RPM, or as dictated by the drive selected, see drive technical data sheet for speed range.
2. Response to supply variation - 1% for 6% fluctuation.
3. Regulation is defined as the ability of the system to maintain a set speed when the applied load is decreased or increased. The regulation accuracy is a function of the setting of regulation, integral, and differential control pots. These are set at the factory to give a good performance against most normal applications. With a factory setting of 90 Volt output to the coil, a change of 1 V would give a speed change of 0.085% at 3300 RPM. Where tighter regulation is required, the control can be further adjusted in the field against actual dynamic conditions.
4. Speed stability $\pm$ 1 RPM over the speed range.
5. Linearity of speed against reference signal is less than 0.5% error of maximum speed.
6. Linearity of speed against speed control potentiometer rotation is dependent upon the type and make of potentiometer supplied. However, typical figures are:

a) Single turn pot

Sensitivity	2 Pole	9 RPM per degree rotation
	4 Pole	4.5 RPM per degree rotation
Resolution	2 Pole	5 RPM per degree rotation
	4 Pole	2.5 RPM per degree rotation
Linearity	$\pm 4\%$	

b) 10 Turn Pot

Sensitivity	2 Pole	0.67 RPM per degree rotation
	4 Pole	0.33 RPM per degree rotation
Resolution	2 Pole	0.6 RPM per degree rotation
	4 Pole	0.3 RPM per degree rotation
Linearity	$\pm 0.25\%$	

7. Repeatability is the ability of the system to return to the original set speed after this speed has been changed. The system will revert to within ± 1 RPM providing load, temperature and supply voltage remains constant.
8. Long term drift due to tachogenerator temperature change - since the feedback signal is digital, there is no drift.
9. Reference voltage at terminal A10 and A12 is 10 VDC $\pm 5\%$, stability 0.05% for a 12% supply change.
10. Supply transient protection is provided by an input filter and a surge suppressor.
11. Factory preset controls; the 13 internal board mounted pots have the following functions:

P1 - Minimum speed pot, factory set for zero output speed. Clockwise rotation will increase minimum speed. Interactive with max speed pot. Adjustment range is 0 - 55%.

P2 - Maximum speed pot, factory set at 1500/3000 RPM. Counter-clockwise reduces set speed. Adjustment range is 30 - 100%

P3 - Acceleration, factory set fully clockwise for fastest acceleration.

P4 - Internal torque, factory set fully clockwise for maximum torque, range of setting is 0 to 100%. External resistance of 2K can be added between terminals A5, A6, & A7 for remote adjustment.

P5 - Set for 4 MADC output proportional to zero speed.

P6 - Set maximum 20 MADC output signal proportional to 100% speed

P7 - Calibration for 0 to 10 VDC meter output at terminals A13, A12, proportional to 0 to 100% speed.

P8 - Differential control increases response of the system to speed or load changes. Factory set at 1/3 clockwise. Clockwise rotation improves stability and minimizes overshoot and undershoot. CCW increases increases speed change with load change, increases min/max speed settings.

P9 - Regulation, factory preset at 1/3 clockwise. Counter-clockwise rotation improves regulation. Interactive with P1, P2, P8, and P10, these controls should be re-adjusted.

P10 - Integral control smoothes response of system to speed/load changes. Factory preset at 1/3 clockwise. Clockwise rotation reduces system response and improves stability. Affects min/max speed settings.

P11 - Current feedback, factory set fully counter-clockwise. Range is from 1 to 5 AMP. For 1 AMP coil set fully clockwise, for 2 AMP set midway, for 5 AMP set fully counter-clockwise.

P12 - Current gain, factory set fully clockwise. Set counter-clockwise for 2 AMP coils and at factory setting for 4 AMP coils. Note: If set in the counter-clockwise position, speed run away may be seen. Reset to clockwise to rectify.

P13 - Current rate, factory set fully clockwise for slowest response to load change.

Controls P8, P9, P10, P12, and P13 should be adjusted under actual load conditions to obtain the best possible performance, all three are used to compensate for drastic or cyclic load changes.

12. Input Signals

0 to 10 VDC at terminals A11 and A12. (Max 12 VDC)

4-20 MADDC at A12 (-) and A16 (+) (jumper between A11 and A16)

Supply-to-control circuit isolation is provided on the control board.

WARNINGS

1. Provision must be made, at an external point, to isolate the supply voltage from the drive controller and motor.
2. Be sure the supply voltage, frequency and amperage are compatible.
3. The enclosure that the controller is to be fitted into must be grounded.
4. The neutral must be connected to terminal N1 only when 120 (110) VAC is used as the supply voltage. For 240 (220) VAC connect neutral to A1.
5. **The supply to the controller must be interlocked with the motor starter in such a way as to prevent the control board from being powered up if the motor is not operating.**
6. Please contact our service department if you experience any difficulties that are not covered in this manual.

ADDITIONAL FACILITIES

a) Transducer Inputs

For 0 - 10 VDC, connect (-) to A12 and (+) to A11

For 4 - 20 MADDC, connect (-) to A12 and (+) to A16

The negative signal line may be grounded.

- b) Terminal A15 is an input for external reference signal such as synchronization, it bypasses the acceleration circuit.
- c) Terminal A19 and A12 provide a square wave output signal for use with a digital meter. The frequency is .2 HZ/RPM. A meter with a time base of 1 second will read frequency directly where as a time base of 5 seconds will read RPM. The signal is fed from one source of 5 kilohms.
- d) When A14 is connected to A10 by means of an isolated contact, it provides an **inhibit function** that not only stops the controller output, but also resets the acceleration circuit.
- e) If your application requires more than 5 Amps @ 90 VDC, the board can easily setup for a maximum of 8 AMPS @ 160 VDC. The board will have to be wired for 240 VAC supply, place the double jumper JP1 in the 240V position and the single jumper JP2 in the 120V position. Depending on the load you may have to increase the size of the fuse rating to a maximum of 10 AMPS for the time delay fuses or 15 AMPS for fast blow fuses.

Be sure only JP2 is in the 120V position, otherwise damage to the board will result.

INSTALLATION

Each control has thirteen pots, which have been factory set to give a nominal performance, so in most cases the control may be installed and operated without further adjustment. However, optimum performance can be achieved with further calibration to match the control with the dynamic characteristics of the load. See page 6 for more details.

The adjustments per default are made considering this control board will control Torspec brand eddy current clutch. If you have another brand of ec clutch (Dynamitic, Eaton, Luis Allis etc) further adjustments are required and you may contact Torspec for additional help.

If the reference signal and tach feedback wires are run in the same cableway as current-carrying conductors then shielded cable should be used. Please note that only one end of the shield wire is to be grounded; the other end should float.

Connect the system as per the attached connection drawing, ensuring the correct terminals are being used. It is important the connection of the drive tach and coil are correct or damage to the drive will result. A8 and A9 are for the tach, while A3 and A4 are for the coil. At the drive the smaller wires are from the tach, the larger wires are from the main coil.

Check the supply voltage and place jumpers JP1, JP2 in the corresponding position. This determines whether the board is operating on 120 or 240V. The board is marked as to the correct position.

The 2 pole/4 pole switch, SW2, should be down for the 2 pole (3000/3600-RPM motor) position and up for the 4 pole (1500/1800) position for the 100, 132, 160, 180 and 225TCD DC clutches. For use with the 280TCD and 305TCD, the position needs to be set in the 2-pole position. If used on different eddy drive brand (Dyanamatic, Eaton, L. Allis) you need to set SW2 to 2P position and do speed recalibration.

SW 1 is for selecting the acceleration time, down for 10 seconds range and up for 100 seconds range. The time is adjusted within the range by P3.

JP3 provides for a deceleration rate (right position for normal decel and left position for faster decel.)

The current feedback must be set to match the drive's main coil amperage. This figure is stamped on the drive's nameplate or the factory can advise. Set the current feedback pot (P11) as follows:

- for 1 AMP or less, set full clockwise
- for 1 to 2 AMP, set midway
- for 2 to 5 AMP, set fully counter-clockwise

Before engaging the drive, ensure the rotation is correct by starting only the AC motor and noting the direction of the fan's rotation. The output direction of the drive will be the same. The direction can be changed by changing phase polarity of any two of the three motor leads. **Ensure power is OFF before attempting this.**

The green LED 1- OUTPUT when lit indicates there is an output from the controller to the TORSPEC clutch.

There are 5 LED lights on this board:

LED 1 (output VDC to clutch): at the start it will lit fully bright and after several second it will start flickering (normal)); it can be checked across terminals A3-A4

LED 2 (Tacho Feedback VAC/ Hz): it will lit when receiving tacho feedback from clutch tacho generator (it can be checked across A8-A9).

LED 3 (Input signal 0-10 vdc): it will lit when receiving input signal 0-10 vdc (check across A11-A12)

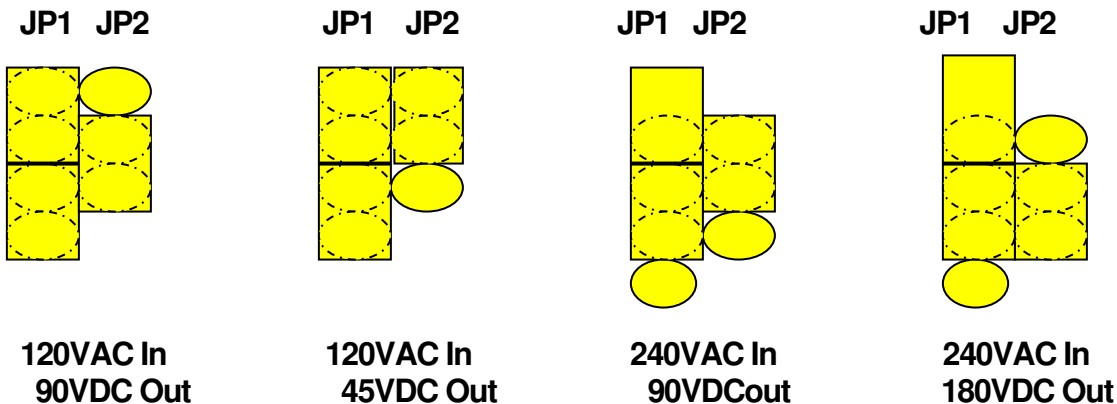
LED 4 (Input Power 120VAC/240VAC/1/50/60Hz): it will lit if board receives input power 120/240VAC (check across N-A2 for 120VAC or A1-A2 for 240VAC)

LED 5 (reference 10VDC): it will lit if board has 10vdc internal supply (check across A10-A12)

5001TCP JUMPER SETTINGS

The 5001TCP can be set up for 120 or 240VAC input. These input voltages, long with jumpers JP1 and JP2 set in the proper locations, can give the user different voltages on the output.

Jumpers can be set as follows to achieve desired output voltages.



Torque Pot - P4 can be used to adjust output VDC between these numbers if required in the field. For example if you have jumpers setting for output 45VDC you can use P4 pot to adjust it anywhere between 30 to 45VDC.

If you have jumpers settings for 90VDC output , you can adjust with P4 anywhere between 45 to 90 VDC if required in the field. If you have jumper settings for 180VDC output you can adjust with P4 to be anywhere between 90 and 180VDC.

SETTING UP

All controls are factory preset and the system can be installed and operated with minor adjustments. Optimum performance can be achieved with further fine-tuning.

Apply power to the motor and verify rotation. Power up the control panel and adjust P1 for zero output volts. Turn RV1 (main speed pot) to maximum and set P2 to match the drives maximum rated speed. As P1 and P2 are inter-active, a repeat of the above may be necessary.

If adjustments of P8, P9 and P10 are made, then P1 and P2 must be reset.

To calibrate the speed indicator, the drive should be set for maximum speed and P7 trim pot adjusted to provide the desired reading on the meter scale for full speed.

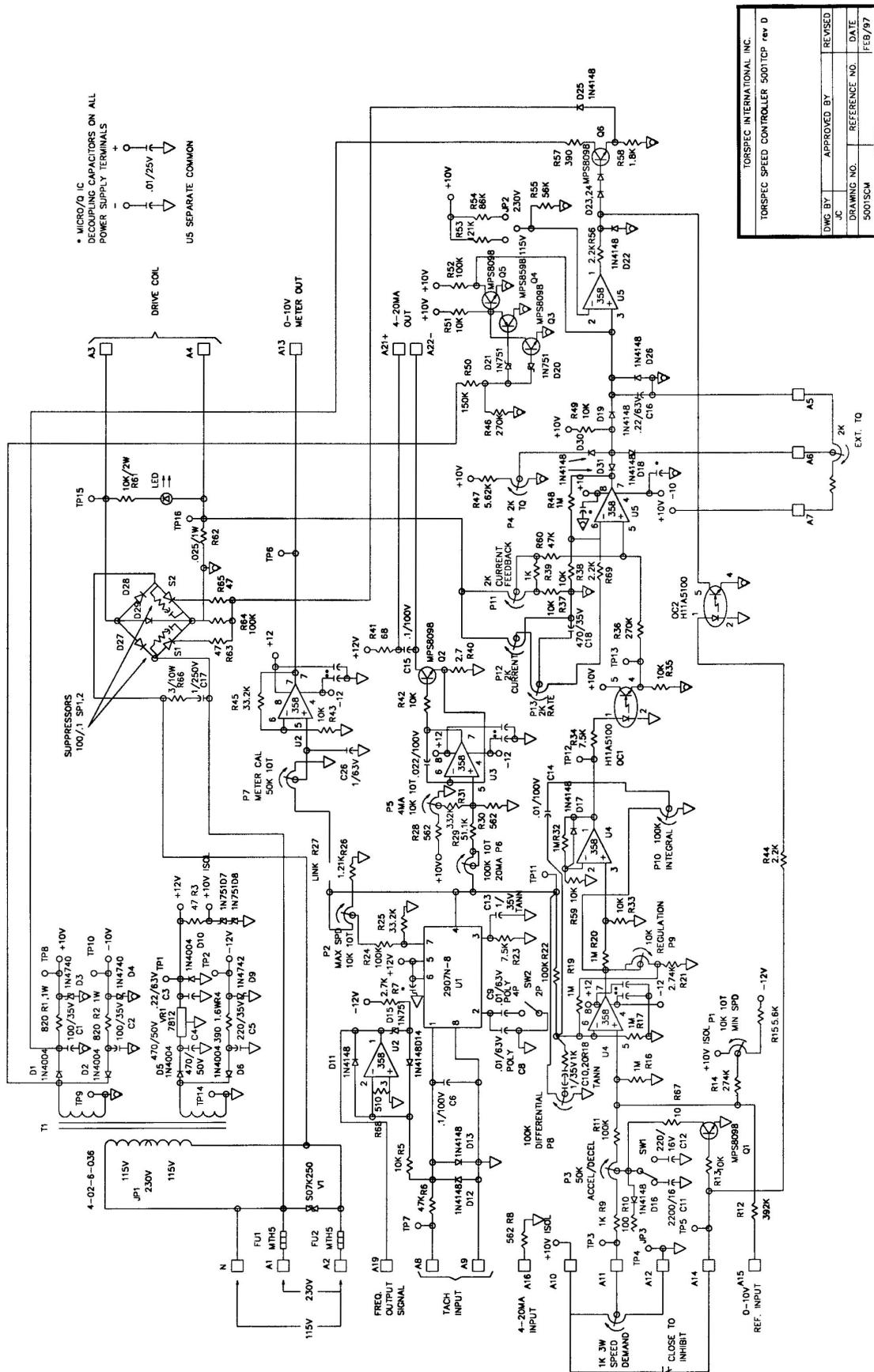
For digital meters, use the meter's offset pot to set 000 at zero speed and the meter's range pot to set the desired reading at maximum speed, this reading can be 100% or the desired engineered units, the top and bottom settings may have to be repeated for the desired result. As an alternate, the 5001TCP 4-20mA output signal and board mounted trim pots, P5 and P6 can be used.

With completion of these steps the drive is fully operational.

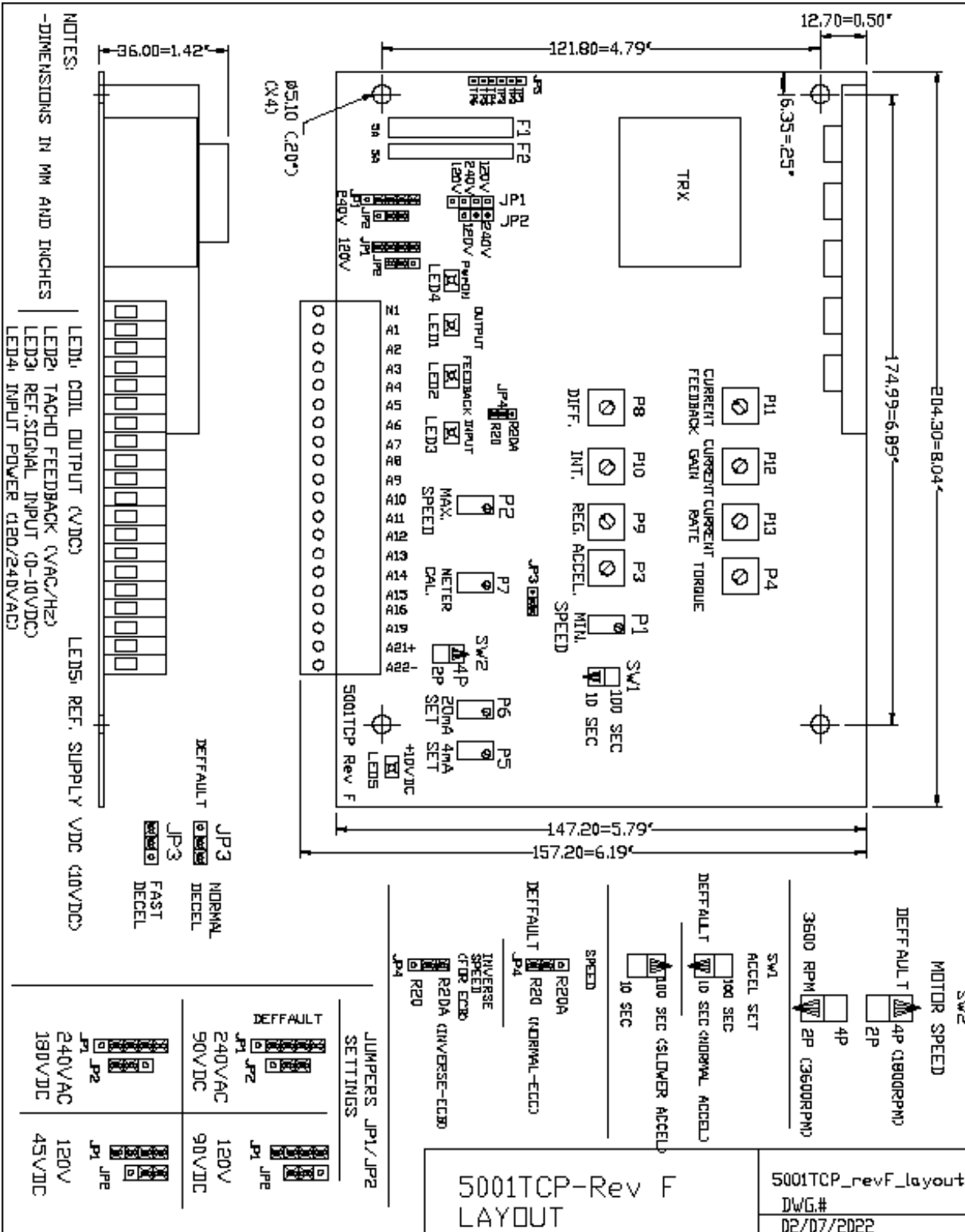
POT	PARAMETER	FACTORY SET	ADJUSTMENT	EFFECT
P1	Min. speed	Set @0	CW to increase min. speed	Interactive with P2
P2	Max. speed	Set for 1500/3000 RPM	CW to increase drive speed	Interactive with P1
P3	Acceleration	Full CW	CCW to increase acceleration time	
P4	Torque limit	Full CW	CCW to limit drive torque	
P5	4MA set	Set for 4ma meter reading @0 speed	CW to increase output	
P6	20MA set	Set for 20MA reading @ max. speed	CW to increase output	
P7	Meter Cal.	Set for 10VDC reading @ max. speed	CW to increase output	
P8	Differential	1/3 CW	CW to increase drive speed	Affects min/max speed setting
P9	Regulation	1/3 CW	CW to decrease speed change with load	Affects P1, P2, P8, P10
P10	Integral	1/3 CW	CW to smooth response to load change	Affects min/max speed settings
P11	Current Feedback	CCW	Set to match coil amps	
P12	Current Gain	CW	Set to reduce speed drop on load increase	Affects min/max speed setting
P13	Current Rate	CW	Determines the speed that the control reacts to load change	

*CW = Clockwise rotation **CCW = Counter-clockwise rotation-**

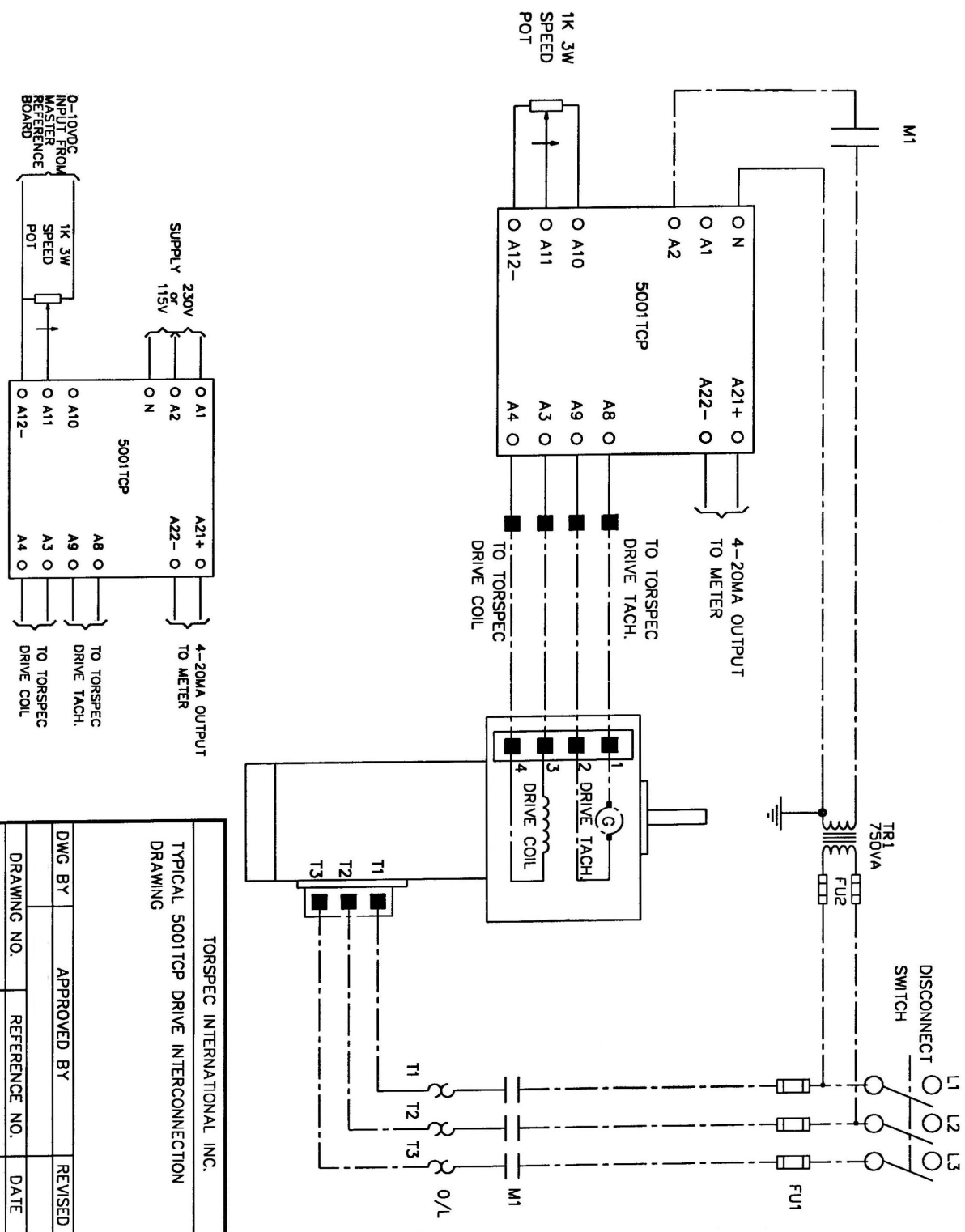
5001TCP SCHEMATIC DRAWING



FOR SPEED CONTROL BOARD



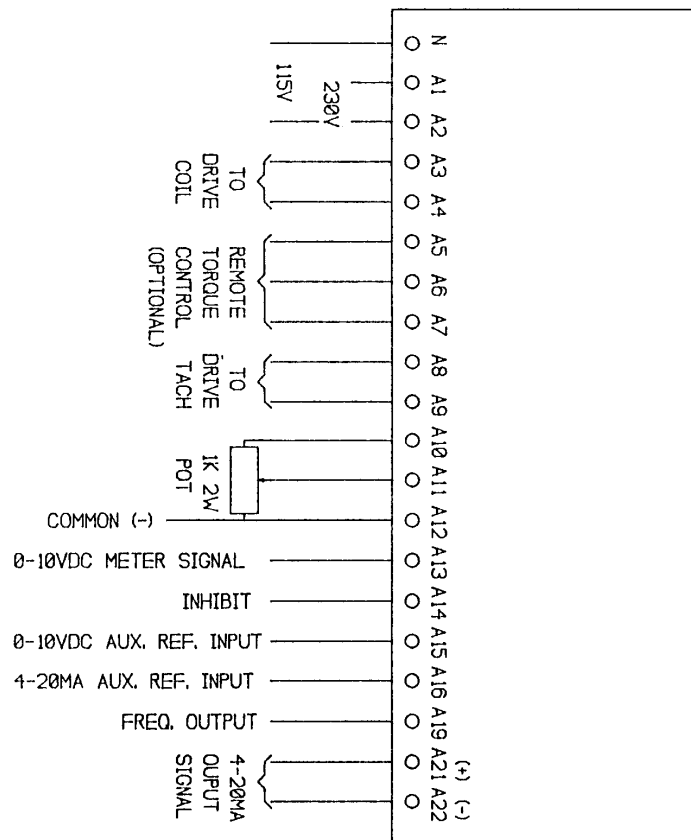
5001TCP DRIVE INTERCONNECTION DRAWING



TORSPEC INTERNATIONAL INC.
TYPICAL 5001TCP DRIVE INTERCONNECTION
DRAWING

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5001 TERMINAL STRIP CONNECTION DRAWING



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