

Greer Company *Crane Systems*

MICROGUARD[®] 500 EXTENSION REEL

TRAINING MANUAL

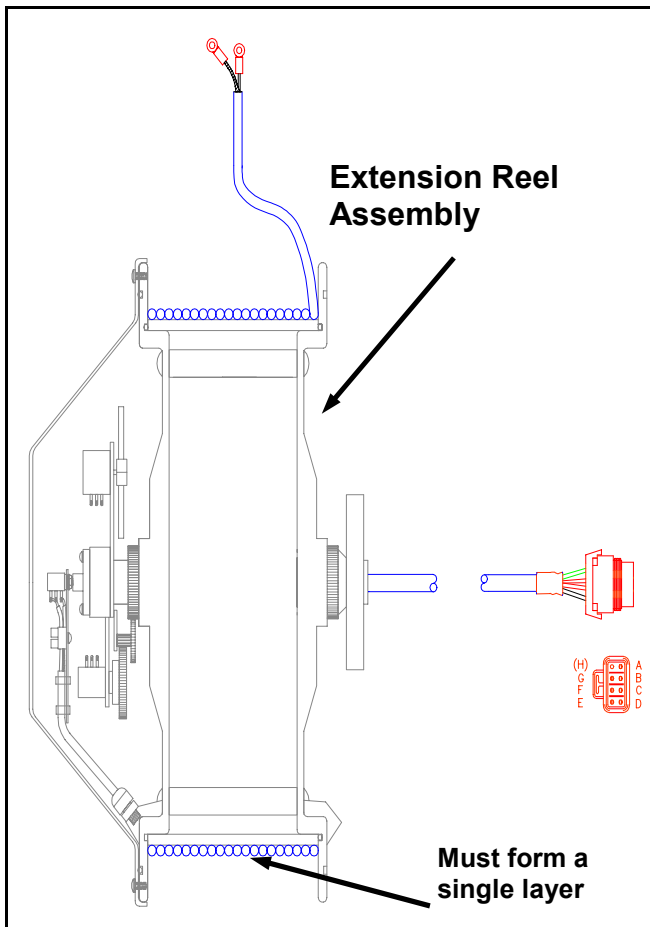


TABLE OF CONTENTS
MICROGUARD 500 SERIES EXTENSION REEL
TRAINING MANUAL

EXTENSION REEL OVERVIEW.....	3
REEL-OFF CABLE LAYERING	3
CHECKING THE REEL-OFF CABLE LAYERING.....	4
SENSOR BASEPLATE ASSEMBLY.....	5
CHECKING BOOM SENSOR DRIVE VOLTAGE.....	6
CHECKING THE BOOM EXTENSION SENSOR VOLTAGE.....	6
EXTENSION SENSOR SETUP	7
PHYSICAL ZERO.....	7
ZERO CALIBRATION.....	7
CHECKING THE ANGLE SENSOR PENDULUM.....	8
CHECKING THE ANGLE SENSOR DRIVE VOLTAGE	9
CHECKING THE ANGLE SENSOR VOLTAGE.....	9
REMOVING THE SENSOR ASSEMBLY	10
INSTALLING THE SENSOR ASSEMBLY.....	10
SIGNAL CABLE ASSEMBLY.....	11
REMOVING THE EXTENSION REEL FROM THE BOOM	11
REMOVING THE SIGNAL CABLE FROM THE EXTENSION REEL	11
INSTALLING THE SIGNAL CABLE	12
ANTI TWO-BLOCK FUNCTION OVERVIEW.....	13
CHECKING THE EXTENSION REEL-OFF CABLE	14
CHECKING THE ANTI TWO-BLOCK CIRCUIT.....	14
EXTENSION REEL REPLACEABLE PARTS	16
EXTENSION REEL-OFF CABLE.....	16
REMOVING THE EXTENSION REEL-OFF CABLE.....	17
INSTALLING THE EXTENSION REEL-OFF CABLE	17
SLIP-RING ASSEMBLY.....	18

EXTENSION REEL OVERVIEW

The primary operation of the EXTENSION REEL is to measure the extension of the telescoping sections of the main boom. The extension reel also includes an angle sensor to measure the main boom angle, and an electrical slip-ring which transfers the Two-Block signal from the reel-off cable to the system computer.



REEL-OFF CABLE LAYERING

The extension reel is designed to provide accurate measurement of boom extension when the REEL-OFF CABLE forms a single flat layer across the surface of the extension reel as the boom is telescoped in and out.

Any stacking of the cable will cause extension errors as the boom retracts.

1. Telescope the boom fully out and then fully in.
2. Check that the reel-off cable forms a flat single layer across the surface of the extension reel, with each successive turn of cable laying next to the last.

If any stacking or build up of the cable occurs, make sure that the first cable guide at the top of the boom root section is correctly aligned with the outside edge of the extension reel, as shown in the figure at the left. Clean the reel-off cable; then lubricate it with a silicone oil.

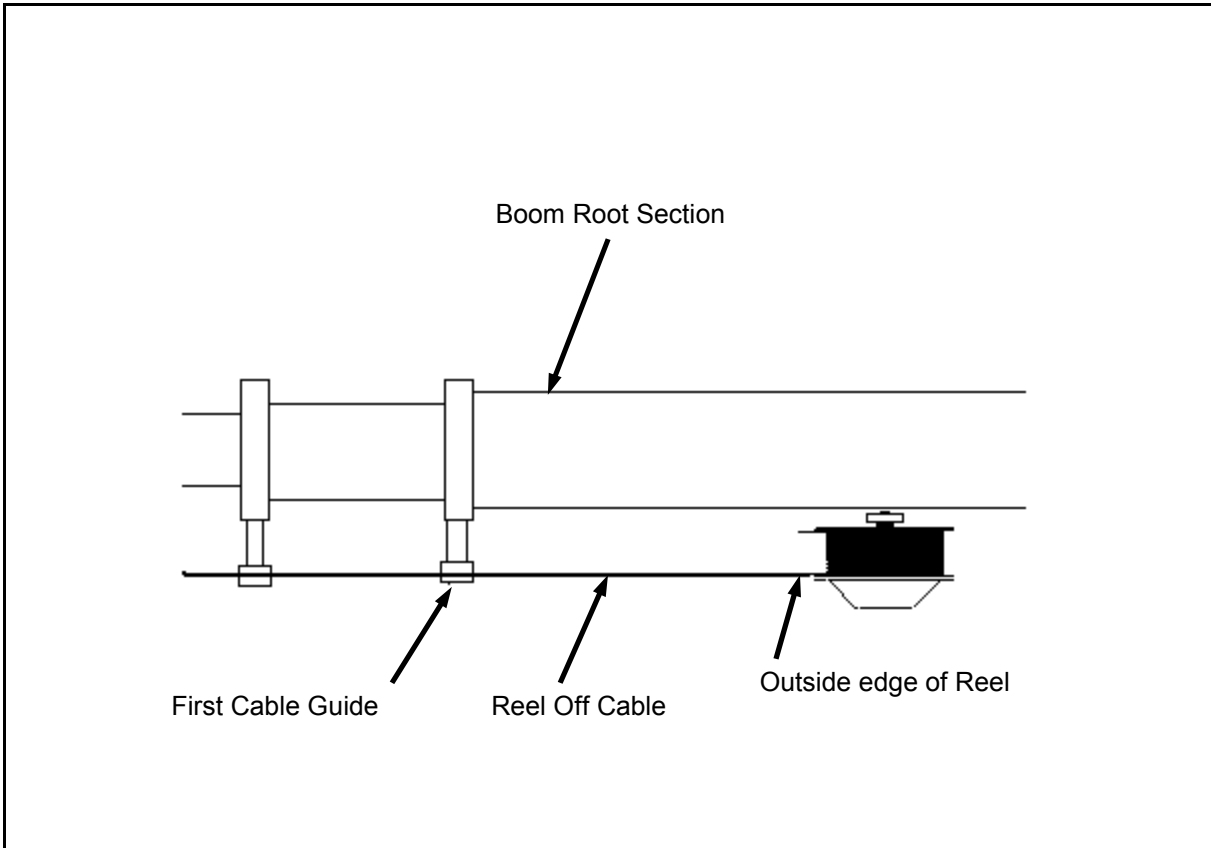
CHECKING THE REEL-OFF CABLE LAYERING

The extension reel is designed to provide accurate measurement of boom extension when the REEL-OFF CABLE forms a single flat layer across the surface of the extension reel as the boom is telescoped in and out. Any stacking of the cable will cause extension errors as the boom retracts.

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Clean the reel-off cable; then lubricate it with a silicone oil.

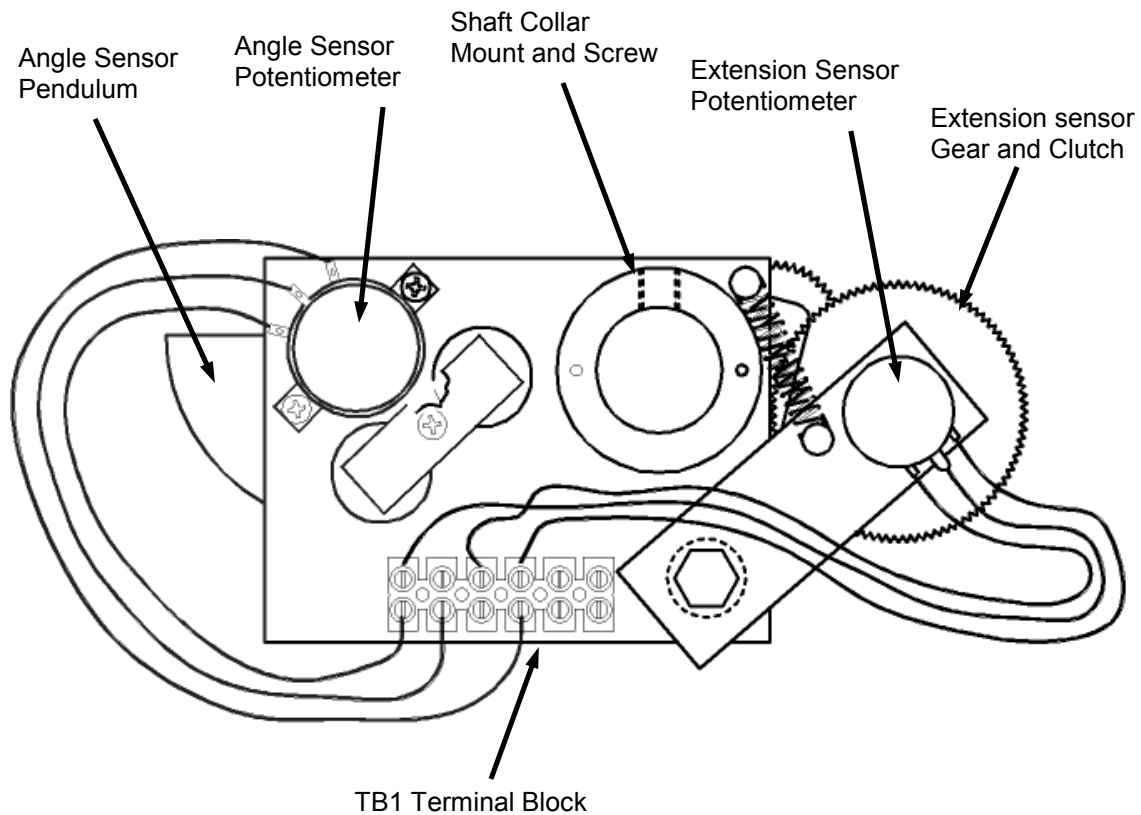


SENSOR BASEPLATE ASSEMBLY

The SENSOR BASEPLATE ASSEMBLY supports both the extension and angle sensors and provides interconnection between the sensors, the Two-Block switch to the slip ring, and the signal cable to the system computer.

Electrical or mechanical failure of either the angle sensor or the extension sensor potentiometers may not be field repaired, since the angle sensor pendulum is factory set on the potentiometer shaft, and the extension potentiometer gear contains a protection clutch which is difficult to replace in the field. In the event of failure of either of these items, the whole sensor baseplate assembly must be replaced.

The terminal block (TB1), mounted on the assembly, provides wiring connection for all internal parts of the extension reel, and the signal cable connecting the reel to the system computer. Most electrical diagnoses of the boom sensors may be made at this terminal block.



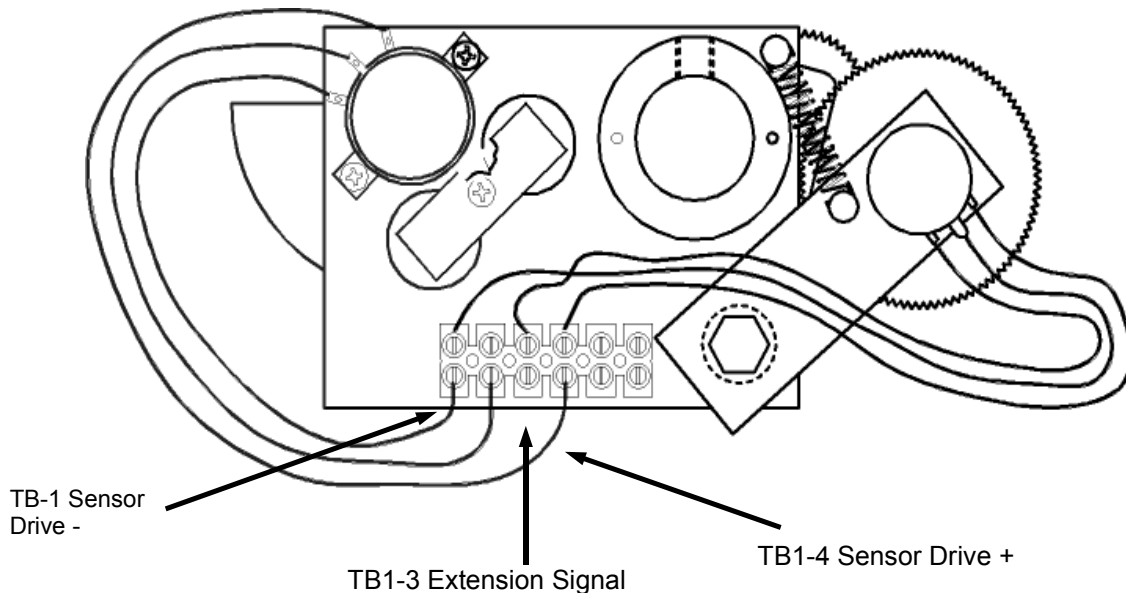
CHECKING BOOM SENSOR DRIVE VOLTAGE

1. Remove the extension reel cover.
2. Using a digital voltmeter, measure the voltage between the RED (TB1-4) and BLUE (TB1-1) wires at the terminal block mounted on the sensor baseplate assembly.
3. Check that the voltage is between 4.7 and 5.3 volts.

Voltages outside the range specified above will indicate an interconnection problem between the extension reel and the computer or, a short circuit within the extension reel.

CHECKING THE BOOM EXTENSION SENSOR VOLTAGE

1. Fully retract the boom.
2. Remove the extension reel cover.
3. With a digital voltmeter, measure the voltage between the BLUE wire (TB1-1) and the WHITE wire (TB1-3).
4. With the boom fully retracted, the voltage should be between 0.1 and 0.3 volts. If the voltage is incorrect, follow the EXTENSION SENSOR SETUP PROCEDURE.
5. Still measuring the voltage at the same points, telescope the boom out and check that the potentiometer is operating by verifying that the voltage increases.



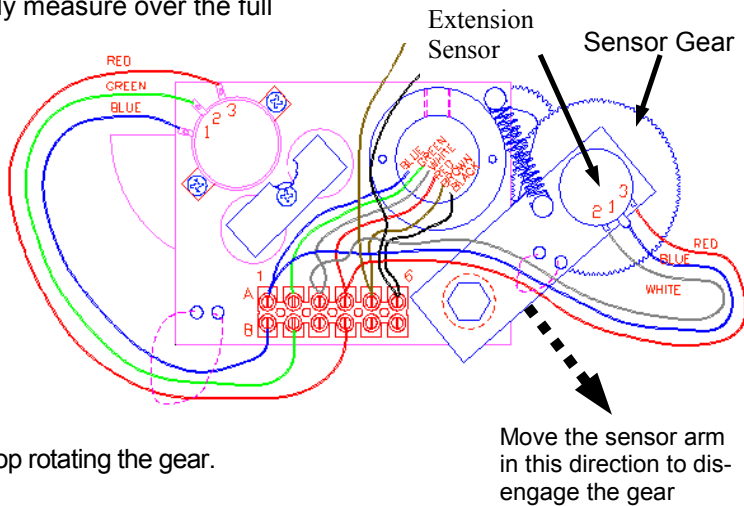
EXTENSION SENSOR SETUP

The following procedures define how to reset and calibrate the EXTENSION SENSOR, if necessary. Before any of these procedures are used, check that the reel-off cable is layering correctly.

PHYSICAL ZERO

It is necessary to ensure that the extension sensor potentiometer is correctly set to its minimum "zero" setting when the boom is fully retracted. This ensures that the sensor will correctly measure over the full telescoping range of the boom.

1. Fully retract the boom.
2. With the cover of the extension reel removed, disengage the main gear wheel connected to the extension sensor by pulling the sensor arm in the direction shown.
3. Rotate the gear clockwise until the sensors clutch detonate starts to click. At the next click, stop rotating the gear.
4. Measure the voltage between TB1-3 and TB1-1 Rotate the gear counterclockwise about half a turn setting the voltage to 0.2 volts. Then, carefully release the sensor arm, ensuring that the voltage remains at 0.2 volts as the gears re-engage.



ZERO CALIBRATION

The computer must identify where the ZERO POINT of the extension sensor has been set (see above). It is therefore necessary to calibrate the zero setting of the potentiometer.

Before continuing, ensure that the mechanical zero has been properly set. Fully retract the boom.

1. Enter the setup mode at the display console.
2. Zero the extension sensor.
3. Before exiting the command, ensure that the displayed value is between -4 and +4.

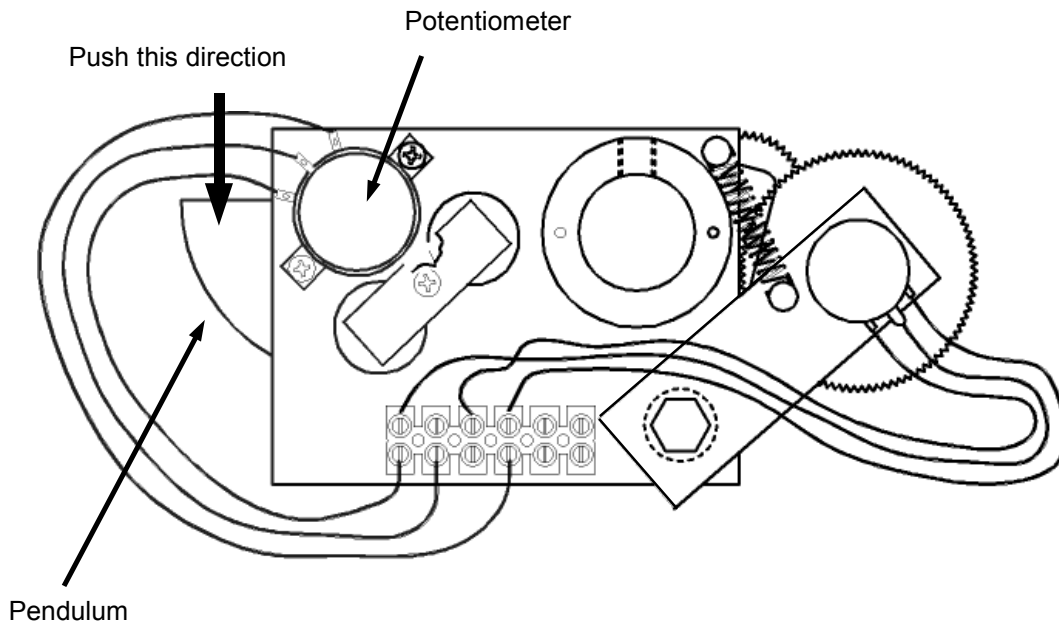
CHECKING THE ANGLE SENSOR PENDULUM

The ANGLE SENSOR uses a copper PENDULUM, mounted behind the sensor assembly. In order to stop the pendulum from swinging uncontrollably during movements of the boom, two magnets provide damping.

If problems with the angle sensor are suspected, check that the pendulum and potentiometer are operating without restriction, before continuing to check electrical operation and performing any calibration.

1. Remove the extension reel cover.
2. Locate the PENDULUM in the graphic below. Push the pendulum downwards in the direction shown and ensure that it doesn't feel as if it is sticking. Some resistance of movement may be encountered as the pendulum is moved; however, this is due to the magnets that provide the damping.
3. Release the pendulum and make sure that it returns with free, but controlled movement, directly back to its original position.
4. Push the pendulum downwards a few more times, checking that it returns, each time, to its starting position.

NOTE: If any "sticking" of the pendulum is encountered while performing the above checks, ensure that there are no wires touching the pendulum, or that other obvious problems are present. If not, it will be necessary to replace the sensor assembly.



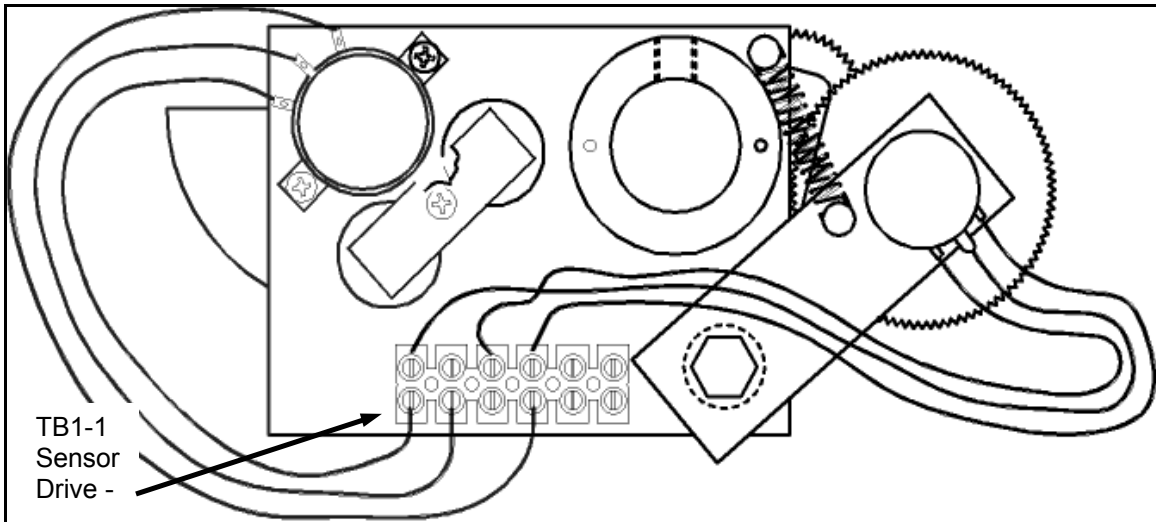
CHECKING THE ANGLE SENSOR DRIVE VOLTAGE

1. Remove the extension reel cover.
2. Using a digital voltmeter, measure the voltage between the RED (TB1-4) and BLUE (TB1-1) wires at the terminal block mounted on the sensor baseplate assembly.
3. Check that the voltage is between 4.7 and 5.3 volts.

Voltages outside the range specified above will indicate an interconnection problem between the extension reel and the computer or, a short circuit within the extension reel. Check extension reel wiring within the reel and at the boom foot base connector.

CHECKING THE ANGLE SENSOR VOLTAGE

4. Using an inclinometer for verification, place the main boom at a 0° (zero) angle; then remove the extension reel cover.
5. With a digital voltmeter, measure the voltage between the BLUE wire (TB1-1) and the GREEN wire (TB1-2). With the boom horizontal, the voltage should be between 0.3 and 0.5 volts. If the voltage is incorrect, follow the ANGLE SENSOR SETUP PROCEDURE.
6. Still measuring the voltage at the same points, move the exposed side of the angle sensor pendulum downwards, and check that the potentiometer is operating by verifying that the voltage increases.
7. Check that the pendulum moves freely, and when released, falls smoothly back to the original 0° (zero) voltage reading, as measured in Step 5.



REMOVING THE SENSOR ASSEMBLY

1. Remove the aluminum cover on the extension reel.
2. Unscrew the screws holding the slip-ring to the mounting ring of the SENSOR ASSEMBLY.
3. Disconnect the brown and black wires.
4. Disconnect the signal cable wires to terminal block TB1.
5. Using a 5/32" Allen wrench, loosen the set-screw that holds the baseplate on the shaft.
6. Remove the sensor assembly.

INSTALLING THE SENSOR ASSEMBLY

Place the boom in a horizontal position when installing the SENSOR ASSEMBLY.

1. Feed the wires coming out of the main shaft through the mounting collar on the sensor assembly.
2. While pulling both extension sensor gears out, against the spring, slide the sensor assembly onto the shaft until the top of the shaft aligns with the top of the mounting collar. Align the top edge of the assembly parallel with the boom.
3. Tighten the set-screw and release the gears allowing them to mesh with the extension reel spline. Route the wires to the terminal block and hook up the wires, as indicated below.
4. Tuck the unconnected remaining yellow and orange wires down into the shaft.

SENSOR ASSEMBLY TERMINAL BLOCK WIRING						
TERMINAL	TB1-1	TB1-2	TB1-3	TB1-4	TB1-5	TB1-6
WIRE COLOR	BLUE	GREEN	WHITE	RED	BROWN	BLACK
SIGNAL	SENSOR DRIVE -	ANGLE	EXTENSION	SENSOR DRIVE +	ATB-SIGNAL	ATB-FEED

5. Screw the slip-ring assembly to the baseplate of the sensor assembly.
6. Connect the brown wire on the slip-ring assembly to TB1-5; connect the black wire to TB1-6. Strip wires, if not already stripped.

7. **Note:** Ensure that the wires lay flat. Ensure that there will be enough space to allow the slip-ring arm to freely rotate.
8. Check the wiring and then follow the procedures to set up both the angle and extension sensors later in this section.

SIGNAL CABLE ASSEMBLY

The SIGNAL CABLE ASSEMBLY provides interconnection between the extension reel sensors, the Two-Block switch and the system computer.

REMOVING THE EXTENSION REEL FROM THE BOOM

1. Fully lower and retract the boom.
2. Disconnect the EXTENSION REEL CABLE from the Anti Two-Block switch.
3. Gripping the extension reel cable firmly, remove it from the tie-off post.
4. Maintain a firm hold on the extension reel cable as the cable unwinds back onto the reel.
5. Secure the end of the extension reel cable to prevent unwinding.
6. Disconnect the signal cable at the distal end.
7. Unbolt the extension reel from the crane with a wrench.

REMOVING THE SIGNAL CABLE FROM THE EXTENSION REEL

1. Remove the cover from the extension reel.
2. Remove the slip-ring on the baseplate of the sensor assembly.
3. Disconnect all wires from the sensor assembly **EXCEPT** for the 6 wires leading to the angle and extension sensor potentiometers.
4. To protect the sensors within the extension reel, use two screws to temporarily reattach the cover of the extension reel.
5. Turn over the extension reel with cover attached, exposing the back of the device.
6. With the wires still disconnected, pull the SIGNAL CABLE out of the main shaft in the center of the reel. This cable has a strain-relief encircled with an "O"-Ring, creating a tight fit that seals out water.

NOTE: If it is difficult to remove the cable, use the Insertion/Extraction tool from the **FRONT** of the extension reel to release the cable.

INSTALLING THE SIGNAL CABLE

1. Unpack the new SIGNAL CABLE and ensure that the "O"-ring on the strain-relief is greased.
2. With the back of the extension reel still exposed, insert the end of the signal cable with the "O"-ring into the mounting plate and down the shaft in the center of the reel.
3. Seat the strain-relief, with attached "O"-ring, as follows, using the tool provided in the kit.
4. Bend the cable to the side. Position the hollowed-out section of the tool on the strain-relief plug at the top of the shaft.
5. With a hammer, gently tap the top of the tool forcing the strain-relief into proper position in the shaft. Continue to tap gently until the strain-relief plug will go no further.
6. Turn over the extension reel and remove the cover.
7. Connect the wires to the terminal block on the baseplate, as indicated below.
8. Tuck the unconnected remaining yellow and orange wires down into the shaft.
9. Connect the brown wire from the slip-ring assembly to TB1-5; connect the black wire to TB1-6. Strip wires, if not already stripped.
10. Screw the slip-ring assembly to the baseplate of the sensor assembly.
11. **NOTE:** Ensure that the wires lay flat and toward the terminal connectors, as shown in Figure 6.1 on page 39. Ensure that there will be enough space to clear the wires when the arm of the slip-ring rotates.
12. Replace the cover on the extension reel; reinstall the extension reel.

SIGNAL CABLE TERMINAL BLOCK WIRING						
TERMINAL	TB1-1	TB1-2	TB1-3	TB1-4	TB1-5	TB1-6
WIRE COLOR	BLUE	GREEN	WHITE	RED	BROWN	BLACK
SIGNAL	SENSOR DRIVE -	ANGLE	EXTENSION	SENSOR DRIVE +	ATB-SIGNAL	ATB-FEED

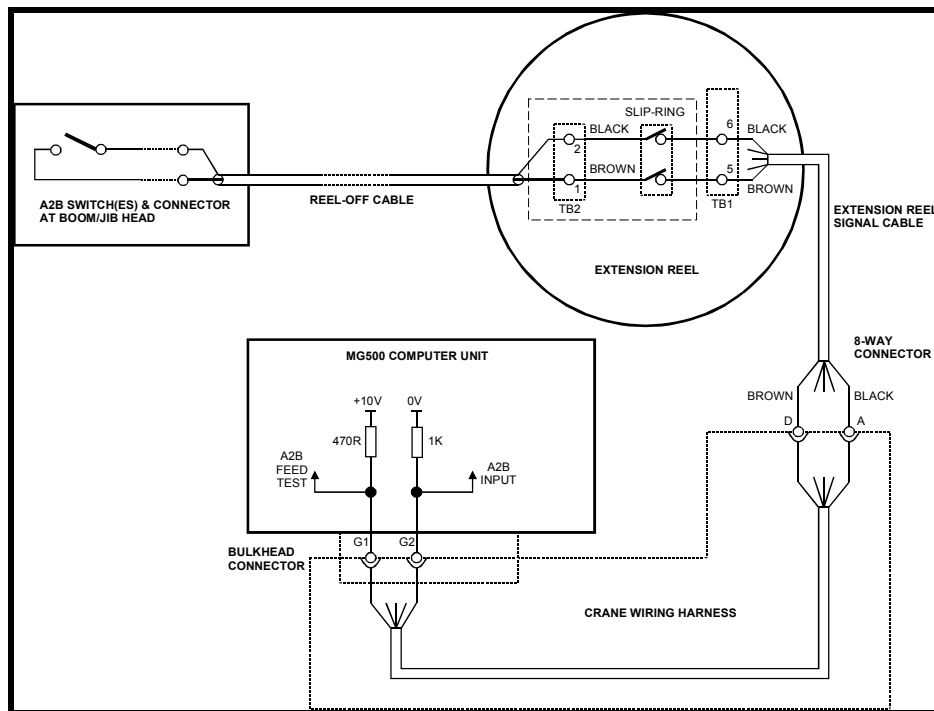
ANTI TWO-BLOCK FUNCTION OVERVIEW

This section describes fault diagnoses of the Anti Two-Block detection circuit. For details of function kickouts (including the Anti Two-Block kickout), refer to SECTION 8.

The computer supplies a protected positive feed to the Anti Two-Block switches at the boom/jib head via the extension reel signal cable, slip-ring, and extension reel-off cable. With the Anti Two-Block weight hanging freely on the switch(es), the switch contact is closed and the signal return to the computer is high (6.25 volts). When the weight is lifted by the hook block, the switch contact is opened, and the computer will sense a low signal input (0 volts) from the A2B signal return.

Since the computer checks the protected feed voltage internally, the system is capable of detecting a short circuit of the feed (or the A2B signal return when the switch is closed) to the crane chassis. fault codes are defined in SECTION 2.

The Anti Two-Block detection circuit is probably the most susceptible part of the System, since it is carried through so many of the system components. Often, most problems with this circuit may be identified through inspection of cables, switches, and the extension reel. Damage to these parts may result in continuous or intermittent A2B alarms.



CHECKING THE EXTENSION REEL-OFF CABLE

The outer braid of the cable carries the Anti Two-Block feed to the switches. If the cable sheath is damaged, this may cause a short circuit to the boom/chassis. If this is the case, a fault code above "B 8" will be indicated. The same fault code will be indicated if the A2B switch is closed and the inner core of the cable is shorted to chassis at some point in the wiring.

- Carefully inspect the reel-off cable for wear.
- Check for signs of damage to the outer sheath of the cable.
- Check for any signs of severe "kinking" or crushing of the cable.

CHECKING THE ANTI TWO-BLOCK CIRCUIT

Before continuing, ensure that connectors are correctly connected to the A2B switches at the boom head/jib.

1. Remove the extension reel cover.
2. Disconnect the slip-ring arm from the plug by pulling it away from the center of the reel.
3. Close the A2B switch at the boom head by suspending the weight from it or pulling on the chain.
4. Measure the resistance between TB2-1 & TB2-2 terminal connections on the sensor arm.
5. With the A2B switch closed, the resistance should be less than 300 ohms. If not, this suggests that the reel-off cable, A2B switch, or one of the boom head connectors has an Open circuit.
6. Open the A2B switch at the boom head by lifting the weight.
7. Measure the resistance between TB2-1 and TB2-2 terminal connections on the sensor arm.
8. With the A2B switch open, the resistance should be greater than 10,000 ohms. If not, this suggests that the reel-off cable, A2B switch, or one of the boom head connectors has a short circuit.

EXTENSION REEL REPLACEABLE PARTS

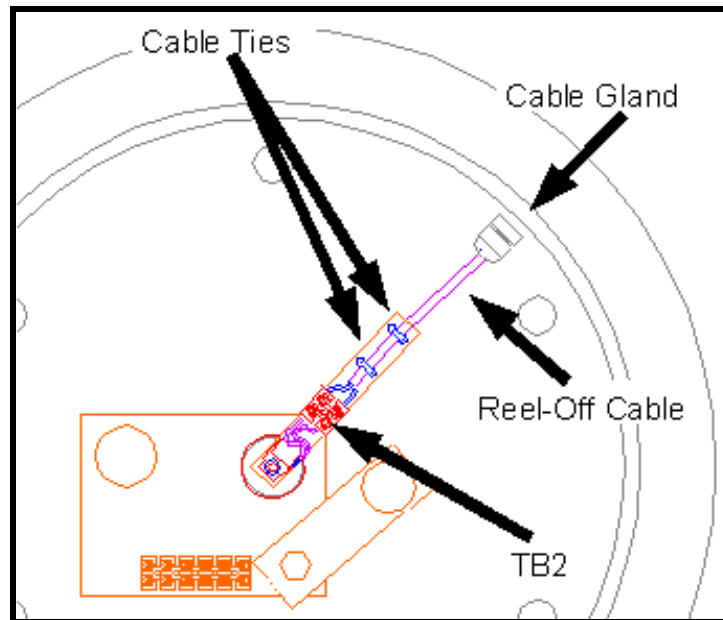
The EXTENSION REEL is field-serviceable in every respect except for the spring chamber/extension reel surface and shaft assembly. Failure of the recoil spring, damage to the shaft or reel surface and side plates requires complete replacement of the extension reel.

The following parts of the extension reel, are field-replaceable:

- EXTENSION/REEL-OFF CABLE ASSY
- SLIP-RING ASSEMBLY
- SENSOR BASEPLATE ASSEMBLY
- CABLE TAIL ASSEMBLY (SIGNAL CABLE)
- COVER

EXTENSION REEL-OFF CABLE

The EXTENSION REEL-OFF CABLE, running from the extension reel to the main boom head, carries the Anti Two-Block signal from the switches at the main boom head, aux head and erected jib/fly. The cable is made from stainless steel wire and a durable outer sheath. Damage to the cable will often result in bad Two-Block signals or bad measurement of boom extension. If the cable has been broken or damaged in any way, it can be field-replaced.



REMOVING THE EXTENSION REEL-OFF CABLE

1. Fully retract and lower the boom. Then, disconnect the REEL-OFF CABLE from the Anti Two-Block switch or connector.
2. Gripping the cable firmly, release it from the tie-off post.
3. Continue to grip the cable firmly while allowing it to fully wind back onto the extension reel.
4. Remove the extension reel cover.
5. Cut the 2 tie-wraps that secure the extension reel-off cable to the slip-ring support arm.
6. Unscrew the extension reel-off cable from the terminal block on the slip-ring support arm.
7. Loosen the gray cable gland mounted on the cheekplate.
8. Pull the existing extension reel-off cable out through the cable gland.

INSTALLING THE EXTENSION REEL-OFF CABLE

1. Loosen the strain relief on the cheekplate and feed the EXTENSION REEL-OFF CABLE through the wall of the cheekplate. Leave enough slack to work easily with the cable.
2. If not already stripped, remove 1" of the outer jacket of the cable with an X-ACTO knife.
3. Unravel the stainless steel braid and twist it into a single wire.
4. Remove 1/4" insulation from the center wire. The insulation bonded to the center wire is difficult to remove. Remove small increments about 0.1" at a time with wire strippers.
5. Connect the extension reel-off cable to TB2 on the arm of the slip-ring. The braided wire connects to the black wire and the center core connects to the brown wire. Using two cable ties, tie the cable to the arm of the slip-ring.
6. Secure the extension reel-off cable to the arm of the slip-ring with 2 tie-wraps.
7. Adjust the cable to bend slightly from the strain relief to the slip-ring. Rotate the extension reel. Ensure that the path of the new cable is unimpeded; then, tighten the strain relief.
8. Wind the extension reel-off cable onto the extension reel in a single layer.
9. Set pre-tension (5 turns counterclockwise). Thread the extension reel off-cable through the cable guides. Attach the cable to the boom tie-off-post and connect it to the Anti Two-Block switch.
10. Set the potentiometer to zero as needed.

11. Fully telescope the boom in and out at least twice ensuring that the cable remains in a single flat layer on the drum, and length display on console is accurate with a fully extended or fully retracted boom. surface will cause measurement errors. If this is the case, it may be necessary to check that the first cable guide aligns correctly with the outside edge of the extension reel surface.
12. Fully telescope the boom in and out at least twice ensuring that the cable remains in a single flat layer on the drum, and length display on console is accurate with a fully extended or fully retracted boom. surface will cause measurement errors. If this is the case, it may be necessary to check that the first cable guide aligns correctly with the outside edge of the extension reel surface.
13. Reinstall the cover of the extension reel, ensuring that the "O" ring on the inside of the Extension Reel is intact.

SLIP-RING ASSEMBLY

