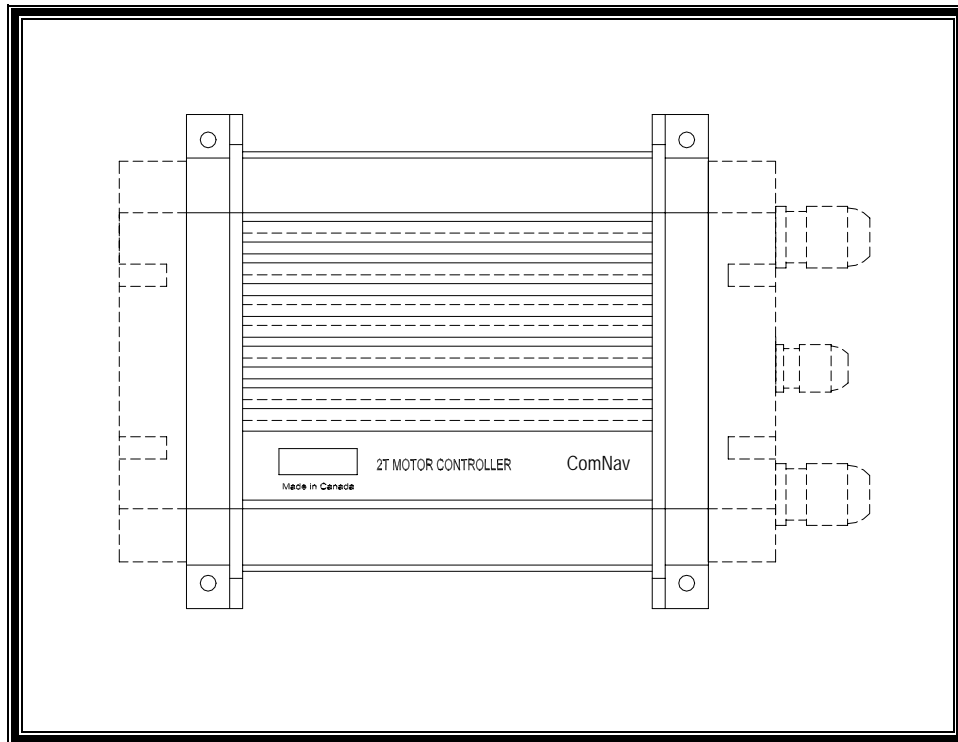


# ComNav<sup>®</sup>

Marine Ltd.

**CT2-40A**  
**MOTOR CONTROLLER**  
PART NUMBER 20350001  
DOCUMENT PART NUMBER 29010024

**Permanent Magnet • Shunt Field Compound • D.C. Motors**



## Installation Instructions Version 3.3

## Introduction:

CT2-40A Motor Controllers are designed to connect a ComNav Autopilot to a steering system using a permanent magnet, shunt field, or compound reversing D.C. Motor.

CT2-40A Motor Controllers feature dynamic braking, current limiting and thermal protection of the MOSFET driving transistors while allowing full power acceleration and drive when needed. CT2 Motor Controllers can be used with 12, 24 and 32 VDC battery systems.

CT2 Motor Controllers also feature automatic field control for use with Shunt Field and Compound Reversing D.C. Motors. The field of the motor is energised any time the Autopilot is turned on.

## Installation:

### **WARNING**

**To ensure that the CT2 Motor Controller case will stay watertight, it is very important that you use round cables in all three watertight cable fittings. The two large cable fittings will require a cable with an outer diameter ranging from 5/32"(4.0mm) to 13/32"(10.0mm). The smaller cable fitting will require a cable with an outer diameter ranging from 3/32"(2.5mm) to 1/4"(6.5mm).**

For mounting, a #10 size hole is provided in each foot of the 2T Motor Controller box.

**The Autopilot and the CT2 Motor Controller must be run from the same source of power**, although they do not need to be powered from the same breaker. In fact, for installations that use two drive units, it is preferable to power the Autopilot and each CT2 Motor Controller from a separate breaker. This way either or both drive units may be selected to operate independently from the Autopilot.

**To provide power to the CT2 Motor Controller**, use #12 AWG wire if the combined run from the breaker to the box and from the box to the motor, is 25 feet or less. If the combined run is greater than 25 feet use #10 AWG wire. Run the power lead from a 50 Amp breaker to the CT2 Motor Controller.

**If the Autopilot is powered from the same breaker as the CT2 Motor Controller**, run a separate wire from the breaker to the Autopilot as shown in the diagram. **DO NOT** run the power lead to the Autopilot from the CT2 Motor Controller. Before providing power to the Autopilot, refer to the Autopilot Installation and Operation Manual for the appropriate wire gauge.

**For the correct interconnection of the CT2 Motor Controller and the Autopilot** refer to Figures 2 through 4. A four-conductor, #24 AWG cable with shield will be satisfactory. The shield of the cable should be terminated to the **JOG COMMON** terminal (or **V-**) in the Autopilot distribution box and unterminated at the other end.

**If Jog Levers are used** to override the Autopilot, connect them to the terminals provided in the Autopilot distribution box (see enclosed diagrams or the Autopilot manual).

**If the drive system is a Rotary Drive or Linear Actuator**, the clutch of the rotary drive, or the lockup solenoid of the linear actuator, should be wired to the Switched Power and Jog Common terminals in the Autopilot distribution box (refer to the interconnection diagram in your ComNav Autopilot Installation and Operation Manual).

## **TESTING:**

**Close the breaker which provides power to the Type CT2 Motor Controller.** It is normal to hear a pop when the breaker is closed as the large capacitors in the CT2 Motor Controller charge up.

**To ensure correct rudder direction movement**, place the Autopilot master select switch in the **POWER STEER** position and press either the red or green **ARROW** key. The rudder should move in the correct direction. If not, reverse M1 and M2 leads from the CT2 Controller to the motor.

**Refer to the Autopilot Installation and Operation manual**, and complete the Dockside Setup procedure for the autopilot. After completing the Dockside Setup procedure, measure the hard-over to hard-over time of the drive system.

**To measure the maximum hard-over to hard-over time of the drive system**, place the Autopilot master select switch in the **POWER STEER** position and hold the red or green **ARROW** key to make the rudder move fully from Port to Starboard or vice versa.

**If the hard-over to hard-over time is less than 8 seconds**, the rudder must be slowed down by decreasing the pumpset displacement, or changing to a smaller pumpset / slower acting drive unit.

**If the hard-over to hard-over time is more than 16 seconds**, the rudder must be sped up by increasing the pumpset displacement or changing to larger pumpset / faster acting drive unit.

When the hard-over time is between 8 - 16 seconds, testing of the CT2 Motor Controller Drive Box is complete.

## TROUBLESHOOTING:

- **Check with a voltmeter** that voltage is present between Terminals J1, V+ and J1, V- (the battery voltage).
- **If no voltage is present**, check that there is power to the breaker panel, and that the breaker for the motor is turned on. Recheck the wiring from the breaker panel to the CT2 Drive Box.
- **If voltage is present**, use an ohmmeter to check the 30 AMP Fuse (F1). Check the 1 AMP Fuse (F2) as well. If either is faulty, replace with the same size fuse.
- **If fuses are OK** check the voltage between Terminal J1 (V-) and Terminal J2 (+5V) for the +5 volts from the Autopilot. Check that the voltage between Test Points TP3 and TP4 is between 12 and 13.5 volts. Check that the voltage between Test Points TP1 and TP4 is 15 to 20 volts higher than the voltage between Terminals J1 (V+) and J1 (V-) (the battery voltage).

If all test voltages are correct, connect the Port or Starboard terminal (J2, STBD or J2, PORT) momentarily to the battery negative terminal (J1, V-) - **the motor should run.**

- **If the motor doesn't run:**

1. If the motor is a Shunt Field or Compound Motor, check that full (within a volt) battery voltage appears between J1, Field+ and J1, Field- when there is +5V between J2, +5V and Test Point TP4. If there is no voltage, disconnect the field connection to the motor and check for a short circuit between the field wire and motor leads, or for a nail or staple through the cable.
2. Check that the full input voltage appears between the **M1** and **M2** terminals while the Port or Starboard terminal is connected to the V- terminal. The polarity of the voltage will depend on whether the Port or Starboard input is activated.
3. If the voltage is present the motor may be faulty. Connect the motor leads directly to the battery briefly to confirm whether it runs in both directions. If it does not run, contact your dealer or the supplier of the drive system for assistance. If it does run, the CT2 Motor Controller may be faulty. Contact your Dealer or ComNav Marine for assistance.
4. If there is no voltage present the CT2 Motor Controller may be faulty. Contact your Dealer or ComNav Marine for assistance.

- **If the motor runs:**

1. Check the outputs from the Autopilot for correct operation. The red and green output diagnostic LED's in the Autopilot distribution box should come on as described in the ComNav Autopilot Installation and Operation Manual.
2. If the diagnostic LED's do come on and the rudder still will not move, examine the wiring between the Autopilot and the CT2 Motor Controller again. Check for open or short circuits. Check for nails or staples which may have penetrated the cable.
3. If the diagnostic LED's do not come on, you may have a faulty Distribution Box or Control Head. Contact your Dealer or ComNav Marine for assistance.

### **Electrical Noise:**

The CT2 Motor Controller uses high current switching transistors to control the motor. Every effort has been made to reduce or eliminate the generation of electrical noise by the motor controller. If some noise is heard on the vessel radios, and it is traced to the motor controller, a ground lug has been provided to bond it to the vessel's grounding system. In most cases, this should eliminate any electrical noise.

### **Specifications:**

Operating Voltage Range:	10 to 40 volts D.C.
Operating Temperature Range:	-10 degrees C to +70 degrees C
Current Limit:	50 Amps for 1 second
Normal Operating Current:	30 Amps (CT2-40A model) maximum, thermally limited
Field Control:	Up to 5 Amps maximum. Overcurrent and Short Circuit Protected

### **Note:**

When the maximum operating limits are exceeded, the output from the CT2 Motor Controller will automatically be turned off. This will allow the internal temperature of the output driving transistors to fall back into the safe operating area and power will then be re-applied to the motor. This happens in a fraction of a second, with a very strong pulsating effect to the steering gear. This will only happen if the steering gear goes hard-over or is in some way jammed and will not move.

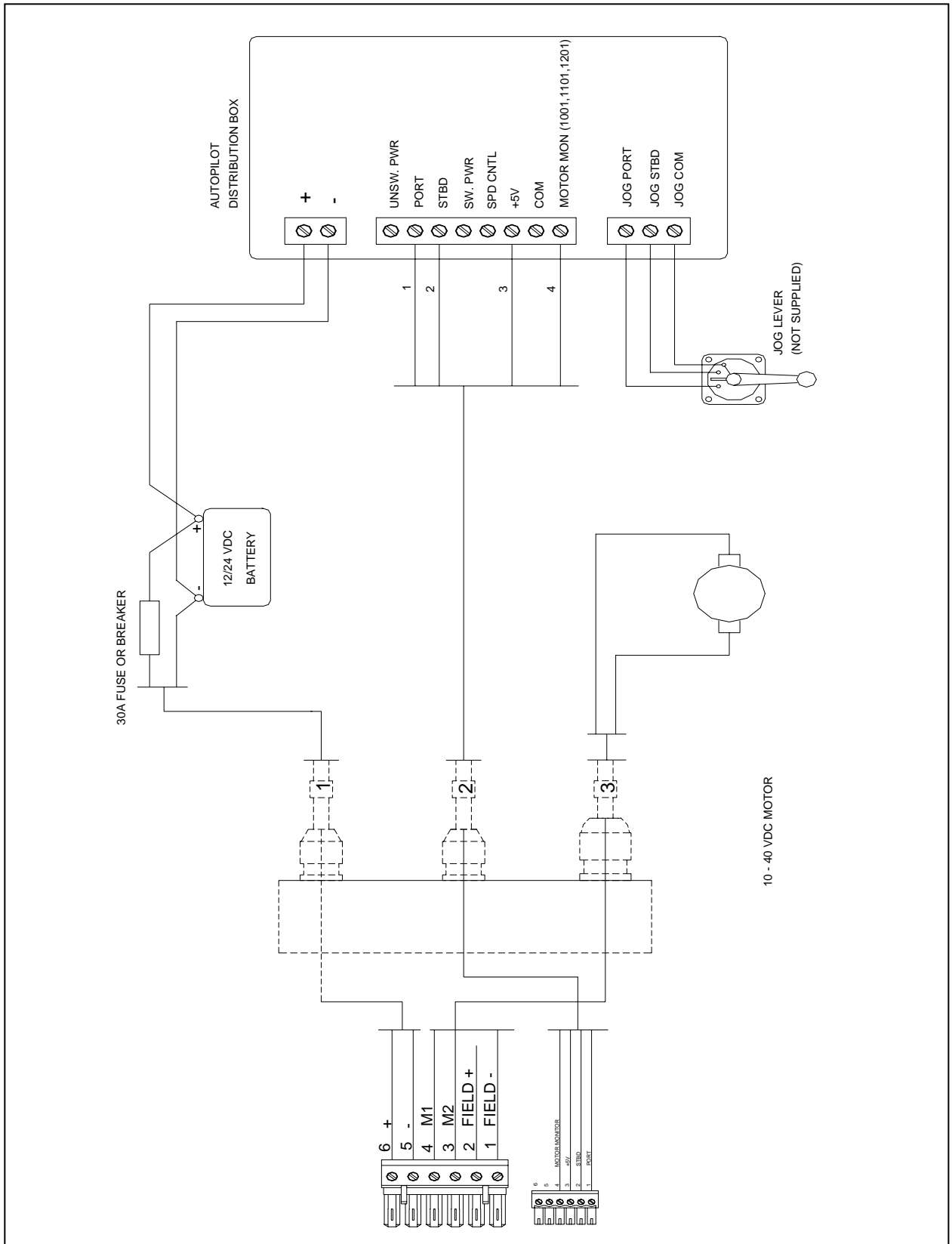


Figure 2 Connection to Permanent Magnet Motor

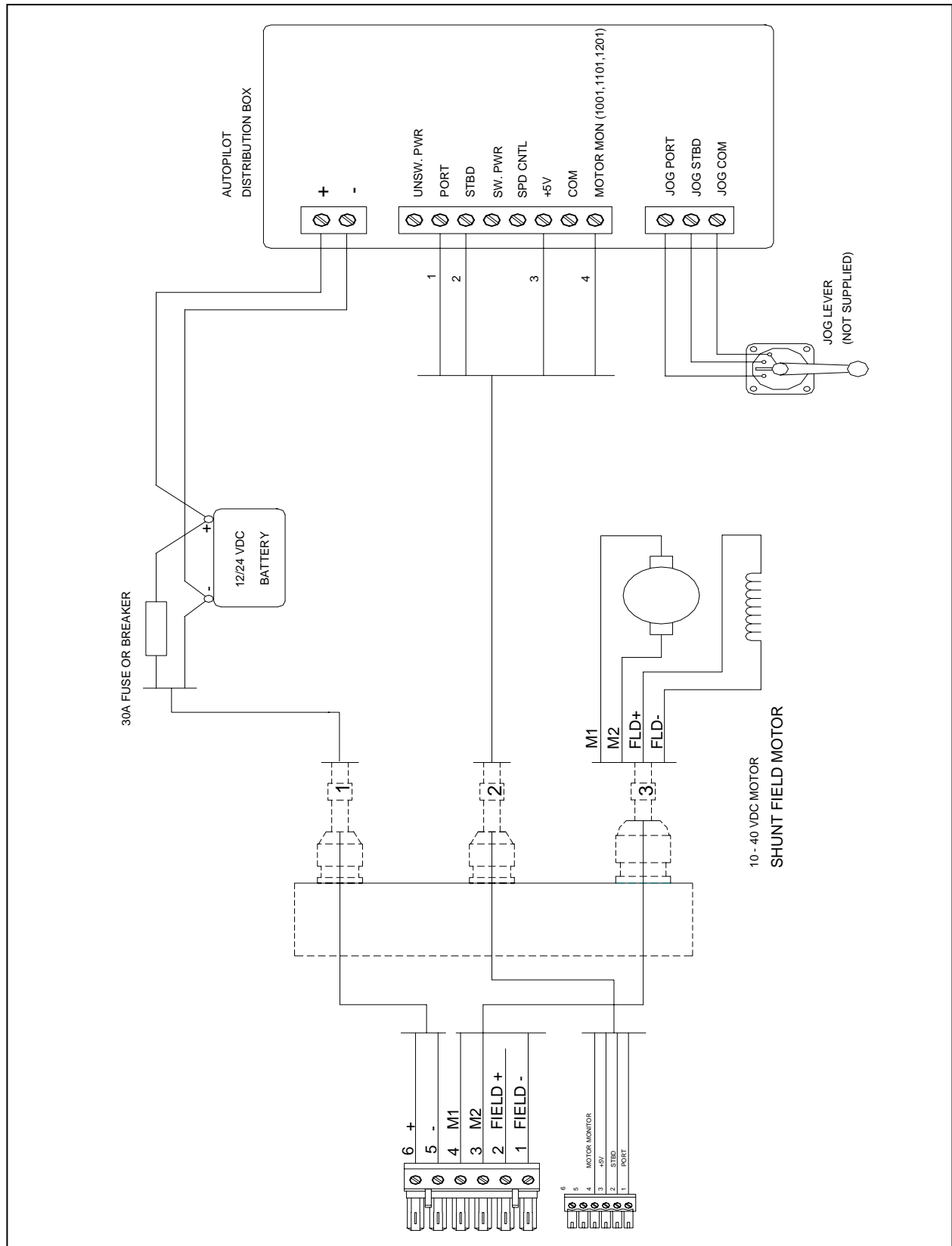


Figure 3 Connection to Shunt Field Motor

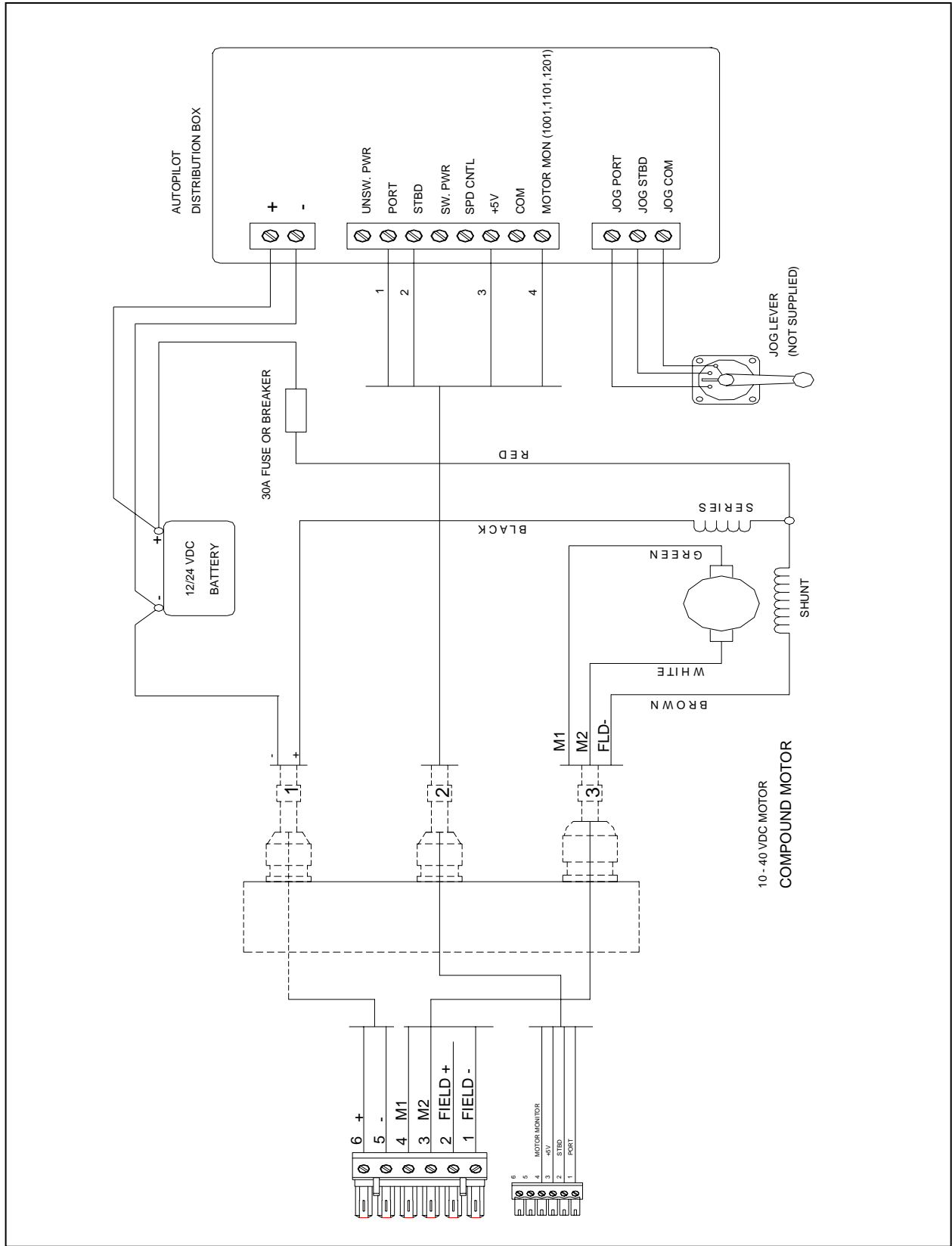


Figure 4 Connection to Compound Motor

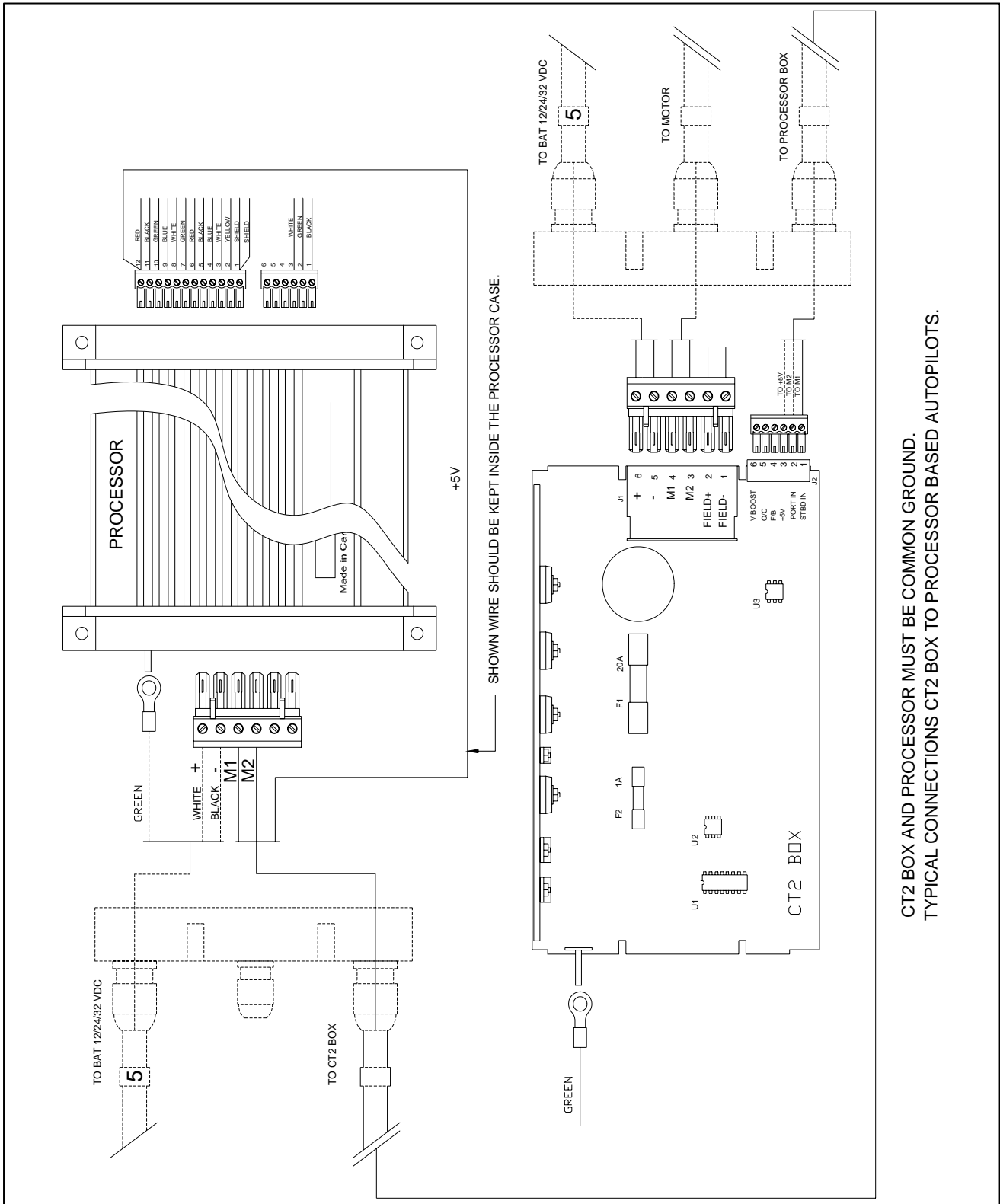


Figure 5 Connection to Processor Based Autopilots

**INSTALLATION STEPS:**

- 1) Loosen six screws and remove the cover from the DU 1500 Servo unit to expose the PCB.
- 2) On the PCB, set DIP SWITCHES (S1-1) to UP to select Solenoid configuration.
- 3) Remove EndCaps and Enclosure from the CT2 box to expose the CT2 PCB.
- 4) On the PCB, shift the two-position shunt to between Pin1 and Pin2 of J3.
- 5) Use a #10 or #12 AWG cable to connect 2 wires from Permanent Magnet Motor to CT2 Box..
- 6) Use a #22 AWG cable to connect 3 wires from DU 1500 Box to CT2 Box. (See the Diagram below).
- 7) Install a 30A fuse or breaker in line with power input to CT2 box.
- 8) Reassemble the units.

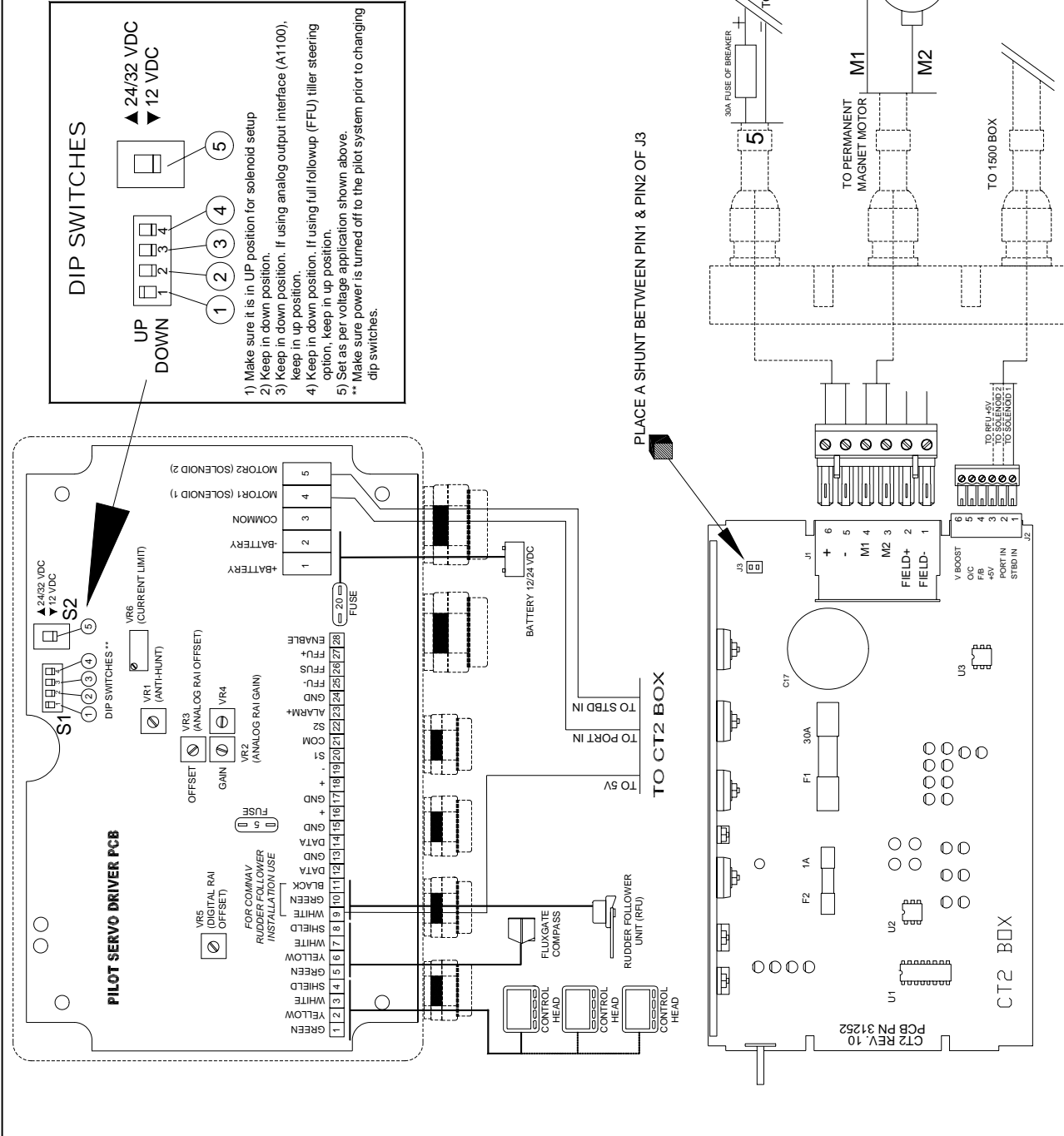
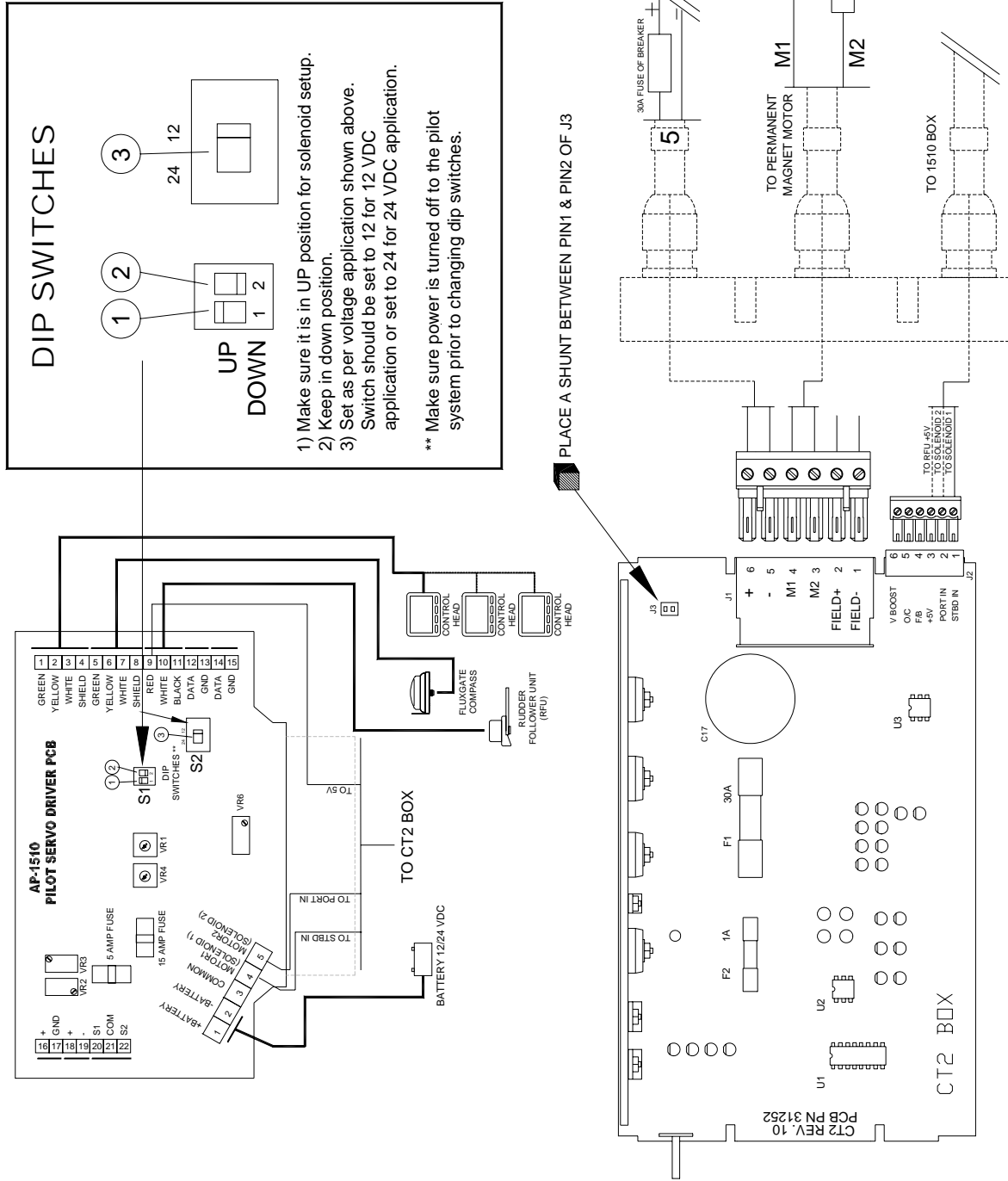


Figure 6 Connection to 1500 Autopilot

### INSTALLATION STEPS:

- 1) Loosen two screws and remove the cover from the DU 1510 Servo unit to expose the PCB.
- 2) On the PCB, set DIP SWITCHES (S1-1) to UP to select Solenoid configuration.
- 3) Remove EndCaps and Enclosure from CT2 box to expose the CT2 PCB.
- 4) On the PCB, shift the two-position shunt to between Pin1 and Pin2 of J3.
- 5) Use a #10 or #12 AWG cable to connect 2 wires from Permanent Magnet Motor to CT2 Box.
- 6) Use a #22 AWG cable to connect 3 wires from DU 1510 Box to CT2 Box.  
(See the Diagram below).
- 7) Install a 30A fuse or breaker in line with power input to CT2 Box.
- 8) Reassemble the units.



## TYPICAL CONNECTIONS CT2 BOX TO 1510 AUTOPILOTS

Figure 7 Connection to 1510 Autopilot