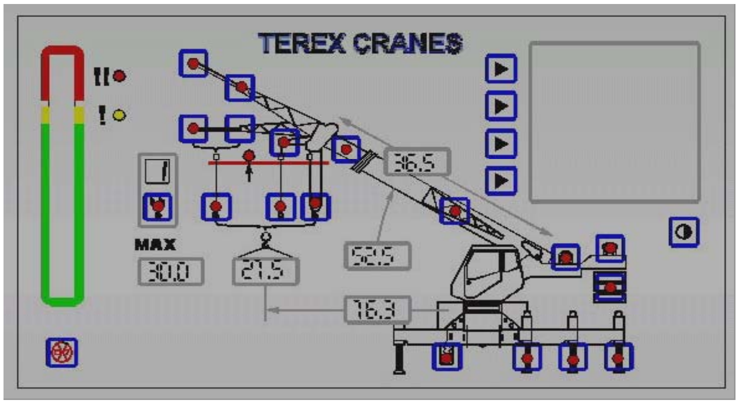
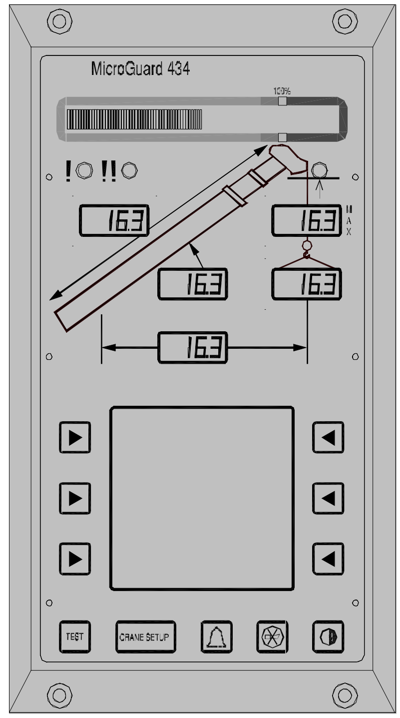
MicroGuard®400 Service Training

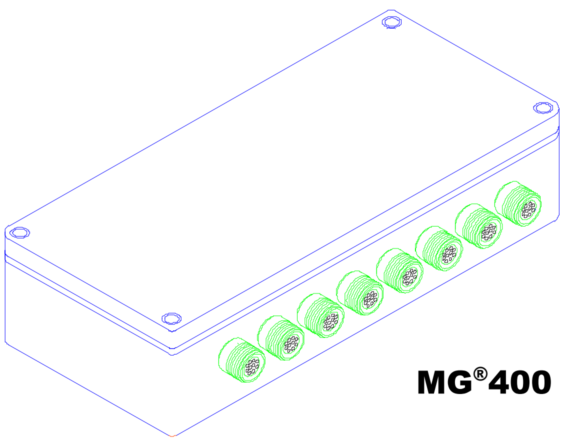
Troubleshooting & Maintenance



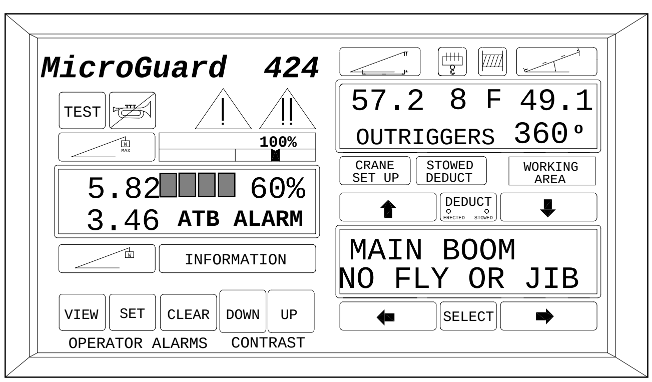
RCI 500 Display



RCI 434 Display



MG®400 Computer Assembly



RCI 414/424 Display

MicroGuard® 400 Service Training Manual

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MicroGuard® 400 Computer
Troubleshooting & Maintenance

Overview

The MG® 400 Computer can be used with several different Greer RCI displays, most commonly the RCI 500. Prior to 1999, several OEM's used the MG® 400 as a "production line" computer. In 1999, Greer introduced the MG® 500 Computer and the **"Fast Cal"** methods that equipment manufacturers now employ.

General Description

The MG® 400 Computer is larger than the MG® 500 Computer. It contains two separate boards called the processor board and the interface board.

The processor board on top contains all of the computer programming, stores the memory, does the calculating, and supplies the visual outputs for the RCI display. The interface board below contains two voltage power supplies that provide the voltages necessary for operation of the computer and the display, including the analog and digital functions. The interface board routes these voltages to the appropriate locations.

The larger power supply source with the light is responsible for 5 volt power; the smaller power supply produces the 15 volts used in conjunction with several different power applications. There are numerous ***"voltage check points"*** on both the processor and the interface boards, as well as electrical checks involving the interface board terminal blocks, e.g., drive voltage for the analog sensor functions.

Improper handling of the computer unit may cause damage to the upper board as the cover and boards are not hinged. For handling instructions, refer to the Greer maintenance manual.

Fault Codes

When a fault is detected by the system, a number will appear under one or more of the four fault group headings (A - D) shown on the next page. The information screen will illuminate the word **"FAULT,"** the RED LED will light up, and the audible alarm will sound.

To diagnose Faults in the system at any time during operation, PRESS and HOLD the "TEST" button, which will initiate the self-test function followed by an on-screen display of identied faults in groups A through D.

Fault Codes continued

Group "A" Sensor Faults	Group "B" I/O Faults	Group "C" Memory Faults	Group "D" General Faults
001 Piston Pressure	00 No Fault	00 No Fault	00 No Fault
002 Rod Pressure	01 Digital input/output	01 Executive Rom	01 No Duty Found
004 Boom Extension	02 Analog input/output	02 Duty Rom	02 Current Duty Bad
008 Boom Angle	04 Display	03 Not Used	04 Configuration Uncalibrated
016 Not Used		04 Scratchpad Rom	
032 Swing "A"		08 Personality Rom	
064 Swing "B"			

Faults in the external sensors are detected without the need of the self-test .

The above faults do not include the entire list of possible Faults and Fault Codes. Please see the maintenance manual for a complete listing.

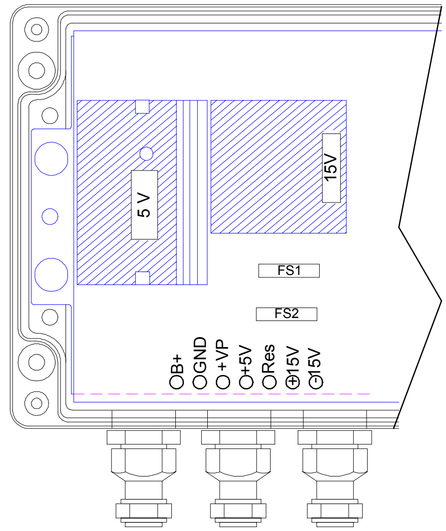
Interpreting Multiple Faults that Add Up to More than the Numbers Listed.

Example: If the fault is 012, pick the largest fault(s) from the list that will subtract from 12 and then add to get the equivalent. In this instance, the answer would be 008 and 004.

In this example, the faults indicate that both the **extension** and **angle sensor** have failed. Fault indications of this type are unlikely, however, there should be an investigation of electrical readings and cable routings. Outputs from analog sensors can be measured with an accurate voltmeter.

Voltage Supplies and Check Points

Look at the terminal board and begin supplying power to it. The main power coming into the terminal board is usually a 9-36 VDC supply coming directly from the crane. If the voltages at the B + and B - terminals on TB -1 are not present, check the voltage on the vehicle.



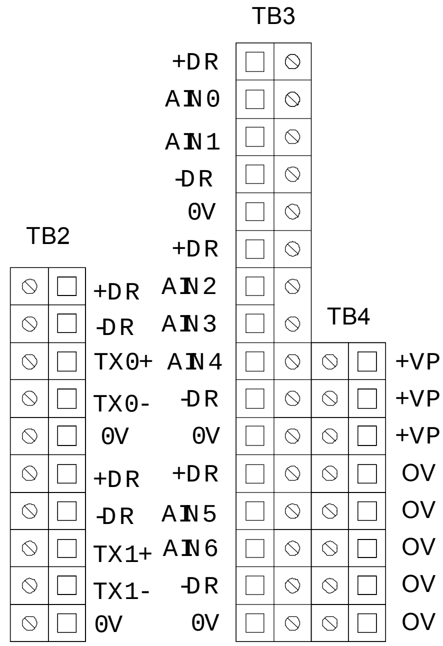
Internal Power Supplies: The computer generates its own internal power from the incoming battery voltage. This power can be monitored at the test points inside the computer adjacent to the fuses and Battery Input Terminals. The tolerances for these voltages are listed in the table below as well as in a graphic illustrating the voltage check points.

Checkpoint	Requirement	Tolerance
B+	+9-36V	.5
+VP	+12V	-.5
+5	+5	+/- .1
+15	+15	+/- .1
-15	-15	+/- .1

To monitor the internal power supplies, use a digital voltmeter set to the appropriate VDC setting and attach to the appropriate voltage check points on the terminal board. Note the two power supplies sitting side-by-side on the board. The larger (left) power supply provides 5 V power. The smaller (right) power supply provides 15 V. There are two fuses on the face of the board immediately above the voltage checkpoints. These 1A fuses, labeled “FS1” and “FS2,” protect the functions of display power and power supply. **Replace these fuses ONLY with an identical replacement, or damage may occur to the main board or tracings.**

Terminal Block Markings

Terminal blocks are marked as shown in the graphic to the right. Note that there are multiple Drive Voltage terminals (DR+ and DR-) in different locations. Note that these terminals are all common on the computer board assembly. The same is true of any OV or +VP terminals. For example, checking the drive voltage on TB2 should provide exactly the same readout as at any drive voltage terminal on TB3.



Voltage Checks

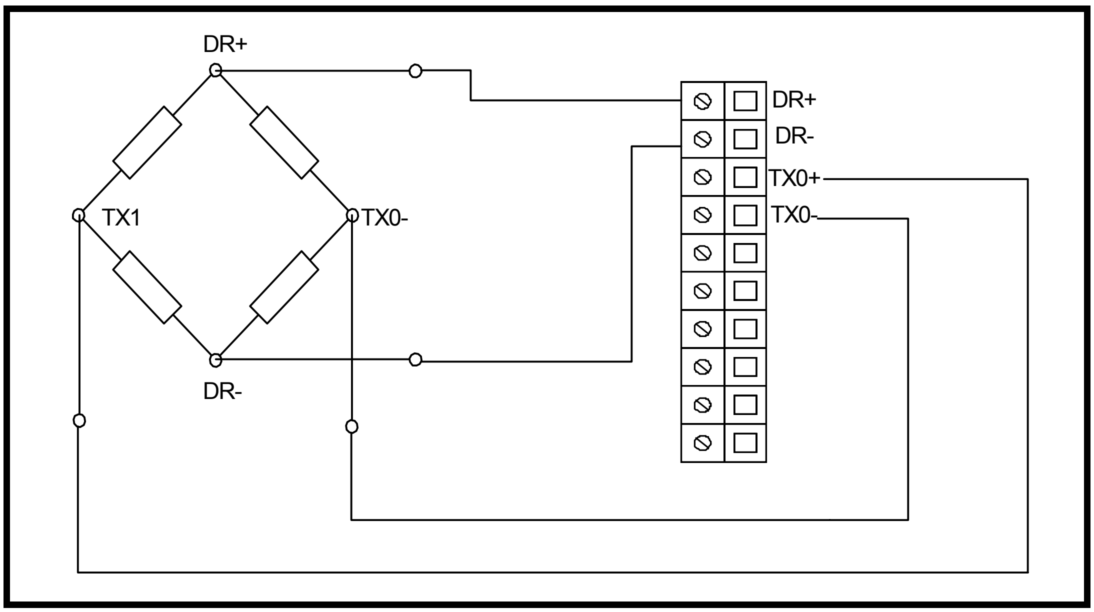
AIN2 and AIN3 are typical voltages checkpoints for analog input signals from the boom angle and length pots. These signals will vary depending on how the unit is operated at the time the reading is taken. Refer to the maintenance manual for further definition of terminal blocks.

Because the drive voltages are all common, any analog sensor can be suspect. If, for example, drive voltage is low, and +15 V is within tolerance, each of the analog sensors must be removed, one at a time, until the sensor that is causing the voltage to sag is located and replaced. If the voltage continues to sag, the processor board should be replaced as the drive voltage power supply is integrated into the processor board.

This is a simple process of elimination, which will help pinpoint a failing sensor, an abrasion, or a pinch in a wire or loom. All wiring could become suspect at this time and should be carefully checked. Output tests can also be run at the sensors by attaching the voltage meter at the sensor output and watching as the sensor is extended or raised. Voltage skips or gaps can be detected using this technique.

Testing Pressure Transducers Through Drive Voltage

The pressure transducer used with the MG® 400 Computer is a remote pressure transducer. It is usually mounted directly onto the boom lift cylinder and cabled into the computer through connectors that are attached to the proper drive and output channels. The transducer starts out as a balanced bridge with Drive Voltage input, and "0" output. As soon as the boom is raised, which applies moment to the cylinder, the internal pressure will change in the transducer and the resistance across the bridge will change, causing output to the TX0, TX1 side of the bridge. This output indicates to the computer that the weight or center of gravity of the boom is changing. The reading is then converted to load.



To check the input and outputs on this circuit, go to the terminal blocks marked DR+ and DR-, and TX0+ and TX0-. The terminal located immediately below the base-side transducer is the rod-side transducer. In the maintenance manual, there is a procedure for the changeout and setup of a new transducer. Refer to the Greer Calibration manual for the procedures for zeroing the transducer and performing load tests.

Refer to the procedure on the following page for testing the resistance of a normal transducer. Remember that the readings must balance. If not, the transducer is unbalanced and may give faulty load readings.

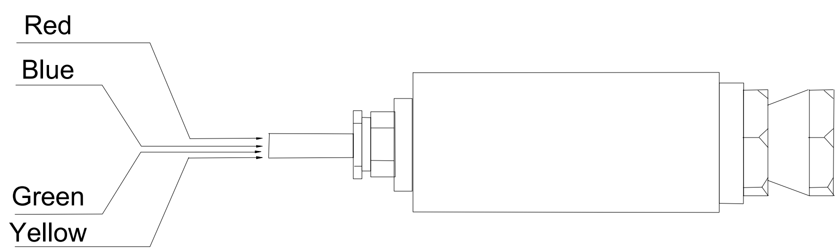
Pressure Transducer Resistance Measurement

- With the power to the computer off, disconnect the piston pressure transducer from the terminal blocks **+DR, -DR, TX0+** and **TX0-** within the computer.

- With the DVM set to the Ohms range, measure the resistance between red and blue wires. The resistance should be **350 Ω +/- 10 Ω.**

- With the DVM set to the Ohms range, measure the resistance between yellow and green wires. The resistance should be **350 Ω +/- 10 Ω.**

- With the DVM set to the Ohms range, measure the resistance between pins. Each of the open wires red, blue, green, yellow and the case of the transducer. There should be no connection between the case and any of the pins.



Typical Transducer W/ Wiring

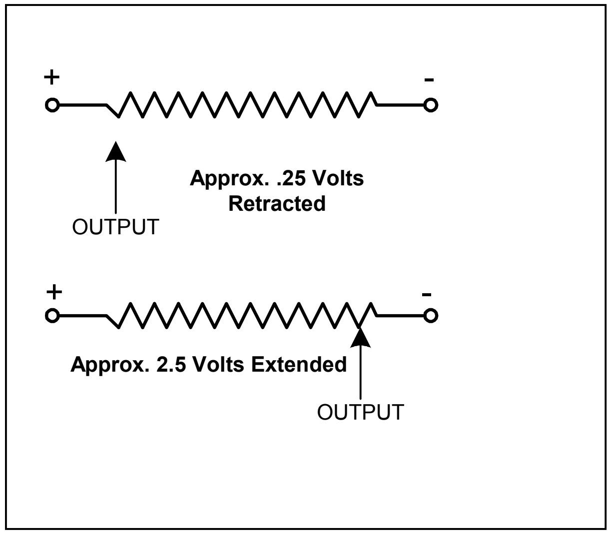
Analog Input Terminals (AIN)

Some terminals on terminal strip TB3 will be marked “AIN” followed by a numeral (0, 1, 2, etc.) “AIN” stands for Analog Input. This means that at this terminal there is an incoming signal to the computer from an analog sensor, such as extension, or boom angle. It is important to be able to identify which terminal goes to which function, as a voltage reading may be necessary to determine if a problem with one of the analog sensors exists. Therefore, each of the “AIN” channels must be identified as well as what information each one feeds into the computer. The first Analog sensor identified here will be the extension sensor.

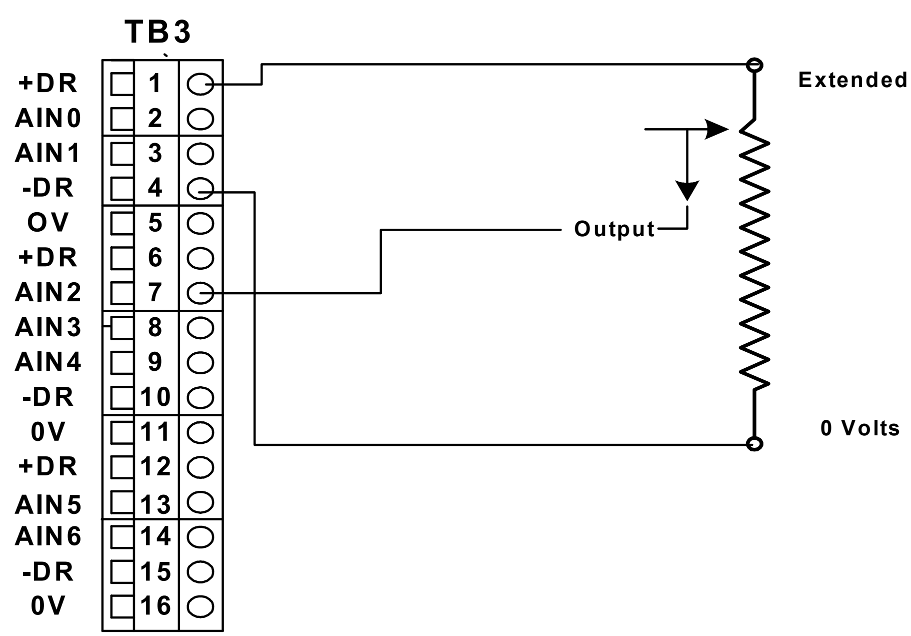
Extension Pot Operation

As discussed in earlier lessons, the extension pot is a precision 10-turn pot. Drive voltage is introduced into the + side, and - to the other end of the coil.

The output side or “wiper,” as it is sometimes called, will have a set starting point **(normally .25 V)** and as the pot is rotated, the voltage will linearly increase until at some point, it will reach the drive voltage, which is **5.25 V (+- .25 V).**



This voltage rise must be steady and consistent without voltage spikes or skips where the voltage drops off. Using a voltmeter, measure the reading at **“AIN2”** on the computer termination board. The schematic below illustrates checkpoints, followed by an explanation of the checkout procedure on the next page.



Extension Pot Schematic

Boom Extension Sensor Ain2

To check the Boom Extension Sensor Voltage, follow the procedure below. To access the voltage checkpoints, carefully remove the computer cover. Move the processor board out of the way and secure it to prevent damage. Remove the extension reel cover for access to the terminal strip in the computer reel.

1. Fully retract the boom. Access the computer and termination boards. Using a digital voltmeter set to read DC voltage, measure the analog sensor drive voltage. Place the negative lead on any 0 (Zero) volt or DR- terminal of the Analog Input Group.
2. Place the positive lead of the meter on the AIN2 terminal of the Analog Input Group. The voltage should be greater than 0.25 volts.
3. Extend the boom as far as is safe to do so. The boom need not be horizontal for this test. The voltage should be less than 5 volts. (Usually around 2.5 volts depending on the boom length). During **extension**, the voltage should **increase** linearly; during **retraction** the voltage should **decrease** linearly.
4. If the voltage is out of the range listed above, remove the four screws that secure the cover on the extension reel, which is located on the left side of the main boom section; remove the cover.
5. Under the cover on the right side of the extension reel is a terminal strip. This terminal strip has six wires connected to the bottom screws. With a digital voltmeter set to read DC voltage, place the negative lead on the terminal with the attached blue wire (- Drive) and the positive lead on the terminal with the attached red wire (+Drive).
6. The voltage should be 5.25+/-0.1 volts. If this voltage is out of range, and if the Analog Drive Voltage measured in the computer was OK, it is possible that the cable is open or grounded between the computer and the extension reel. Check all connections and plugs that may be between these two components. Repair or replace as required. Refer to the proper wiring schematic for the unit being worked on. For wiring details, refer to the Installation Manual for the model of the crane being tested or OEM wiring schematics.
7. With the negative lead of the voltmeter connected to the blue drive (negative) and the positive lead of the voltmeter connected to white (extension signal), the voltage should be the same as the voltage measured at AIN2 of the analog input group in the computer. If this voltage is not the same, it is possible that the cable between the reel and the computer is faulty.

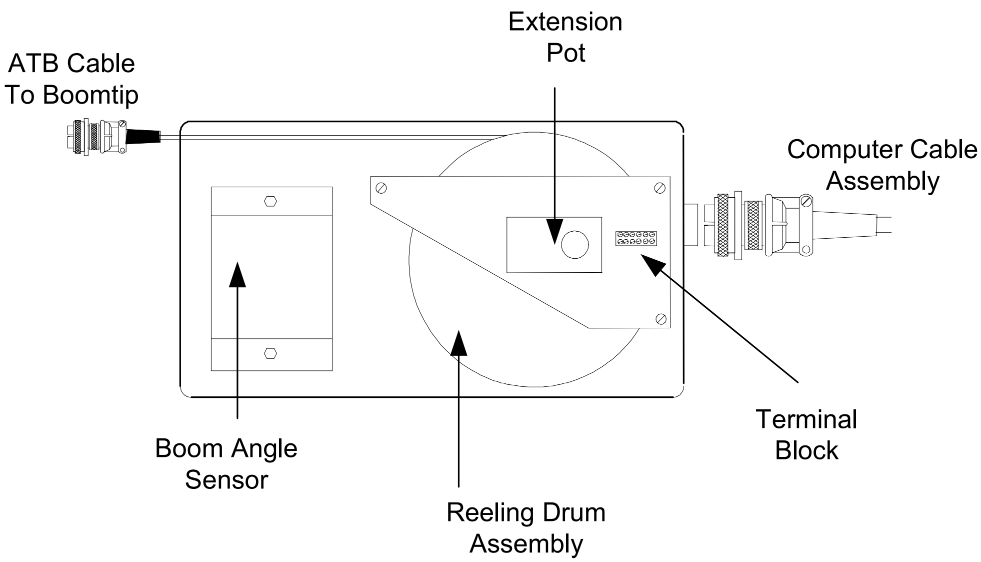
Boom Angle Sensor Ain3

To check the Boom Angle Sensor Voltage, follow the procedure below. To access the voltage check points, carefully remove the computer cover and move the processor board out of the way and secure it to prevent damage. You may also want to remove the angle reel cover to access the terminal strip in the computer reel.

1. Place the main boom at a 0 ° (zero) angle. Verify that it is at a 0 ° (zero) angle with an inclinometer.
2. Access the Termination Board. Check the Analog Drive Voltage. With a digital voltmeter set for DC volts, connect the negative lead of the meter to any 0 (zero) volt terminal of the Analog Input Group.
3. Connect the positive lead to the AIN 3 terminal of the Analog Input Group.
4. With the boom horizontal, the voltage should be 0.4 +/- 0.1 volts.
5. Raise the main boom to a 60 ° angle. Verify that the main boom is at a 60 ° angle with an inclinometer.
6. With the boom at a 60 ° angle, the voltage should be 3.02 +/-0.1 volts. If this is out of range, remove the cover from the extension reel located on the left side of the main boom.
7. Under the cover on the right side of the extension reel is a terminal strip. This terminal strip has six wires connected to the bottom screws.
8. With a digital voltmeter set to read DC voltage, place the negative lead on the terminal with the blue wire (-Drive) and the positive lead on the terminal with the red wire (+Drive).
9. The voltage should be 5.25+/-0.1 volts. If this voltage is out of range and the Analog Drive Voltage has been checked as in step 2 and is OK, it is possible that the extension reel cable is open or grounded between the computer and the extension reel. Check all connections and plugs between these two components. Repair or replace, as required. Refer to the installation manual for the particular unit you're working on, or the OEM manual of the crane being tested for wiring details.

On the following page, see an illustration of the Extension Reeling Assembly for reference and identification of components discussed in the last two procedures. Also listed are procedures for setting up the extension reel sensors after reel or potentiometer replacement.

Extension Reel Assembly (reeling drum)



The Greer Extension Reel Assembly has several important functions. These functions are as follows:

- To store the ATB cable on the extension reel. The cable must be layered neatly so that the cable is maintained and the lay will be as neat as possible.
- To house the angle sensor enclosure. The angle sensor is enclosed inside the housing shown above and has its own cover. The pendulum is made of brass and attaches to the shaft of the angle pot and it is dampened with magnets to assure the movement is precise.
- Provides a terminal strip for termination of all wiring for the length, angle, and ATB sensors.
- Houses a separate bracket to house the length potentiometer length pot clutch assembly.

The reel is normally mounted on the left side of the boom, and in most cases has at least 1 cable guide per boom section.

Anti 2-Block System Components

The signal from the Anti Two-Block (ATB) switches at the boom and fly tips is a switched ground. The ground signal is powered in the computer at the 0 ° volt terminal of the digital input group.

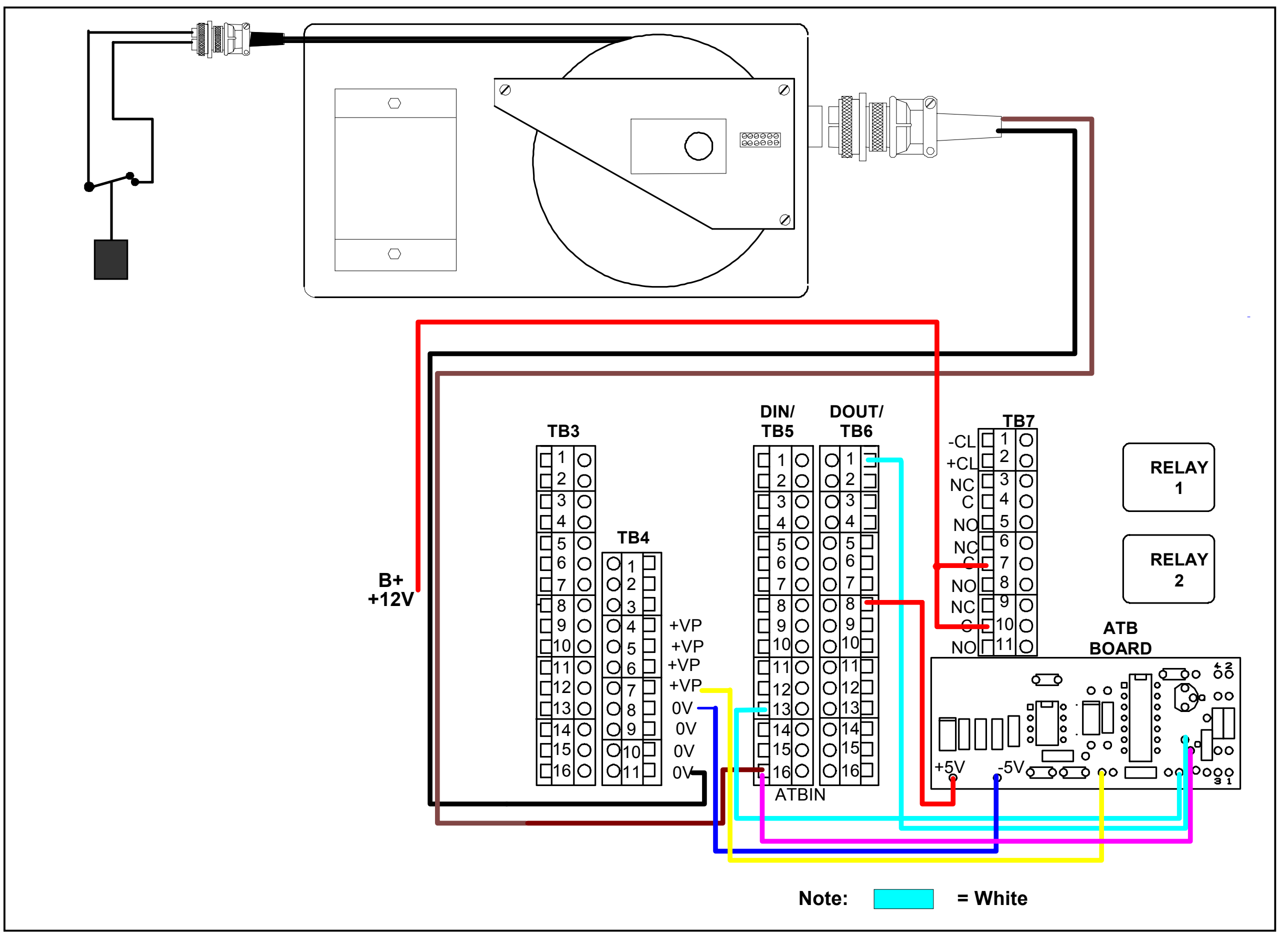
When there is no ATB alarm, the switches at the boom head are closed allowing the ground to be returned to the computer at the ATBIN terminal.

When there is a two-block condition, the appropriate ATB switch will go to the open position, thereby removing the ground from ATBIN and causing ATB Alarm and Function Disconnect.

The ATB board in the computer controls the ATB alarm and Function Disconnects separately.

The ATB board, located in the computer box:

- Operates the function disconnects by controlling the coil of RL2, ATB relay, at DOUT 1.
- Operates the audible alarm and on-screen message by controlling the logic level at DIN13.

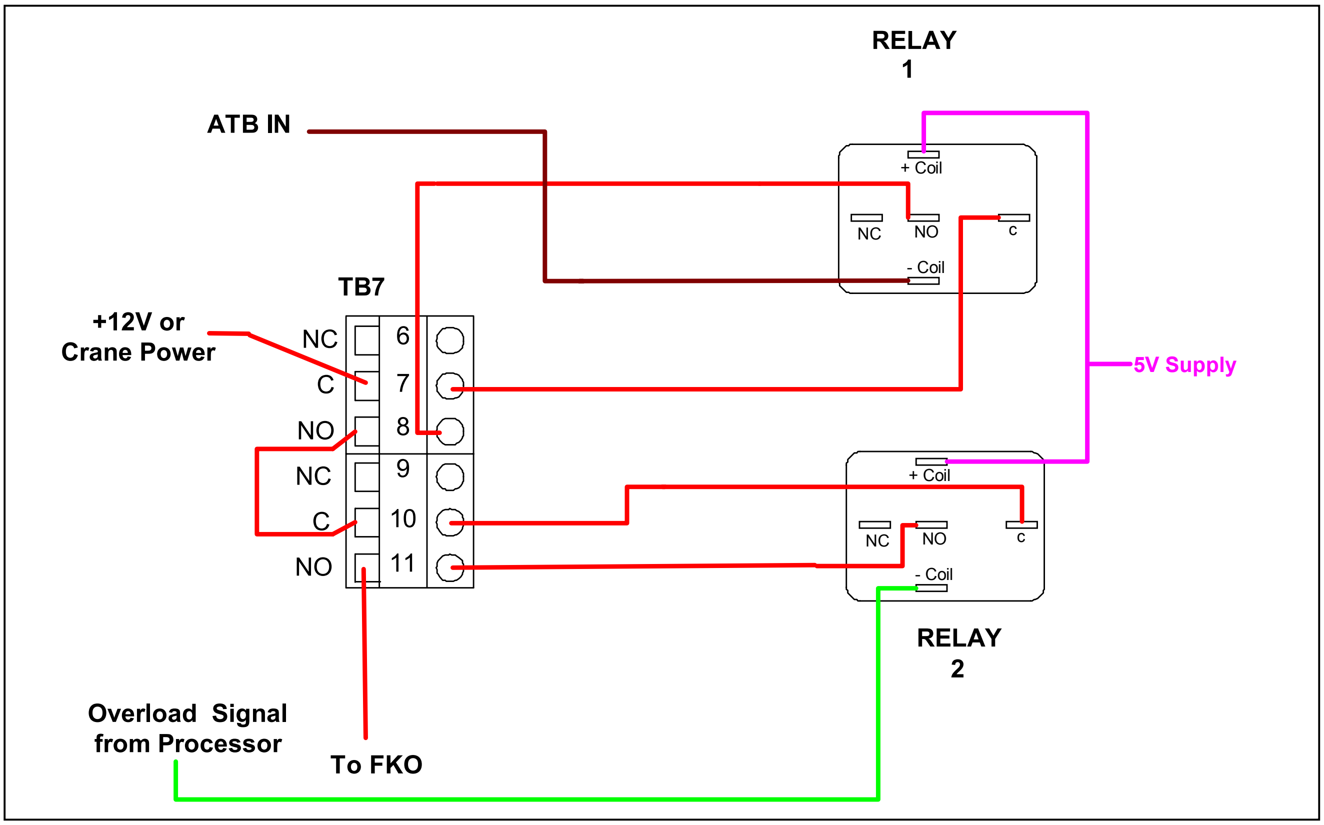


Where Do Relay Signals Come From?

There are two relays on the termination board (lower) that are marked Relay 1and Relay 2. These relays are mounted in such a way, that they can work parallel with each other as well as separately. (When ATB function is tripped, the overload signal may still be closed (the opposite also applies) There are two signals that may interrupt the flow of power to the relay coils:

- The brown wire, which is the ground signal that is returning from the reel to the ATBIN port on the termination board
- The green signal that is directed by the processor on the upper board. If either connection to the relay coils is interrupted, it will cause function lockout.

This circuit is built into the circuit board, making it impossible to visually see the color-codes inside the computer. The purpose of this system is to be able to separate the two conditions when they occur, visually as well as with warnings on the display console.

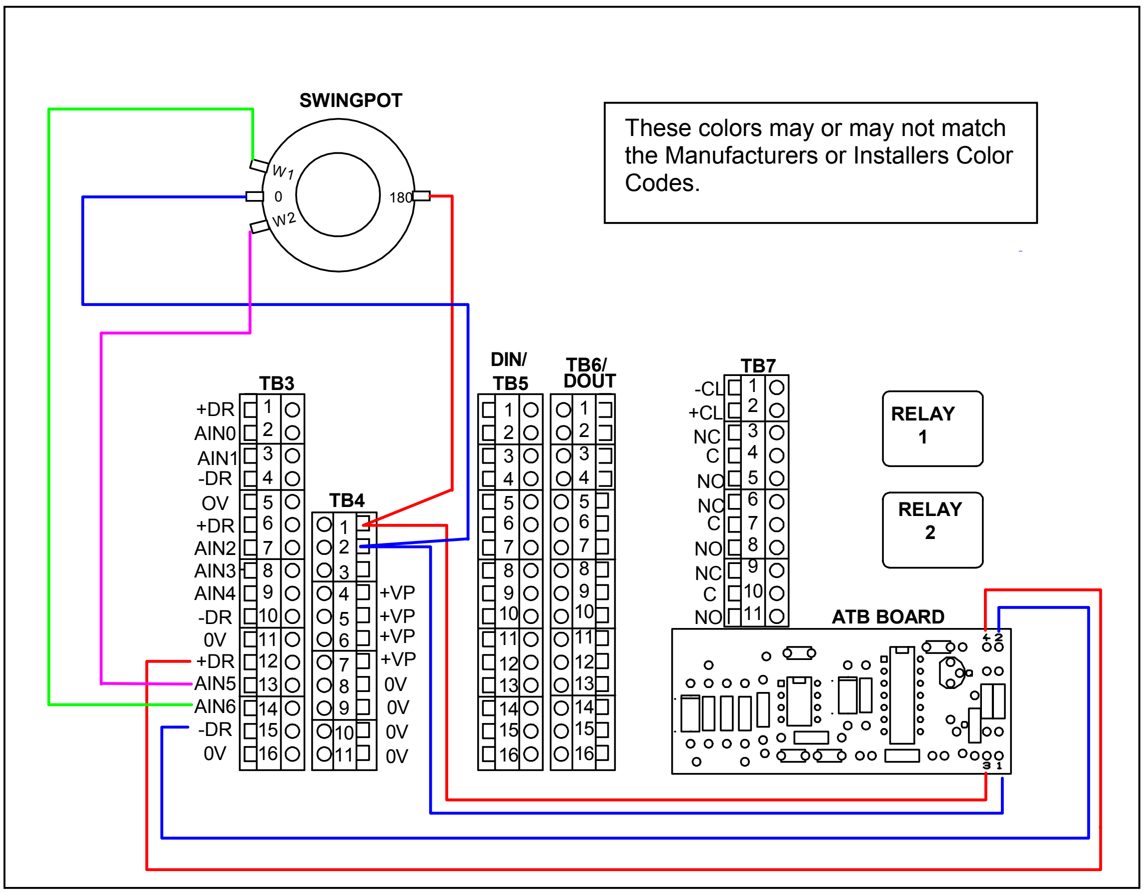


Typical Relay Wiring Diagram FKO

Swing Potentiometer (Swing Pot)

The position of the upper structure in relation to the carrier must be determined. This is accomplished by means of a swing potentiometer generally mounted in the collector ring under the hydraulic swivel. If the system does not have input from the swing potentiometer, it will not be able to find a duty. The swing pot is a multi-directional pot that has overlapping ends to assure that as the upper structure of the crane rotates around in a circle "the end" is never reached. The potentiometer is furnished by the manufacturer of the crane and is nearly always mounted inside the collector ring on the bottom of the hydraulic swivel. The swing pot is reliable and usually does not cause a problem.

First explore the wiring diagram of the swing pot to see the source of the drive and analog voltages that run this circuit. Note the schematic below:



Typical Swing Pot Schematic

To check the Swing Potentiometer, follow the procedure below:

1. Access the computer and Termination Board.
2. Check the Analog Drive voltage.
3. With a digital voltmeter set for DC volts, check the voltage at the connections to the potentiometer located on the ATB board. Connection 1 has an attached red wire and connection 3 has an attached black wire.
4. Connect the black lead of the DVM to connection 3 (black wire) and the red lead of the DVM to connection 1 (red wire). The voltage should be 4.125 +/- 0.1 volts. If this voltage is out of range, the Termination Board may need to be replaced.
5. With the black lead on any 0 volt terminal, check the voltage at the AIN 5 and AIN 6 terminals. The voltage should be 4.50 +/- 0.1 maximum and 0.365 +/-0.1 minimum.
   Both of these voltages should rise and fall linearly within this range, as the upper is rotated left or right. If the Drive Voltage and the voltage at the connection to the potentiometer were correct and the voltages on AIN 5 and AIN 6 are out of range, the swing potentiometer must be replaced.

Contact your distributor or your Factory Service Department for procedures on replacing the swing potentiometer.