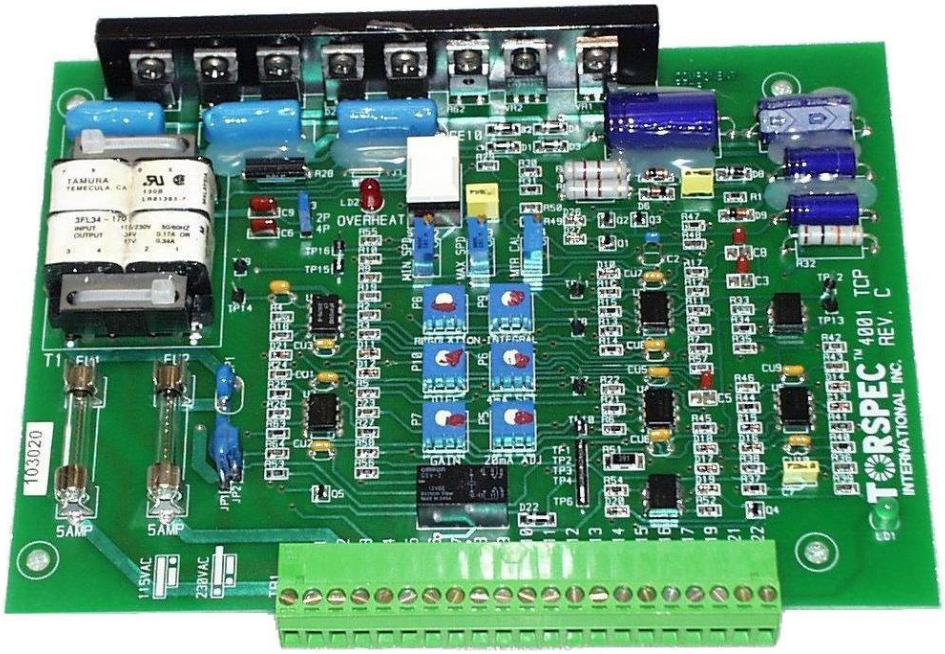

INSTALLATION AND SETTING UP MANUAL

4001TCP SPEED CONTROLLER

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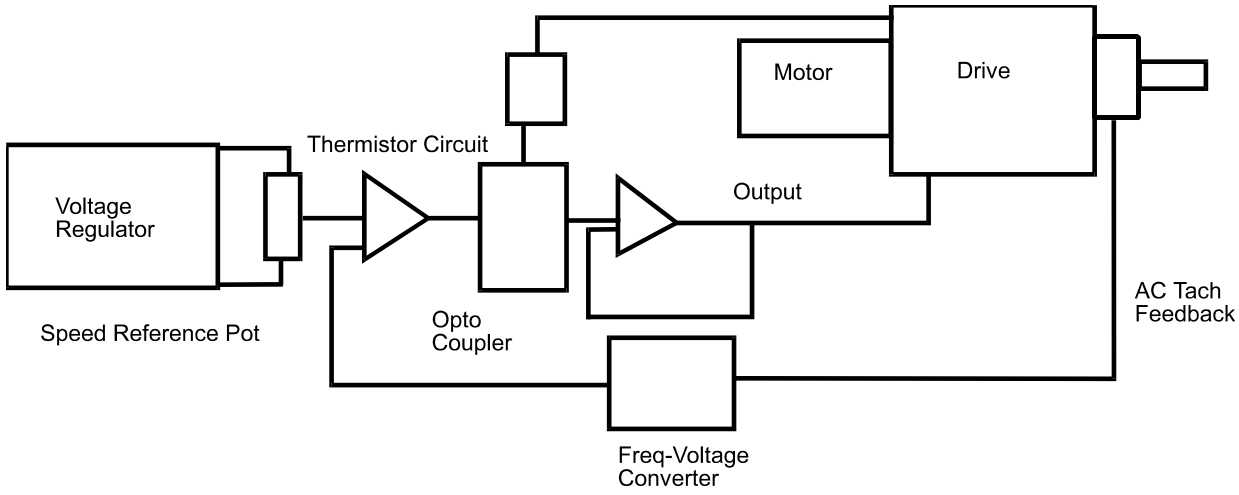
Manufacturers & Suppliers of World Class Quality Variable Speed Drives & Controls

TABLE OF CONTENTS

SYSTEM DESCRIPTION

The 4001TCP drive panel is a solid-state controller which as been developed for the aggregate industry and is used to control speed on the TORSPEC Drive. The 9 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 that 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 is an optical coupler between the 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

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: Approximate 8.0" long x 6.0" high x 1.5" deep
Weight: 1 lb.

Permissible temperature is 0-160°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 - 120V, 220 - 240V ± 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
Thermistor:	Standard PTC
Reset	Provisional for remote normally open reset
Analog Reference:	Isolated 4-20 MADC

Outputs

Maximum Nominal Output:	160 VDC
Maximum Current:	8 ADC
Reference Signal Load:	16 MADC (625 ohm)
Speed Output Signal:	0-10 VDC
Thermistor Relay Contacts	1 normally open/normally closed, rated for 0.5A @ 120VAC

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 20 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 V 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 that 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	± 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	± 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 ± 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 9 board mounted pots have the following functions:

    P2 - Minimum speed pot, factory set for zero output speed. Clockwise rotation will increase minimum speed. Interactive with max speed pot.

    P3 - Maximum speed pot, factory set at 1500/3000 RPM. Counter clockwise reduces set speed.

    P4 - Calibration for the 0 to 10 VDC meter output at terminals A13, A12, this is proportional to 0 to 100% speed.

    P5 - Set maximum 20 MADC input signal for maximum speed.

    P6 - Set 4 MADC input for zero speed.

    P7 - Gain adjust for linearity of 4-20ma signal to output signal.

    P8 - Regulation, factory preset at 1/3 clockwise. Counter-clockwise rotation improves regulation. Interactive with P2, P3, P9 and P10, these controls should be re-adjusted.

    P9 - 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.

    P10 - 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. Counter-clockwise increases speed change with load change, increases min/max speed settings.

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

12. Input Signals:

    8 to 12 VDC at terminals A11 and A12.
    4-20 MADC at A21 (+) and A22 (-) (jumper between A11 and A19)

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

    For 4 - 20 MADC, connect (+) to A21 and (-) to A22 (jumper A11 and A19).

(b) Terminals A14 and A15 is the input for an external thermistor sensor installed as a standard in the coil of the 180TCD, 225TCD, 280TCD AND 305 TCD units. **If the thermistor is not used, a jumper must be placed across A14 and A15.**

(c) Terminals A16 and A17 are for an optional remote reset contact to restore the thermistor circuit after a high temperature trip.

(d) There is a center tap normally open and normally closed contact across terminals A7, A5, and A6 respectively. These change state during a high temperature trip. The contacts are rated for 0.5A @ 120VAC or 2.0A @ 30VDC. These contacts can be used to operate an indicator light, or to open the pot circuit on terminal A10 or signal a PLC that is controlling the process equipment. It is not recommended to use these contacts to remove the power to the controller, as this will reset the thermistor circuit causing surging and chatter.

INSTALLATION

Each control has nine 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.

Check the motor RPM and place the 2 pole/4 pole jumper (JP3) in the 4P position for 1500/1800 RPM motors and in the 2P position for 3000/3600 RPM motors, for the 100, 132, 160, 180 and 225 DC clutches. For use with the 280TCD and 305TCD, the position needs to be set in the 2-pole position.

Connect the thermistor to terminals A14 and A15 if the thermistor option is being used. If the thermistor sensor is not going to be connected, then the link wire must be installed. No changes are needed if the remote reset is or is not going to be used. The red LED indicates a trip. The circuit is not internally active. The thermistor relay contact must be connected externally to provide over temperature protection.

An isolated 4-20ma input is provided on terminal A21+ and A22-. P6 is used to set the 4001TCP at minimum speed (normally zero), P5 sets the maximum speed and P7 is used to adjust the linearity of the signal.

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.

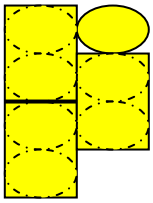
The Red LED when lit indicates that a thermal trip has occurred.

4001TCP JUMPER SETTINGS

The 4001TCP 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.

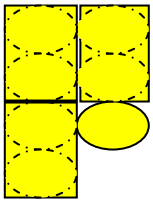
Jumpers can be set as follows to achieve desired output voltages.

JP1 JP2



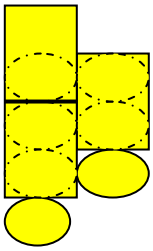
120VAC In
90VDC Out

JP1 JP2



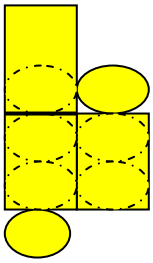
120VAC In
45VDC Out

JP1 JP2



240VAC In
90VDCout

JP1 JP2



240VAC In
180VDC Out

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.

The board is factory set for 240VAC, verify your power supply and set JP1 and JP2 accordingly. Be sure to confirm the jumper setting before powering the control, as damage will result if the wrong settings are made.

Be sure the motor starter is interlocked with the controller power supply so the controller cannot be powered up unless the motor is running. Damage to the TORSPEC drive will result if this is not done.

Apply power to the motor and verify rotation. Power up the control panel and adjust P2 for zero output volts. Turn main speed pot to maximum and set P3 to the maximum desired speed. As P2 and P3 are inter-active, a repeat of the above may be necessary.

If adjustment of P8, P9, and P10 are made, then P2 and P3 must be reset.

To calibrate the speed indicator, the drive should be set for maximum speed and P4 trim pot adjusted to provide the desired reading on the meter scale for full speed. For 4-20ma input, insert a jumper between A19 and A11. The pot cannot be connected at the same time as the jumper from A19. To use both a potentiometer and 4-ma Input contacts are required to isolate the two circuits. Set P6 so at 4ma the green led just flickers, set P5 at 20ma to the maximum desired speed. At 12ma adjust P7 to give 50% of set maximum speed. Recheck 20ma setting.

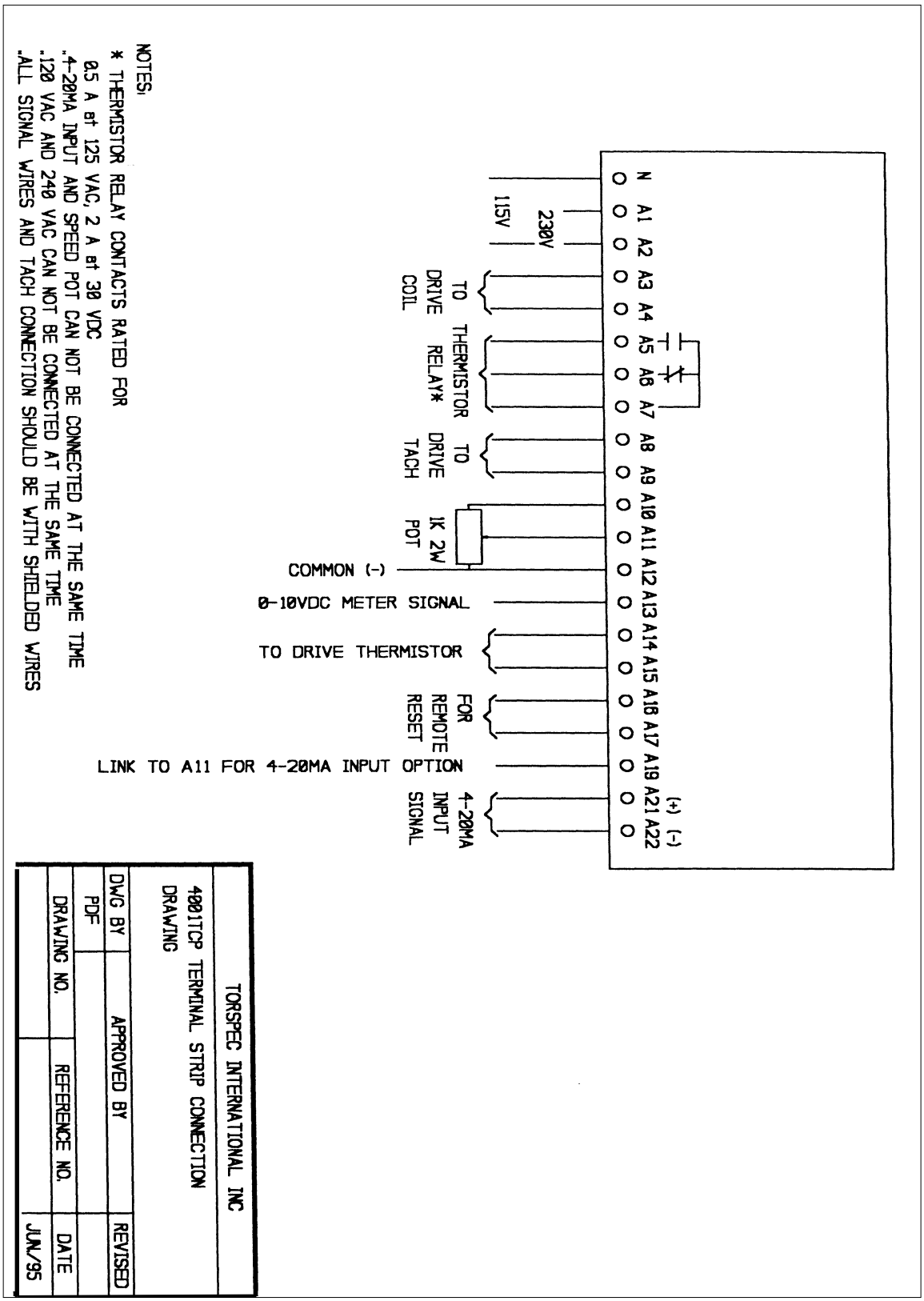
No adjustments are provided with the thermistor circuit as the thermistor sensor controls the trip point. Once tripped and the drive has cooled down, the circuit can be reset by the board mounted button, the remote reset button or by switching the power supply off, then on again.

If the controller is supplied with 240 (220)V the controller can supply a higher output voltage than the factory set 90VDC. Move jumper **JP2 only** to the 120V position. This will allow the board to supply 160VDC maximum output. This option will allow the eddy current drive to supply a higher starting torque.

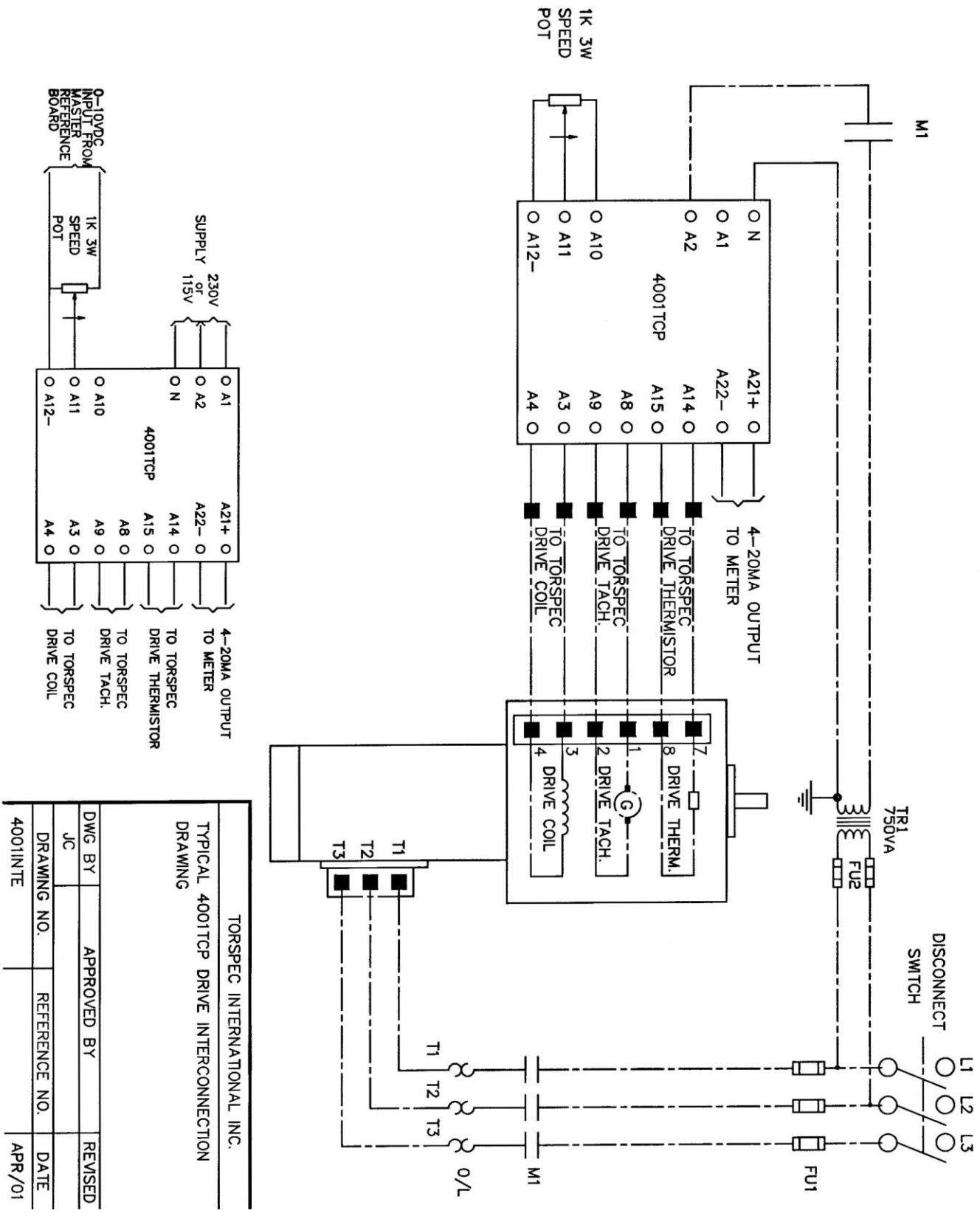
Please note, move JP2 only, also moving JP1 will result in damage to the controller.

With completion of these steps the drive is fully operational.

4001TCP CONNECTION DRAWING



4001TCP DRIVE INTERCONNECTION DRAWING



TORSPEC INTERNATIONAL INC.			
TYPICAL 4001TCP DRIVE INTERCONNECTION DRAWING			
DWG BY	APPROVED BY		REVISED
JC			
DRAWING NO.	REFERENCE NO.		DATE
4001INTE			APR/01