



D.C. Motor Control

Instruction Manual

Models

| | |
|------------|------------|
| TDP502-000 | TDP503-000 |
| TDP502-E00 | TDP503-E00 |
| TDP502-00T | TDP503-00T |
| TDP502-E0T | TDP503-E0T |
| TDP502-0RT | TDP503-0RT |
| TDP502-ERT | TDP503-ERT |
| TDP502-0PF | TDP503-0PF |
| TDP502-EPF | TDP503-EPF |



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1

General Description

The TROOPER® TDP500 Series of D.C. motor controls provides full range speed or torque control of shunt wound or permanent magnet D.C. motors. Model TDP502 operates motors between 1/8 and 2 horsepower. Model TDP503 operates motors between 1/2 and 3 horsepower. Both models are offered in a compact chassis or enclosed NEMA 4 version. Some standard features of these models are as follows:

- Model TDP502 operates at 115 or 230 VAC input for 90 or 180 VDC motor armatures
- Model TDP503 operates at 230 VAC input for 180 VDC motor armatures
- Armature voltage, tachometer, or encoder feedback selectable by programming jumper
- Adjustable acceleration from 1 to 25 seconds
- Digital logic for sequencing Start, Stop, and Jog functions
- A hard firing gating circuit
- Inner current loop for fast stable response under varying load conditions
- I.C. regulated power supplies, metal film resistors, and cermet potentiometers for stable operation with fluctuations in temperature and line voltage
- .100 quick connect type terminals for test points and optional circuit access
- Power On/Off switch(enclosed models only)
- Membrane switch control panel for Start, Stop, and Jog pushbuttons (enclosed models only)
- Torque/Taper control function with provisions for external Torque pot (Optional)
- Manual reversing-Armature and Encoder feedback only (Optional)
- Process follower feature for 4-20mA input (Optional)

2

Specifications

2.1 Electrical

AC Input

- 115 VAC $\pm 10\%$, 50/60 Hz, ± 2 Hz
- 230 VAC $\pm 10\%$, 50/60 Hz, ± 2 Hz

Suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical amps, 240V maximum.

Armature Output

- 0 - 90 VDC for 115 VAC input
- 0 - 180 VDC for 230 VAC input

Field Output

- 50/100VDC @ 1A for 115VAC input
- 100/200VDC @ 1A for 230VAC input

TDP502 Horsepower Range

- 1/8 - 1HP @ 90 VDC
- 1/4 - 2HP @ 180 VDC

TDP503 Horsepower Range

- 1/2 - 3HP @ 180 VDC

Encoder Supply

- 50mA @ 12 VDC

Current Limit

- 150% of current range selected

Adjustments

MAX: (Speed) -20 to +10% of full speed
(Torque) -20 to +10% of rated torque

MIN: (Speed) 0 to 25% of full speed
(Torque) 0 to 10% of rated torque

IR COMPENSATION: Range set by current range jumper

ACCEL: Independently adjustable from 1 to 25 seconds

TORQUE(Torque/Taper Option Only): Sets tension level for core diameter

TAPER(Torque/Taper Option Only): Sets tension level for full package diameter

Speed Regulation

- **Armature Feedback:** $\pm 1\%$ of base speed
- **Tachometer Feedback:** (7V/1000RPM) $\pm 0.5\%$ of base speed
- **Encoder Feedback:** (60 PPR) $\pm 0.5\%$ of base speed

Torque Regulation

- $\pm 2\%$ of range selected

Speed Range (determined by motor)

- 20 to 1 Typical

Power Dissipation

- TDP502: 30 Watts Maximum
- TDP503: 40 Watts Maximum

Temperature Range

- Chassis: 0 - 55°C
- Enclosed: 0 - 40°C

2.2 Physical

Refer to dimension drawings C11681 and C11682 in Section 8 for complete mounting dimension information on all models.

3

Installation

3.1 Circuit Protection

All TROOPER® models should be installed in accordance with the National Electric Code and any applicable local or state codes.

All wiring should be rated at a minimum of 90°C.

On all TROOPER® models, field wiring terminals at TB2 and TB5 are for copper conductors only and should be torqued to 12 in. - lbs.

On all TDP502 models, field wiring terminals at TB1 and TB3 are for copper conductors only and should be torqued to 7 in. - lbs.

On all TDP502 models, field wiring terminals at TB4 are for copper conductors only and should be torqued to 12 in. - lbs.

On all TDP503 models, field wiring terminals at TB1 and TB3 are for copper conductors only and should be torqued to 9 in. - lbs.

On all TDP503 models, field wiring terminal lugs L1, L2, A1, A2, and TB4 are for copper conductors only and should be torqued to 16 in. - lbs.

On TDP502 models, a 20 amp maximum circuit breaker should be used for branch circuit protection. On TDP503 models, a 30 amp maximum circuit breaker should be used for branch circuit protection.

The drives are supplied from the factory with line fuses (FU1 & FU2) sized to allow maximum horsepower rating. Use the following table to determine fuse sizes if maximum horsepower is not required.

| Table 1: Fuse Sizing | | | | |
|----------------------|-------|---------------|---------------------------|------------------|
| Model | Hp | Input Voltage | Input A.C. Current @ F.L. | Recommended Fuse |
| TDP502 | 1/8 | 115 VAC | 2.3 Amps | 3 Amp, 326 |
| | 1/4 | 115 VAC | 4.3 Amps | 5 Amp, 326 |
| | 1/2 | 115 VAC | 7.9 Amps | 8 Amp, 326 |
| | 3/4 | 115 VAC | 11.7 Amps | 15 Amp, 326 |
| | 1 | 115 VAC | 14.8 Amps | 15 Amp, 326 |
| | 1/4 | 230 VAC | 2.3 Amps | 3 Amp, 326 |
| | 1/2 | 230 VAC | 4.3 Amps | 5 Amp, 326 |
| | 1 | 230 VAC | 7.9 Amps | 8 Amp, 326 |
| | 1 1/2 | 230 VAC | 12.2 Amps | 15 Amp, 326 |
| | 2 | 230 VAC | 14.8 Amps | 15 Amp, 326 |
| TDP503 | 1/2 | 230 VAC | 4.3 Amps | 5 Amp, FLM |
| | 1 | 230 VAC | 7.9 Amps | 8 Amp, FLM |
| | 1 1/2 | 230 VAC | 12.2 Amps | 15 Amp, FLM |
| | 2 | 230 VAC | 15.0 Amps | 20 Amp, FLM |
| | 3 | 230 VAC | 22.0 Amps | 30 Amp, FLM |

Note: Fuses shown are manufactured by Littelfuse. Bussman type MDA may be substituted for type 326. Gould type TRM may be substituted for type FLM. Refer to Section 6.

3.2 Connection Information

Refer to connection diagram D11675 for all -000 models, D11676 for all -E00 models, D11677 for all -00T & -0RT models, and D11678 for all -E0T & -ERT models. Also refer to Section 3.1 to ensure proper installation.

WIRING PRECAUTIONS

WARNING:

CIRCUIT COMMON ON THE TROOPER® IS NOT EARTH OR CHASSIS GROUND. HIGH VOLTAGE POTENTIALS CAN BE PRESENT BETWEEN EARTH GROUND AND ANY POINT IN THE CIRCUIT. ALL TEST INSTRUMENTS SHOULD BE ISOLATED FROM EARTH GROUND TO PREVENT DAMAGE TO THE INSTRUMENT OR THE CONTROL. ANY INSTRUMENT CONNECTED TO THE CIRCUIT IS FLOATING AT POTENTIALS THAT APPROACH THE A.C. LINE AND SHOULD BE HANDLED WITH CARE.

Ground the control only at TB2-7 in TDP502 models and TB2-1 on TDP503 models.

Use shielded cable for all speed pot, tachometer, encoder, start, stop, and jog wiring. Connect the shield to circuit common at the control end only. These wires should be routed away from all A.C. power, armature, field and relay coil wiring.

WARNING:

CONNECTION OF THE SHIELD TO CIRCUIT COMMON PLACES THE SHIELD AT LINE POTENTIAL WITH RESPECT TO EARTH GROUND AND REQUIRES THAT THE SHIELD BE INSULATED FROM GROUND AT BOTH ENDS. FAILURE TO INSULATE PROPERLY CAN CAUSE DAMAGE TO THE CONTROL.

Any relays, contactors, motor starters, solenoids, etc. located in close proximity to or on the same A.C. line as the TROOPER® control should have a transient suppression device in parallel with the coil to minimize interference with the control.

TDP502 & TDP503 TERMINAL CONNECTIONS

TB1-1, 2, & 3 (SPEED POT): A potentiometer with a resistance value between 2K and 10K ohms connects to these terminals. The CCW lead and shield connect to terminal 1. The wiper connects to terminal 2, and the CW lead connects to terminal 3.

Start/Stop with Momentary Remote Operators (3-Wire Control)

TB1-4 & 7 (START): Momentarily closing a set of contacts across these terminals will start the drive, and allows the output to accelerate to a level set by the speed pot. No connection to these terminals is required for enclosed models, but may be used for an optional remote station.

TB1-5 & 7 (STOP): The momentary contact action required to initiate a STOP function is determined by the position of Jumper J7. For a Normally Open remote STOP operator (momentarily close to stop), place J7 in the NO position. For a normally closed remote STOP operator (momentarily open to stop), place J7 in the NC position. If no remote STOP operator is required, place J7 in the NO position and make no connection to the terminals.

Start/Stop with Maintained Remote Contact (2-Wire Control)

TB1-4/5 & 7 (START/STOP): If the drive is to be Started and Stopped with a single maintained contact, connect TB1-4 to TB1-5 and select the NC position for J7. Connect the maintained Start/Stop contact between TB1-4/5 and TB1-7; the drive will start when the contact is closed and stop when it is opened.

Caution: If 2-wire control is used with an enclosed drive, the operation of the enclosure mounted Start and Stop membrane switches is altered; both function only when they are maintained closed (pressed in). These switches can be disabled by disconnecting connector CN1 on the Trooper board.

TB1-6 & 7 (JOG): Closing a set of contacts across these terminals allows the output to accelerate to 20% output. No connection to these terminals is required for enclosed models, but may be used for an optional remote station.

TB1-8, 9, & 10 (ENCODER INPUT): An optional motor mounted 60 PPR encoder, magnetic pickup, or reluctance pickup may be connected to these terminals. Any encoder or pickup used should be capable of operating down to zero speed and have a square wave type output. Terminal 8 connects to the encoder output (open collector also acceptable), terminal 9 is the 12 VDC supply for the encoder, and terminal 10 connects to the encoder common. See connection diagrams in Section 8 for further connection information.

TB1-10 & 11 (TACHOMETER): An optional motor mounted 7 VDC/1000 RPM tachometer may be connected to these terminals for speed feedback with 1750 RPM base speed motors. Terminal 11 connects to the positive lead and terminal 10 connects to the negative lead of the tachometer. See connection diagrams in Section 8 for further connection information.

NOTE: Tachometer feedback cannot be used with reversing models.

TDP502 POWER TERMINAL CONNECTIONS

TB2-1 & 2 (AC INPUT): These terminals are used for the A.C. line input. TDP502 models will accept either 115 VAC or 230 VAC input. If 115 VAC input is used, place jumpers J2, 5 & 6 in the 115V position. If 230 VAC input is used, place jumpers J2, 5 & 6 in the 230V position.

TB2-3 & 4 (ARMATURE): Motor lead A1 connects to terminal 3 and motor lead A2 connects to terminal 4. These connections will produce CCW motor rotation when viewed from the commutator end and with the field connected as shown on the connection diagram. The armature leads should be switched if reverse rotation is desired.

NOTE: When operating in tachometer feedback, the tachometer leads must also be reversed when motor rotation is reversed.

TB2-5 & 6 (FIELD): Motor field lead F2 connects to terminal 6 and motor field lead F1 connects to terminal 5. There is no connection required for these terminals when a permanent magnet type motor is used.

TB2-7 (GROUND): This is the only terminal that should be connected to earth or chassis ground.

TDP503 POWER TERMINAL CONNECTIONS

L1 & L2 (AC INPUT): TDP503 models accept only 230 VAC input which connects to these terminals.

A1 & A2 (ARMATURE): Motor lead A1 connects to terminal A1 and motor lead A2 connects to terminal A2. These connections will produce CCW motor rotation when viewed from the commutator end and with the field connected as shown on the connection diagram. The armature leads should be switched if reverse rotation is desired.

NOTE: When operating in tachometer feedback, the tachometer leads must also be reversed when motor rotation is reversed.

TB2-1 (GROUND): This is the only terminal that should be connected to earth or chassis ground.

TB2-2 & 3 (FIELD): Motor field lead F2 connects to terminal 3 and motor field lead F1 connects to terminal 2. There is no connection required for these terminals when a permanent magnet type motor is used.

OPTIONAL TERMINAL CONNECTIONS

TDP502 REVERSING & TORQUE TAPER

TB3-1, 2 & 3 (EXTERNAL TORQUE): A potentiometer with a resistance value between 2K and 10K ohms connects to these terminals if an external torque pot is desired when using the Torque/Taper option. The CCW lead and shield connects to terminal 1. The wiper connects to terminal 2, and the CW lead connects to terminal 3.

TB3-4 & 5 (FORWARD OR REVERSE SELECT): These terminals should be connected to a selector or toggle switch when the reversing option is used. When the contact across these terminals is open, the drive will produce CCW rotation. When the contact across these terminals is closed, the drive will produce CW rotation. The motor must be at zero speed before the direction of the motor can be changed.

TB4-1 & 2 (ARMATURE INPUT): TB4-1 should be connected to TB2-3 and TB4-2 should be connected to TB2-4 when the reversing option is used.

TB4-3 & 4 (ARMATURE OUTPUT): Motor lead A1 connects to TB4-3 and Motor lead A2 connects to TB4-4 when the reversing option is used.

TDP503 REVERSING & TORQUE TAPER

TB3-1, 2, & 3 (EXTERNAL TORQUE): A potentiometer with a resistance value between 2K and 10K ohms connects to these terminals if an external torque pot is desired when using the Torque/Taper option. The CCW lead and shield connects to terminal 1. The wiper connects to terminal 2, and the CW lead connects to terminal 3.

TB3-4 & 5 (FORWARD OR REVERSE SELECT): These terminals should be connected to a selector or toggle switch when the reversing option is used. When the contact across these terminals is open, the drive will produce CCW rotation. When the contact across these terminals is closed, the drive will produce CW rotation. The motor must be at zero speed before the direction of the motor can be changed.

TB4-A1-OUT & A2-OUT (ARMATURE OUTPUT): Motor lead A1 connects to TB4-A1-OUT, and motor lead A2 connects to TB4-A2-OUT when the reversing option is used.

PROCESS FOLLOWER

TB5-1 (WIPER): On the enclosed TROOPER® models, this is the wiper from the potentiometer of the front of the enclosure. For chassis models, this is the input voltage signal for the unisolated (manual) drive. Normally a potentiometer with a resistance value between 2K and 10K ohms is used. The CCW lead and shield are connected to TB1-1.

The wiper connects to TB5-1, and the CW lead connects to TB1-3.

TB5-2 (OUTPUT): This is the signal output terminal from the Process Follower Option board. A jumper is connected from TB5-2 to TB1-2.

TB5-3 & 4 (MAN/AUTO): A SPST switch is connected across these two terminals. When the switch is open, the drive is set to manual control. When the switch is closed, the drive is set to automatic control.

TB5-5 (VOLTS IN): This terminal is used if the reference signal is to be 0 to 10V. Remember to set the J3 jumper to VOLTS.

TB5-6 (AMPS IN): This terminal is used if the reference signal is to be 4 to 20mA. Remember to set the J3 jumper to AMPS.

TB5-7 (INPUT COMMON): This is the circuit common for the isolated (automatic) input signal.

4

Programming & Adjustments

4.1 Programming Jumpers

J1 (SPEED TORQUE): J1 selects either speed or torque mode.

J2 (AC INPUT VOLTAGE): J2 selects the armature feedback voltage level according to the A.C. line voltage to be used. Position at 115V for 115 VAC input or 230V for 230 VAC input.

NOTE: TDP502 models only. Jumper is omitted on TDP503 models.

J3 (ARMATURE CURRENT/TORQUE RANGE): Five full load current ranges are selectable for different motors. The Current Limit range is fixed at 150% of the value selected. Refer to the following tables to select the proper jumper location based on motor horsepower and input voltage.

| Table 2: Model TDP502 | | | | | |
|-----------------------|--------------------|--------|--------|----------|------|
| INPUT VOLTAGE | J3 JUMPER POSITION | | | | |
| | 1.5A | 3A | 6A | 8A | 10A |
| 115 VAC | 1/8 HP | 1/4 HP | 1/2 HP | 3/4 HP | 1 HP |
| 230 VAC | 1/4 HP | 1/2 HP | 1 HP | 1 1/2 HP | 2 HP |

| Table 3: Model TDP503 | | | | | |
|-----------------------|--------------------|------|----------|------|------|
| INPUT VOLTAGE | J3 JUMPER POSITION | | | | |
| | 3A | 6A | 8A | 10A | 15A |
| 230 VAC | 1/2 HP | 1 HP | 1 1/2 HP | 2 HP | 3 HP |

J4 (FEEDBACK MODE): Either armature, tachometer, or encoder feedback is selected by J4. For Torque Regulator mode, remove J4 so that no speed feedback is applied to the circuit.

NOTE: When operating in tachometer or encoder feedback, the IR COMP pot must be turned full CCW. Also, tachometer feedback cannot be used with reversing models.

J5 & J6 (A.C. INPUT VOLTAGE): The J5 and J6 jumper wires program the supply transformer according to the A.C. line voltage to be used. Position each at 115V for 115 VAC input or 230V for 230 VAC input.

NOTE: TDP502 models only. Jumpers are omitted on TDP503 models.

J7 (STOP MODE): Jumper J7 determines the type of remote operator required to STOP the Trooper® control. For a Normally Open STOP operator, place J7 in the NO position. For a Normally closed STOP operator, place J7 in the NC position. If no remote STOP operator is required, place J7 in the NO position and make no connection to Terminal TB1-5. Reference Section 3.2 for additional information.

4.2 Potentiometers

P1 ACCEL (ACCELERATION TIME): ACCEL sets the acceleration time from 1 to 25 seconds. Clockwise rotation increases the time taken to accelerate the motor linearly to full speed. To accelerate to speeds less than full speed will take less time. To accelerate to 50% speed would take 50% of the accel time.

P2 MAX (MAXIMUM): MAX sets the maximum motor speed when the speed pot is set for 100%. Clockwise rotation increases speed. When the control is used as a torque regulator; the MAX pot sets the maximum torque level.

P3 MIN (MINIMUM): MIN sets the minimum motor speed when the speed pot is set to zero. Clockwise rotation increases the output speed. In the torque regulator mode, this pot sets the minimum torque level.

P4 IR (IR COMP): IR provides a signal proportional to armature current to compensate for motor losses as the motor load increases. This improves speed regulation in armature feedback. Clockwise rotation increases the compensation. When tachometer or encoder feedback is used, or when the control is operated as a torque regulator, the IR pot should be set to minimum (full CCW).

4.3 Adjustment Procedure: Speed Regulator

Step 1

Visually inspect all connections to check for tightness, proper insulation, and agreement with the connection diagram. ONLY TB2-7 on TDP502 models and TB2-1 on TDP503 models should be connected to earth ground.

Verify the proper line voltage level. On TDP502 models, verify the proper jumper locations of J2, J5, & J6.

Place jumper J1 in the SPD position.

Note the motor nameplate full load current and select the proper current range at J3. Place jumper J4 in the ARM position even if tachometer or encoder feedback is to be used.

Initially set the potentiometers as follows:

MIN.....fully CCW

MAX.....mid-range

IR.....fully CCW

ACCEL.....mid-range

Step 2

With no load on the motor or machine and with the speed pot at zero, apply power to the control. Momentarily close a set of contacts across TB1-4 & 7 to start drive. Enclosed models only require pressing the start button.

Increase the MIN pot CW until the motor just begins to creep and then CCW until the motor just stops.

Step 3

Rotate the speed pot to maximum. Measure the motor speed or armature voltage. Adjust the MAX pot for base speed or full rated armature voltage.

Step 4

NOTE: Armature Feedback Only- Omit this step if tachometer Feedback is used.

Adjust the speed pot to mid range or, if known, the speed at which the motor will be run most often. Closely note the motor or line speed. Apply rated or normal machine load to the motor. The speed will usually drop off a small percentage. Increase the IR pot clockwise until the loaded speed matches the unloaded speed. Recheck the unloaded speed level and repeat this step until there is no difference in speed from no load to full load.

NOTE: The signal from the IR pot may affect the MIN and MAX pot settings. Recheck MIN and MAX speed after adjusting the IR pot and readjust if necessary.

Step 5

NOTE: Tachometer Feedback Only- Omit this step if Armature or Encoder Feedback is used.

With the control in Armature Feedback, run the motor and measure the tachometer voltage at TB1-11 and 10. Verify that terminal 11 is positive with respect to terminal 10. Remove power and reverse the connections if necessary to correct the polarity.

Remove power from the control. Move J4 from the AFB position to the TFB position. Adjust the IR pot to minimum (full CCW).

NOTE: The decel rate on the TROOPER® is fixed. If the decel rate is required to be the same as the accel rate, clip diode D4 out of the circuit.

4.4 Adjustment Procedure: Torque Regulator

Step 1

Visually inspect all connections to check for tightness, proper insulation, and agreement with the connection diagram. ONLY TB2-7 on TDP502 models and TB2-1 on TDP503 models should be connected to earth ground.

Verify the proper line voltage level. On TDP502 models, verify the proper jumper locations of J2, J5, & J6.

Place jumper J1 in the TORQ position.

Note the motor nameplate full load current and select the proper current range at J3. Remove jumper J4.

Initially set the potentiometers as follows:

MIN.....full CCW
MAX.....mid-range
IR.....full CCW
ACCEL.....mid-range

Note: In the following steps, motor torque should be monitored directly by use of a D.C. ammeter in series with the armature. Full rated torque is produced at full rated current. The motor shaft must be mechanically locked to prevent rotation.

Step 2

In The Torque Regulator mode, the external pot connected to TB1-1, 2, & 3 becomes the torque reference pot. Turn this pot full CCW. Apply power to the control and momentarily close a set of contacts across TB1-4 & 7 to start the drive. Enclosed models only require pressing the start button.

Step 3

Adjust the MIN pot clockwise to set the minimum current level with the torque reference pot at zero.

Step 4

Turn the torque reference pot to 100%. Adjust the Max pot clockwise to set the current for 100% of rated motor current.

NOTE: DO NOT operate the motor for more than several seconds at full load while stalled to prevent overheating.

Step 5

Adjust the ACCEL to control the desired rate of increase in current in response to a change in the torque reference pot.

Step 6

Turn off the power and remove the mechanical lock from the motor shaft. The Torque Regulator is now ready for use. Use caution in operating the motor at slow speeds near rated torque to prevent overheating. Verify the speed range of the motor to determine the lowest continuous operating speed at full torque.

4.5 Adjustment Procedure: Torque Taper Option

General: The Torque/Taper option allows the Trooper drive to operate as a speed controller with the motor torque operating level acting as a "speed subtracting" signal. The net effect is "motor torque increase only with a corresponding speed decrease".

The Speed/Torque characteristic can be adjusted to closely match that required by "Constant Tension" **center driven winders** for diameter increases approaching three times the core diameter, a 3:1 build range.

The slope or amount of torque increase versus speed decrease is controlled by the TAPER pot. With the Taper pot adjusted to Minimum, full CCW rotation, the torque limiting action is similar to normal "current limiting" in a drive where an increase in motor torque loading above the Current Limit, i.e. Torque Limit, level will cause a rapid fall-off in motor speed to a **stalled** condition.

The main difference here is that use of the Torque Taper option allows an unloaded Maximum Speed level and the Torque level to be adjusted.

Turning the TAPER pot up, CW rotation, will extend the slope of the Torque/Taper action so that more torque is allowed but, only at a decreased speed. For **constant** tension control, a doubling of motor torque (DC motor armature amperes) should cause the speed to be reduced to one half.

Constant tension is not always required; sometimes the finished winder package looks better with slightly less than constant tension. This is Taper Tension.

The Torque/Taper option also makes a good **surface drive "pull roll"** controller to help maintain a taut web even under an increasing load condition where a constant torque pull roll may be stalled. An example of this would be where material is being pulled through a process that sees a load increase due to an abnormal thickness increase. Use of an extended Taper setting may allow a slow down but, with a corresponding increase in motor torque which "pulls through" the thicker material.

Adjustment Steps:

Step 1

Refer to connection diagram D11677 for all -00T & -0RT models, and D11678 for all -E0T & -ERT models.

Control Board:

Place jumper J1 in the SPD, Speed, position and J4 in the AFB position.

Note the AC line voltage level and on TDP502 models, set corresponding jumper positions for J2, J5, & J6. These jumpers are not on TDP503 models.

Note the motor nameplate full load amperes and select the proper current range with J3.

Place a jumper between TB1-2 & 3.

Initially set the potentiometers as follows:

MIN.....full CCW
MAX.....mid-range
IR.....full CCW
ACCEL.....mid-range

Torque/Taper Option Board:

Note the AC line voltage level and set corresponding jumper positions for J1 & J2.

Initially set the potentiometers as follows:

TORQUE.....full CW

TAPER.....full CCW

Step 2

If an External or door mounted TORQUE Pot is used, turn the P.C. board mounted TORQ pot fully CCW. Connect the external torque pot to TB3 with the CCW lead on TB3-1, the wiper on TB3-2 and the CW lead to TB3-3.

Note: The board mounted TORQ pot can still be used as a MINIMUM Torque pot.

Step 3

Turn the TORQUE potentiometer full CW.

Step 4

With no load on the motor, apply power and start the drive. Adjust the no load speed (core speed) using the MAX potentiometer. Use the ACCEL potentiometer to adjust the acceleration time on start-up.

Step 5

With material loaded, start the drive and adjust the TORQUE potentiometer counter-clockwise to set the desired tension at core (counter-clockwise decreases tension). The **TORQUE LIMIT** light turns on when the drive begins to limit the motor Torque.

Step 6

As maximum diameter is reached, adjust the TAPER potentiometer clockwise to set the material Tension (clockwise increases torque).

4.6 Adjustment Procedure: Process Follower Option

Step 1

Refer to the connection diagram D11679 for all -OPF models and D11680 for all -EPF models.

Step 2

Place J3 in the VOLTS position if the automatic (or remote) signal is to be a voltage reference between 0 and +10 volts. If the reference is to be a current reference between 4 and 20mA, place J3 in the AMPS position.

Note the AC line voltage level and set corresponding jumper positions for J1 & J2.

Step 3

Final TROOPER® setup can be done in either automatic or manual mode by simply selecting the desired mode with the AUTO/MAN switch and following the proper adjustment procedure. For Speed Regulator mode, refer to Section 4.3. For Torque Regulator mode, refer to Section 4.4.

Contactor Reversing, Torque/Taper & Process Follower Models

There are 12 models which have either Reversing and Torque/Taper, Torque/Taper only, or Process Follower Options. The TDP502 models cover the 1/8 to 2 HP range, and the TDP503 models cover the 1/2 to 3HP range. The reversing models are provided with a zero speed circuit which prevents the motor from changing direction until the motor is brought to a complete stop.

MODEL TDP502-00T is a chassis unit which has only the torque/taper option. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11677 in Section 8 for connections to model TDP502-00T.

MODEL TDP502-0RT is a chassis unit which has both the torque/taper and reversing options. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11677 in Section 8 for connections to model TDP502-0RT.

MODEL TDP502-0PF is a chassis unit which features a process follower option. This option allows the drive to be operated with a 4 to 20mA signal or an external voltage reference that may be common to other drives or equipment. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11679 in Section 8 for connections to model TDP502-0PF.

MODEL TDP502-E0T is an enclosed unit which has only the torque/taper option. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11678 in Section 8 for connections to model TDP502-E0T.

MODEL TDP502-ERT is an enclosed unit which has both the torque/taper and reversing options. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11678 in Section 8 for connections to model TDP502-ERT.

MODEL TDP502-EPF is an enclosed unit which features a process follower option. This option allows the drive to be operated with a 4 to 20mA signal or an external voltage reference that may be common to other drives or equipment. A mounted switch allows operation in manual or auto mode. It operates from 115 or 230 VAC for 90 or 180VDC motors. Refer to connection diagram D11680 in Section 8 for connections to model TDP502-EPF.

MODEL TDP503-00T is a chassis unit which has only the torque/taper option. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11677 in Section 8 for connections to model TDP503-00T.

MODEL TDP503-0RT is a chassis unit which has both the torque/taper and reversing options. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11677 in Section 8 for connections to model TDP503-0RT.

MODEL TDP503-0PF is a chassis unit which features a process follower option. This option allows the drive to be operated with a 4 to 20mA signal or an external voltage reference that may be common to other drives or equipment. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11679 in Section 8 for connections to model TDP503-0PF.

MODEL TDP503-E0T is an enclosed unit which has only the torque/taper option. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11678 in Section 8 for connections to model TDP503-E0T.

MODEL TDP503-ERT is an enclosed unit which has both the torque/taper and reversing options. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11678 in Section 8 for connections to model TDP503-ERT.

MODEL TDP503-EPF is an enclosed unit which features a process follower option. This option allows the drive to be operated with a 4 to 20mA signal or an external voltage reference that may be common to other drives or equipment. A mounted switch allows operation in manual or auto mode. It operates at 230 VAC for 180VDC motors. Refer to connection diagram D11680 in Section 8 for connections to model TDP503-EPF.

6

Spare Parts

Motor Control Assemblies

| | |
|----------|------------|
| 2HP..... | D10783-000 |
| 3HP..... | D10980-000 |

Printed Circuit Assemblies

| | |
|--|------------|
| 2HP Reversing & Torque/Taper Option..... | C10820-000 |
| 2HP Torque/Taper Option..... | C10820-001 |
| 3HP Reversing & Torque/Taper Option..... | C11036-000 |
| 3HP Torque/Taper Option..... | C11036-001 |
| Process Follower Option..... | C11087-000 |

Fuses

FU1 & FU2: Line Fuse, time delay, 250 VAC

15 Amp (2HP)

| | |
|-----------------|------------|
| Carotron..... | FUS1005-00 |
| Littelfuse..... | 326015 |
| Bussmann..... | MDA-15 |

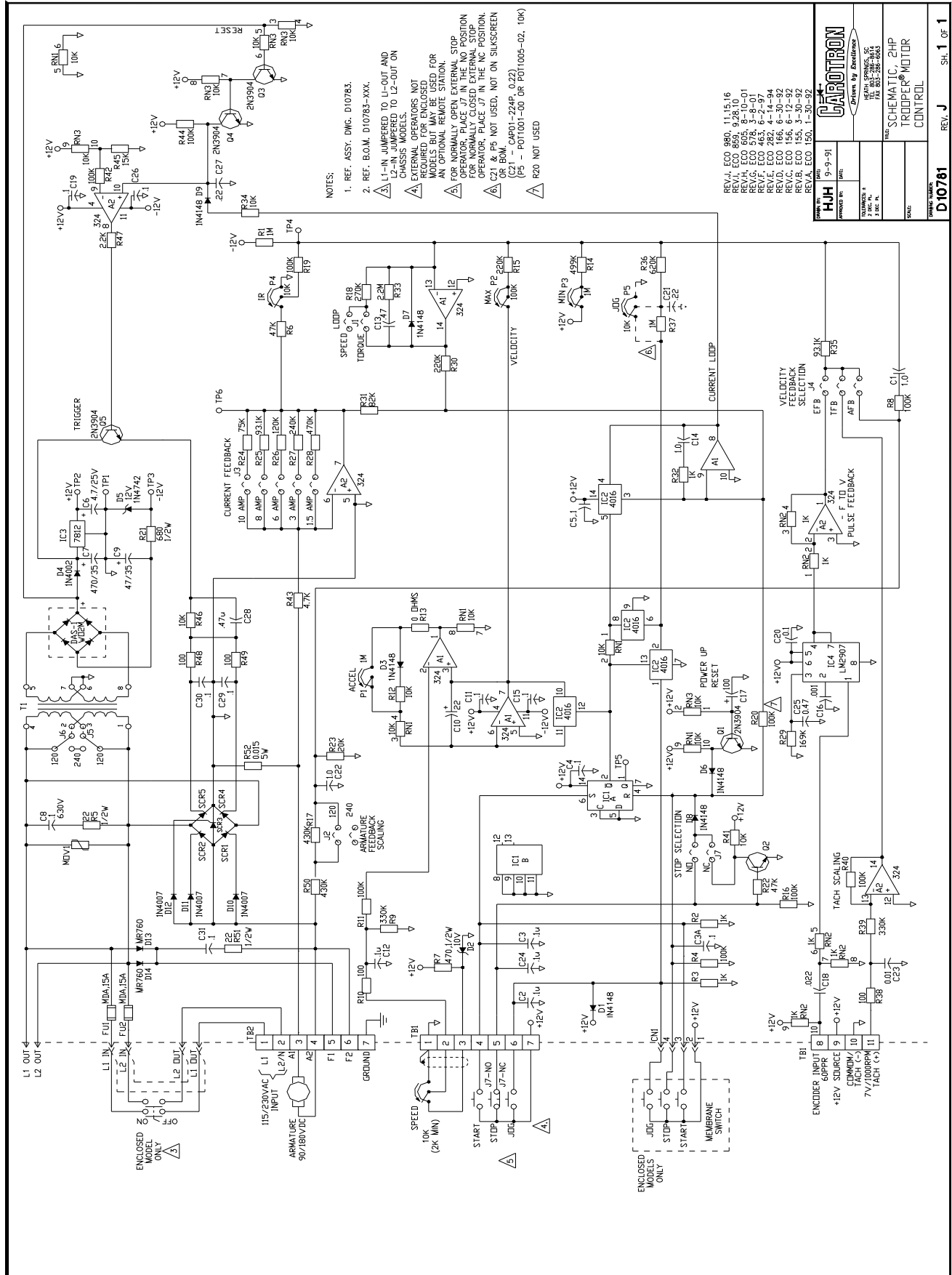
30 Amp (3HP)

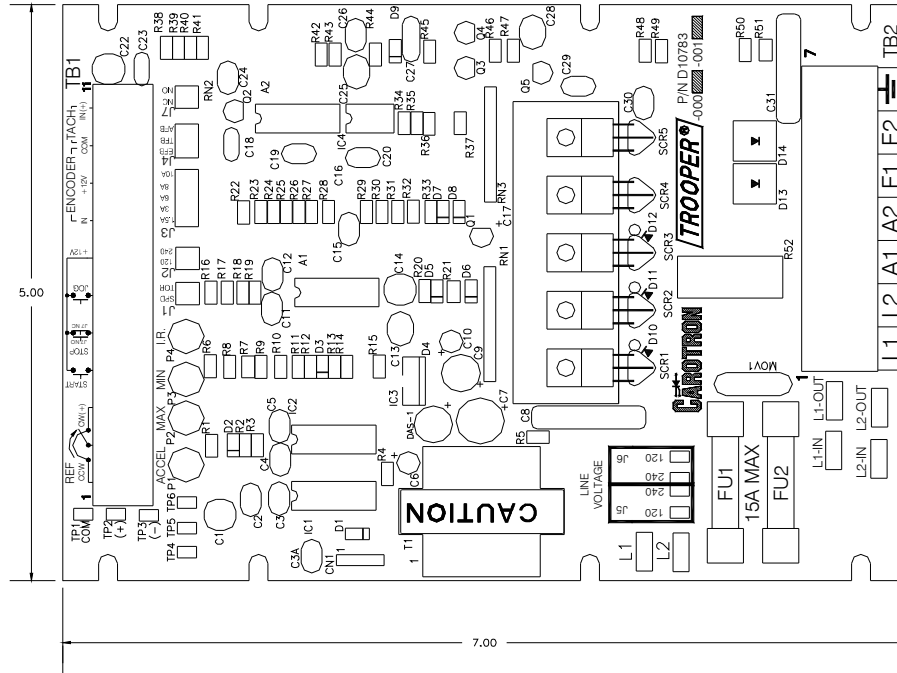
| | |
|-----------------|------------|
| Carotron..... | FUS1001-05 |
| Littelfuse..... | FLM-30 |
| Gould..... | TRM-30 |

Miscellaneous

| | |
|--------------------------------------|------------|
| Control Panel (membrane switch)..... | SWI5002-00 |
|--------------------------------------|------------|

| | |
|--|------------|
| Torque/Taper Conversion Kit..... | TDP500-001 |
| Reversing & Torque/Taper Conversion Kit..... | TDP500-002 |
| Process Follower Conversion..... | TDP500-005 |

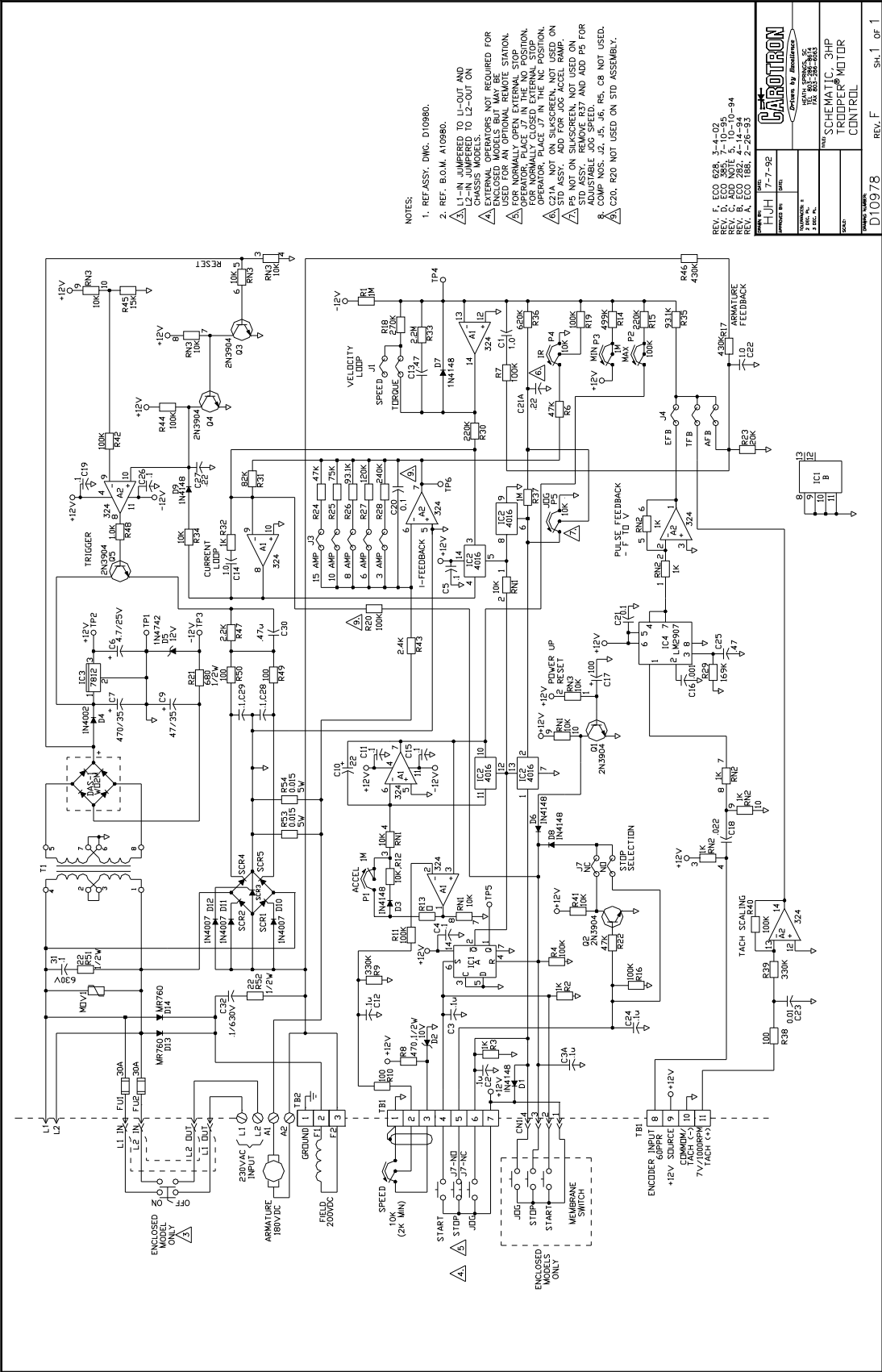


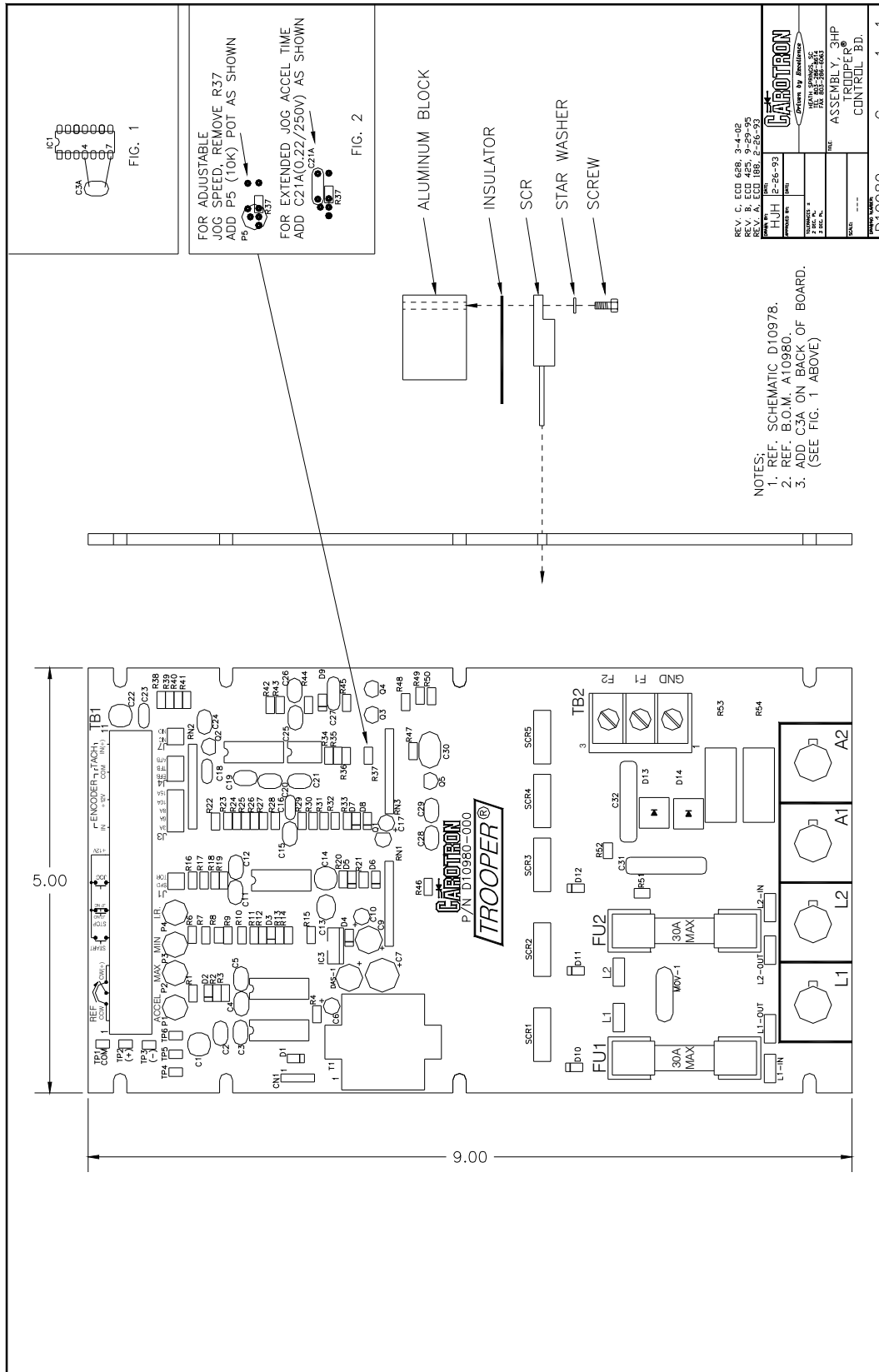


- NOTES:
1. FOR STD MODELS: REF SCHEM D10781 / BOM D10783-000
 2. FOR -LV MODELS: REF SCHEM D12401 / BOM D10783-001

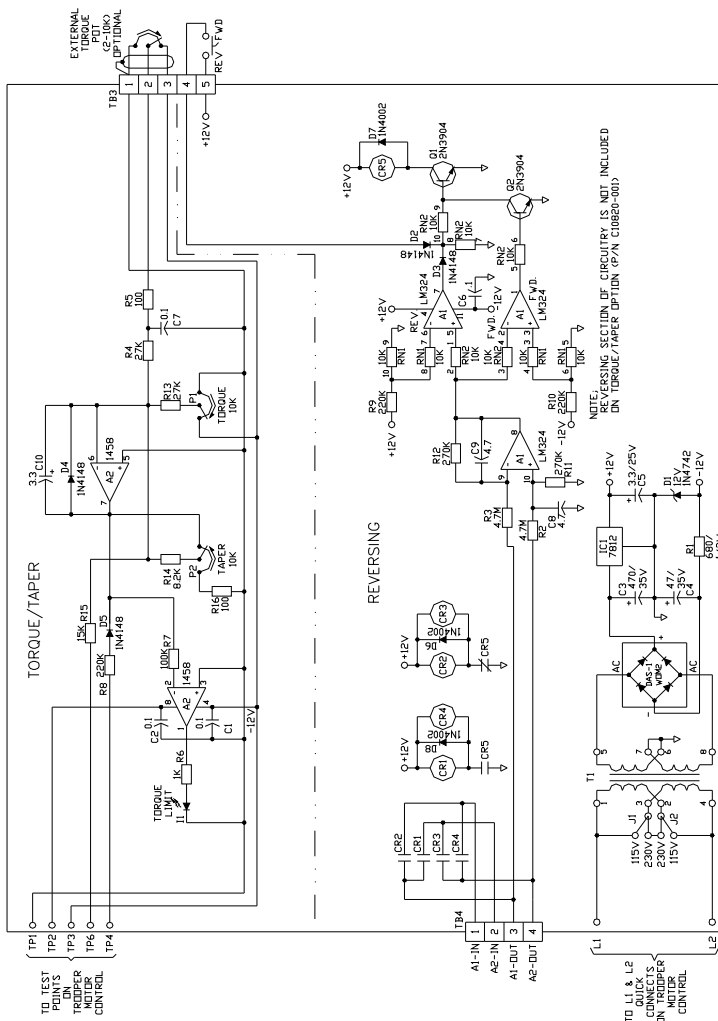
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 REV. ECO 658, 8-10-10
 REV. ECO 608, 3-10-03
 REV. ECO 605, 8-10-01
 REV. ECO 578, 3-5-01
 REV. ECO 483, 1-31-01
 REV. ECO 1568-12-92
 REV. ECO 1502-4-92

| | | |
|---|-------|----------|
| WPM | | 12-11-91 |
| DESIGNED BY | DATE | |
| APPROVED BY | DATE | |
| CAROTRON <i>Driven by Excellence</i> 6470A, CHAMBERS, SC TEL: 803-286-3614 FAX: 803-286-3615 | | |
| TITLE ASSY, TROOPER [®] 2HP MOTOR CONTROL | | |
| SCALE | | |
| PART NUMBER D10783 | | |
| REV. I | SH. 1 | OF 1 |



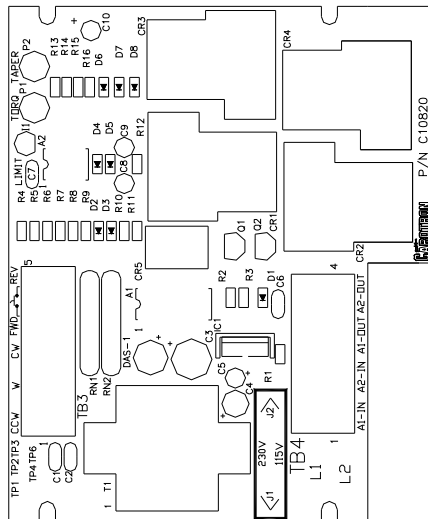


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| REV. B, ECD 423, 2-29-95 | |
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SCHEMATIC C10818

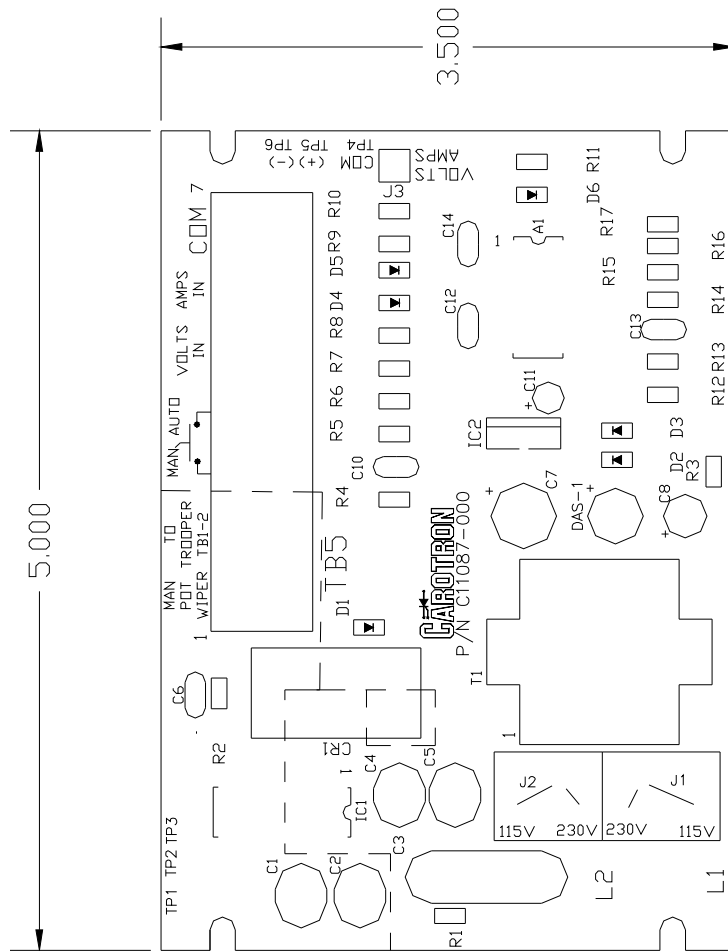
- NOTES:
1. REF. ASSY. DWG. C10820.
2. REF. B.O.M.
ASSY. C10820-000; A10820-000 - INCLUDED ON TDP500-002
ASSY. C10820-001; A10820-001 - INCLUDED ON TDP500-001



ASSEMBLY C10820

- NOTES:
1. REF. B.O.M.:
ASSY C10820-000: A10820-000
ASSY C10820-001: A10820-001
ASSY C10820-002: A10820-002
2. REF. SCHEM. DWG. C10818
3. C3,C4,C5,C6,C8,C9,J1,J2,
D1,D2,D3,D6,D7,D8,DAS-1,
IC1A1,CR1-5,R1,R2,R3,R9,
R10,R11,R12,RN1,RN2,TB4,T1,
Q1 & Q2 ARE NOT USED
ON ASSY C10820-001

| | | | |
|---------------------------------------|--------|---|--|
| DATE | 6-9-95 |  Carotron | |
| DESIGNED BY | BKP | Drawn by Bentzen | |
| INVENTED BY | JMC | TO: THE NEW YORK TEL: 212-261-1000 FAX: 212-261-0663 | |
| DIMENSIONS: 1" HP 3" REC. N. - 3HP | | TITLE SCHEMATIC & ASSEMBLY, REVERSING TORQUE TAPER OPTION | |
| SCALE | | | |
| DRAWING NUMBER D11673 | | REV. SH. 1 OF 1 | |

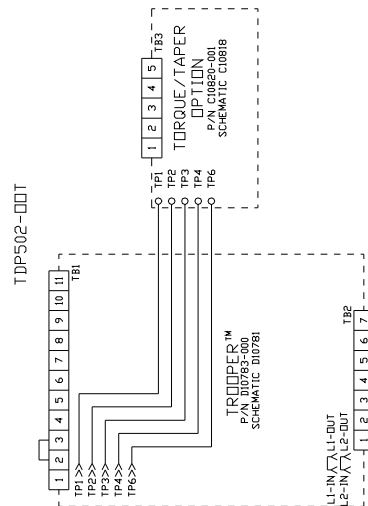
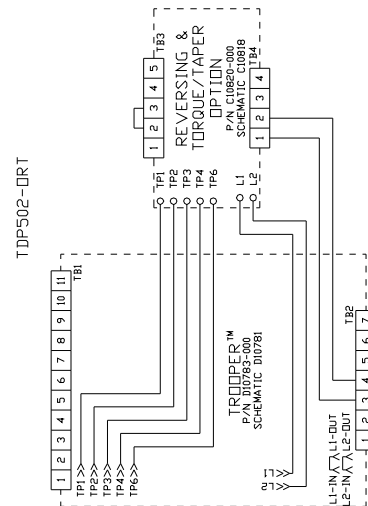


REV. A, ECO 201, 6-10-93

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| APPROVED BY: | DATE: |
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| 3 DEC. PL | |
| SCALE: | |
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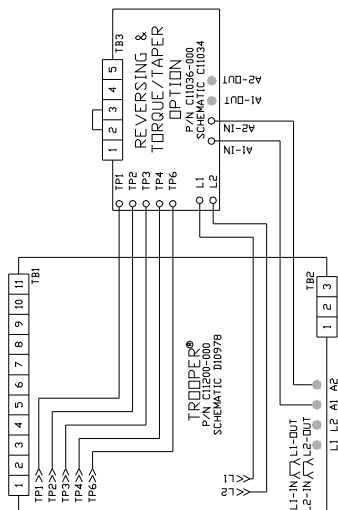
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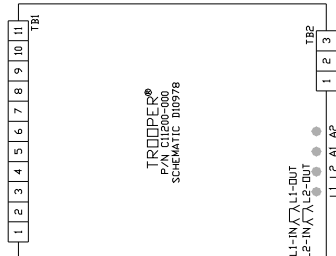


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| DRAWN BY HJH | | DATE 1-29-92 | |
| APPROVED BY | | DATE | |
| TOLERANCES: FRACTIONS: 1/16" MIN. DEC. INCHES: .005" MIN. | | TITLE WIRING DIAGRAM TROOPER® CHASSIS MODELS | |
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| DRAWING NUMBER 10821 | | PART NUMBER | |

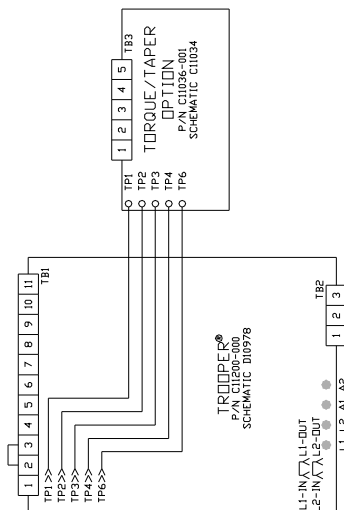
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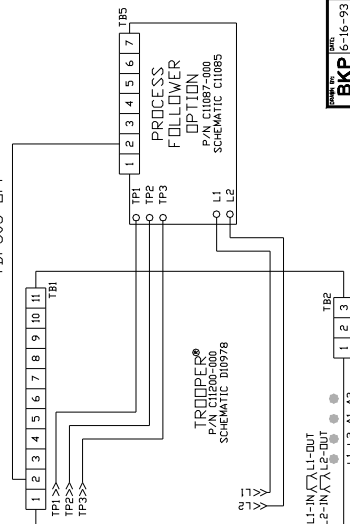
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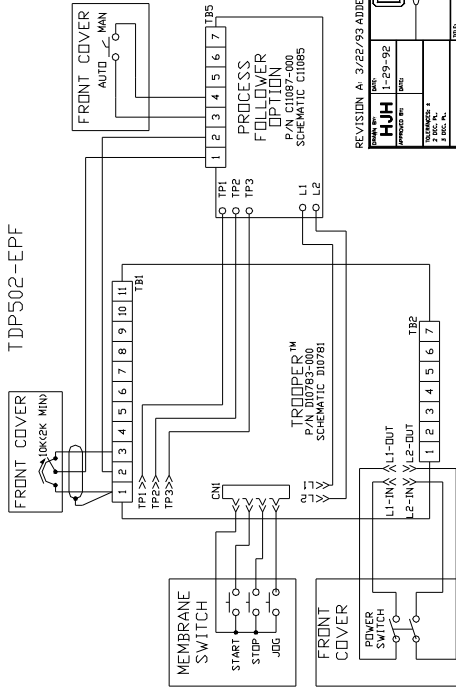
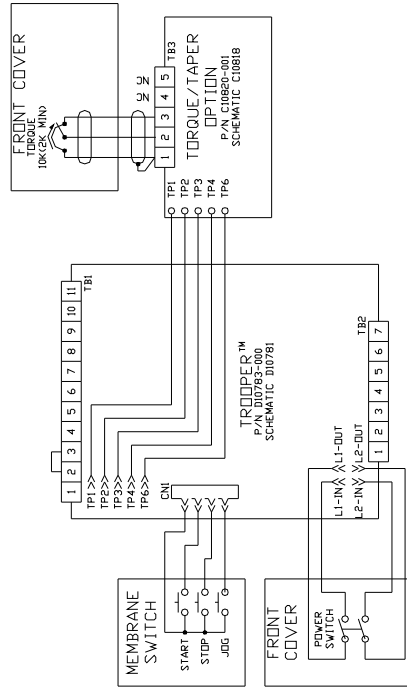
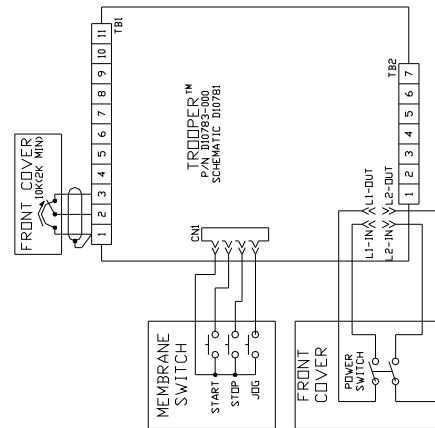
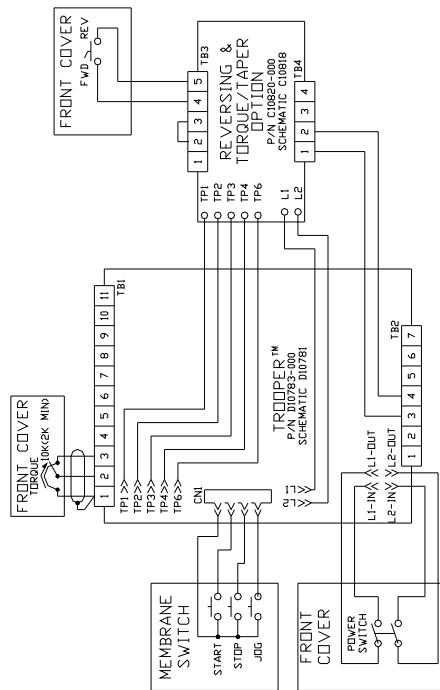


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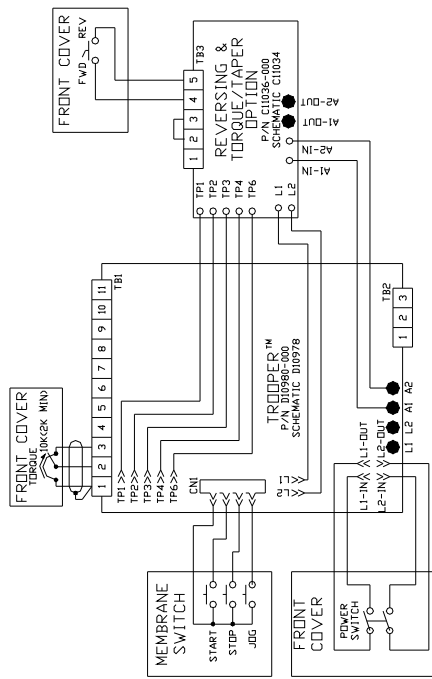


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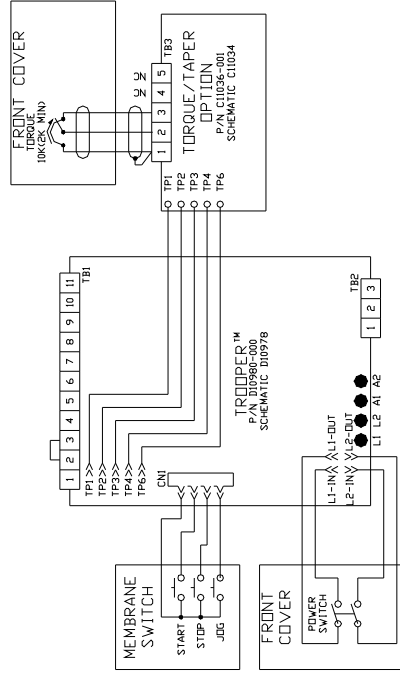
WIRING DIAGRAM
TROOPER
3HP CHASSIS MODELS
REV. 1 OF 1

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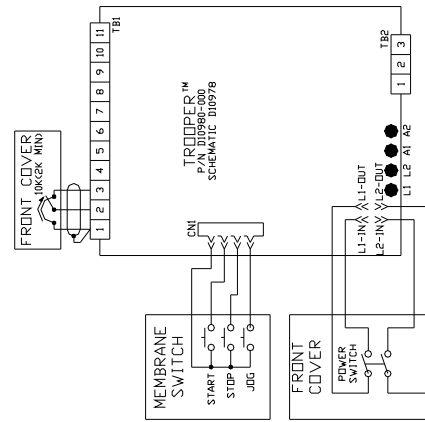
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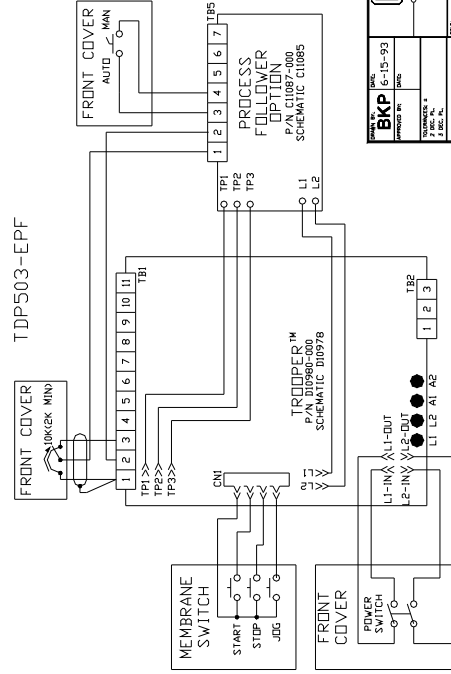
TDP503-EOT



TDP503-EOD



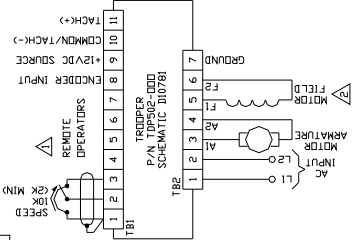
TDP503-EFP



| | | |
|--|---------------------------------------|---|
| BK 6-15-93 2 DOC. Pgs. 3HP ENCLOSED MODELS | CAUTION Drive by Revolution | WIRING DIAGRAM TROOPER™ 3HP ENCLOSED MODELS |
| | | |
| D11198 REV. 1 OF 1 | | |

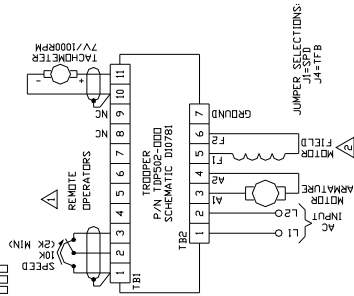
GENERAL CONNECTIONS FOR VELOCITY MODE

TDP502-000



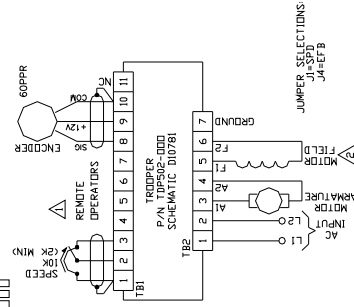
CONNECTIONS USING TACH FEEDBACK

TDP502-000



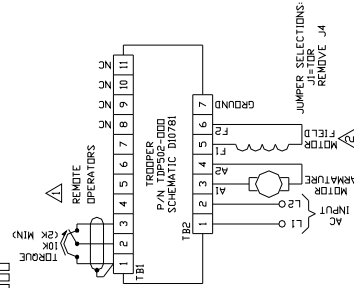
CONNECTIONS USING ENCODER FEEDBACK

TDP502-000



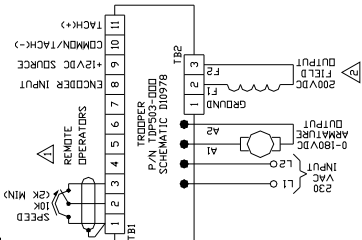
CONNECTIONS FOR TORQUE MODE

TDP502-000



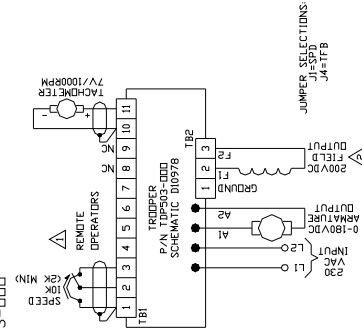
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TDP503-000



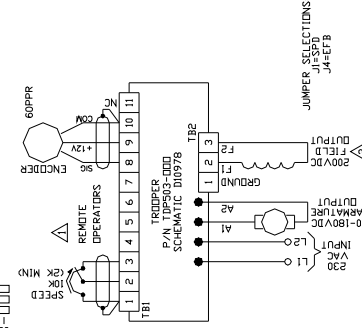
CONNECTIONS USING TACH FEEDBACK

TDP503-000



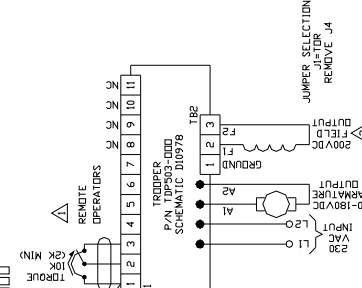
CONNECTIONS USING ENCODER FEEDBACK

TDP503-000



CONNECTIONS FOR TORQUE MODE

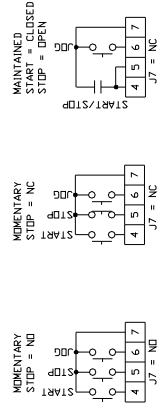
TDP503-000



| JUMPER SELECTION CHART - TDP502 ONLY | | | |
|--------------------------------------|--------|--------|--------|
| INPUT | IP | IS | IS |
| 115VAC | 115VAC | 115VAC | 115VAC |
| 230VAC | 230VAC | 230VAC | 230VAC |

| MOTOR RATING CHART | | | |
|--------------------|--------|----------|-----------|
| MODEL | INPUT | RANGE | ARMATURE |
| TDP502 | 115VAC | 1/4-2 HP | 0-180 VDC |
| TDP502 | 230VAC | 1/4-2 HP | 0-180 VDC |
| TDP503 | 230VAC | 1/4-2 HP | 0-180 VDC |

REMOTE OPERATOR CONNECTIONS

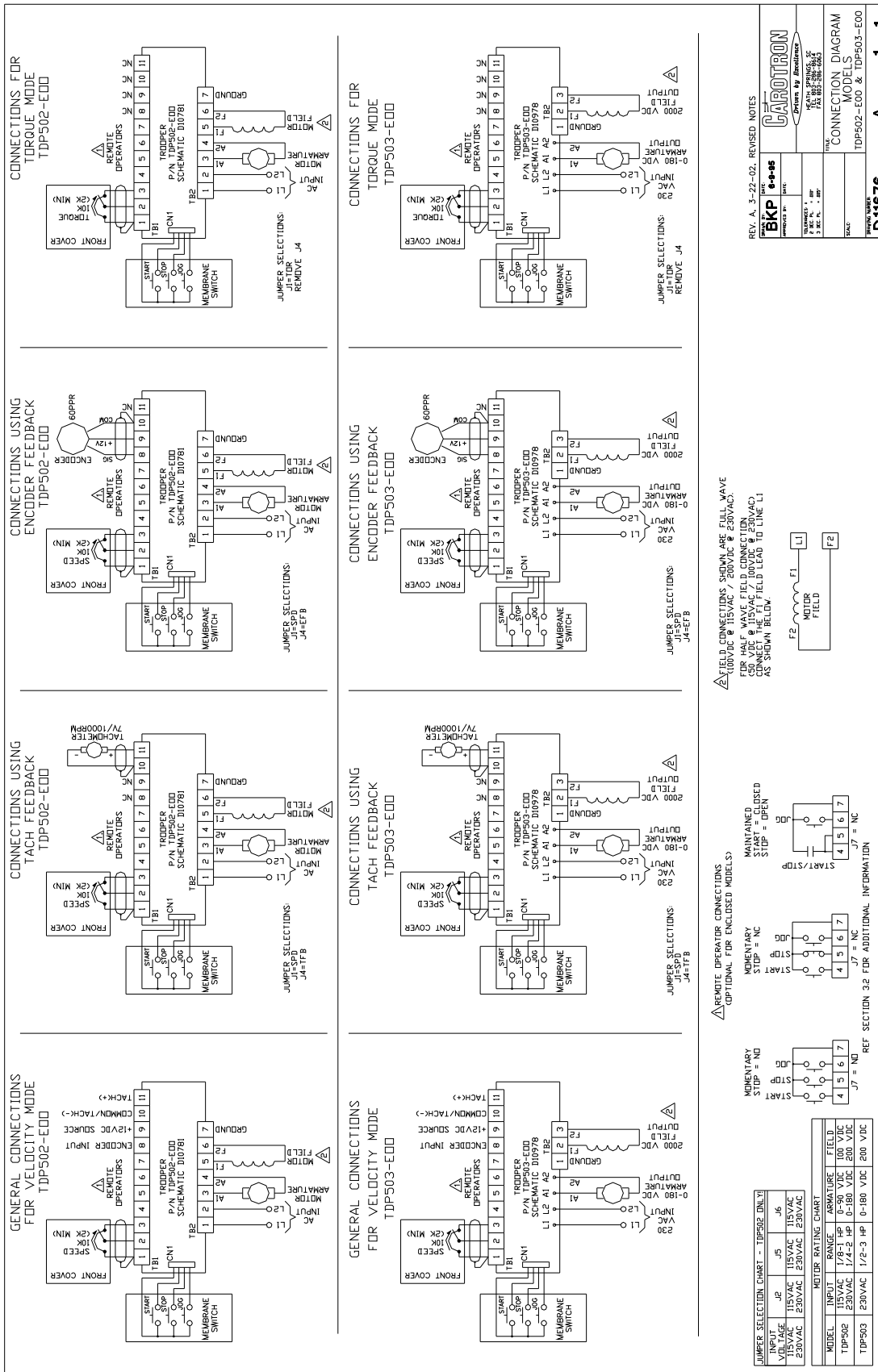


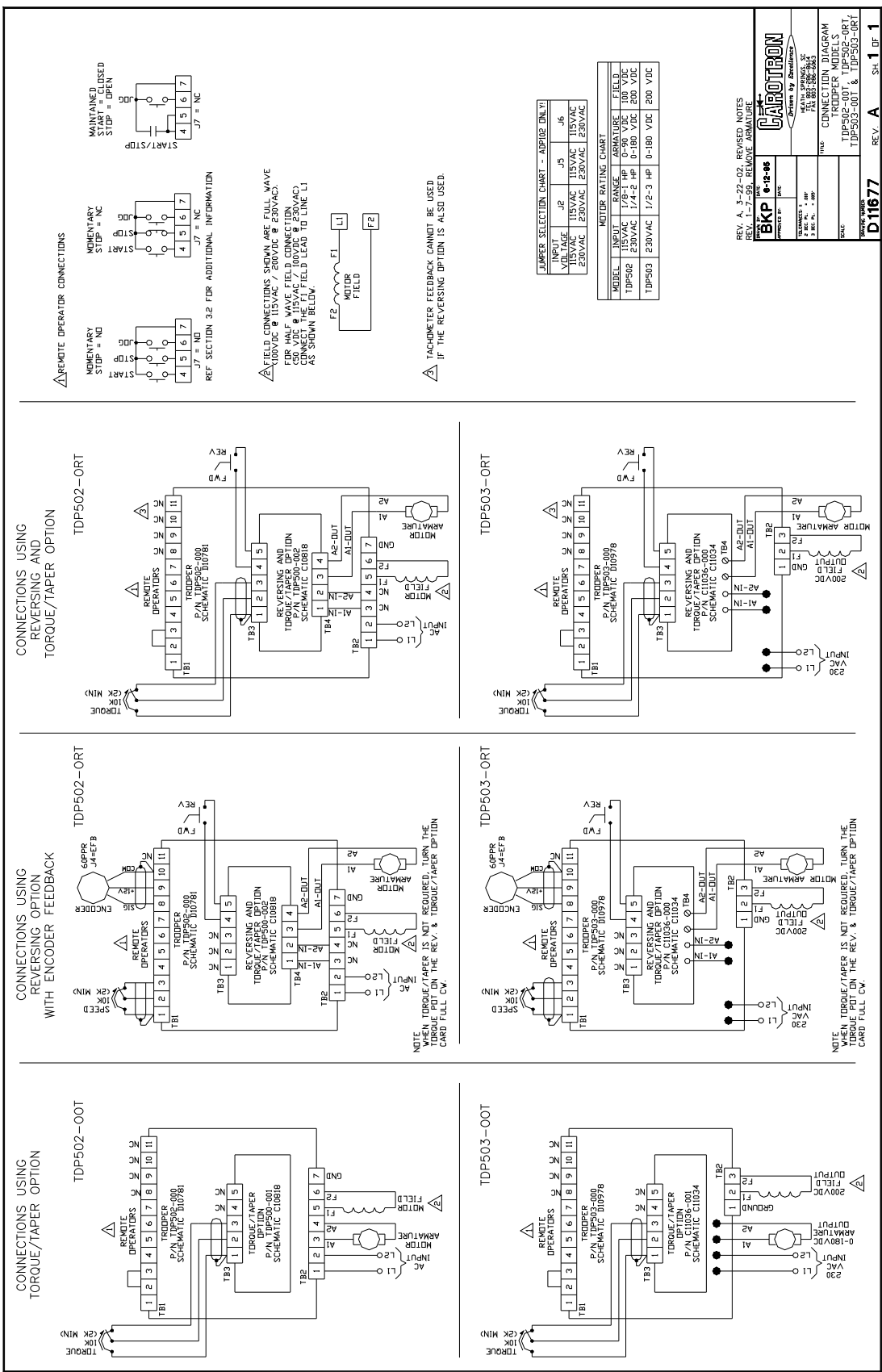
REF SECTION 3.2 FOR ADDITIONAL INFORMATION

FIELD CONNECTIONS SHOWN ARE FULL WAVE (100VDC @ 115VAC / 200VDC @ 230VAC).
 FOR HALF WAVE FIELD CONNECTION (50VDC @ 115VAC / 100VDC @ 230VAC),
 REMOVE J4 AND REWIRE FIELD LEAD TO LINE L1
 AS SHOWN BELOW



| REV. A, 3-22-02, REVISED NOTES | | | |
|--------------------------------|--------|-------------|------|
| BKP | 8-8-86 | DATE | |
| BY | DATE | BY | DATE |
| DESIGNED BY | DATE | DESIGNED BY | DATE |
| TESTED BY | DATE | TESTED BY | DATE |
| APPROVED BY | DATE | APPROVED BY | DATE |
| CARATRON | | | |
| HEATH, SPRINGS, NC | | | |
| FAX 919-586-1865 | | | |
| CONNECTION DIAGRAM | | | |
| MODELS | | | |
| TDP502-000 & TDP503-000 | | | |
| REV. A | SH 1 | OF 1 | |





[illegible][illegible]

NOTE
WHEN TORQUE/TAPER IS NOT REQUIRED, TURN THE TORQUE
POT ON THE REV. & TORQUE/TAPER OPTION CARD FULL CW.

TDP502-ERT

REMOTE OPERATOR

TROOPER

P/W TDP502-ERT SCHEMATIC 010781

FRONT COVER (TORQUE, REVERSE, FORWARD)

START, STOP, 50, MEMBRANE SWITCH

REVERSE, FORWARD, 12V BATTERY

AC, L1, L2, N, GND, FLD, T0, A1, A2, A1-OUT, A2-OUT

MOTOR

ARMATURE

[illegible]

The diagram illustrates the electrical connections for the TDP503-ER1 motor control system. Key components and their connections include:

- Power Input:** 220 VAC Input (L1, L2) connected to the main power lines.
- Control Switching:** A MEMBRANE SWITCH and a STOP button are connected to the control circuit, which includes a thermal relay (CMT) and a thermal fuse (CMTF).
- Motor Protection:** A 60PPR J4=EFB encoder is connected to the motor's feedback circuit.
- Motor and Drive:** The motor is connected to the drive circuit, which includes a 200VDC supply and a 200VAC supply. The motor's field winding (F) and armature (A) are connected to the drive circuit.
- Control Circuitry:** The TDP503-ER1 control unit is connected to the motor's feedback circuit and the drive circuit. It includes a 60PPR J4=EFB encoder and a 200VDC supply.
- Wiring Details:** The diagram shows various wiring paths, including a 60PPR J4=EFB encoder, a 200VDC supply, a 200VAC supply, and a 200VDC supply.

NOTE
WHEN TORQUE/TAPER IS NOT REQUIRED, TURN THE TORQUE
POT ON THE REV. & TORQUE/TAPER OPTION CARD FULL CW.

The diagram illustrates the TDP503-ERT remote control system. It consists of a transmitter (TDP503-ERT) and a receiver (TDP503-000). The transmitter has a front cover with a start button and a remote operator section with 12 buttons (1-12). The receiver has a front cover with a start button and a remote operator section with 12 buttons (1-12). The receiver also has a motor armature and a 230V AC input. The diagram includes labels for various components like the front cover, remote operator, transmitter, receiver, motor armature, and 230V AC input.

MAINTAINED
 START = CLOSED
 STOP = OPEN

MOMENTARY
 STOP = NC
 START = NC

MOMENTARY
 STOP = NO
 START = NO

REF SECTION 3.2 FOR ADDITIONAL INFORMATION

2 FIELD CONNECTIONS SHOWN ARE FULL WAVE
(100VDC @ 115VAC / 200VDC @ 230VAC).
FOR HALF WAVE FIELD CONNECTION
(50 VDC @ 115VAC / 100VDC @ 230VAC)
CONNECT THE F1 FIELD LEAD TO LINE L1
AS SHOWN BELOW.



3 TACHOMETER FEEDBACK CAN NOT BE USED IF THE REVERSING OPTION IS ALSO USED.

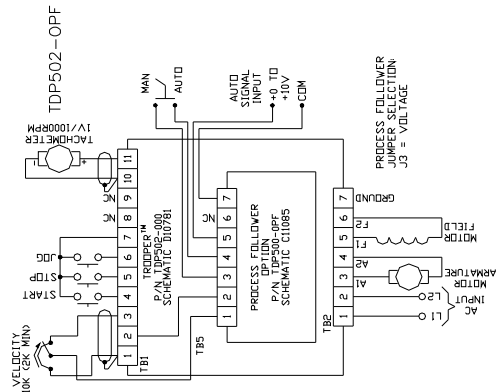
| INPUT VOLTAGE | J2 | J5 | J6 |
|------------------|--------|--------|--------|
| 115VAC | 115VAC | 115VAC | 115VAC |
| 230VAC | 230VAC | 230VAC | 230VAC |

| MOTOR RATING CHART | | | | |
|--------------------|------------------|----------------------|-----------------------|--------------------|
| MODEL | INPUT | RANGE | ARMATURE | FIELD |
| TDP502 | 115VAC 230VAC | 1/8-1 HP 1/4-2 HP | 0-90 VDC 0-180 VDC | 100 VDC 200 VDC |
| TDP503 | 230VAC | 1/2-3 HP | 0-180 VDC | 200 VDC |

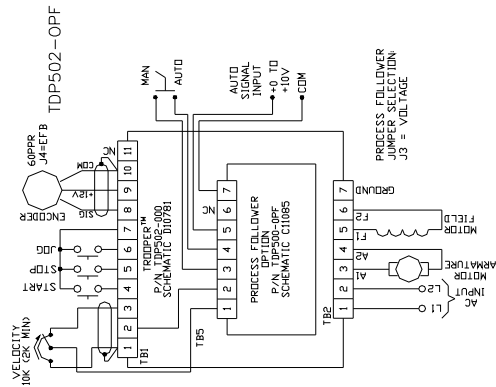
REV. A, 3-22-02, REVISED NOTES

REV. 1-7-98, REMOVE ARM

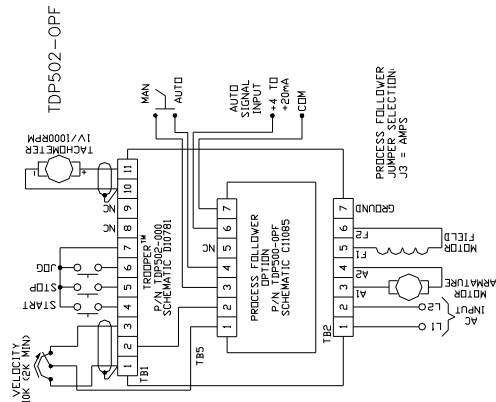
[illegible]



CONNECTIONS USING PROCESS FOLLOWER OPTION WITH ENCODER FEEDBACK



CONNECTIONS USING PROCESS FOLLOWER OPTION WITH TACHOMETER FEEDBACK AND CURRENT REFERENCE INPUT



NOTES:

- CR = CR TO START DRIVE
ENERGIZE CR
TO START DRIVE

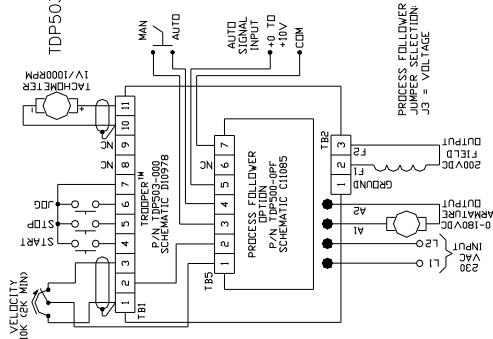
| JUMPER SELECTION CHART | | | | | | |
|------------------------|------------------|------------------|------------------|------------------|------------------|--------------|
| MODEL | INPUT VOLTAGE | PROCESS FOLL | | | TROOPER | |
| | | J1 | J2 | J3 | J4 | J5 |
| TD502 | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | J6 230VAC |
| TD503 | 230VAC | 230VAC | 230VAC | 230VAC | N/A | N/A |

| MOTOR RATING CHART | | | | |
|--------------------|------------------|----------------------|-----------------------|--------------------|
| MODEL | INPUT | RANGE | ARMATURE | FIELD |
| TDP502 | 115VAC 230VAC | 1/8-1 HP 1/4-2 HP | 0-90 VDC 0-180 VDC | 100 VDC 200 VDC |
| TDP503 | 230VAC | 1/2-3 HP | 0-180 VDC | 200 VDC |

VELOCITY
10K (2K MIN)

START
STOP
JOG

TDP503-0PE
METER
000RPM

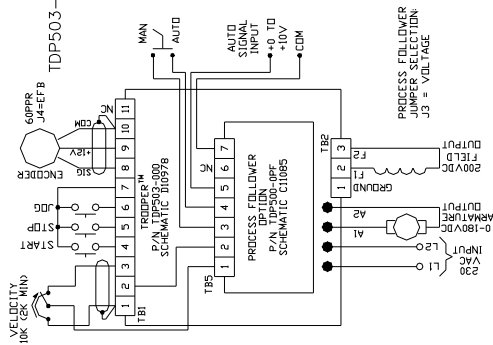


VELOCITY
10K (2K MIN)

START
STOP
JOG

ENCODER
60PPR
JA=EFB

TDP503-0PF

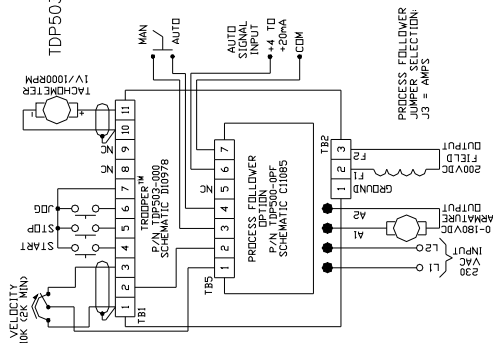


VELOCITY
0K (2K MIN)

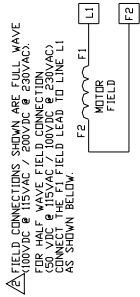
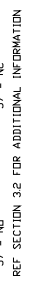
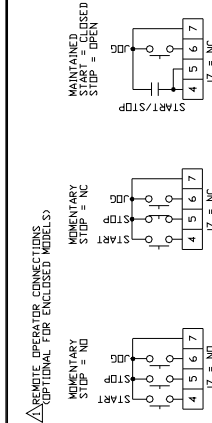
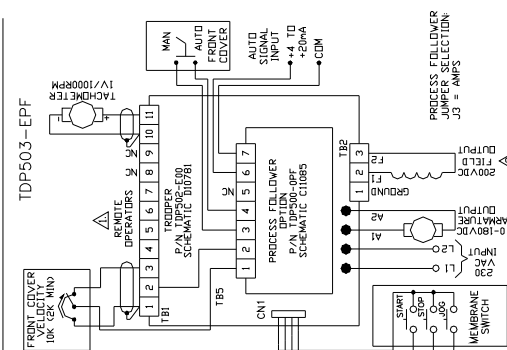
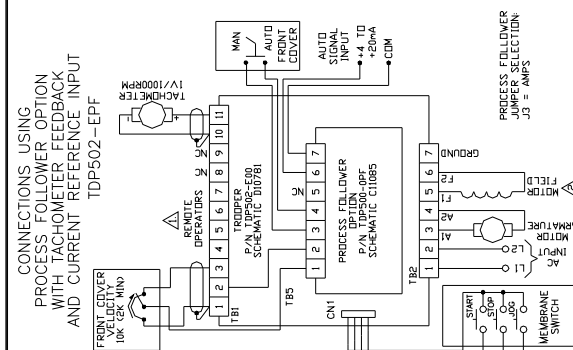
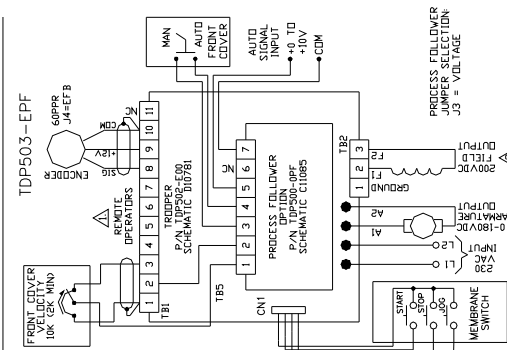
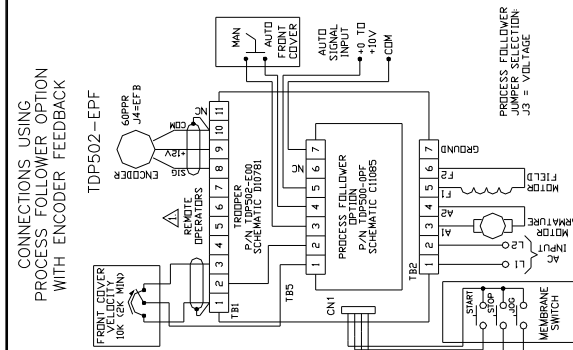
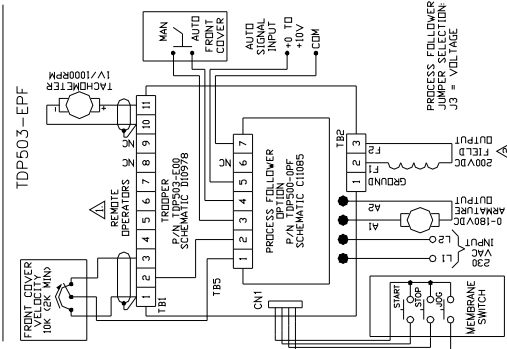
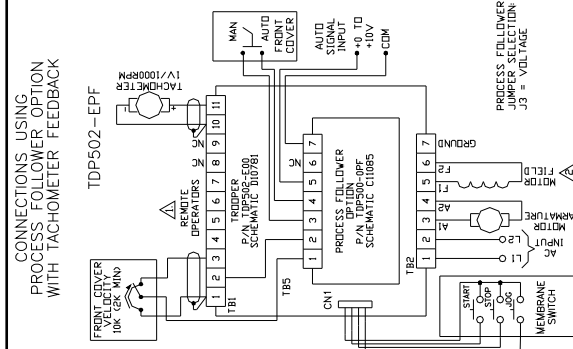
START
STOP
JOG

TDP503-0PF

COMETER
000RPM




| | |
|----------------|---|
| ISSUE NO. | DATE |
| BKP | 8-22-95 |
| PROJECT BY | DRAWN BY |
| DATE | DATE |
| CHECKED BY | TOLERANCES ± |
| DATE | 2 DEC. IN. ± .00" |
| | 3 DEC. IN. ± .00" |
| SCALE | |
| SHEET NUMBER | CONNECTION DIAGRAM TROOPER MODELS TDP502-00F & TDP503-00F |
| Drawing Number | REV. |
| D11679 | SH. 1 OF 1 |

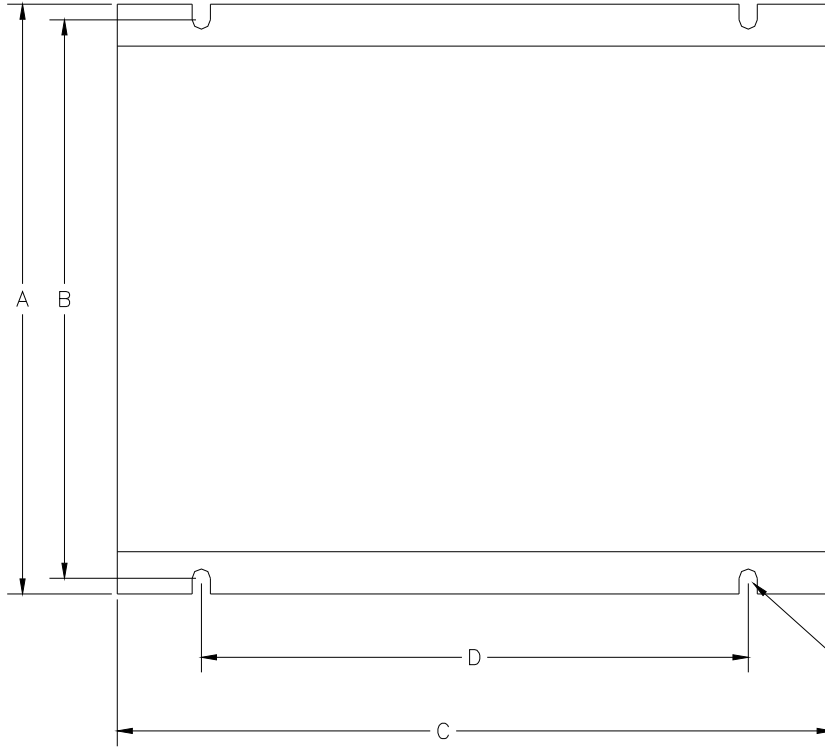


| MODEL | INPUT | RANGE | ARMATURE | FIELD |
|--------|------------------|----------------------|-----------------------|--------------------|
| TDPS02 | 115VAC 230VAC | 1/8-1 HP 1/4-2 HP | 0-90 VDC 0-180 VDC | 100 VDC 200 VDC |
| TDPS03 | 230VAC | 1/2-3 HP | 0-180 VDC | 200 VDC |

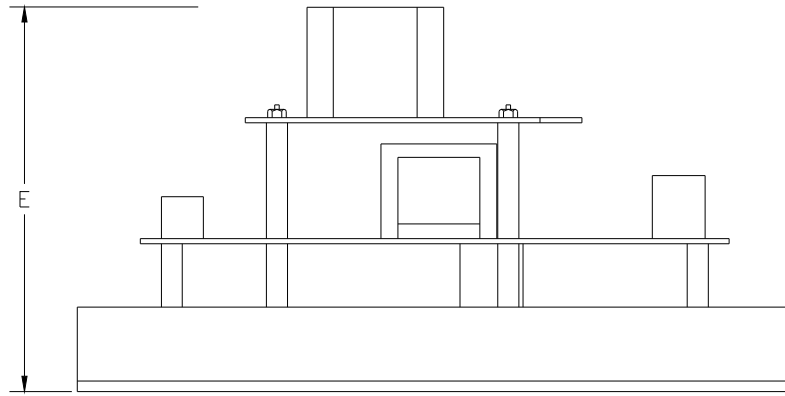
| JUMPER SELECTION CHART | | | | | | |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| MODEL | INPUT VOLTAGE | PROCESS FOL. | | | TROOPER | |
| | | J1 | J2 | J3 | J5 | J6 |
| TDPS02 | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC | 115VAC 230VAC |
| TDPS03 | 230VAC | 230VAC | 230VAC | NA | NA | NA |

REV. A. 3-22-02, REVISED NOTES

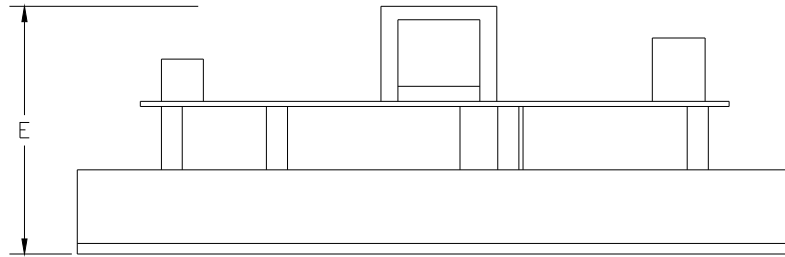
| | | | | | | | | | |
|---|--|---|--|---|--|---|--|---|--|
| DATE: 8-12-85 BY: BKP APPROVED BY: | | DATE: BY: APPROVED BY: | | TELEPHONE: 1 EXT. P.: 497 OFF.: | | SCALE: | | REV. A SH. 1 OF 1 | |
|  | | Driven by Excellence | | HEATH SPINDLES, SC PO BOX 1000 FAIRFAX, VA 22033 | | TITLE CONNECTION DIAGRAM TRUPER MODELS TDP502-EFF & TDP503-EFF | | REV. A SH. 1 OF 1 | |



0.218" SLOT (TYP)
TYP. MOUNTING DIMENSION



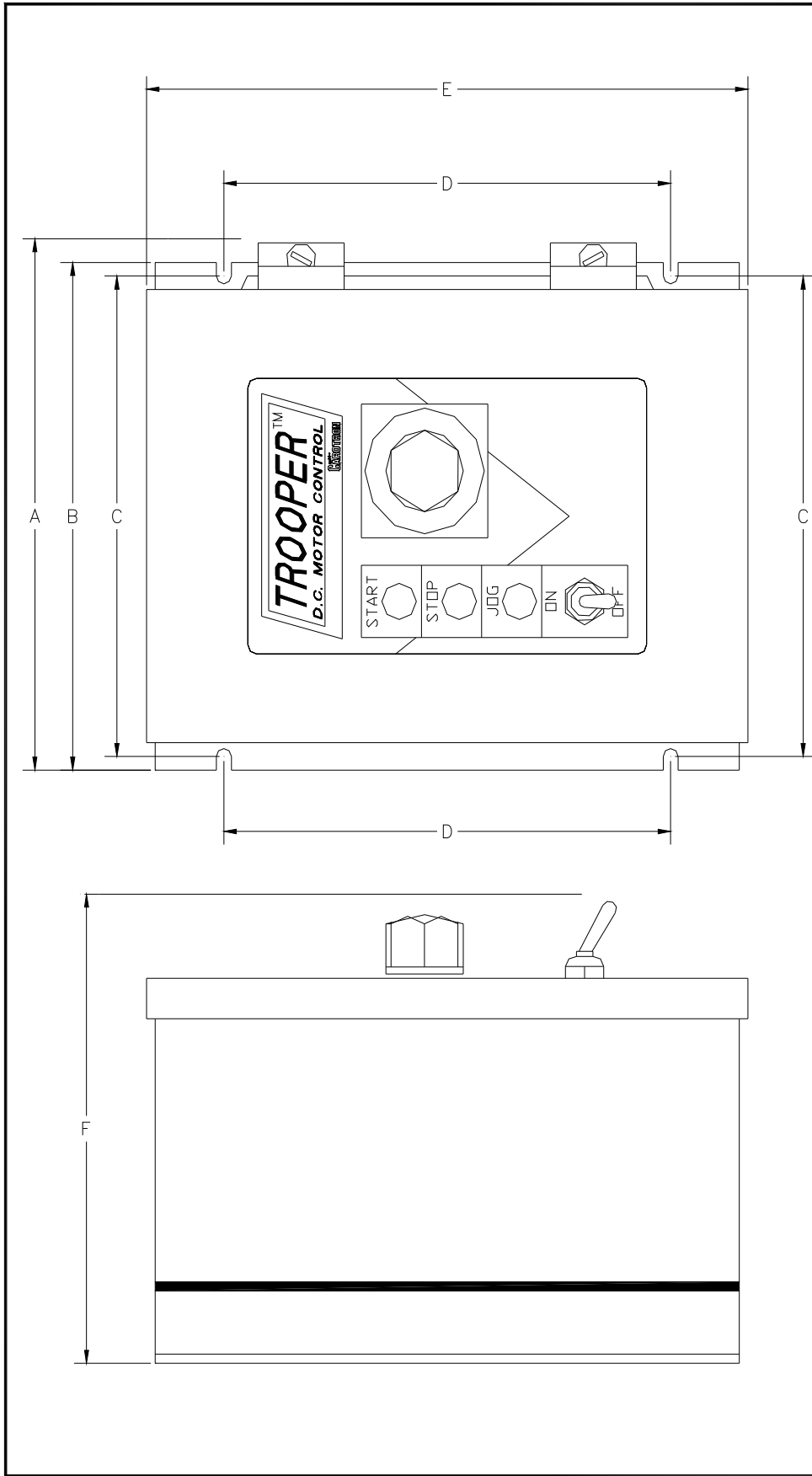
MODEL TDP502-00T
TDP502-0RT
TDP502-0PF
TDP503-00T
TDP503-0RT
TDP503-0PF




MODEL TDP502-000
TDP503-000

| | | |
|----------------------------------|-----------------|--|
| DRAWN BY: BKP | DATE: 6-9-95 | |
| | APPROVED BY: | |
| DESIGNED BY: T. H. H. H. | DATE: | <i>Driven by Excellence</i> HEATH SPRINGS, SC TEL: 803-288-8031 FAX: 803-288-8033 |
| TITLE: | --- | DIMENSION DWG. TROOPER® CHASSIS MODELS |
| SCALE: | --- | |
| DRAWING NUMBER: C11681 | | REV. SH. 1 OF 1 |

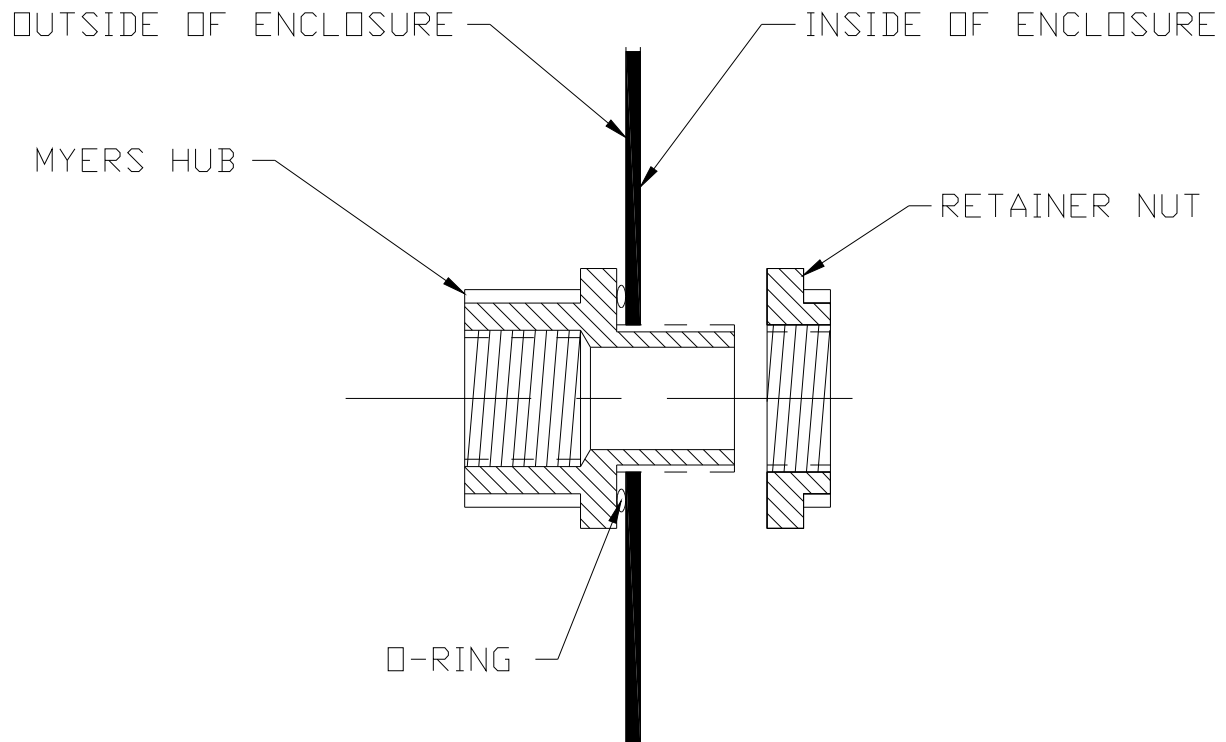
| MODEL | A | B | C | D | E |
|------------|-------|-------|-------|-------|-----------|
| TDP502-000 | 7.000 | 6.625 | 8.500 | 6.500 | 3.000 MAX |
| TDP502-00T | 7.000 | 6.625 | 8.500 | 6.500 | 4.600 MAX |
| TDP502-0RT | 7.000 | 6.625 | 8.500 | 6.500 | 4.600 MAX |
| TDP502-0PF | 7.000 | 6.625 | 8.500 | 6.500 | 4.600 MAX |
| TDP503-000 | 7.000 | 6.625 | 10.50 | 8.500 | 3.563 MAX |
| TDP503-00T | 7.000 | 6.625 | 10.50 | 8.500 | 5.163 MAX |
| TDP503-0RT | 7.000 | 6.625 | 10.50 | 8.500 | 5.163 MAX |
| TDP503-0PF | 7.000 | 6.625 | 10.50 | 8.500 | 5.163 MAX |



| MODEL | A | B | C | D | E | F |
|--------|-----------|-------|-------|-------|--------|-----------|
| TDP502 | 7.375 MAX | 7.000 | 6.625 | 6.500 | 8.750 | 6.500 MAX |
| TDP503 | 7.375 MAX | 7.000 | 6.625 | 8.500 | 10.750 | 7.750 MAX |

| | | |
|----------------------------------|------------------|---|
| DRAWN BY: BKP | DATE: 12-5-91 |  Driven by Excellence |
| | APPROVED BY: | |
| TOLERANCES: ± | | HEATH SPRINGS, SC TEL. 803-286-8614 FAX 803-286-8683 |
| 2 DEC. PL. | | |
| 3 DEC. PL. | | TITLE: |
| SCALE: --- | | DIMENSIONS, TROOPER®, ENCLOSED MODELS |
| ISSUING NUMBER: C11682 | | REV. SH. 1 OF 1 |

TYPICAL INSTALLATION OF A MYERS HUB FOR A TYPE 4 APPLICATION



MAKE SURE SURFACE FOR O-RING IS CLEAN AND FREE OF BURRS OR SHARP EDGES.
TORQUE RETAINER NUT TO COMPRESS O-RING.

CAROTRON

TITLE: MYERS HUB INSTALLATION

DWG. NO. **A11097**

DRAWN BY:

APPROVED BY:

DATE:

SCALE:

SHEET 1 OF 1

Standard Terms and Condition of Sale

1. General

The Standard Terms and Conditions of Sale of Carotron, Inc. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company.

In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that (c) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warrant in regard to such systems, including but not limited to remedy for consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the Company's satisfaction to have failed to so perform, or refund to the Purchaser the purchase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during reasonable hours, and (b) the Company is notified of the failure within one (1) year after

date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

a. Products and parts damaged or abused in shipment without fault of the Company.

b. Defects and failures due to operation, either intentional or otherwise, (1) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.

c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.

d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.

e. Products, parts and systems designed by the Purchaser.

f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

5. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

8. Returned material

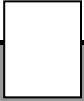
If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURN TAG" attached thereon which has been issued by the Company.

9. Packing


Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefor shall cease when the carrier signs for and accepts the shipment.



Notes



CAROTRON

Driven by Excellence

D.C. DRIVES, A.C. INVERTERS,
SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

3204 Rocky River Road
Heath Springs, SC 29058
Phone: (803) 286-8614
Fax: (803) 286-6063
Email: saleserv@carotron.com
Web: www.carotron.com
MAN1004-00 Rev. G
Issued 03-05-2019