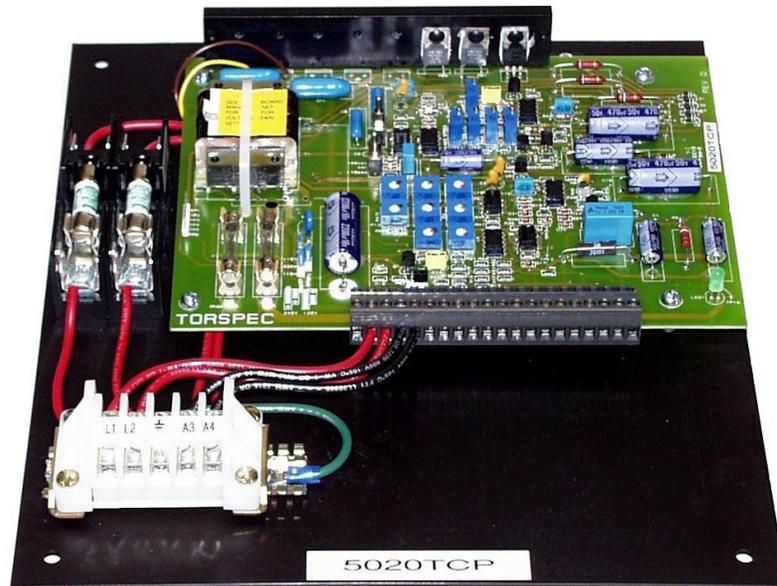


TORSPEC™ VARIABLE SPEED DRIVE CONTROLLER



INSTALLATION AND SETTING UP MANUAL 5020 TCP SPEED CONTROLLER

UP TO 30 AMP OUTPUT

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.

TORSPEC™

Torspec International Inc.
15 Cargill Drive
Seguin, Ontario, Canada P2A 0B2
Phone: (416) 213-1026
Fax: (705) 732-4466
E-mail: sales@torspec.com

Torspec International (USA) Inc.
13507-C East Boundary Road
Midlothian (Richmond), VA U.S.A. 23112
Phone: (804) 744-5521
Fax: (705) 732-4466
E-mail: sales@torspec.com

Web-Site: www.torspec.com

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

TABLE OF CONTENTS

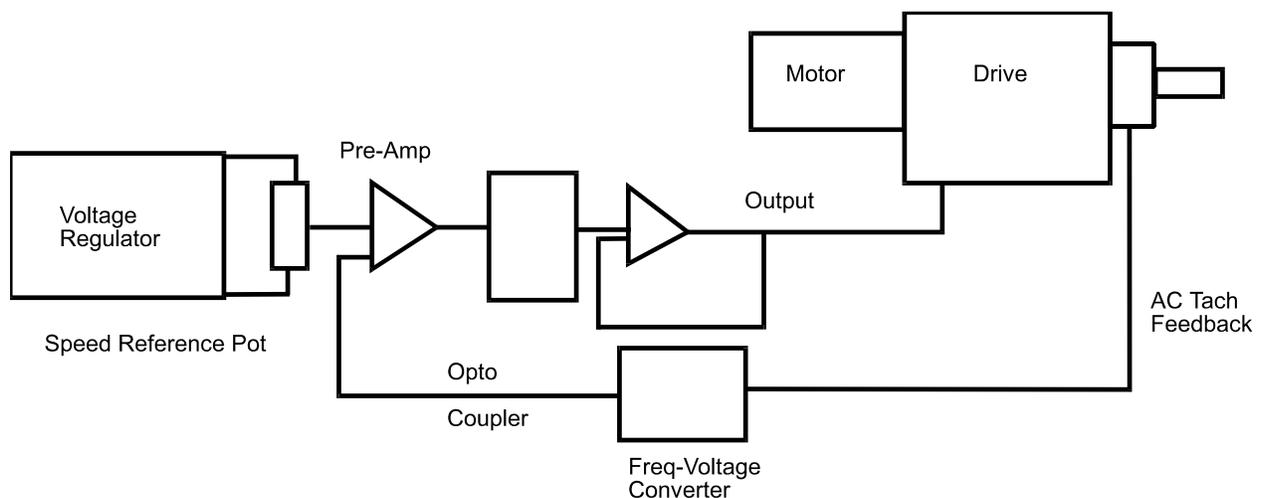
SYSTEM DESCRIPTION	3
SCHEMATIC SYSTEM DESCRIPTION.....	3
CONSTRUCTION	4
CONTROLLER PHYSICAL DETAILS	4
SPECIFICATIONS	4
Inputs.....	4
Outputs	4
Abbreviations.....	4
PERFORMANCE	5
WARNINGS	7
ADDITIONAL FACILITIES.....	7
INSTALLATION	8
JUMPER SETTINGS.....	9
SETTING UP.....	9
5020TCP WIRING DIAGRAM.....	11
5001TCP SCHEMATIC DRAWING	12
5001TCP DIMENSIONAL LAYOUT DRAWING FOR SPEED CONTROL BOARD	13
5001TCP TERMINAL STRIP CONNECTION DRAWING.....	14
5020TCP TROUBLESHOOTING GUIDE	15
5020TCP TROUBLESHOOTING GUIDE	16
5020TCP TROUBLESHOOTING GUIDE.....	17

SYSTEM DESCRIPTION

(THE 5020 TCP IS A 5001 TCP WITH HIGH-CURRENT OUTPUT DEVICES INSTALLED)

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 drive's, 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

The 5020 TCP consists of a standard 5001 TCP mounted onto a black anodized back plate, which forms a heat sink for the output devices. A separate terminal block is provided for connection of the input power and output coil voltage. Fuses are also provided for the input power.

All of the other 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 10.0" long x 11.0" high x 2.5" deep

Permissible temperature is 1-160°F local ambient around the controller providing the 160°F local ambient is equivalent to 122°F 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 (160 VDC optional)
Maximum Current:	30 ADC
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 = Millie-amperes 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 ± 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 2/3 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 full counter 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.
 - 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.
 - 13** - 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 MADC 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 ampacity are compatible.
3. The enclosure that the controller is to be fitted into must be grounded.
4. The neutral must be connected to terminal N 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 MADC, 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.

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.

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.

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 quicker deceleration time (left position for quicker decel.)

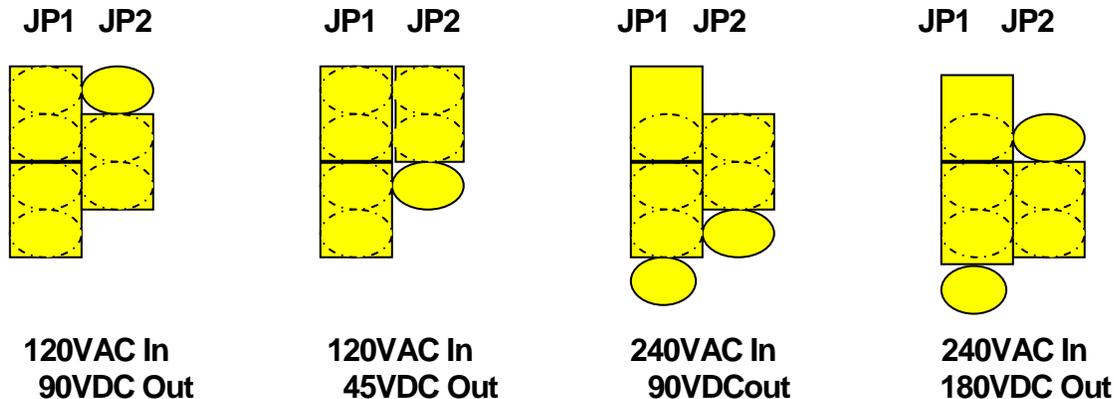
Before engaging the drive, ensure the rotation is correct by starting only the AC motor and noting the direction of the fan's rotation. The output direction of the drive will be the same. The direction can be changed by changing phase polarity of any two of the three motor leads. **Ensure power is OFF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

The green LED when lit indicates there is an output from the controller to the TORSPEC drive.

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.



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.

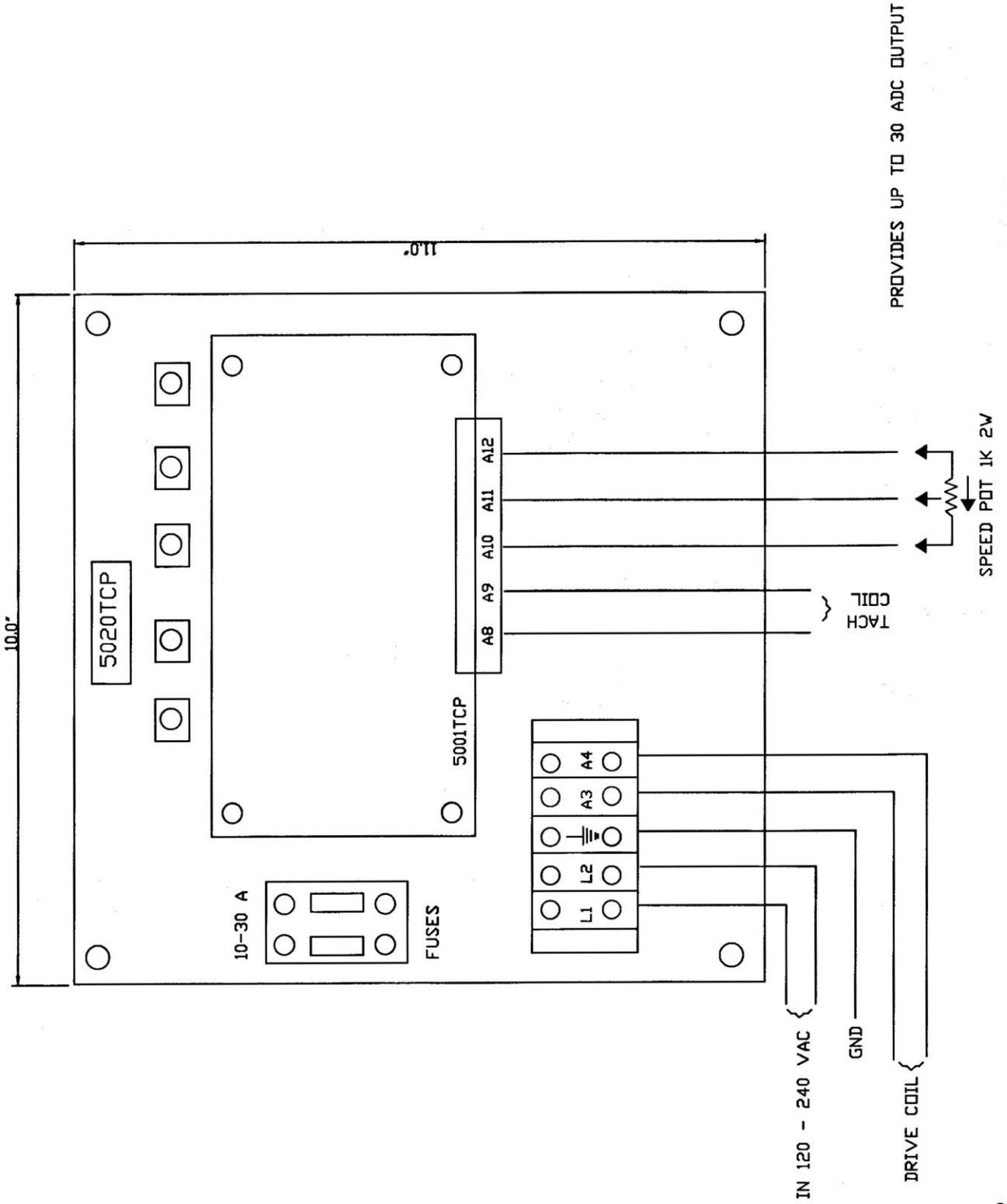
POT	PARAMETER	FACTORY SET	ADJUSTMENT	EFFECT
P1	Min. speed	Set @0	CW to increase min. speed	Interactive with P2
P2	Max. speed	Set for 1500/3000 RPM	CW to increase drive speed	Interactive with P1
P3	Acceleration	Full CW	CCW to increase accel. time	
P4	Torque limit	Full CW	CCW to limit drive torque	
P5	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	2/3 CW	CW to increase drive speed	Affects min/max speed setting
P9	Regulation	Full CCW	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		
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-**

5020TCP BASIC WIRING DIAGRAM

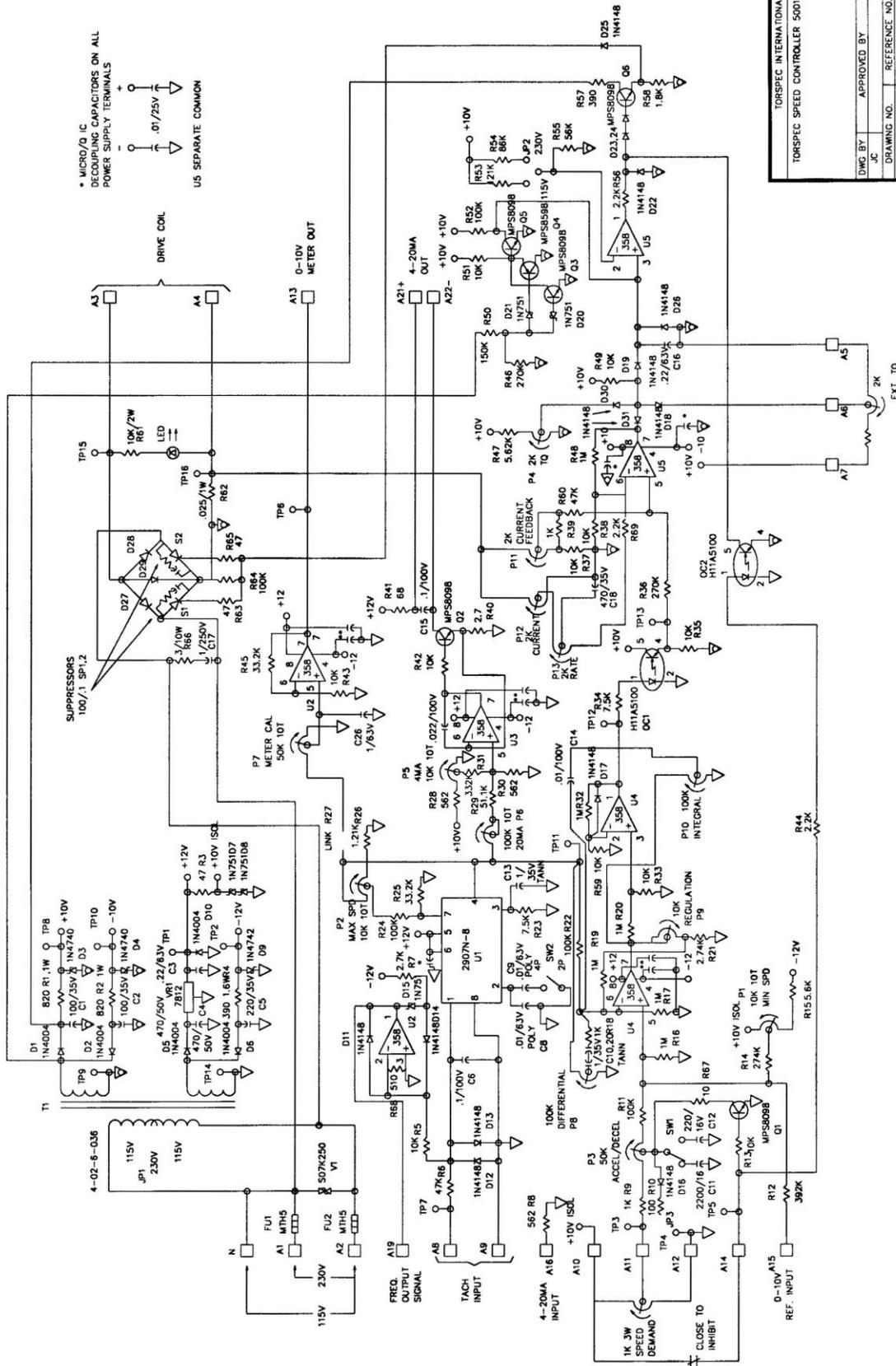
BASIC WIRING DIAGRAM

<SEE TERMINAL STRIP CONNECTION DIAGRAM FOR MORE OPTIONS>



5020tcp

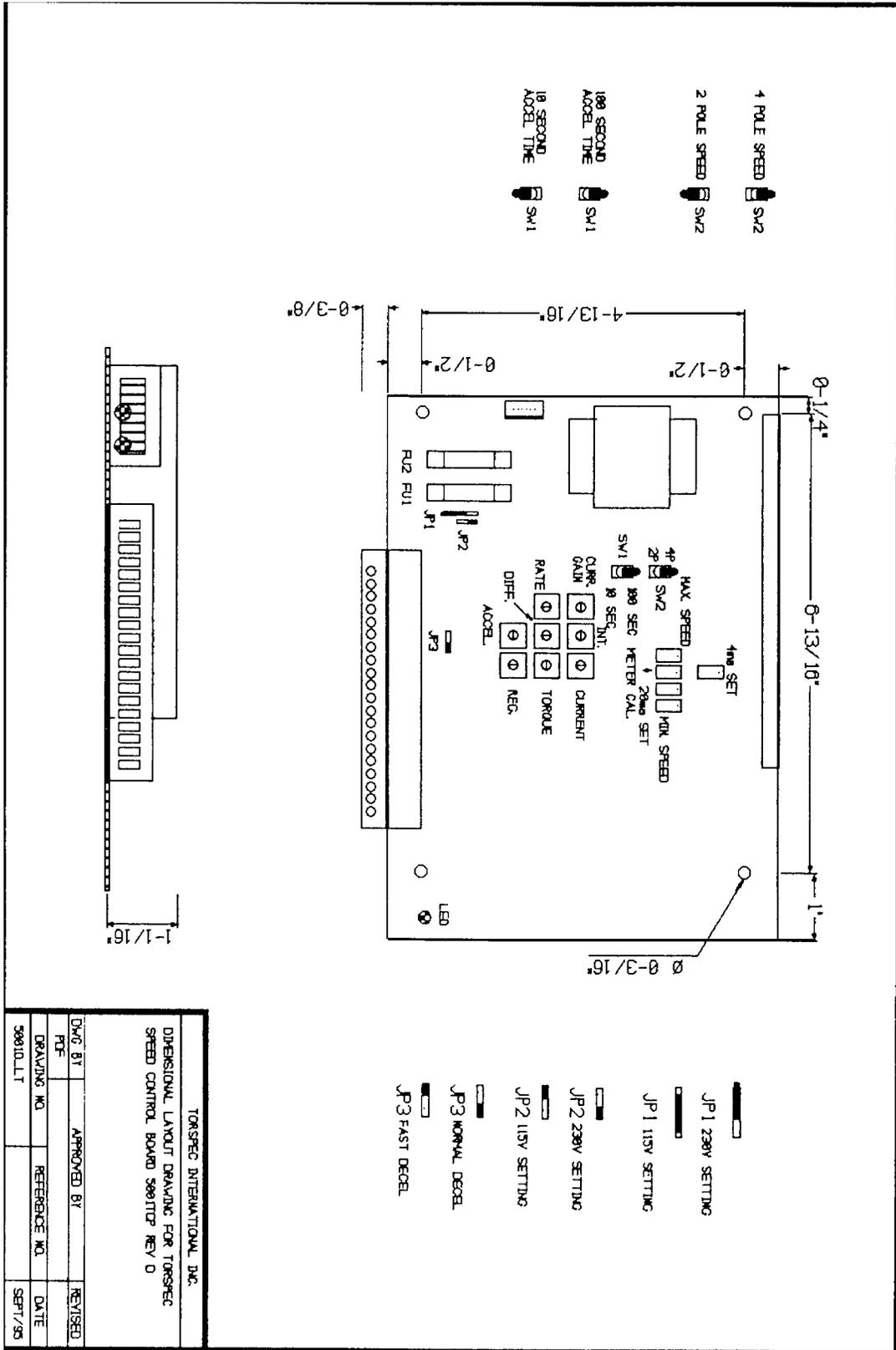
5001TCP SCHEMATIC DRAWING



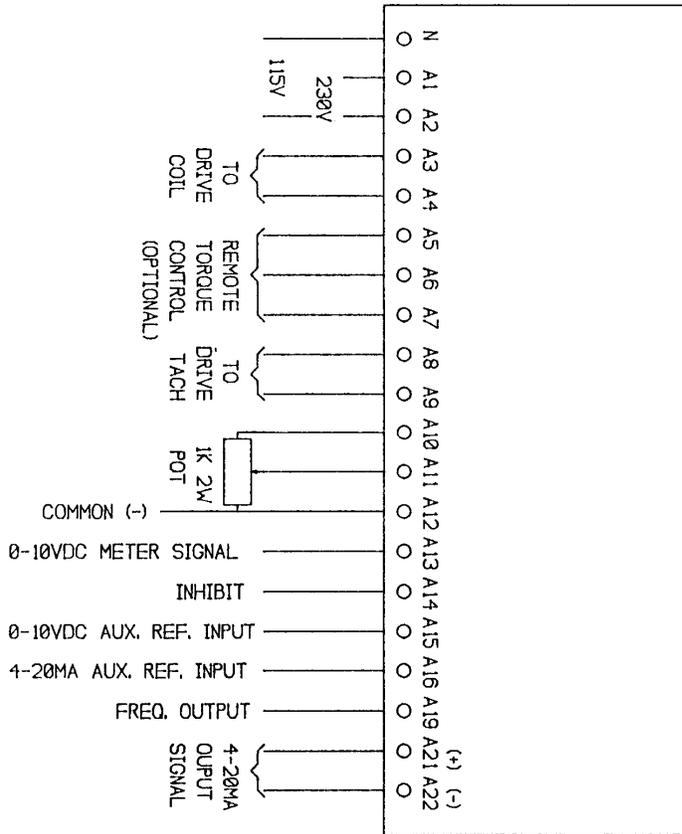
* MICRO/D IC
DECOUPLING CAPACITORS ON ALL
POWER SUPPLY TERMINALS
+
- 01/25V
US SEPARATE COMMON

TORSPEC INTERNATIONAL INC.			
TORSPEC SPEED CONTROLLER 5001TCP rev D			
DWG BY	APPROVED BY	REVISED	
JC			
DRAWING NO.	REFERENCE NO.	DATE	
5001SCM		FEB/97	

5001TCP DIMENSIONAL LAYOUT DRAWING



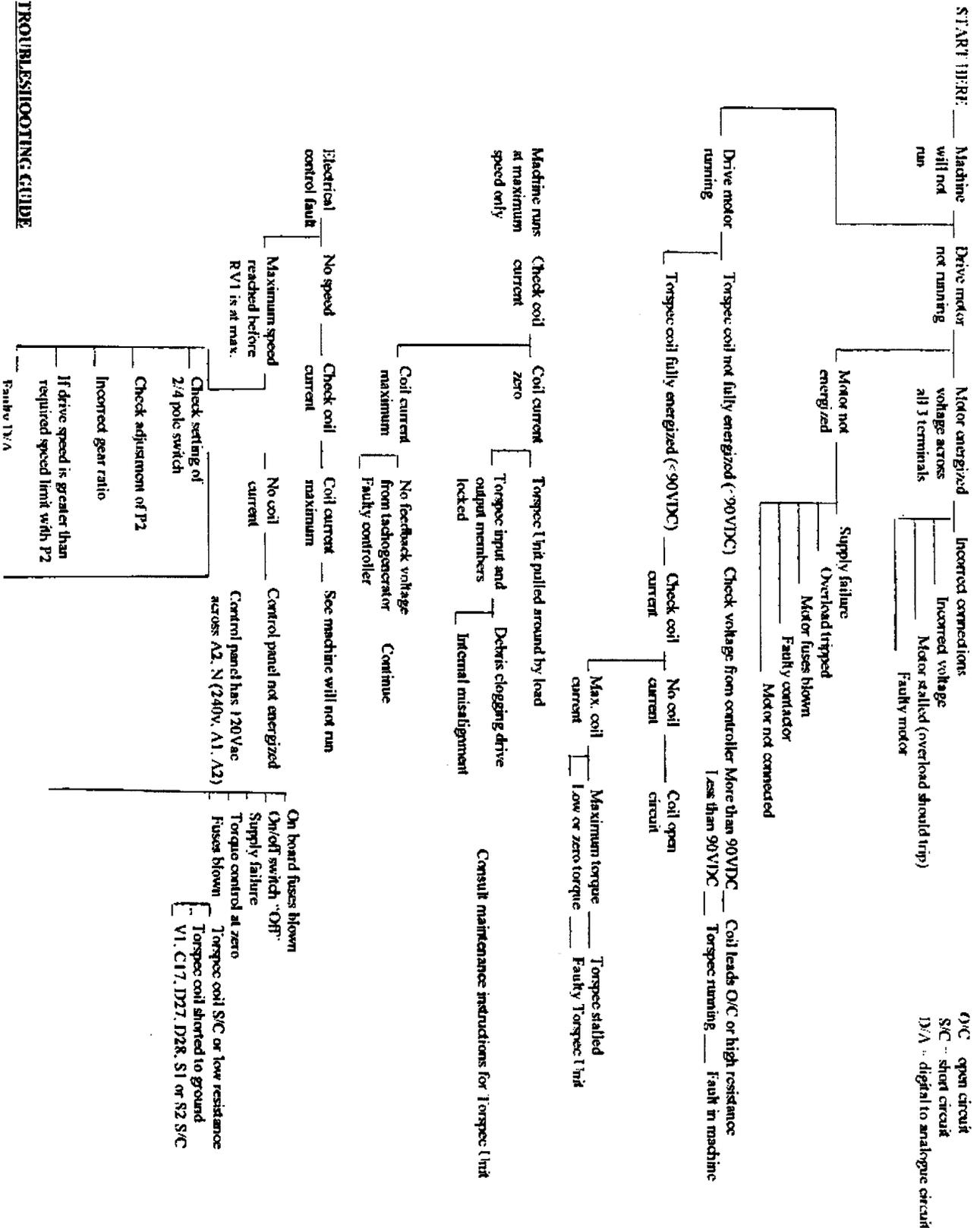
5001 TERMINAL STRIP CONNECTION DRAWING



5001 TERMINAL STRIP CONNECTION DRAWING			
DATE	BY	APPROVED BY	REVISION
04/14/02	JG		
DATE	BY	APPROVED BY	REVISION

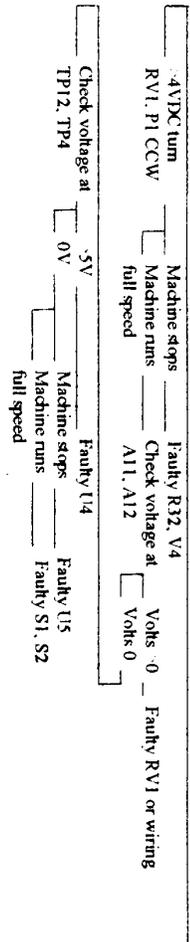
5020TCP TROUBLESHOOTING GUIDE

TRUBLESHOOTING GUIDE



Consult maintenance instructions for Torque Unit

O/C = open circuit
 S/C = short circuit
 D/A = digital to analogue circuit



TORSPEC™ ADJUSTABLE SPEED DRIVE

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