Pelican 2024 NP T4F

DIAGNOSTICS MANUAL

ELGIN
Subsidiary of Federal Signal Corporation

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02/2025


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2024 Pelican NP T4F

DIAGNOSTICS MANUAL

Elgin Sweeper Company
Subsidiary of Federal Signal Corporation
1300 West Bartlett Road, Elgin, Illinois 60120
Phone: 1.847.741.5370 Fax: 1.847.742.3035


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CONTENTS

USER NOTES

REVISION HISTORY

The Elgin Sweeper Technical Publications Department releases this manual at Revision B to incorporate the changes in Table 1: Revision History:

Table 1: Revision History

Revision Level	Release Date	Change Description
A	11/2024	• Initial release to support Pelican NP T4F sweepers equipped with touch screen display interface/electronic control system.
B	2/2025	• Update Fuel Level Sender Circuit on page 98 and Fig. 93: Fuel Level Sender Circuit on page 98

USER NOTES

PRELIMINARY CHECKS

Before starting to diagnose and check components related to an error condition, always check all fuses protecting the circuit. See the back side of the fuse box cover for fuse and relay locations.

NOTICE

In some circumstances, the fuse may route a limited amount of current. If doubt exists, replace the fuse.

See the sections in the diagnostics manual related to the error, such as circuit descriptions and fault code descriptions, and become familiar with the switches and electrical circuits associated with the error.

See Hydraulic Solenoid Valves on page 32 for a description and location of the solenoid valves.

All the electrical circuits associated with the sweeper are contained in the diagnostics manual. Before starting a diagnostics procedure, read and understand each circuit description, which includes an electrical schematic with illustrations to aid in the circuit diagnostics and component location.

The Pelican uses controller CR721S for logic type operations and a CR1203 display controller that converts inputs from the controller CR721S to the display, illustrating sweeper operations and messages for the operator. Read and understand the diagnostics manual sections related to control modules, controller pin locations and uses. Use the controller pin locator tables to determine controller inputs, outputs and wire colors for locating the correct wire and pin association. Also, see Sweeper CAN Backbone on page 17 to understand the communications between the operator, components and controllers.

Use the diagnostics sections to help locate and correct errors and problems. The electronically generated fault code is included in each circuit description along with display screens and suggested troubleshooting steps for resolving any errors. If a circuit description does not show a fault code description, there are no fault codes for that circuit.

The sweeper battery and related circuits (i.e. sweep power circuit, battery power circuit and switched power circuit) are critical for proper circuit operation. Perform a complete battery and charging circuit test and evaluation. Make sure the battery terminals are clean and secure. Inspect the ground cable for excessive wear, damage and corrosion.

RELAYS

Relays are electrical devices used to transfer one circuit of the electrical system to another circuit or circuits. The relay can use low power to transfer higher power from circuit to circuit.

The relays are mounted in the relay panel. The relay wiring connections can be accessed from the back of the panel (Fig. 1: Relay Panel Back).

Fig. 1: Relay Panel Back

Use the relay chart mounted on the back of the relay cover to locate a relay (Fig. 2: Relay Locator). After locating the relay, find the reverse side of the relay.

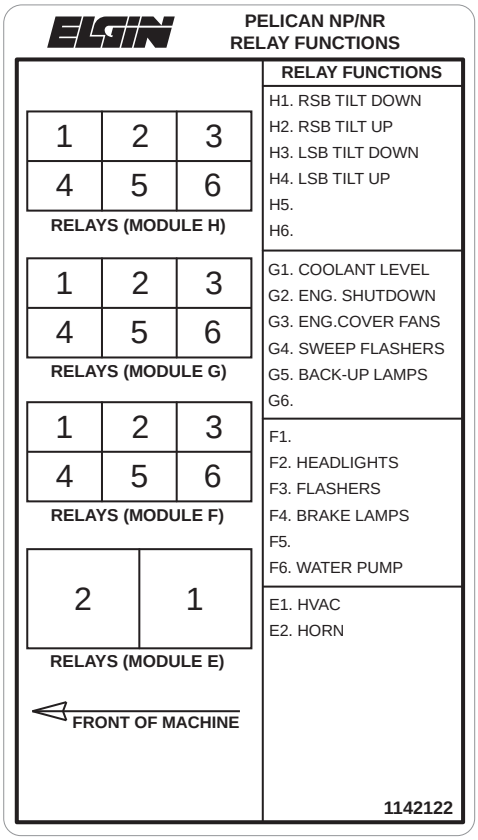

Fig. 2: Relay Locator

Ensure proper testing by matching the wire number, wire color, and pin number, as described in the error code description and shown in the electrical schematic before performing tests (Fig. 3: Relay Socket and Pin Locator).

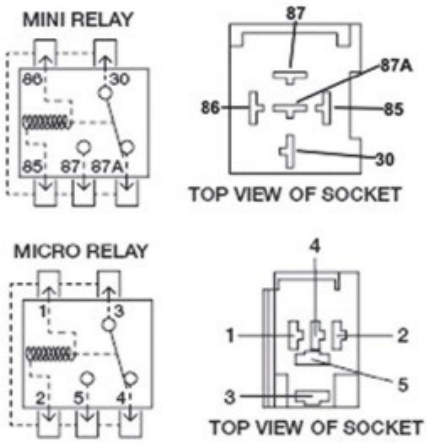

Fig. 3: Relay Socket and Pin Locator

DIODES

Diodes allow voltage to flow in one direction but not in the opposite direction. Diodes are made from semi-conducting materials (Fig. 4: Typical Diode). The diode resistance is very low in one direction and very high in the opposite direction. When diode operation is measured using a multimeter and multimeter reads low ohms, the reading does not represent the diode resistance. The reading represents the voltage drop across the diode. A multimeter can only be used to detect a damaged diode.

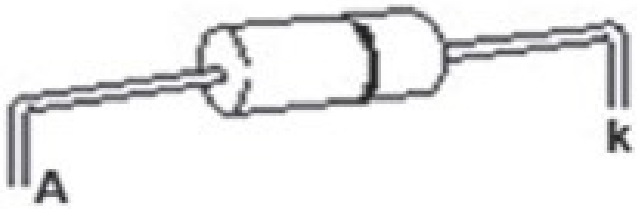

Fig. 4: Typical Diode

Place one lead on one side of the diode and the other lead on the opposite side of the diode and read the multimeter (Fig. 5: Typical Diode Connector). Then reverse the leads and read the multimeter. If the reading is low in one direction and very high in the other direction, the diode is operational. When a diode is placed in a circuit and the voltage on the anode is higher than the cathode, the diode acts similar to a low value resistor and current flows through the diode. When connected in the opposite direction, the diode acts like a large value resistor and current does not flow through the diode. In the first case the diode is said to be “forward biased” and in the second case, “reversed biased.”

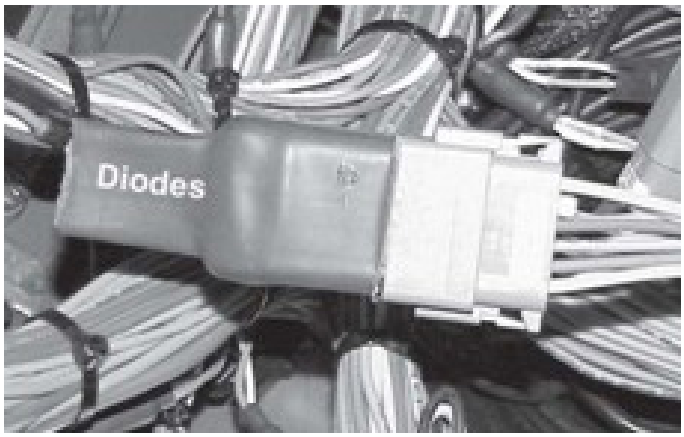

Fig. 5: Typical Diode Connector

Using a multimeter, use the low resistances (ohms) scale. A diode should read low resistance in the forward direction and infinite resistance in the reverse direction. The diode should not read zero (0) ohms or open in both directions.

Digital multimeters may have a diode test mode. Using the diode test mode, a silicon diode should read between 0.5 V to 0.8 V in the forward direction and open in the reverse direction.

NOTICE

A defective diode may indicate resistances lower than infinity especially on the highest ohms range. Any reading of this sort indicates a bad diode.

NOTICE

The above procedures assume the diode is not part of any circuit. A diode that is part of a circuit board or connected to other components should be disconnected before testing. Feedback from components on the same circuit as the diode can distort or change the test readings.

CONTROL MODULE OPERATION

Before performing troubleshooting, diagnostic checks, and tests on components, always shut down the sweeper completely, including the engine. Allow the sweeper systems to de-energize and shut down.

After shutdown, start the engine. See the Operator's Manual for sweeper start up and operation.

PELICAN CAN NETWORK

The Pelican electronic control system uses an IFM electronic control system. This system integrates engine response and hydrostatic control to provide improved performance. The controller, display, and engine ECU are connected to the control area network (CAN) allowing communication with the engine ECU.

See Fig. 6: Communication CANbus Backbone Circuit Sheet 1 and Fig. 7: Communication CANbus Backbone Circuit Sheet 2.

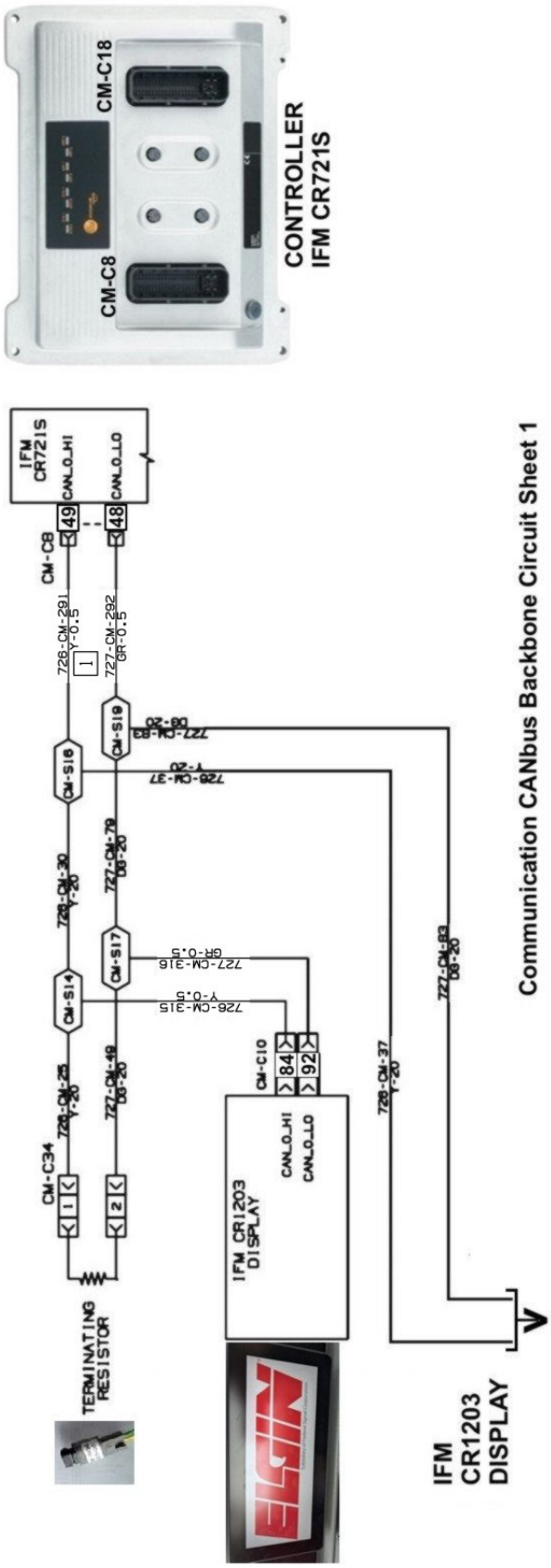

Fig. 6: Communication CANbus Backbone Circuit Sheet 1

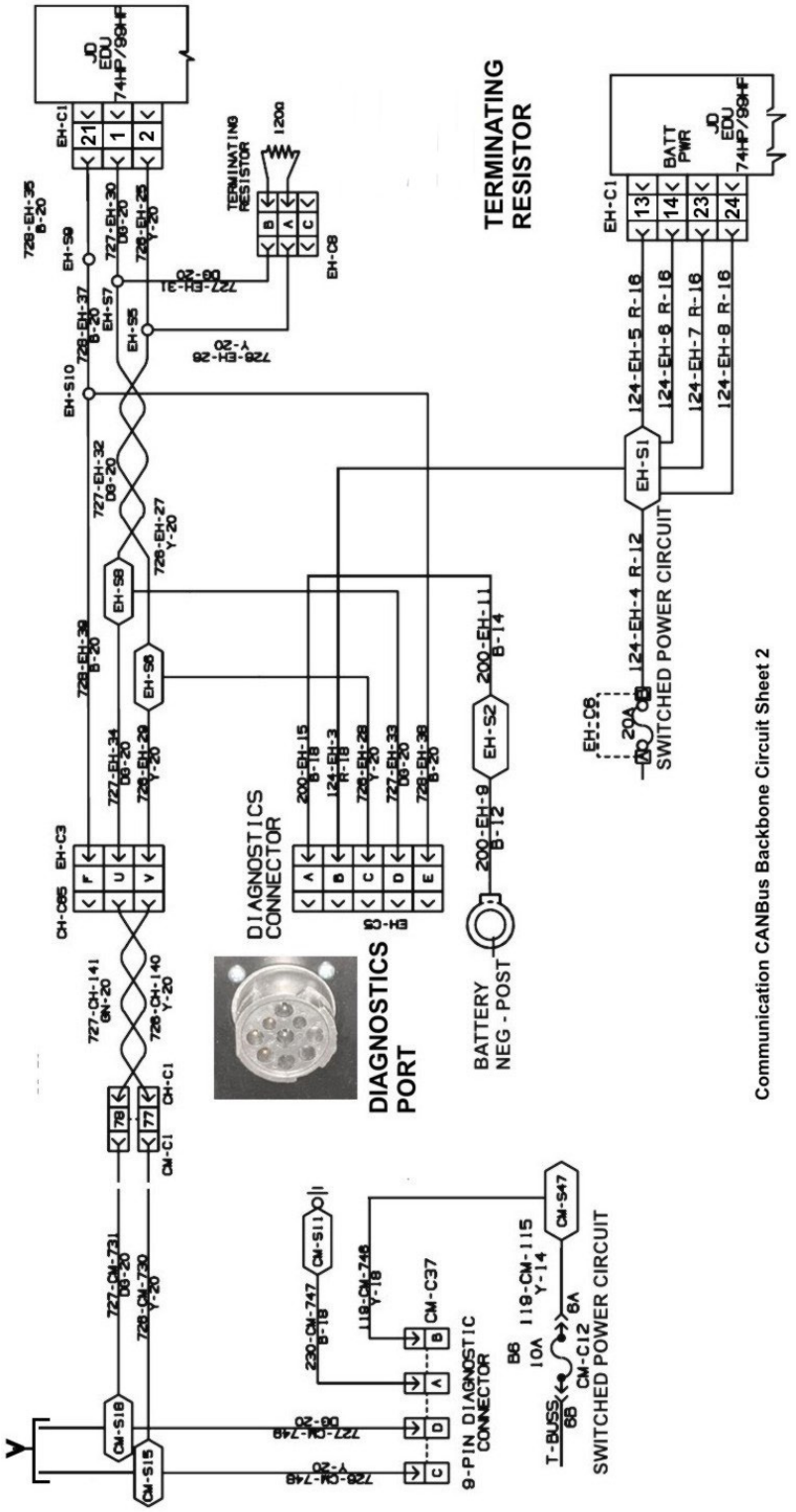

Fig. 7: Communication CANbus Backbone Circuit Sheet 2

The IFM control system uses Ethernet for communication between controller CR721S and the CR1203 display. See Fig. 8: Ethernet Local Area Network Backbone and Fig. 9: 500K Baud Display Control Circuit.

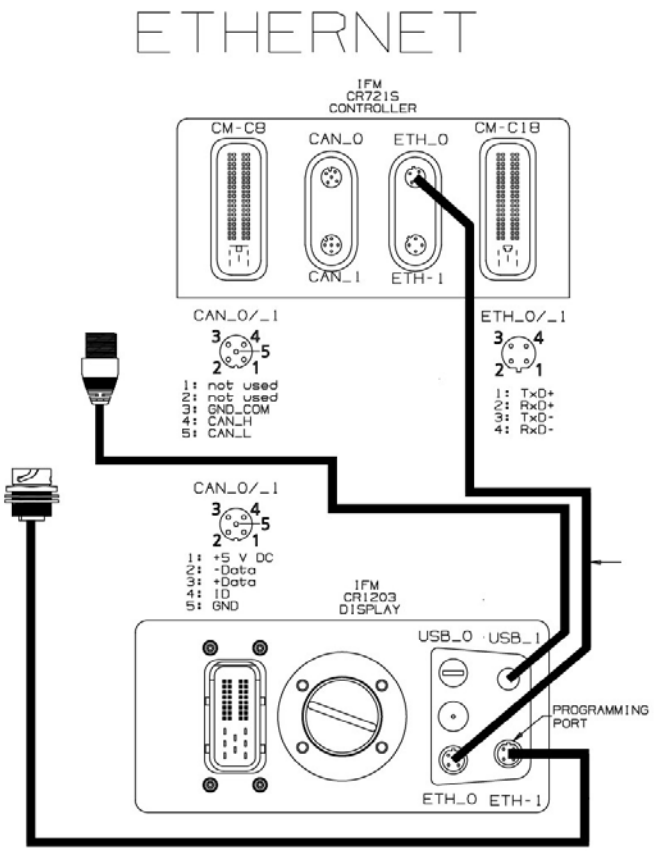

Fig. 8: Ethernet Local Area Network Backbone

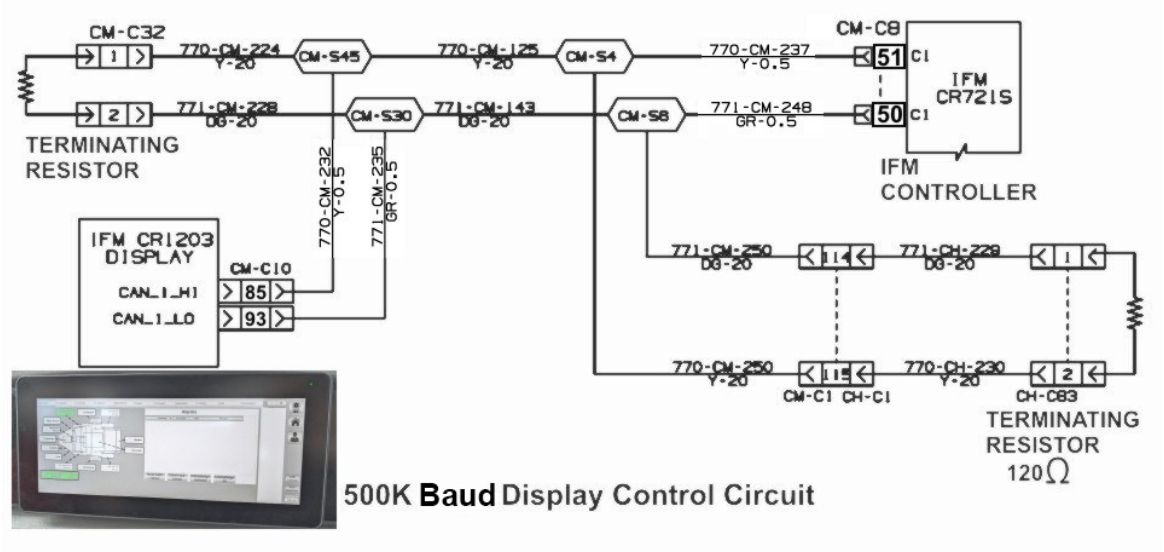

Fig. 9: 500K Baud Display Control Circuit

The following information provides an overview of the Elgin Sweeper CAN Network. This overview explains how component signals are transmitted from the operator controls to the sweeper components. This section is concerned primarily with CAN communication failure and not with individual module or circuit failure. Faults in individual components (nodes) will not generally cause total loss of CAN communication but will affect system inputs and outputs. Component testing is included in the fault code diagnostics section.

NOTICE

The backbone of the CAN system is a two wire harness that contains a CAN High wire (yellow) and a CAN Low wire (green). The backbone is routed throughout the CAN system for communication between components. Each section of the CAN contains a node connection. These nodes provide a link to the CAN for the individual components. A short in the node CAN high to CAN low connection or a short to ground causes loss of communication. A short exists when a stripped portion of the CAN high wire touches a stripped portion of the CAN low wire. A short can also exist between the CAN wires and a ground. The short may exist between node terminals and not always between the wires. *See* Testing for CAN Shorts on page 28 *for testing procedures.*

The control area network (CAN) communicates with the components in the sweeper system using a bus. The bus is a subsystem that transfers data between components inside a controller or between controllers. The bus can logically connect several nodes over the same set of wires. A node sends or receives communication. The bus connects the nodes together in a logical system. All nodes see all CANBus information in real time. The nodes used in the sweeper control system include:

- Sweeper Network, including the J1939 CAN and controller – Contains the sweeper system programming and manages component interaction between components to provide sweep control. The J1939 CAN is the backbone of the communication system.
- The controllers make decisions based on initial programming and signals transmitted over the CANBus.
- Also contains a translator used to share data on the J1939 (CAN) network. The display module is used to display sweeper and engine faults and status messages.

NOTICE

A normal or proper reading on the backbone would display as 60 Ω with both terminating resistors installed or 120 Ω with one terminating resistor removed.

- John Deere Engine Electronic Control Unit (ECU) – Provides engine operational control (John Deere programming). Also connects to the J1939 CAN to receive sweeper commands (throttle, status, etc) and to transmit fault information to the display for operator action.
- If communication is lost to the ECU, a fault code (X0040-07), module not responding, displays.
- If the CR721S loses communication with the ECU, the APP1 LED on the CR721S lights RED.

SWEEPER CAN BACKBONE

The backbone of the network communication system takes place through a pair of wires that must be physically next to each other. A ground shield may be used to provide additional protection from electrical interference.

The pair must be contiguous from end to end with individual node connections spliced to the backbone. The 120 Ω resistors (terminating resistors) in the end of the backbone between CAN high and CAN Low wires prevent reflection or bounce-back of the transmissions in the network. If the resistors are not present, data in the transmissions may be missed and the functions will not work correctly.

SWEEPER NETWORK

The controller receives all network communication and responds with operational outputs to the sweeper components. The programming responds to predetermined signals from control switches and devices. During the process of communication, if a signal is not responsive, fault codes appear on the touch screen display.

JOHN DEERE ELECTRONIC CONTROL UNIT (ECU)

The John Deere auxiliary engine is equipped with a remotely mounted ECU (Fig. 10: John Deere ECU). The ECU connects to the sweeper CAN using J1939 protocol.

Fig. 10: John Deere ECU

The controllers also use ECU information as part of the operational program and transmit engine speed (throttle output) commands to the ECU. Auxiliary engine faults are displayed on the display screen.

A console-mounted access port is supplied for connecting a John Deere service tool to the system for auxiliary engine evaluation.

FUSES AND RELAYS

The diagnostic procedures in this manual require identifying fuses and relays.

Fig. 11: Fuse Locator shows the fuse locator.

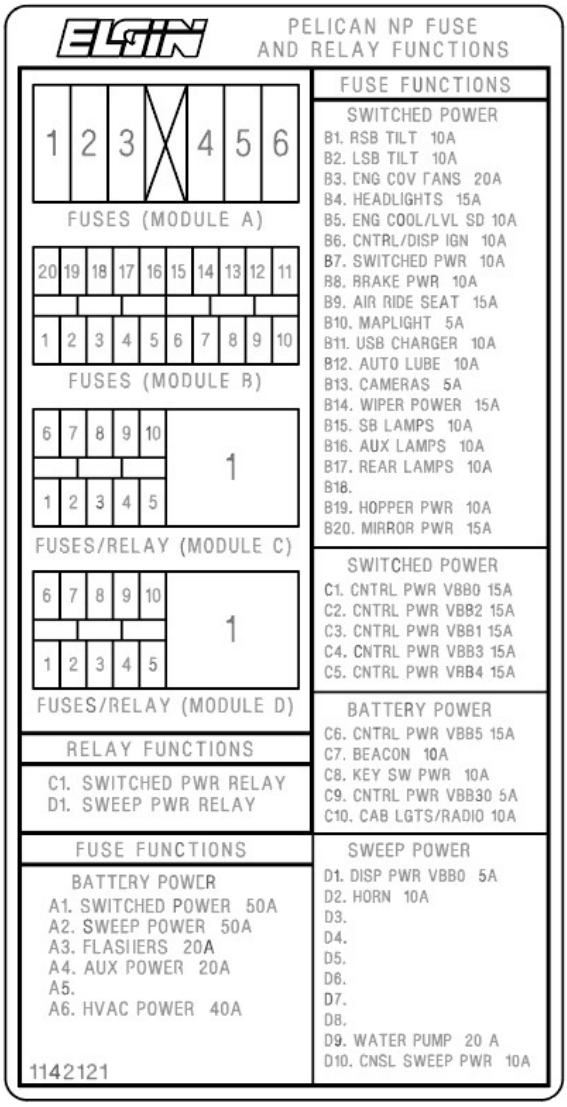

Fig. 11: Fuse Locator

Fig. 12: Relay Locator shows the relay locator.

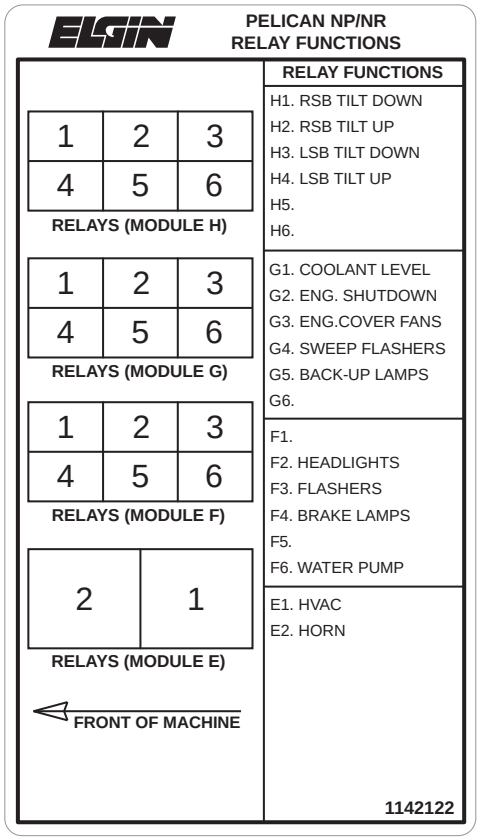

Fig. 12: Relay Locator

The fuses are mounted in fuse modules along with an 80A in-line fuse (Fig. 13: 80A In-line Fuse). The individual fuses are illustrated in each diagnostics circuit description.

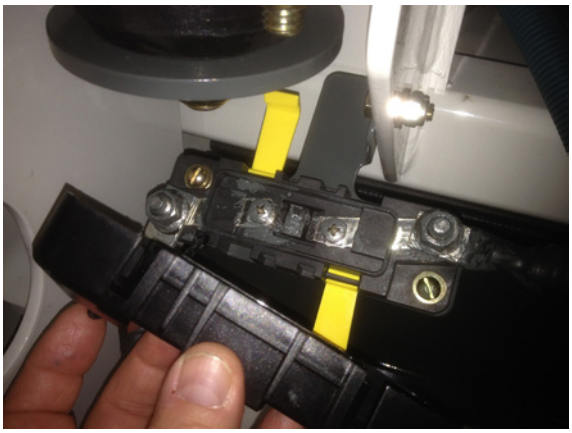

Fig. 13: 80A In-line Fuse

CONTROLLER PIN LOCATOR AND USAGE

Fig. 14: Controller CR721S shows the CR721S controller.

Fig. 14: Controller CR721S

Fig. 15: Controller CR721S Pin Locator on page 20 shows the location of pins on the controller.

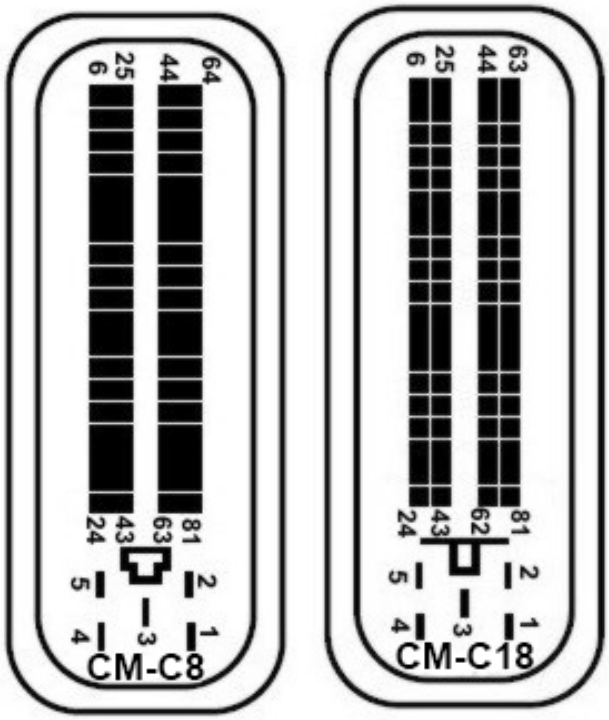

Fig. 15: Controller CR721S Pin Locator

Table 2: Controller CR721S CM-C8 on page 21 shows the usage of the CR721S CM-C8 controller pins.

Table 2: Controller CR721S CM-C8

Pin #	Component Terminal #	Wire Color
1	Power to Outputs 0200-0208	Red
2	Ground	Black
3	Power to Outputs 0100-0108	Red
4	Power to Outputs 0000-0008	Red
5	Ground	Black
6	Engine Cover Fans Relay #1 OUT	Green
7	Backup Alarm #EC-T2 OUT	Light Green
8	NOT USED	
9	Brake Lamps Relay #1 OUT	Red
10	RSB Lower Solenoid #1 OUT	Light Green
11	Charge Air Cooler (CAC) Fan OUT	Blue
12	LSB Raise Solenoid #1 OUT	Violet
13	CB Balance Solenoid #1 OUT	White
14	Propel Pump EDC Rev #1 OUT	Light Blue
15	Controller CR721S Wake Power	Yellow
16	NOT USED	
17	Starter Relay #86 OUT	Red
18	NOT USED	
19	Sweep Power Relay #85 OUT	Gray
20	NOT USED	
21	Headlights & Flashers Relays #1 OUT (Operator Stalk Select)	Blue
22	Radiator Fan Hyd Motor #1 OUT	Light Green
23	Shaker Solenoid Coil #A OUT	Dark Green
24	Propel Pump EDC Fwd #1 OUT	Violet
25	Vacuum Hose Gate Lever Sensor #1 IN	Light Green
26	Left Wheel Motor Direction IN	Gray
27	RSB Tilt Down Sw #5 IN	Brown
28	RSB Tilt Up Sw #2 IN	Dark Green
29	Ground	Black
30	Controller CR721S Power	Yellow
31	5 Volt Power OUT	Yellow
32	NOT USED	
33	NOT USED	
34	NOT USED	
35	NOT USED	
36	Sweep Mode Switch #3 IN	Blue
37	Operator Pos Switch #3 IN	Blue
38	Fuel Level Sender #CH-T2 IN	Violet
39	Hyd Oil Temp Sender #CH-T12 IN	Violet
40	Right Wheel Motor Speed IN	Dark Green
41	Right Wheel Motor Direction IN	White
42	LSB Tilt Down Sw #5 IN	Green

Pin #	Component Terminal #	Wire Color
43	Dust Fan Speed Sensor #B IN	White
44	Joystick Hopper Return #5 IN	Green
45	Joystick Hopper Dump #6 IN	Blue
46	Joystick Hopper Lower #3 IN	Green
47	Joystick Hopper Raise #4 IN	Blue
48	250K CANBus Low Side I/O	Green
49	250K CANBus High Side I/O	Yellow
50	500K CANBus Low Side I/O	Green
51	500K CANBus High Side I/O	Yellow
52	Ground	Grey
53	NOT USED	
54	NOT USED	
55	LSB Pres Transducer #B IN	White
56	Pelican NE Conveyor Raised Proximity Switch	Yellow
57	NOT USED	
58	NOT USED	
59	RSB Pres Transducer #B IN	Light Green
60	RSB Tilt Position #B IN	White
61	RSB Down Pres Switch # IN	Green
62	LSB Down Pres Switch #B IN	Green
63	Left Pedal Forward Switch #D IN	Blue
64	Left Pedal Position Switch #A IN	Dark Blue
65	Left Pedal Reverse Switch #E IN	White
66	CB Balance Transducer #B IN	White
67	Right Pedal Forward Switch #D IN	Blue
68	Right Pedal Position #A IN	Green
69	Right Pedal Reverse Switch #E IN	Green
70	CB Pres Transducer #B IN	Green
71	Sensor Ground	Black
72	NOT USED	
73	NOT USED	
74	LSB Lower Solenoid #1 OUT	Dark Green
75	CB Lower Solenoid #1 OUT	Violet
76	NOT USED	
77	RSB Raise Solenoid #1 OUT	Dark Blue
78	Water Pump Relay #1 OUT	Green
79	CB Pressure Solenoid #1 OUT	Violet
80	Dust Fan Pump Coil #1 OUT	Dark Blue
81	Right Brake Defeat Sol #1 OUT	Green

Table 3: Controller CR721S CM-C18 shows the usage of the CR721S CM-C19 controller pins.

Table 3: Controller CR721S CM-C18

Pin #	Component Terminal #	Wire Color
1	Power to Outputs 0500-0508	Red
2	Ground	Black
3	Power to Outputs 0400-0408	Red
4	Power to Outputs 0300-0308	Red
5	Ground	Black
6	CB Rot Transducer # B IN	Blue
7	CB Down Pres Sw #B IN	Blue
8	LSB Tilt Position B IN	White
9	NR Vac Sensor #C IN	Grey
10	LSB Sw #3 IN	Green
11	LSB Water Sw #3 IN	Blue
12	Conveyor Forward SW #3 IN	Green
13	Wash down Sw #3 IN	Blue
14	Ground ANA	Grey
15	NOT USED	
16	RSB Water Solenoid #1 OUT	Light Blue
17	LSB Tilt Dwn Relay #2 OUT	Green
18	Common Valve SOL #1 OUT	Pink
19	LSB Tilt Up Relay #2 OUT	Violet
20	Conv Raise Solenoid #1 OUT	Light Blue
21	RSB Tilt Down Relay #2 OUT	Brown
22	Conv Reverse Rotate SOL #1 OUT	Green
23	Hop Raise SOL #1 OUT	Light Blue
24	Left Brake Defeat #1 OUT	Dark Blue
25	Turn Signal Sw #2 IN Right	Green
26	Turn Signal Sw 33 IN Left	Violet
27	Head Lamp High Beam IN	Violet
28	Sweep Flash Relay #5 IN	Pink
29	RSB Sw #3 IN	Green
30	RSB Water SW #3 IN	Blue
31	Conveyor Reverse SW #1 IN	Green
32	NRVac Hose Flange Sensor #1 IN	Blue
33	NOT USED	
34	NOT USED	
35	NOT USED	
36	Engine Throttle IN	Green
37	Ignition Switch #4 IN	White
38	Park Brake Switch #2 IN	Green
39	Brake Switch #B IN	Violet
40	CB Conv Raise/Low SW #3 IN	Violet
41	NP Center Broom Rotate Sw #3 IN	Green
42	NP RSB Rotation SW #3 IN	Green
43	NRVac Hose Boom Pos Sensor #1 IN	Violet

Pin #	Component Terminal #	Wire Color
44	Hydraulic Level Switch #A IN	Violet
45	Low Water Pressure (3 PSI) Switch #1 IN	Light Blue
46	Accumulator Low Pressure Switch #1 IN	Dark Green
47	Eng Air Filter Sw #CH-T8 IN	White
48	Ground	Black
49	NOT USED	
50	NOT USED	
51	NOT USED	
52	NOT USED	
53	NOT USED	
54	NOT USED	
55	NOT USED	
56	Conv Raised Pos Sw #2 IN Note: Pelican NE only	Yellow
57	NP LSB Rotation SW #3 IN	Blue
58	LSB Tilt Up Sw #2 IN	Violet
59	Hyd Filter Restrict Sw #A IN	Violet
60	Conveyor Stall Light IN	Light Green
61	Left Wheel Motor Speed #3 IN	Light Green
62	NR Vac Hose Blank Plate Sensor #2 IN	Brown
63	LSB Out Solenoid #1 OUT	Dark Blue
64	RSB Tilt Up Relay #2 OUT	Green
65	LSB Rotate Solenoid #1 OUT	Dark Blue
66	NR Sweep Mode Inhibited Light OUT	Green
67	Conveyor Lower SOL #1 OUT	Dark Green
68	NR Vacuum Hose Unstowed Alarm OUT	Yellow
69	Conveyor Forward Rotate SOL #1 OUT	Blue
70	Hop Return SOL #1 OUT	Light Green
71	RSB Rotate Forward Solenoid #1 OUT	Green
72	NOT USED	
73	NOT USED	
74	Eng Shutdown Relay #1 OUT	Grey
75	NOT USED	
76	LSB Water Solenoid #1 OUT	Light Blue
77	NOT USED	
78	NOT USED	
79	Hop Dump SOL #1 OUT	Dark Blue
80	Hop Lower SOL #1 OUT	Dark Green
81	CB Rotate SOL #1 OUT	Green

The following describe the CR1203 CM-C10:

- Fig. 16: CM-C10 Connector
- Fig. 17: Four Pin Ethernet
- Fig. 18: IFM CR1203 Display
- Table 4: CR1203 CM-C10 Display

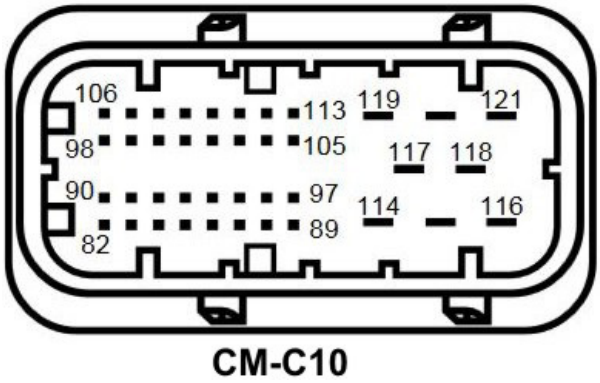

Fig. 16: CM-C10 Connector

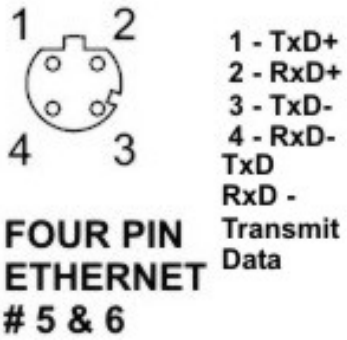

Fig. 17: Four Pin Ethernet

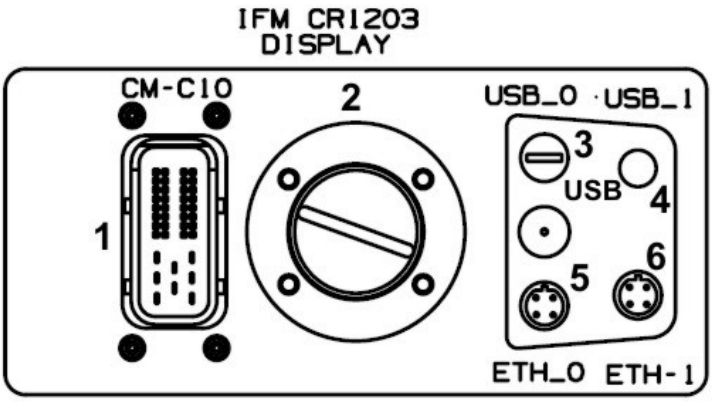

Fig. 18: IFM CR1203 Display

Table 4: CR1203 CM-C10 Display

Pin #	Component Terminal #	Wire Color
82	Spare Camera Ground	Gray
83	IFM 0 CAN0_L	not applicable
84	CAN0_High (250K)	Yellow
85	CAN1_High (500K)	Yellow
86	CAN3_L	not applicable
87	IFM1	not applicable
88	IFM1	not applicable
89	Service1	not applicable
90	Spare Camera Signal	Yellow
91	IFM0	not applicable
92	CAN0_Low (250K)	Green
93	CAN1_Low (500K)	Green
94	CAN2_H	not applicable
95	CAN3_H	not applicable

Pin #	Component Terminal #	Wire Color
96	IFM1+	not applicable
97	Service0	not applicable
98	Reverse Camera Ground	Gray
99	Side Camera Ground	Gray
100	Video2 Ground	Gray
101	Reverse Camera Audio Right In Black	not applicable
102	Audio Ground	not applicable
103	Head Out Right	not applicable
104	Audio Out – Right Speaker	Green
105	Audio Out – Left Speaker	Blue
106	Reverse Camera Signal	Yellow
107	Side Camera Signal	Yellow
108	Spare Camera Signal	Yellow
109	Side Camera Audio IN Left	Black
110	NOT USED	
111	Head Out	not applicable
112	Audio Out + Right Speaker	Green
113	Audio Out + Left Speaker	Blue
114	Power to Display	Red
115	Input0	Green
116	Input 1	Blue
117	Output 0	Violet
118	Output 1	Blue
119	VBB15, Wake Up	Yellow
120	Ground	Black
121	Display Power	Yellow

Table 5: John Deere ECU T4F EH-C1 Pin Locator describes the John Deere EH-C1 pins.

Table 5: John Deere ECU T4F EH-C1 Pin Locator

Pin #	Component Terminal #	Wire Color
1	CANBus Low Side I/O	Dark Green
2	CANBus High Side I/O	Yellow
7	Switched Power Circuit CM-C12 Fuse B6 (10A) IN Note: Wake Power	Yellow
10	Throttle	Dark Green
13	Battery Inline 20A Fuse	Red
14	Battery Inline 20A Fuse	Red
21	Ground	Black
23	Battery Inline 20A Fuse	Red
24	Battery Inline 20A Fuse	Red
27	Battery Ground EH-S3	Black
33	5 VDC Return	Light Green
43	Battery Ground EH-S3	Black
44	Battery Ground EH-S3	Black
49	5 VDC	Yellow

Table 6: John Deere T4F A5502 Pin Locator describes the John Deere A5502 pins.

Table 6: John Deere T4F A5502 Pin Locator

Pin #	Component Terminal #	Wire Color
10	Throttle	not applicable
17	Coolant Level Terminal 87 IN	Green
32	20 Ω Resistor Terminal 1	Dark Green
33	20 Ω Resistor Terminal 2	Black
36	5 VDC Return	not applicable

Table 7: John Deere EH-C1 Pin Locator describes the John Deere EH-C1 pins.

Table 7: John Deere EH-C1 Pin Locator

Pin #	Component Terminal #	Wire Color
7	Wake Up Power	Yellow
31	Coolant Level Terminal 87 IN	Green
51	Engine Shutdown Relay Terminal 4	White

CONTROL AREA NETWORK (CAN) DIAGNOSTIC STEPS

- Check for active faults using the display. Active faults appear on the display screen.
- Compile recorded data of faults, dates and occurrences.

CONTROL AREA NETWORK (CAN) DIAGNOSTIC TIPS

Elgin Sweeper fault codes are generated by missing information or faulty circuits. Sweeper fault codes may be repaired by using the information in the fault codes and description section and service manual information. John Deere fault codes are generated by missing information or faulty circuits. Engine fault codes may be repaired using the information in the John Deere service manual.

TOTAL CAN COMMUNICATION FAILURE

Total CAN communication failure is the most serious failure for the Control Area Network. A complete CAN failure is generally caused by a short between CAN High and CAN Low or to ground. Some symptoms of a CAN failure are:

- No sweep system operation.
- Engine may not run. Display connection cannot be completed.

NOTICE

The backbone of the CAN system is a two-wire harness that contains a CAN High wire (yellow) and a CAN Low wire (Green). The backbone is routed throughout the CAN system for communication between components. Each section of the CAN contains a node connection. These nodes provide a link to the CAN for the individual components. A short in the node CAN high to CAN low connection or a short to ground causes loss of communication. A shielded ground within the backbone may be present in some earlier systems. A short exists when a stripped portion of the CAN high wire touches a stripped portion of the CAN low wire. A short can also exist between the CAN wires and a ground. The short may exist between node terminals and not always between the wires. See Testing for CAN Shorts *for testing procedures.*

TESTING FOR CAN SHORTS

CAUTION

Make sure the ignition switch is in the OFF position before testing CAN resistance.

With the ignition switch in the OFF position, the resistance within the backbone (two-wire twisted harness) is measured using a multimeter set for resistance. The terminating resistors installed at the ends of the backbone are 120 Ω resistors. The multimeter should be set to display resistance not greater than 200 Ω. Place one multimeter lead in one node pin connection and one lead in the other pin connection.

NOTICE

The CAN high wire is yellow and the CAN low wire is green. The multimeter leads should be contacting the pin connections associated with the yellow and green wires.

- A normal or proper reading on the backbone is 60 Ω with both terminating resistors installed or 120 Ω with one terminating resistor removed.
- A low reading may indicate that a partial intermittent short exists between CAN high (yellow) and CAN low (green). Check for resistance between nodes until the short is located.
- A low reading may also indicate an intermittent short or water in the node. Check for resistance between nodes until the short is located.
- A low reading indicates a complete short between CAN high and CAN low. Check resistance between each backbone node until the short is located. Very low resistance may indicate CAN high and CAN low wire strands are in contact, incorrect pin connections short terminating resistors. Check each node to find the short.
- An infinite resistance reading (open) may indicate a terminating resistor is missing or failed (open) or a CAN high or CAN low wire is broken. Check between each node until the open is located.

NOTICE

A single break in one of the CAN wires will generally not cause complete system failure but may cause inconsistent functions.

A CAN short at any point in the backbone or node causes a loss of system communication. Individual nodes may still function if the input and output takes place internally but information passed outside the node will cease. The short may be caused by one of the following:

- CAN terminal pins displaced and shorted together.
- Harness damage that permits CAN high and low to make contact.
- Water in a node causing partial or complete failure.
- Damaged terminating resistor.

CAN BACKBONE LOSS OF CONNECTION

Any disconnect in the CAN causes a disruption of communication. An open, such as a broken wire in the backbone circuit, may cause inconsistent or intermittent operation. One broken or damaged wire causes weak signals. Any open prevents the CAN from operating normally. An open in both wires, such as disconnected node terminals, causes partial operation. The modules will be powered but communication will be impossible between sections of the backbone.

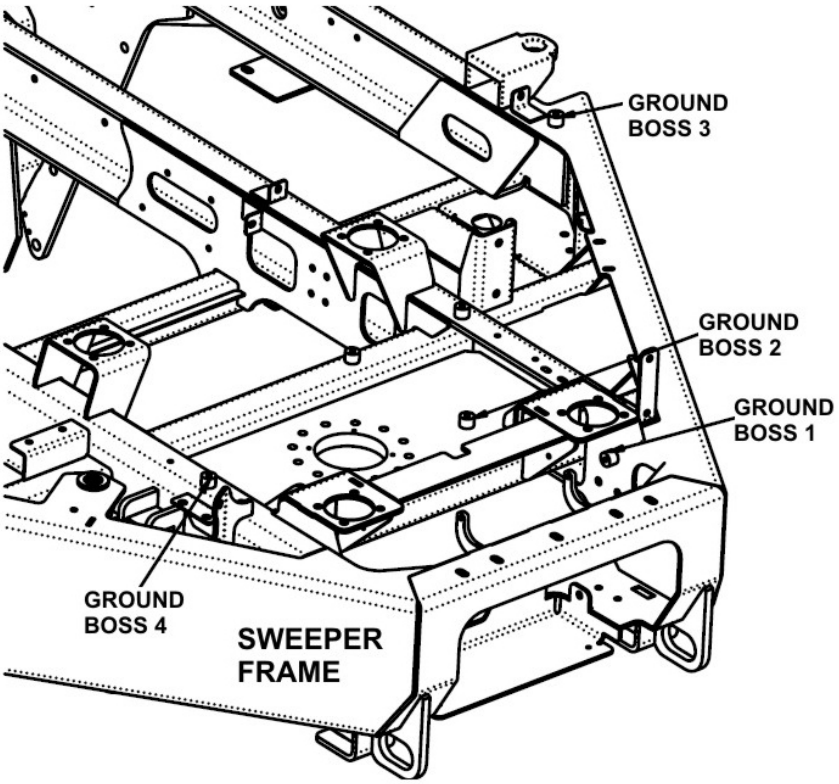

Fig. 19: Ground Boss Locator

Fig. 20: External Ground Stud (Underneath Cab)

POWER AND GROUND CONNECTIONS

Pelican electronic systems may demonstrate multiple failures that seem unrelated. When failures or unrelated operations are present, they may be found to have common circuit connections for power or ground. Seemingly unrelated malfunctions may include but are not limited to:

- Incorrect hydro pedal control
- Inoperative start circuit or “starter runs when the key is ON”
- Inconsistent or inoperable broom down pressure control
- Wiper, light, signal or other stalk malfunctions

CIRCUIT GROUND POINT FAILURE

Thoroughly check all circuit ground point connections. Resistance across terminal connections must be less than 1 Ω.

1. Battery “-” negative connection terminal must be clean of corrosion and tightened securely. All circuits must be grounded to the battery terminal.
2. Check the connections as shown for paint or powder coat deposits, corrosion damaged wires or terminals. Remove any paint, repair any damage or corrosion and tighten securely.
3. Check the connections at the Main External Ground. Remove any paint, repair any damage or corrosion and tighten securely.
4. Check the connections at the Main External Ground. Remove any paint, repair any damage or corrosion and tighten securely.

IMPORTANT

Failure of a ring terminal may not be obvious because the terminal crimp may be covered with heat-shrink. It may be necessary to remove the heat shrink to inspect the terminal.

- Over tightening the retaining nut on a ring-terminal can cause the terminal to fail or be twisted so that it will eventually break. Clean the terminal studs thoroughly and tighten enough to retain the connection.
- Route the harness away from moveable components or hydraulic hoses that may flex and cause terminal failure due to fatigue.

CAB AND CHASSIS CIRCUITS

The 102-pin connector (Fig. 21: Pin Connector (Harness Side CM-C1)) is mounted on the bottom rear of the cab provides a connection between the main cab wiring harness (CM-C1). These circuit connections provide a path for control of the sweeping components using the switches on the cab control panel.

GROUNDS

The circuit ground trees provide ground circuits for many components. See Grounds and Ground Tree Circuits on page 226. If any of the ground connections become loose, broken or corroded the electronic control system and other circuits may not function as needed.

CONFIRM CORRECT CIRCUIT OPERATION

- Check the cab display and observe that the INPUT and OUTPUT functions perform correctly.
- Operate the circuits and ensure that sweeper functions are operational.

Fig. 21: Pin Connector (Harness Side CM-C1)

HYDRAULIC CONTROL VALVES

The hydraulic control valves contain solenoid valves, transducers, relief valves, and other components needed to direct and control the hydraulic oil flow to and from components such as cylinders, motors and other components used by the hydraulic system to operate the sweeper.

The control valves include:

Fig. 22: Hopper Lift Tilt Manifold
Fig. 23: Broom Rotate Manifold
Fig. 24: Broom Raise Manifold

HYDRAULIC SOLENOID VALVES

A solenoid is an electric coil wound with copper wire, generally, around a magnetic core at the center. The flow of electrical current causes a magnetic force that opens or closes the valve, allowing hydraulic oil to flow through the solenoid ports to a component actuating the component.

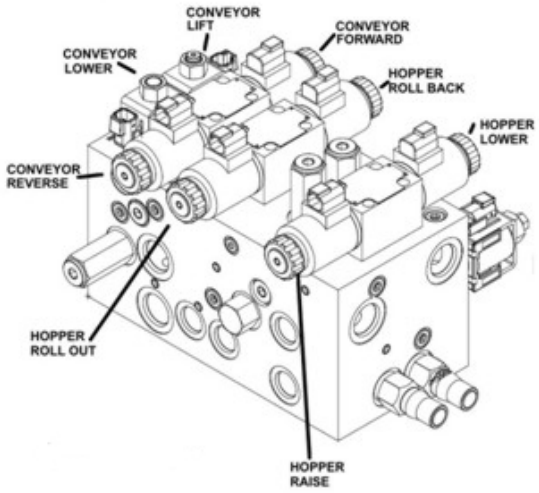

Fig. 22: Hopper Lift Tilt Manifold

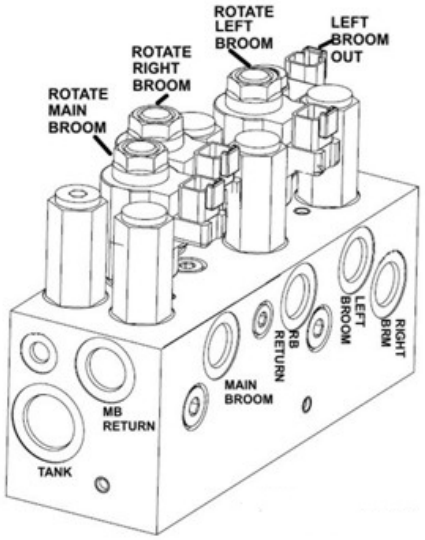

Fig. 23: Broom Rotate Manifold

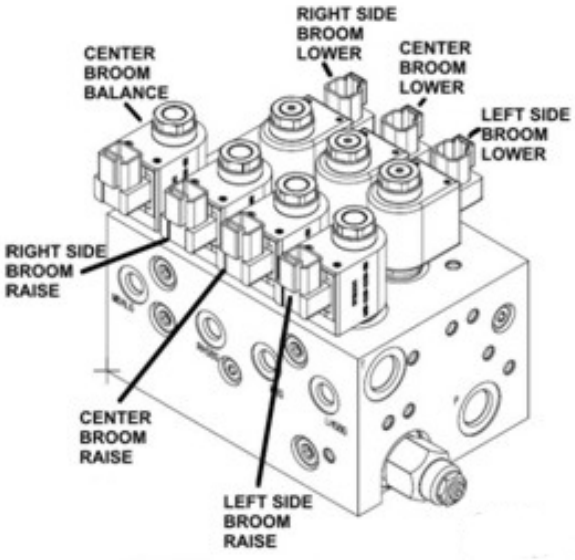

Fig. 24: Broom Raise Manifold

The cab control console contains most of the switches, dials and components needed to control sweeper operation (Fig. 25: Cab Control Console). While the switches and other controls are shown in each circuit description later in the diagnostics manual, the position of each switch/control is shown in the cab control console illustrations.

See the operator's manual for a description of the cab control console.

Fig. 25: Cab Control Console

FAULT CODES

The fault codes identify components and conditions triggering a fault. The fault number (code) is listed on the first page of each individual circuit, as necessary, to help explain and give suggestions for the resolution of fault conditions. The fault numbers (codes) at the end of each circuit are listed in numerical order. If fault codes are not listed at the end of a circuit, there are no fault codes for that circuit. See the circuit related to the fault for further information. The fault code and related information is shown on the cab display faults screen (Fig. 26: Main View, Faults). See the operator's manual for display screen operation.

See the fault codes and descriptions table for a description of the fault code displayed on the cab display.

H0100 – 05 (Example)

- The fault code first letter is for:
  - H = hopper functions
  - P = propulsion, brakes and steering functions
  - S = sweep functions
  - X = controls functions
- The first digit (letter) (H) identifies the main function.
- The next four digits (numbers) (0100) represent a function with the main group.
- The last two digits (numbers) (05) are FMI-type codes (error description):
  - 00 – High, Most Severe
  - 01 – Low, Most Severe
  - 03 – Voltage Above Normal
  - 04 – Voltage Below Normal
  - 05 – Current Below Normal (Open Circuit)
  - 06 – Current Above Normal (Short to Ground)
  - 07 – Module Not Responding
  - 11 – Rationality Fault (two things conflict, also used for interlocks)
  - 12 – Unexpected Voltage at Pin (typically a short to ground)
  - 13 – Out of Calibration
  - 20 – Resistance Drifted High (typically higher than normal resistance in a circuit, caused by a condtion such as corrosion of connectors)
  - 21 – Resistance Drifted Low (less than expected resistance on a coil, caused by conditions such as a bad coil or partial short to ground)

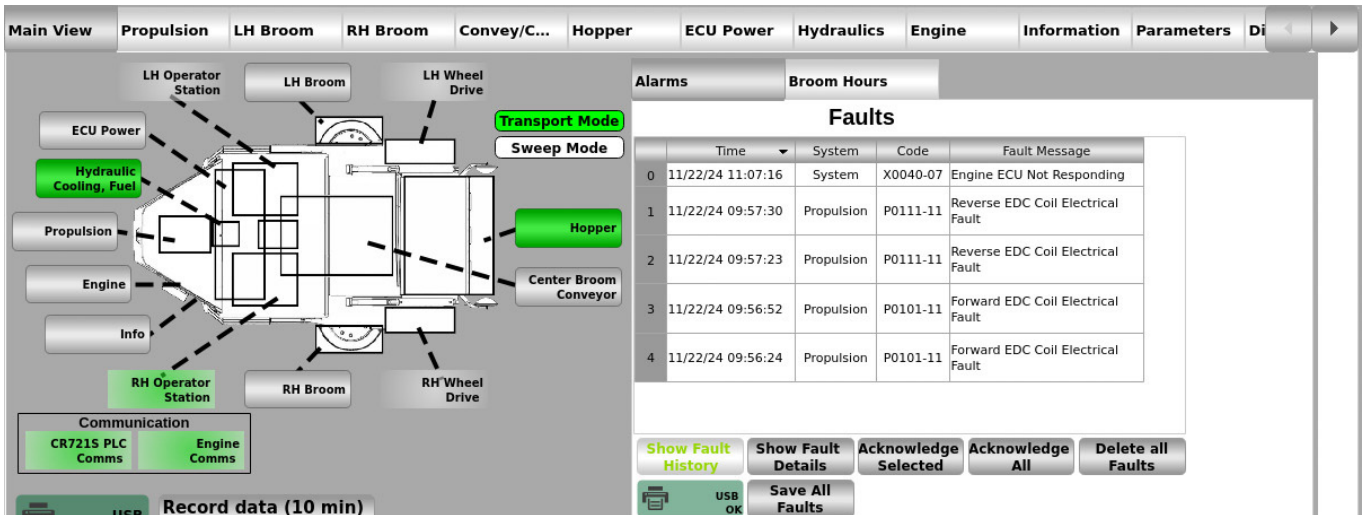

Fig. 26: Main View, Faults

The illumination of the fault warning icon indicates a fault condition exist and can be viewed in Fig. 27: Main Screen.

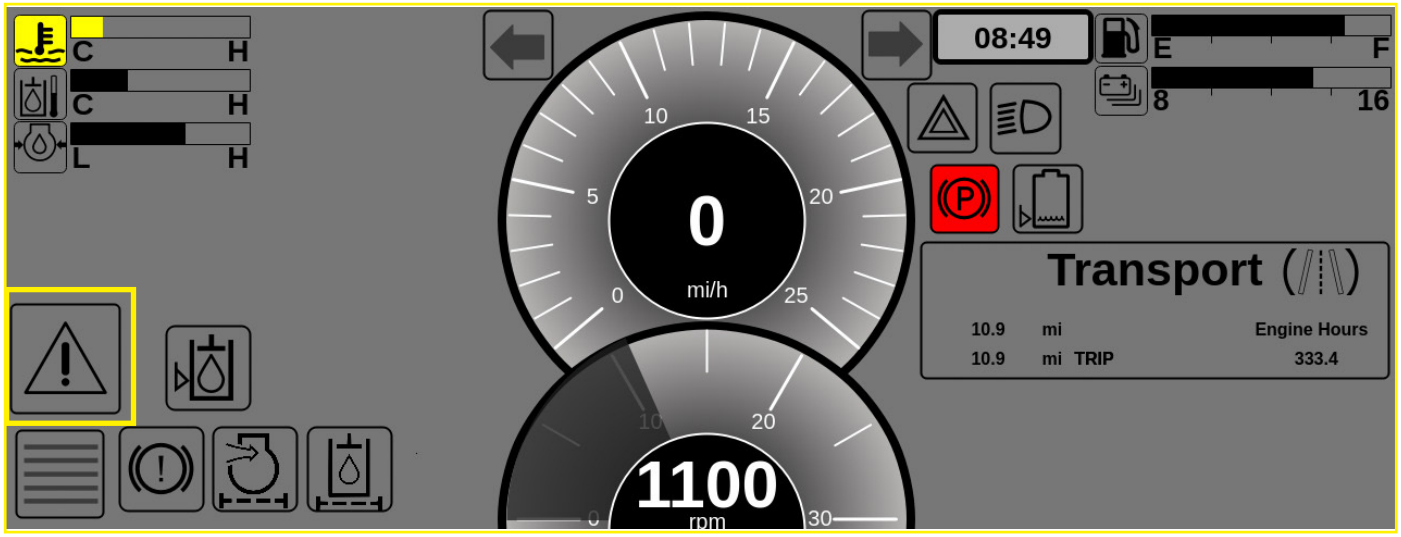

Fig. 27: Main Screen

See Table 8: Fault Codes and Descriptions for fault codes and descriptions.

Table 8: Fault Codes and Descriptions

Fault Code	Plain Text	Description
H0100-05	Hopper Raise Solenoid Open Circuit	Hopper Raise Solenoid Open Circuit. CM-C18 Pin 23. Circuit 581 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0100-06	Hopper Raise Solenoid Circuit Short to Ground	Hopper Raise Solenoid Circuit Short to Ground. CM-C18 Pin 23. Circuit 581 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0100-12	Hopper Raise Solenoid Unexpected Voltage on Pin	Hopper Raise Solenoid Unexpected Voltage on Pin. CM-C18 Pin 23. Circuit 581 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0100-20	Hopper Raise Solenoid Resistance Drifted High	Hopper Raise Solenoid Resistance Drifted High. CM-C18 Pin 23. Circuit 581 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0100-21	Hopper Raise Solenoid Resistance Drifted Low	Hopper Raise Solenoid Resistance Drifted Low. CM-C18 Pin 23. Circuit 581 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0110-05	Hopper Lower Solenoid Open Circuit	Hopper Lower Solenoid Open Circuit. CM-C18 Pin 80. Circuit 582 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0110-06	Hopper Lower Solenoid Circuit Short to Ground	Hopper Lower Solenoid Circuit Short to Ground. CM-C18 Pin 80. Circuit 582 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0110-12	Hopper Lower Solenoid Unexpected Voltage on Pin	Hopper Lower Solenoid Unexpected Voltage on Pin. CM-C18 Pin 80. Circuit 582 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0110-20	Hopper Lower Solenoid Resistance Drifted High	Hopper Lower Solenoid Resistance Drifted High. CM-C18 Pin 80. Circuit 582 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0110-21	Hopper Lower Solenoid Resistance Drifted Low	Hopper Lower Solenoid Resistance Drifted Low CM-C18 Pin 80. Circuit 582 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).

Fault Code	Plain Text	Description
H0120-05	Hopper Dump Solenoid Open Circuit	Hopper Dump Solenoid Open Circuit. CM-C18 Pin 79. Circuit 583 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0120-06	Hopper Dump Solenoid Circuit Short to Ground	Hopper Dump Solenoid Circuit Short to Ground. CM-C18 Pin 79. Circuit 583 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0120-12	Hopper Dump Solenoid Unexpected Voltage on Pin	Hopper Dump Solenoid Unexpected Voltage on Pin. CM-C18 Pin 79. Circuit 583 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0120-20	Hopper Dump Solenoid Resistance Drifted High	Hopper Dump Solenoid Resistance Drifted High. CM-C18 Pin 79. Circuit 583 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0120-21	Hopper Dump Solenoid Resistance Drifted Low	Hopper Dump Solenoid Resistance Drifted Low. CM-C18 Pin 79. Circuit 583 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0130-05	Hopper Return Solenoid Open Circuit	Hopper Return Solenoid Open Circuit. CM-C18 Pin 70. Circuit 584 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0130-06	Hopper Return Solenoid Circuit Short to Ground	Hopper Return Solenoid Circuit Short to Ground. CM-C18 Pin 70. Circuit 584 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0130-12	Hopper Return Solenoid Unexpected Voltage on Pin	Hopper Return Solenoid Unexpected Voltage on Pin. CM-C18 Pin 70. Circuit 584 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0130-20	Hopper Return Solenoid Resistance Drifted High	Hopper Return Solenoid Resistance Drifted High. CM-C18 Pin 70. Circuit 584 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
H0130-21	Hopper Return Solenoid Resistance Drifted Low	Hopper Return Solenoid Resistance Drifted Low. CM-C18 Pin 70. Circuit 584 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20° C).
P0101-11	Forward EDC Electrical Fault	Forward EDC Electrical Fault. CM-C8 Pin 24. Circuit 751 Violet. Fault may disable forward movement. Solenoid resistance specification is 3.66 Ω at 68° F (20° C).
P0102-06	Left Brake Defeat Circuit Short to Ground	Left Brake Defeat Circuit Short to Ground. CM-C18 Pin 24. Circuit 713 Blue. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0102-12	Left Brake Defeat Unexpected Voltage on Pin	Left Brake Defeat Unexpected Voltage on Pin. CM-C18 Pin 24. Circuit 713 Blue. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0102-20	Left Brake Defeat Resistance Drifted High	Left Brake Defeat Resistance Drifted High. CM-C18 Pin 24. Circuit 713 Blue. Solenoid resistance specification is 8.4 Ω at 68°F (20 C°).
P0102-21	Left Brake Defeat Resistance Drifted Low	Left Brake Defeat Resistance Drifted Low. CM-C18 Pin 24. Circuit 713 Blue. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0111-11	Reverse EDC Electrical Fault	Reverse EDC Electrical Fault. CM-C8 Pin 14. Circuit 748 Blue. Fault may disable reverse movement. Solenoid resistance specification is 3.66 ohm at 68° F (20 C°).
P0112-05	Right Brake Defeat Open Circuit	Right Brake Defeat Open Circuit. CM-C8 Pin 81. Circuit 712 Green. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
P0112-06	Right Brake Defeat Circuit Short to Ground	Right Brake Defeat Circuit Short to Ground. CM-C8 Pin 81. Circuit 712 Green. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0112-12	Right Brake Defeat Unexpected Voltage on Pin	Right Brake Defeat Unexpected Voltage on Pin. CM-C8 Pin 81. Circuit 712 Green. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0112-20	Right Brake Defeat Resistance Drifted High	Right Brake Defeat Resistance Drifted High. CM-C8 Pin 81. Circuit 712 Green. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0112-21	Right Brake Defeat Resistance Drifted Low	Right Brake Defeat Resistance Drifted Low. CM-C8 Pin 81. Circuit 712 Green. Solenoid resistance specification is 8.4 Ω at 68° F (20 C°).
P0200-03	Engine Throttle Pot Voltage Above Normal	Engine Throttle Hall Effect Voltage above 95% of 5 V Sensor Power. Sensor CM-C18 Pin 36 Circuit 733 Green, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0200-04	Engine Throttle Pot Voltage Below Normal	Engine Throttle Hall Effect Voltage below 5% of 5 V Sensor Power. Sensor CM-C18 Pin 36 Circuit 733 Green, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0210-03	Right Foot Pedal Voltage Above Normal	Right Foot Pedal Position above 95% of 5 V Sensor Power. Pedal Position CM-C8 Pin 68 Circuit 735 Green. 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0210-04	Right Foot Pedal Voltage Below Normal	Right Foot Pedal Position below 5% of 5 V Sensor Power. Pedal Position CM-C8 Pin 68 Circuit 735 Green. 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0210-11	Right Foot Pedal Logic Mismatch	Logic mismatch between Right Pedal Signal and one or more IVS. Pedal CM-C8 Pin 68 Circuit 735 Green, Fwd IVS CM-C8 Pin 67 Circuit 753 Blue, Rev IVS CM-C8 Pin 69 Circuit 736 Green.
P0210-13	Right Foot Pedal Calibration Error	Pedal Calibration lost or corrupted. Recalibrate pedal.
P0220-03	Left Foot Pedal Voltage Above Normal	Left Foot Pedal Position above 95% of 5 V Sensor Power. Pedal Position CM-C8 Pin 64 Circuit 734 Blue, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0220-04	Left Foot Pedal Voltage Below Normal	Left Foot Pedal Position below 5% of 5 V Sensor Power. Pedal Position CM-C8 Pin 64 Circuit 734 Blue, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
P0220-11	Left Foot Pedal Logic Mismatch	Logic mismatch between Left Pedal Signal and one or more IVS. Pedal CM-C8 Pin 64 Circuit 734 Blue, Fwd IVS CM-C8 Pin 63 Circuit 752 Blue, Rev IVS CM-C8 Pin 65 Circuit 739 White.
P0220-13	Left Foot Pedal Calibration Error	Pedal Calibration lost or corrupted. Recalibrate pedal.
P0300-03	Left Speed Sensor Voltage Above Normal	Left PPU Speed - Voltage over 11.2 VDC - short to power or open circuit. CM-C18 Pin 61 Circuit 746 Green.
P0300-04	Left Speed Sensor Voltage Below Normal	Left PPU Speed - Voltage is 0.3 VDC, sensor circuit short to ground. CM-C18 Pin 61 Circuit 746 Green.

Fault Code	Plain Text	Description
P0305-03	Left Direction Sensor Voltage Above Normal	Left PPU Direction - voltage greater than 11.2 VDC. Short to power or open circuit. CM-C8 Pin 26 Circuit 747 Gray.
P0305-04	Left Direction Sensor Voltage Below Normal	Left PPU Direction - voltage less than 0.3 VDC. Short to Ground. CM-C8 Pin 26 Circuit 747 Gray.
P0305-11	Left Direction Sensor Mismatch	Left Direction Sensor direction does not match Right Sensor or Pedal Command. CM-C8 Pin 26 Circuit 747 Gray.
P0310-03	Right Speed Sensor Voltage Above Normal	Right PPU Speed - Voltage over 11.2 VDC -Short to power or open circuit. CM-C8 Pin 40 Circuit 745 Green.
P0310-04	Right Speed Sensor Voltage Below Normal	Right PPU Speed - Voltage less than 0.3 VDC - sensor circuit short to ground. CM-C8 Pin 40 Circuit 745 Green.
P0315-03	Right Direction Sensor Voltage Above Normal	Right PPU Direction - voltage greater than 11.2 VDC. Short to ground or open circuit. CM-C8 Pin 41 Circuit 756 White.
P0315-04	Right Direction Sensor Voltage Below Normal	Right PPU Direction - voltage less than 0.3 VDC. Short to ground. CM-C8 Pin 41 Circuit 756 White.
P0315-11	Right Direction Sensor Mismatch	Right Direction Sensor direction does not match Left Sensor or Pedal Command. CM-C8 Pin 41, Circuit 756 White.
P0320-05	Brake Light Relay Control Open Circuit	Brake Light Relay Control Open Circuit. CM-C8 Pin 9 Circuit 348 Red.
P0320-06	Brake Light Relay Control Circuit Short to Ground	Brake Light Relay Control Circuit Short to Ground. CM-C8 Pin 9 Circuit 348 Red.
P0320-12	Brake Light Relay Control Unexpected Voltage on Pin	Brake Light Relay Control Unexpected Voltage on Pin. CM-C8 Pin 9 Circuit 348 Red.
P0400-00	Hydraulic Temperature Overheat	Hydraulic Temperature over 190 degrees F for over 30 seconds. Sensor CM-C8 Pin 39 Circuit 368 Violet.
P0401-01	Hydraulic Level Low Shutdown	Hydraulic Level Low for over 30 seconds. Switch CM-C18 Pin 44 Circuit 378 Blue.
P0410-05	Radiator Fan Solenoid Open Circuit	Radiator Fan Solenoid Open Circuit. CM-C8 Pin 22 Circuit 794 Green. Solenoid resistance specification is 11 Ω at 68° F (20 C°).
P0410-06	Radiator Fan Solenoid Circuit Short to Ground	Radiator Fan Solenoid Circuit Short to Ground. CM-C8 Pin 22 Circuit 794 Green. Solenoid resistance specification is 11 Ω at 68° F (20 C°).
P0410-12	Radiator Fan Solenoid Unexpected Voltage on Pin	Radiator Fan Solenoid Unexpected Voltage on Pin. CM-C8 Pin 22 Circuit 794 Green. Solenoid resistance specification is 11 Ω at 68° F (20 C°).
P0410-20	Radiator Fan Solenoid Resistance Drifted High	Radiator Fan Solenoid Resistance Drifted High. CM-C8 Pin 22 Circuit 794 Green. Solenoid resistance specification is 11 Ω at 68° F (20 C°).
P0410-21	Radiator Fan Solenoid Resistance Drifted Low	Radiator Fan Solenoid Resistance Drifted Low. CM-C8 Pin 22 Circuit 794 Green. Solenoid resistance specification is 11 Ω at 68° F (20 C°).
P0420-05	Starter Relay Control Circuit Open Circuit	Starter Relay Control Circuit Open Circuit. CM-C8 Pin 17 Circuit 114 Red.
P0420-06	Starter Relay Control Circuit Short to Ground	Starter Relay Control Circuit Short to Ground. CM-C8 Pin 17 Circuit 114 Red.

Fault Code	Plain Text	Description
P0420-12	Starter Relay Control Circuit Unexpected Voltage on Pin	Starter Relay Control Circuit Unexpected Voltage on Pin. CM-C8 Pin 17 Circuit 114 Red.
P0430-05	Engine Shutdown Relay Control Open Circuit	Engine Shutdown Relay control Open Circuit. CM-C18 Pin 74 Circuit 385 Gray.
P0430-06	Engine Shutdown Relay Control Circuit Short to Ground	Engine Shutdown Relay control circuit Short to Ground. CM-C18 Pin 74 Circuit 385 Gray.
P0430-12	Engine Shutdown Relay Control Circuit Unexpected Voltage on Pin	Engine Shutdown Relay control circuit Unexpected Voltage on Pin. CM-C18 Pin 74 Circuit 385 Gray.
P0440-05	Charge Air Cooler Relay Control Open Circuit	Charge Air Cooler Relay control Open Circuit. CM-C8 Pin 11 Circuit 359 Blue.
P0440-06	Charge Air Cooler Relay Control Circuit Short to Ground	Charge Air Cooler Relay control Circuit Short to Ground. CM-C8 Pin 11 Circuit 359 Blue.
P0440-12	Charge Air Cooler Relay Control Circuit Unexpected Voltage on Pin	Charge Air Cooler Relay control Circuit Unexpected Voltage on Pin. CM-C8 Pin 11 Circuit 359 Blue.
P0450-05	Engine Cover Fan Relay Control Open Circuit	Engine Cover Fan Relay Control Circuit Open Circuit. CM-C8 Pin 6 Circuit 611 Green.
P0450-06	Engine Cover Fan Relay Control Circuit Short to Ground	Engine Cover Fan Relay Control Circuit Short to Ground. CM-C8 Pin 6 Circuit 611 Green.
P0450-12	Engine Cover Fan Relay Control Circuit Unexpected Voltage on Pin	Engine Cover Fan Relay Control Circuit Unexpected Voltage on Pin. CM-C8 Pin 6 Circuit 611 Green.
S0100-03	CB Pressure Transducer Voltage Above Normal	CB Pressure Transducer above 4.7 V. CM-C8 Pin 70 Circuit 568 Green.
S0100-04	CB Pressure Transducer Voltage Below Normal	CB Pressure Transducer below 0.3 V. CM-C8 Pin 70 Circuit 568 Green.
S0102-03	CB Balance Transducer Voltage Above Normal	CB Balance Transducer above 4.7 V. CM-C8 Pin 66 Circuit 382 White.
S0102-04	CB Balance Transducer Voltage Below Normal	CB Balance Transducer below 0.3 V. CM-C8 Pin 66 Circuit 382 White.
S0104-03	CB Rotate Transducer Voltage Above Normal	CB Rotate Transducer above 4.7 V. CM-C18 Pin 6 Circuit 574 Blue.
S0104-04	CB Rotate Transducer Voltage Below Normal	CB Rotate Transducer below 0.3 V. CM-C18 Pin 6 Circuit 574 Blue.
S0110-11	CB Down Pressure Switch	CB Down Pressure Switch out of normal range. CM-C18 Pin 7 Circuit 562A Blue.
S0130-05	CB Balance Solenoid Open Circuit	CB Balance Solenoid Open Circuit. CM-C8 Pin 13 Circuit 595 White. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0130-06	CB Balance Solenoid Circuit Short to Ground	CB Balance Solenoid Circuit Short to Ground. CM-C8 Pin 13 Circuit 595 White. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0130-12	CB Balance Solenoid Circuit Unexpected Voltage on Pin	CB Balance Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 13 Circuit 595 White. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°)..
S0130-20	CB Balance Solenoid Resistance Drifted High	CB Balance Solenoid Resistance Drifted High. CM-C8 Pin 13 Circuit 595 White. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
S0130-21	CB Balance Solenoid Resistance Drifted Low	CB Balance Solenoid Resistance Drifted Low. CM-C8 Pin 13 Circuit 595 White. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0140-05	CB Raise Solenoid Open Circuit CB Raise Solenoid Open Circuit	CM-C8 Pin 79 Circuit 565 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0140-06	CB Raise Solenoid Circuit Short to Ground	CB Raise Solenoid Circuit Short to Ground. CM-C8 Pin 79 Circuit 565 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0140-12	CB Raise Solenoid Circuit Unexpected Voltage on Pin	CB Raise Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 79 Circuit 565 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0140-20	CB Raise Solenoid Resistance Drifted High	CB Raise Solenoid Resistance Drifted High. CM-C8 Pin 79 Circuit 565 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0140-21	CB Raise Solenoid Resistance Drifted Low	CB Raise Solenoid Resistance Drifted Low. CM-C8 Pin 79 Circuit 565 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0145-05	CB Lower Solenoid Open Circuit	CB Lower Solenoid Open Circuit. CM-C8 Pin 75 Circuit 561 Violet. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0145-06	CB Lower Solenoid Circuit Short to Ground	CB Lower Solenoid Circuit Short to Ground. CM-C8 Pin 75 Circuit 561 Violet. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0145-12	CB Lower Solenoid Circuit Unexpected Voltage on Pin	CB Lower Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 75 Circuit 561 Violet. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0145-20	CB Lower Solenoid Resistance Drifted High	CB Lower Solenoid Resistance Drifted High. CM-C8 Pin 75 Circuit 561 Violet. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0145-21	CB Lower Solenoid Resistance Drifted Low	CB Lower Solenoid Resistance Drifted Low. CM-C8 Pin 75 Circuit 561 Violet. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0150-05	CB Rotate Solenoid Open Circuit	CB Rotate Solenoid Open Circuit. CM-C18 Pin 81 Circuit 566 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0150-06	CB Rotate Solenoid Circuit Short to Ground	CB Rotate Solenoid Circuit Short to Ground. CM-C18 Pin 81 Circuit 566 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0150-12	CB Rotate Solenoid Circuit Unexpected Voltage on Pin	CB Rotate Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 81 Circuit 566 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0150-20	CB Rotate Solenoid Resistance Drifted High	CB Rotate Solenoid Resistance Drifted High. CM-C18 Pin 81 Circuit 566 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0150-21	CB Rotate Solenoid Resistance Drifted Low	CB Rotate Solenoid Resistance Drifted Low. CM-C18 Pin 81 Circuit 566 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0165-05	Water Pump Relay Control Open Circuit	Water Pump Relay Control Open Circuit. CM-C8 Pin 78 Circuit 533 Green.
S0165-06	Water Pump Relay Control Circuit Short to Ground	Water Pump Relay Control Circuit Short to Ground. CM-C8 Pin 78 Circuit 533 Green.

Fault Code	Plain Text	Description
S0165-12	Water Pump Relay Control Circuit Unexpected Voltage on Pin	Water Pump Relay Control Circuit Unexpected Voltage on Pin. CM-C8 Pin 78 Circuit 533 Green.
S0200-03	RSB Pressure Transducer Voltage Above Normal	RSB Pressure Transducer above 4.7 V. CM-C8 Pin 59 Circuit 549 Green.
S0200-04	RSB Pressure Transducer Voltage Below Normal	RSB Pressure Transducer below 0.3 V. CM-C8 Pin 59 Circuit 549 Green.
S0210-11	RSB Down Pressure Switch out of normal range	Right Broom Pressure Switch out of normal range. CM-C8 Pin 61 Circuit 545A Green.
S0220-11	RSB Tilt Switch Fault	RSB Tilt switch mismatch - both sides showing 12V or Ground, or one open. CM-C8 Pin 27 Circuit 557 Brown and CM-C8 Pin 28 Circuit 556 Green.
S0230-03	RSB Tilt Sensor Voltage Above Normal	RSB Tilt sensor voltage above 95% of 5 V Sensor Power. Sensor CM-C8 Pin 60 Circuit 558 White, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0230-04	RSB Tilt Sensor Voltage Below Normal	RSB Tilt sensor voltage below 5% of 5 V Sensor Power. Sensor CM-C8 Pin 60 Circuit 558 White, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0240-05	RSB Raise Solenoid Open Circuit	RSB Raise Solenoid Open Circuit. CM-C8 Pin 77 Circuit 541 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0240-06	RSB Raise Solenoid Circuit Short to Ground	RSB Raise Solenoid Circuit Short to Ground. CM-C8 Pin 77 Circuit 541 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0240-12	RSB Raise Solenoid Circuit Unexpected Voltage on Pin	RSB Raise Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 77 Circuit 541 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0240-20	RSB Raise Solenoid Resistance Drifted High	RSB Raise Solenoid Resistance Drifted High. CM-C8 Pin 77 Circuit 541 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0240-21	RSB Raise Solenoid Resistance Drifted Low	RSB Raise Solenoid Resistance Drifted Low. CM-C8 Pin 77 Circuit 541 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0245-05	RSB Lower Solenoid Open Circuit	RSB Lower Solenoid Open Circuit. CM-C8 Pin 10 Circuit 543 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0245-06	RSB Lower Solenoid Circuit Short to Ground	RSB Lower Solenoid Circuit Short to Ground. CM-C8 Pin 10 Circuit 543 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0245-12	RSB Lower Solenoid Circuit Unexpected Voltage on Pin	RSB Lower Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 10 Circuit 543 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0245-20	RSB Lower Solenoid Resistance Drifted High	RSB Lower Solenoid Resistance Drifted High. CM-C8 Pin 10 Circuit 543 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0245-21	RSB Lower Solenoid Resistance Drifted Low	RSB Lower Solenoid Resistance Drifted Low. CM-C8 Pin 10 Circuit 543 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0250-05	RSB Rotate Solenoid Open Circuit	RSB Rotate Solenoid Open Circuit. CM-C18 Pin 71 Circuit 546 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
S0250-06	RSB Rotate Solenoid Circuit Short to Ground	RSB Rotate Solenoid Circuit Short to Ground. CM-C18 Pin 71 Circuit 546 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0250-12	RSB Rotate Solenoid Circuit Unexpected Voltage on Pin	RSB Rotate Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 71 Circuit 546 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0250-20	RSB Rotate Solenoid Resistance Drifted High	RSB Rotate Solenoid Resistance Drifted High. CM-C18 Pin 71 Circuit 546 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0250-21	RSB Rotate Solenoid Resistance Drifted Low	RSB Rotate Solenoid Resistance Drifted Low. CM-C18 Pin 71 Circuit 546 Green. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0260-05	RSB Water Solenoid Open Circuit	RSB Water Solenoid Open Circuit. CM-C18 Pin 16 Circuit 547 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0260-06	RSB Water Solenoid Circuit Short to Ground	RSB Water Solenoid Circuit Short to Ground. CM-C18 Pin 16 Circuit 547 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0260-12	RSB Water Solenoid Circuit Unexpected Voltage on Pin	RSB Water Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 16 Circuit 547 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0260-20	RSB Water Solenoid Resistance Drifted High	RSB Water Solenoid Resistance Drifted High. CM-C18 Pin 16 Circuit 547 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0260-21	RSB Water Solenoid Resistance Drifted Low	RSB Water Solenoid Resistance Drifted Low. CM-C18 Pin 16 Circuit 547 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0270-05	RSB Tilt Down Relay Control Open Circuit	RSB Tilt Down Relay Control Open Circuit. CM-C18 Pin 21 Circuit 557 Brown.
S0270-06	RSB Tilt Down Relay Control Circuit Short to Ground	RSB Tilt Down Relay Control Circuit Short to Ground. CM-C18 Pin 21 Circuit 557 Brown.
S0270-12	RSB Tilt Down Relay Control Circuit Unwanted Voltage on Pin	RSB Tilt Down Relay Control Circuit Unexpected Voltage on Pin. CM-C18 Pin 21 Circuit 557 Brown.
S0275-05	RSB Tilt Up Relay Control Open Circuit	RSB Tilt Up Relay Control Open Circuit. CM-C18 Pin 64 Circuit 556 Green.
S0275-06	RSB Tilt Up Relay Control Circuit Short to Ground	RSB Tilt Up Relay Control Circuit Short to Ground. CM-C18 Pin 64 Circuit 556 Green.
S0275-12	RSB Tilt Up Relay Control Circuit Unexpected Voltage on Pin	RSB Tilt Up Relay Control Circuit Unexpected Voltage on Pin. CM-C18 Pin 64 Circuit 556 Green.
S0300-03	LSB Pressure Transducer Voltage Above Normal	LSB Pressure Transducer above 4.7 V. CM-C8 Pin 55 Circuit 511 White.
S0300-04	LSB Pressure Transducer Voltage Below Normal	LSB Pressure Transducer below 0.3 V. CM-C8 Pin 55 Circuit 511 White.
S0310-11	LSB Down Pressure Switch out of normal range	LSB Down Pressure Switch out of normal range. CM-C8 Pin 62 Circuit 504A Green.
S0320-11	LSB Tilt Switch Fault	LSB Tilt switch mismatch - both sides showing 12 V or Ground, or one open. CM-C8 Pin 42 Circuit 517 Green and CM-C18 Pin 58 Circuit 516 Violet.

Fault Code	Plain Text	Description
S0330-03	LSB Tilt Sensor Voltage Above Normal	LSB Tilt sensor voltage above 95% of 5 V Sensor Power. Sensor CM-C18 Pin 8 Circuit 518 White, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0330-04	LSB Tilt Sensor Voltage Below Normal	LSB Tilt sensor voltage below 5% of 5 V Sensor Power. Sensor CM-C18 Pin 8 Circuit 518 White, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0340-05	LSB Raise Solenoid Open Circuit	LSB Raise Solenoid Open Circuit. CM-C8 Pin 12 Circuit 502 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0340-06	LSB Raise Solenoid Circuit Short to Ground	LSB Raise Solenoid Circuit Short to Ground. CM-C8 Pin 12 Circuit 502 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0340-12	LSB Raise Solenoid Circuit Unexpected Voltage on Pin	LSB Raise Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 12 Circuit 502 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0340-20	LSB Raise Solenoid Resistance Drifted High	LSB Raise Solenoid Resistance Drifted High. CM-C8 Pin 12 Circuit 502 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0340-21	LSB Raise Solenoid Resistance Drifted Low	LSB Raise Solenoid Resistance Drifted Low. CM-C8 Pin 12 Circuit 502 Violet. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0345-05	LSB Lower Solenoid Open Circuit	LSB Lower Solenoid Open Circuit. CM-C8 Pin 74 Circuit 503 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0345-06	LSB Lower Solenoid Circuit Short to Ground	LSB Lower Solenoid Circuit Short to Ground. CM-C8 Pin 74 Circuit 503 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0345-12	LSB Lower Solenoid Circuit Unexpected Voltage on Pin	LSB Lower Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 74 Circuit 503 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0345-20	LSB Lower Solenoid Resistance Drifted High	LSB Lower Solenoid Resistance Drifted High. CM-C8 Pin 74 Circuit 503 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0345-21	LSB Lower Solenoid Resistance Drifted Low	LSB Lower Solenoid Resistance Drifted Low. CM-C8 Pin 74 Circuit 503 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0350-05	LSB Rotate Solenoid Open Circuit	LSB Rotate Solenoid Open Circuit. CM-C18 Pin 65 Circuit 509 Blue. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0350-06	LSB Rotate Solenoid Circuit Short to Ground	LSB Rotate Solenoid Circuit Short to Ground. CM-C18 Pin 65 Circuit 509 Blue. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0350-12	LSB Rotate Solenoid Circuit Unexpected Voltage on Pin	LSB Rotate Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 65 Circuit 509 Blue. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0350-20	LSB Rotate Solenoid Resistance Drifted High	LSB Rotate Solenoid Resistance Drifted High. CM-C18 Pin 65 Circuit 509 Blue. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).
S0350-21	LSB Rotate Solenoid Resistance Drifted Low	LSB Rotate Solenoid Resistance Drifted Low. CM-C18 Pin 65 Circuit 509 Blue. Solenoid resistance specification is 5.6 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
S0355-05	LSB Out Solenoid Open Circuit	LSB Out Solenoid Open Circuit. CM-C18 Pin 63 Circuit 509 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0355-06	LSB Out Solenoid Circuit Short to Ground	LSB Out Solenoid Circuit Short to Ground. CM-C18 Pin 63 Circuit 509 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0355-12	LSB Out Solenoid Circuit Unexpected Voltage on Pin	LSB Out Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 63 Circuit 509 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0355-20	LSB Out Solenoid Resistance Drifted High	LSB Out Solenoid Resistance Drifted High. CM-C18 Pin 63 Circuit 509 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0355-21	LSB Out Solenoid Resistance Drifted Low	LSB Out Solenoid Resistance Drifted Low. CM-C18 Pin 63 Circuit 509 Blue. Solenoid resistance specification is 7.2 Ω at 68° F (20 C°).
S0360-05	LSB Water Solenoid Open Circuit	LSB Water Solenoid Open Circuit. CM-C18 Pin 76 Circuit 506 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0360-06	LSB Water Solenoid Circuit Short to Ground	LSB Water Solenoid Circuit Short to Ground. CM-C18 Pin 76 Circuit 506 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0360-12	LSB Water Solenoid Circuit Unexpected Voltage on Pin	LSB Water Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 76 Circuit 506 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0360-20	LSB Water Solenoid Resistance Drifted High	LSB Water Solenoid Resistance Drifted High. CM-C18 Pin 76 Circuit 506 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0360-21	LSB Water Solenoid Resistance Drifted Low	LSB Water Solenoid Resistance Drifted Low. CM-C18 Pin 76 Circuit 506 Blue. Solenoid resistance specification is 11.3 Ω at 68° F (20 C°).
S0370-05	LSB Tilt Down Relay Control Open Circuit	LSB Tilt Down Relay Control Open Circuit. CM-C18 Pin 17 Circuit 517 Green.
S0370-06	LSB Tilt Down Relay Control Circuit Short to Ground	LSB Tilt Down Relay Control Circuit Short to Ground. CM-C18 Pin 17 Circuit 517 Green.
S0370-12	LSB Tilt Down Relay Control Circuit Unexpected Voltage on Pin	LSB Tilt Down Relay Control Circuit Unexpected Voltage on Pin. CM-C18 Pin 17 Circuit 517 Green.
S0375-05	LSB Tilt Up Relay Control Open Circuit	LSB Tilt Up Relay Control Open Circuit. CM-C18 Pin 19 Circuit 516 Violet.
S0375-06	LSB Tilt Up Relay Control Circuit Short to Ground	LSB Tilt Up Relay Control Circuit Short to Ground. CM-C18 Pin 19 Circuit 516 Violet.
S0375-12	LSB Tilt Up Relay Control Circuit Unexpected Voltage on Pin	LSB Tilt Up Relay Control Circuit Unexpected Voltage on Pin. CM-C18 Pin 19 Circuit 516 Violet.
S0440-05	Conveyor Raise Solenoid Open Circuit	Conveyor Raise Solenoid Open Circuit. CM-C18 Pin 20 Circuit 578 Blue. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0440-06	Conveyor Raise Solenoid Circuit Short to Ground	Conveyor Raise Solenoid Circuit Short to Ground. CM-C18 Pin 20 Circuit 578 Blue. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0440-12	Conveyor Raise Solenoid Circuit Unexpected Voltage on Pin	Conveyor Raise Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 20 Circuit 578 Blue. Solenoid resistance specification is 9 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
S0440-20	Conveyor Raise Solenoid Resistance Drifted High	Conveyor Raise Solenoid Resistance Drifted High. CM-C18 Pin 20 Circuit 578 Blue. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0440-21	Conveyor Raise Solenoid Resistance Drifted Low	Conveyor Raise Solenoid Resistance Drifted Low. CM-C18 Pin 20 Circuit 578 Blue. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0445-05	Conveyor Lower Solenoid Open Circuit	Conveyor Lower Solenoid Open Circuit. CM-C18 Pin 67 Circuit 579 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0445-06	Conveyor Lower Solenoid Circuit Short to Ground	Conveyor Lower Solenoid Circuit Short to Ground. CM-C18 Pin 67 Circuit 579 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0445-12	Conveyor Lower Solenoid Circuit Unexpected Voltage on Pin	Conveyor Lower Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 67 Circuit 579 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0445-20	Conveyor Lower Solenoid Resistance Drifted High	Conveyor Lower Solenoid Resistance Drifted High. CM-C18 Pin 67 Circuit 579 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0445-21	Conveyor Lower Solenoid Resistance Drifted Low	Conveyor Lower Solenoid Resistance Drifted Low. CM-C18 Pin 67 Circuit 579 Green. Solenoid resistance specification is 9 Ω at 68° F (20 C°).
S0450-05	Conveyor Fwd Solenoid Open Circuit	Conveyor Fwd Solenoid Open Circuit. CM-C18 Pin 69 Circuit 577 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0450-06	Conveyor Fwd Solenoid Circuit Short to Ground	Conveyor Fwd Solenoid Circuit Short to Ground. CM-C18 Pin 69 Circuit 577 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0450-12	Conveyor Fwd Solenoid Circuit Unexpected Voltage on Pin	Conveyor Fwd Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 69 Circuit 577 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0450-20	Conveyor Fwd Solenoid Resistance Drifted High	Conveyor Fwd Solenoid Resistance Drifted High. CM-C18 Pin 69 Circuit 577 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0450-21	Conveyor Fwd Solenoid Resistance Drifted Low	Conveyor Fwd Solenoid Resistance Drifted Low. CM-C18 Pin 69 Circuit 577 Blue. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0455-05	Conveyor Rev Solenoid Open Circuit	Conveyor Rev Solenoid Open Circuit. CM-C18 Pin 22 Circuit 576 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0455-06	Conveyor Rev Solenoid Circuit Short to Ground	Conveyor Rev Solenoid Circuit Short to Ground. CM-C18 Pin 22 Circuit 576 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0455-12	Conveyor Rev Solenoid Circuit Unexpected Voltage on Pin	Conveyor Rev Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 22 Circuit 576 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0455-20	Conveyor Rev Solenoid Resistance Drifted High	Conveyor Rev Solenoid Resistance Drifted High. CM-C18 Pin 22 Circuit 576 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).

Fault Code	Plain Text	Description
S0455-21	Conveyor Rev Solenoid Resistance Drifted Low	Conveyor Rev Solenoid Resistance Drifted Low. CM-C18 Pin 22 Circuit 576 Green. Solenoid resistance specification is 4.4 Ω at 68° F (20 C°).
S0500-03	Vacuum Sensor Voltage Above Normal	Vacuum Sensor voltage above 95% of 5 V Sensor Power. Sensor CM-C18 Pin 9 Circuit 463 Gray, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0500-04	Vacuum Sensor Voltage Below Normal	Vacuum Sensor voltage below 5% of 5 V Sensor Power. Sensor CM-C18 Pin 9 Circuit 463 Gray, 5 V Power CM-C8 Pin 31 Circuit 721 Yellow.
S0510-11	Fan Speed Sensor Out of Range	Fan Speed Sensor out of range. CM-C8 Pin 43 Circuit 795 White.
S0520-05	Sweep Fan Control Coil Open Circuit	Dust Fan Control Coil Open Circuit. CM-C8 Pin 80 Circuit 529 Blue. Solenoid resistance specification is 3.66 Ω at 68° F (20 C°).
S0520-06	Sweep Fan Control Coil Circuit Short to Ground	Dust Fan Control Coil Circuit Short to Ground. CM-C8 Pin 80 Circuit 529 Blue. Solenoid resistance specification is 3.66 Ω at 68° F (20 C°).
S0520-12	Sweep Fan Control Coil Circuit Unexpected Voltage on Pin	Dust Fan Control Coil Circuit Unexpected Voltage on Pin. CM-C8 Pin 80 Circuit 529 Blue. Solenoid resistance specification is 3.66 Ω at 68° F (20 C°).
S0520-20	Sweep Fan Control Coil Resistance Drifted High	Dust Fan Control Coil Resistance Drifted High. CM-C8 Pin 80 Circuit 529 Blue. Solenoid resistance specification is 3.66 Ω at 68° F (20 C°).
S0520-21	Sweep Fan Control Coil Resistance Drifted Low	Dust Fan Control Coil Resistance Drifted Low. CM-C8 Pin 80 Circuit 529 Blue. Solenoid resistance specification is 3.66 Ω at 68° F (20 C°).
S0530-05	Shaker Solenoid Open Circuit	Shaker Solenoid Open Circuit. CM-C8 Pin 23 Circuit 528 Green. Solenoid resistance specification is 4.6 Ω at 68° F (20 C°).
S0530-06	Shaker Solenoid Circuit Short to Ground	Shaker Solenoid Circuit Short to Ground. CM-C8 Pin 23 Circuit 528 Green. Solenoid resistance specification is 4.6 Ω at 68° F (20 C°).
S0530-12	Shaker Solenoid Circuit Unexpected Voltage on Pin	Shaker Solenoid Circuit Unexpected Voltage on Pin. CM-C8 Pin 23 Circuit 528 Green. Solenoid resistance specification is 4.6 Ω at 68° F (20 C°).
S0530-20	Shaker Solenoid Resistance Drifted High	Shaker Solenoid Resistance Drifted High. CM-C8 Pin 23 Circuit 528 Green. Solenoid resistance specification is 4.6 Ω at 68° F (20 C°).
S0530-21	Shaker Solenoid Resistance Drifted Low	Shaker Solenoid Resistance Drifted Low. CM-C8 Pin 23 Circuit 528 Green. Solenoid resistance specification is 4.6 Ω at 68° F (20 C°).
X0040-07	Engine ECU Not Responding	Engine ECU Not Responding. Check Power, Ground, and Communication connections.
X0100-11	Sweep Transport Switch Stuck ON	Momentary Sweep Transport Switch stuck ON for over 5 seconds. CM-C8 Pin 36 Circuit 705 Blue.
X0150-05	Sweep Power Relay Control Open Circuit	Sweep Power Relay Control Open Circuit. CM-C8 Pin 19 Circuit 702 Gray.
X0150-06	Sweep Power Relay Control Circuit Short to Ground	Sweep Power Relay Control Circuit Short to Ground. CM-C8 Pin 19 Circuit 702 Gray.
X0150-12	Sweep Power Relay Control Unexpected Voltage on Pin	Sweep Power Relay Control Circuit Unexpected Voltage on Pin. CM-C8 Pin 19 Circuit 702 Gray.
X0160-05	Operator Stalk Select Relays Control Open Circuit	Operator Stalk Select Relays Control Open Circuit. CM-C8 Pin 21 Circuit 311 Blue.

Fault Code	Plain Text	Description
X0160-06	Operator Stalk Select Relays Control Circuit Short to Ground	Operator Stalk Select Relays Control Circuit Short to Ground. CM-C8 Pin 21 Circuit 311 Blue.
X0160-12	Operator Stalk Select Relays Control Circuit Unexpected Voltage on Pin	Operator Stalk Select Relays Control Circuit Unexpected Voltage on Pin. CM-C8 Pin 21 Circuit 311 Blue.
X0200-05	Common Valve Solenoid Open Circuit	Common Valve Solenoid Open Circuit. CM-C18 Pin 18 Circuit 599 Pink. Solenoid resistance specification is 6.9 Ω at 68° F (20 C°).
X0200-06	Common Valve Solenoid Circuit Short to Ground	Common Valve Solenoid Circuit Short to Ground. CM-C18 Pin 18 Circuit 599 Pink. Solenoid resistance specification is 6.9 Ω at 68° F (20 C°).
X0200-12	Common Valve Solenoid Circuit Unexpected Voltage on Pin	Common Valve Solenoid Circuit Unexpected Voltage on Pin. CM-C18 Pin 18 Circuit 599 Pink. Solenoid resistance specification is 6.9 Ω at 68° F (20 C°).
X0200-20	Common Valve Solenoid Resistance Drifted High	Common Valve Solenoid Resistance Drifted High. CM-C18 Pin 18 Circuit 599 Pink. Solenoid resistance specification is 6.9 Ω at 68° F (20 C°).
X0200-21	Common Valve Solenoid Resistance Drifted Low	Common Valve Solenoid Resistance Drifted Low. CM-C18 Pin 18 Circuit 599 Pink. Solenoid resistance specification is 6.9 Ω at 68° F (20 C°).
X0210-05	Backup Alarm Open Circuit	Backup Alarm Open Circuit. CM-C8 Pin 7 Circuit 445 Green.
X0210-06	Backup Alarm Circuit Short to Ground	Backup Alarm Short to Ground. CM-C8 Pin 7 Circuit 445 Green.
X0210-12	Backup Alarm Circuit Unexpected Voltage on Pin	Backup Alarm Unexpected Voltage on Pin. CM-C8 Pin 7 Circuit 445 Green.
X0910-11	Park Brake Released, Key in Start Position	Park Brake not applied during engine start.
X0911-11	Park Brake Released, Operator Position Switch	Park brake not applied during operator position switch change.
X0912-11	Park Brake Applied while Moving	Park brake applied, vehicle speed above 5 MPH.
X0913-11	Park Brake Applied, Pedal Not in Neutral	Park brake applied, active pedal commanding movement.
X0920-11	Wheel Motor Direction Fault	One motor direction sensor forward, one direction sensor reverse. **Note**: audible backup alarm.
X0921-11	Loss of Reverse Direction Sense	Pedal commands reverse, motor direction sensors do not read reverse direction. **Note**: audible backup alarm.
X0922-11	Loss of Reverse Speed Sense	Pedal commands reverse, motor direction indicate reverse, no speed pulses. **Note**: audible backup alarm.
X0930-11	Hopper disabled above 5 MPH	Hopper disabled above 5 MPH.
X0940-11	Broom Auto Tilt to Stow Disabled - Conveyor not Stowed	Conveyor stowed switch not active. Brooms will not tilt to stow in Transport Mode. (NE Pelican Only).
X0A00-04	Module “A” Power Supply VBB 0 Below System Voltage	Module “A” Power Supply VBB 0 Below VBB 30. CM-C8 Pin 4 Circuit 181 Red. Fuse C1.
X0A01-04	Module “A” Power Supply VBB 1 Below System Voltage	Module “A” Power Supply VBB 1 Below VBB 30. CM-C8 Pin 3 Circuit 184 Red. Fuse C3.

Fault Code	Plain Text	Description
X0A02-04	Module “A” Power Supply VBB 2 Below System Voltage	Module “A” Power Supply VBB 2 Below VBB 30. CM-C8 Pin 1 Circuit 183 Red. Fuse C2.
X0A03-04	Module “A” Power Supply VBB 3 Below System Voltage	Module “A” Power Supply VBB 3 Below VBB 30. CM-C18 Pin 4 Circuit 182 Red. Fuse C4.
X0A04-04	Module “A” Power Supply VBB 4 Below System Voltage	Module “A” Power Supply VBB 4 Below VBB 30. CM-C18 Pin 3 Circuit 179 Red. Fuse C5.
X0A05-04	Module “A” Power Supply VBB 5 Below System Voltage	Module “A” Power Supply VBB 5 Below VBB 30. CM-C18 Pin 1 Circuit 186 Red. Fuse C6.
X0A30-03	Module “A” Power Supply VBB 30 Above 15 V	Module “A” Power Supply VBB 30 Above 15 V while running. CM-C8 Pin 30 Circuit 360 Yellow.
X0A30-04	Module “A” Power Supply VBB 30 Below 11V	Module “A” Power Supply VBB 30 Below 11V while running. CM-C8 Pin 30 Circuit 360 Yellow.
X0A40-07	Module “A” Not Responding	Module “A” Not Responding. Check Power, Ground, and Communication connections
X0A50-03	Module “A” 5 Volt Sensor Power Above 6V	Module “A” 5 Volt sensor power above 6V. CM-C8 Pin 31 Circuit 721 Yellow.
X0A50-06	Module “A” 5 Volt Sensor Power High Current	Module “A” 5 Volt sensor power high current draw - possible short to ground. CM-C8 Pin 31 Circuit 721 Yellow.

ELECTRICAL SCHEMATICS

All electrical circuit schematics are illustrated in the electrical circuit section of the diagnostics manual. Use the circuit section along with the fault code description to understand each circuit operation and error code implications with suggestions for problem error resolutions.

GRAPHIC DISPLAY MODULE

The screens generated by the display are routed to the display module from the control module through Ethernet connections.

The IFM CR1203 display module is a touchscreen interface that uses CANBus and Ethernet interfaces to help control the sweeper functions and display component variables. See Fig. 28: Display Touch Screen. Use the display to monitor sweeper component operation. See the operator's manual for illustrations and descriptions of the display functions and uses.

You must have park brake applied to use the touch screen display.

Graphic Display Module Fail-Safe Mode

In the event that the park brake sensor has failed, you can interact with the graphic display module in fail-safe mode. Perform the following steps:

1. Park the sweeper in a safe, level area.
2. Chock the tires.
3. On the display touch screen, press the brake icon and press the service brake pedal for five seconds.
4. The color of the menu button changes from gray to yellow, allowing access to the graphic display module menus.

RJ45 Access to Graphic Display Module

Another way to see the diagnostic screens is to connect a computer/tablet to the RJ45 connector on the console (Fig. 29: RJ45 Connector). Open a browser (Edge, Chrome, Safari) and go to 192.168.82.240:8080.

Another connection method is to use a wireless adapter powered by USB. Plug that adapter into the RJ45 port and the USB charging port. You can then connect wirelessly using a laptop, tablet, or phone.

Fig. 29: RJ45 Connector

Fig. 28: Display Touch Screen

TESTING FOR OPENS, SHORTS, AND SHORT TO GROUND

Use this procedure to check for open circuits, short circuits and a short to ground within a circuit. This procedure uses the radiator cooling fan hydraulic motor circuit, as an example. See Radiator Cooling Fan on page 203 for a complete description and diagnostics procedure.

TESTING EXAMPLE

Study the schematic to follow the flow during the description and test steps (Fig. 30: Radiator Cooling Fan Circuit).

As an example only, the suspected open circuit, short circuit or short to ground exist in the circuit between IFM controller CR721S CM-C8 pin 22 and the radiator fan hydraulic motor proportional fan bypass solenoid coil terminal 1.

All connectors attached to the circuit must be disconnected to prevent false readings. Isolate the wire being tested from other wires in the circuit. Install all connectors when the test procedure is complete. The wire and connector at controller CR721S CM-C8 pin 22 must be removed from the controller. The wire and connector at CH-C50 terminal 1 on the radiator fan motor proportional fan bypass solenoid must be removed.

The battery voltage is routed from controller CR721S CM-C8 pin 22 when the control system needs to route voltage for solenoid operation.

1. With the sweeper system shut down and engine off, remove the connector at the controller CR721S pin 22 (light green wire).
2. Remove the connector from the bypass solenoid coil terminal 1.
3. Place a jumper wire between the end of the (light green) wire end connector from the solenoid terminal 1 and a known ground.
4. Check with a multimeter set to resistance (ohms lowest setting) between the controller CM-C8 wire end (light green) connector and a known ground. The multimeter should display a 0, indicating wire continuity. If the multimeter does not display a 0, the wire between the controller CM-C8 pin 22 and the solenoid coil terminal 1 has an open circuit.
5. Repair or replace the wire between controller CM-C8 pin 22 and the solenoid coil terminal 1.
6. If the multimeter displays a 0, remove the jumper wire from the solenoid coil connector at terminal 1. Check with a multimeter set to resistance (ohms lowest setting), a known ground between the wire from controller CM-C8 pin 22, and a known ground. The multimeter should display a 1, indicating an open circuit. If the multimeter does not display a 1, the wire between controller CM-C8 pin 22 wire end and the solenoid coil wire at terminal 1 has a short to ground.
7. Repair or replace the wire between the controller CM-C8 pin 22 (light green) and the solenoid coil terminal 1 (light green) wire.

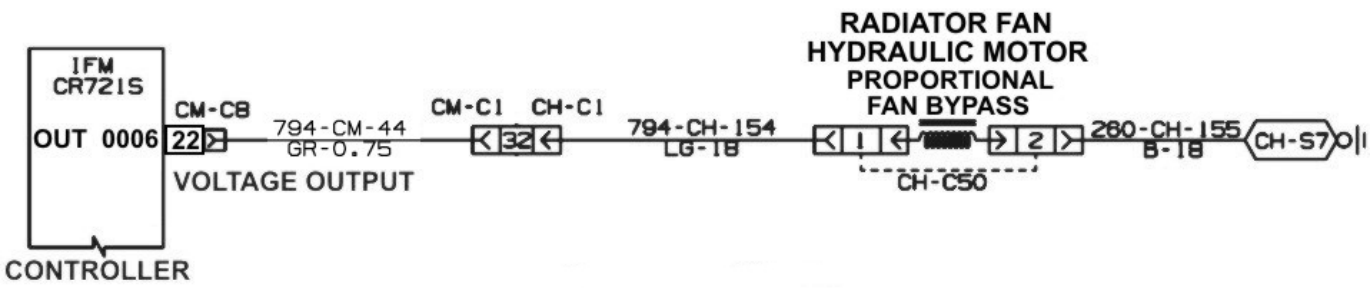

Fig. 30: Radiator Cooling Fan Circuit

AIR CONDITIONING CIRCUIT

Fig. 31: Air Conditioning Circuit Sheet 1 and Fig. 32: Air Conditioning Circuit Sheet 2 show the air conditioning circuit.

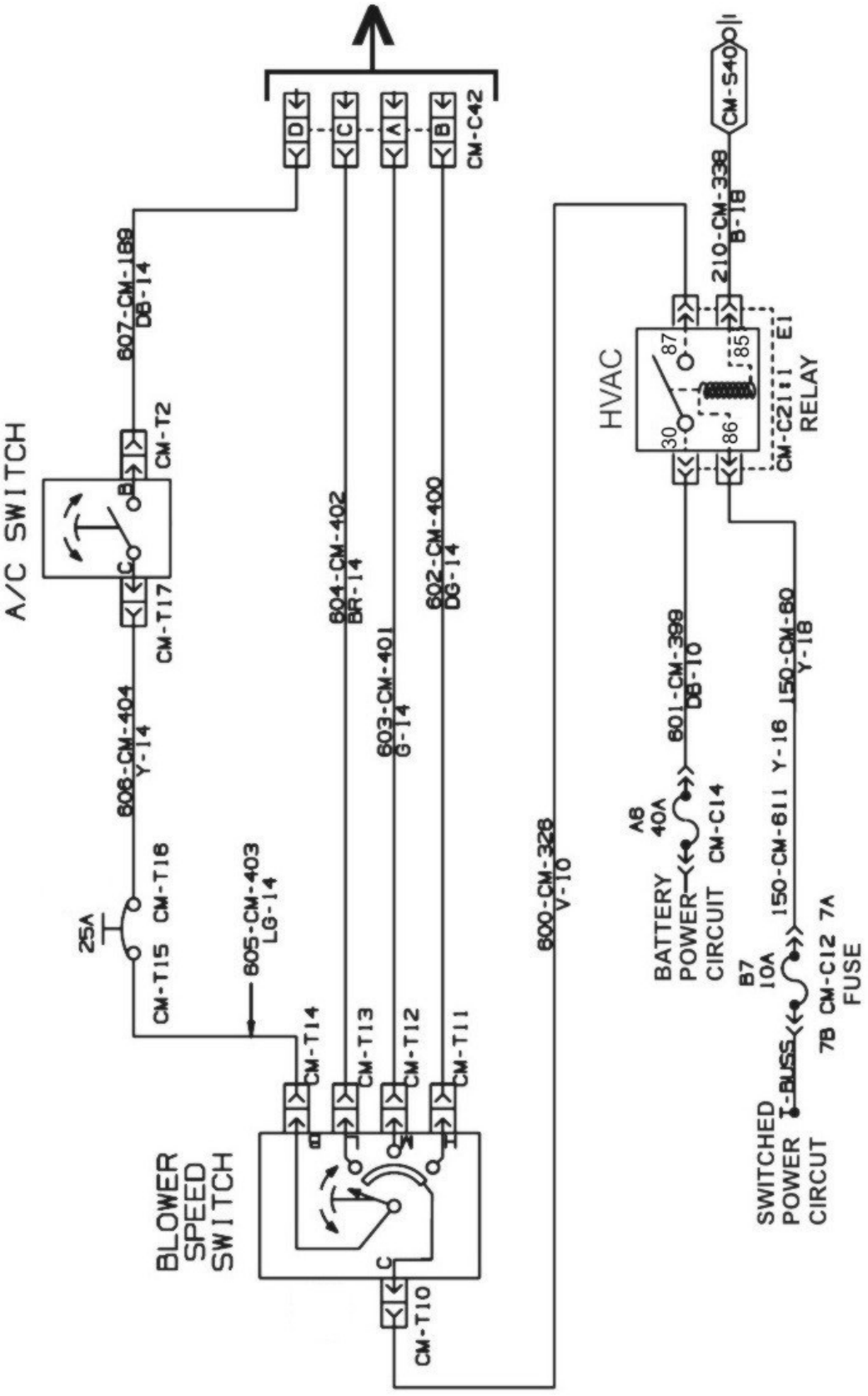

Fig. 31: Air Conditioning Circuit Sheet 1

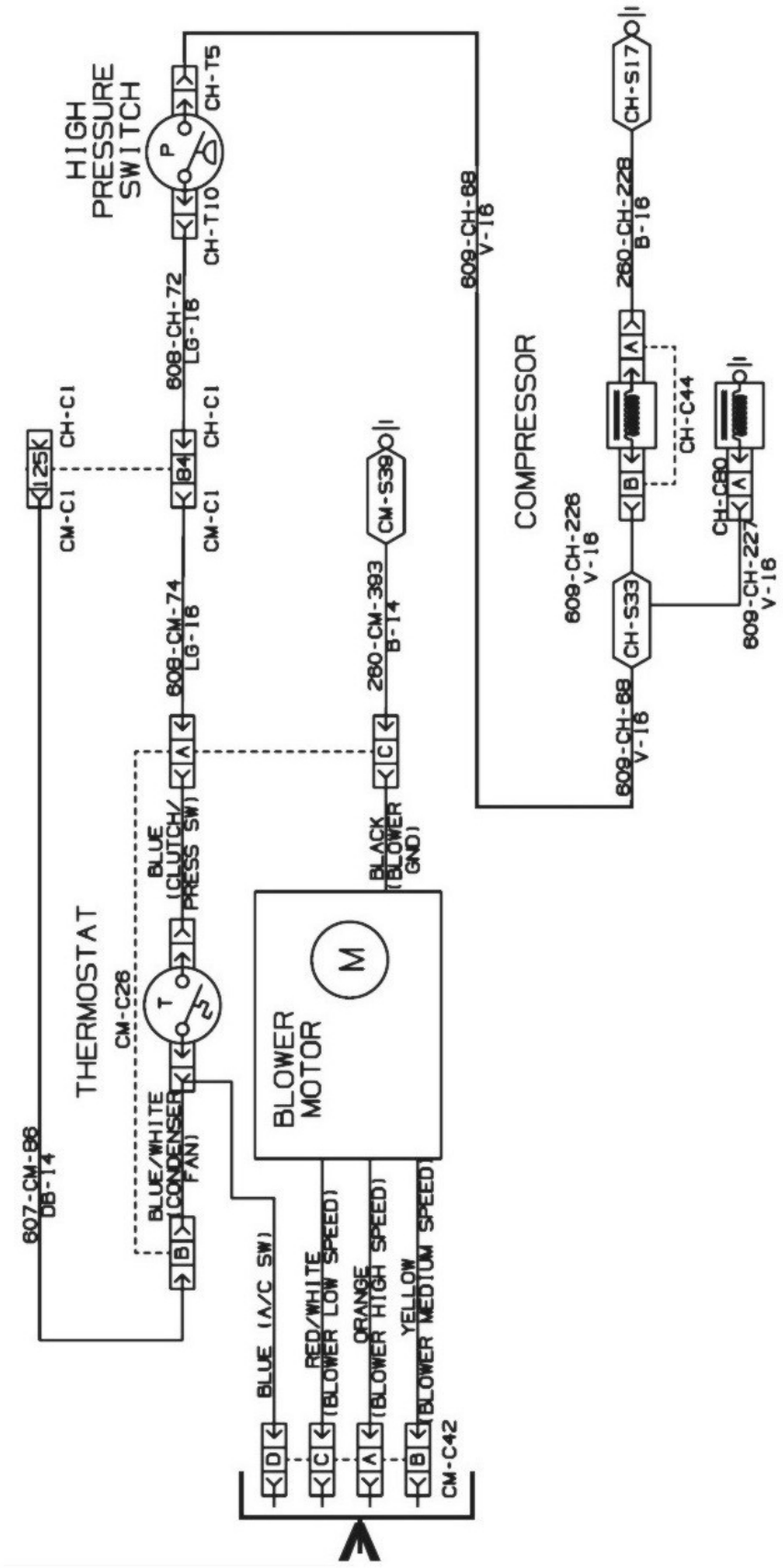

Fig. 32: Air Conditioning Circuit Sheet 2

The sweeper air conditioning is controlled by the air conditioning (AC) switch, blower speed switch, and the HVAC relay. See Fig. 33: Air Conditioning Controls. When the ignition switch is placed in the ON position, battery voltage routes from the ignition switch to the switched power relay, activating the relay. See Fig. 108: Ignition Switch Circuit on page 111 and Fig. 243: Switched Power Circuit on page 215. The battery voltage is routed from the switched power relay to fuse B7 through fuse B7 (10A) to one side of the HVAC relay coil terminal 86. The relay grounds at terminal 85. The battery voltage at terminal 86 and ground circuit at terminal 85 energize the relay. Battery voltage is available at the relay from switched power circuit and fuse A6 (40A) to the HVAC relay terminal 30. When energized, the battery voltage is routed from the HVAC relay terminal 30, through the relay and terminal 87, to the blower speed switch terminal (C) CM-T10. The battery voltage is routed through the blower speed switch to the blower motor. The position of the switch determines the power routed to the blower motor. Each switch position causes circuit resistance to deliver a specific power level to the blower motor. The circuit indicates that switch position CM-T11-H delivers battery voltage to the blower motor (B), providing high speed motor rotation. The switch medium position CM-T12-M delivers enough power to the blower motor (A) for medium blower speed and position CM-T13-L delivers power to the blower motor (C) for low blower speed operation.

The blower speed switch also routes battery voltage from the blower speed switch terminal CM-T14-B through an inline circuit breaker (25A) to the AC switch terminal CM-T17. When the AC switch is placed in the ON position, battery voltage is routed from the AC switch terminal CM-T2 to the thermostat terminal B. The thermostat is a normally closed switch that senses evaporator temperature. Below a certain temperature, the switch opens, disengaging the AC compressor clutch. This prevents the evaporator from freezing. The normally closed high pressure switch routes the battery voltage through the switch terminal CH-T5 to the air compressor magnetic operated coil, locking the drive clutch and rotating the compressor. The normally closed high pressure switch allows the operating voltage to flow through the switch, unless excessive refrigerant pressure causes the switch to open. When opened, the switch no longer routes battery voltage to the compressor clutch, causing the compressor to stop rotation. The high pressure switch is a safety device to protect the AC system from over pressure damage and possible equipment damage.

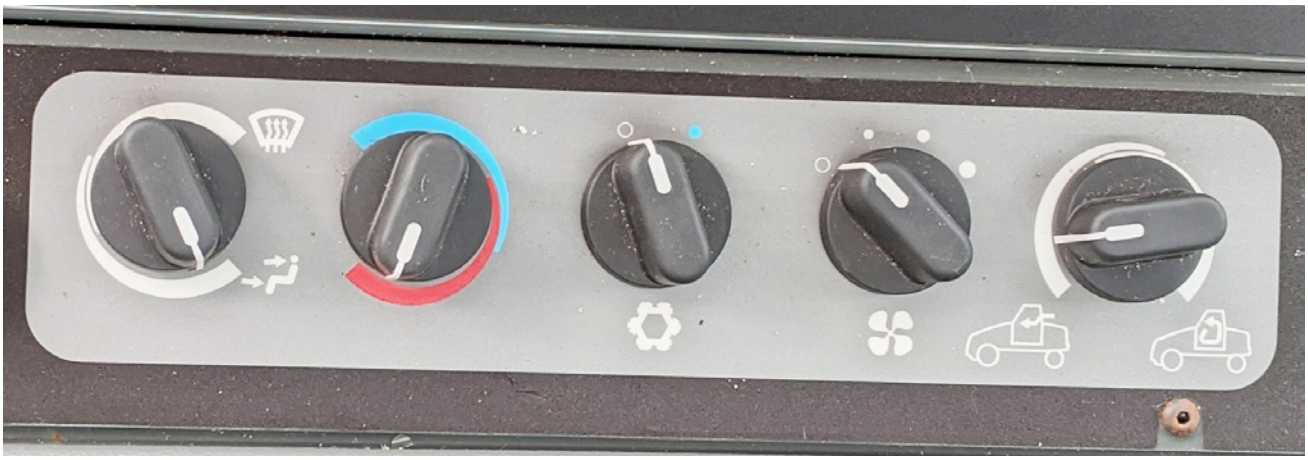

Fig. 33: Air Conditioning Controls

AIR SEAT CIRCUIT

The sweeper air seats are controlled by self contained seat switches. When the ignition switch is placed in the ON position, battery voltage is routed from the ignition switch to the switched power relay, activating the relay. See Fig. 108: Ignition Switch Circuit on page 111 and Fig. 243: Switched Power Circuit on page 215. The battery voltage for operation of the air seat is routed from the switched power circuit and fuse B9 (15A) to the left seat motor CM-C43 terminal A and right seat motor CM-C44 terminal A. The left seat motor is grounded at CM-C43 terminal B and right seat motor is grounded at CM-C44 terminal B (Fig. 34: Air Seat Circuit).

If necessary, see Fuses And Relays on page 19 to locate fuses.

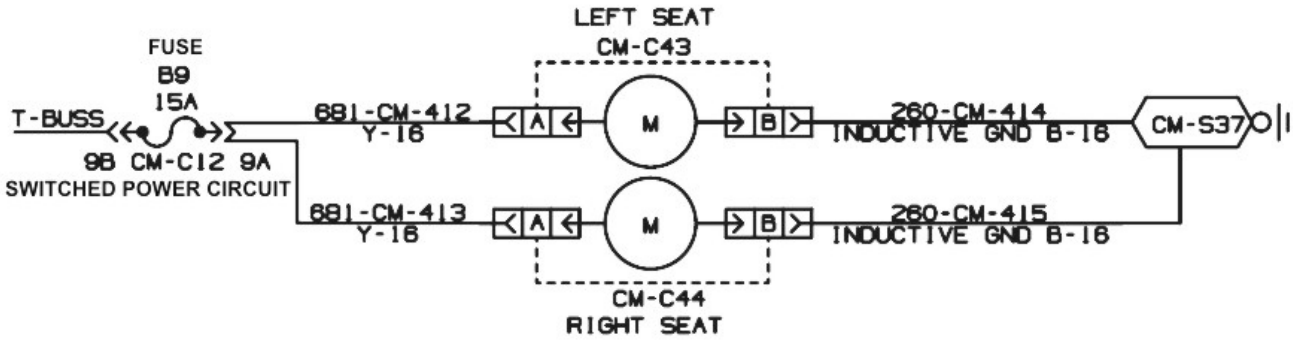

Fig. 34: Air Seat Circuit

AUTO-LUBE CIRCUIT

The auto-lube system automatically lubricates the sweeper components, as needed (Fig. 35: Auto Lube Motor and Dispenser). The voltage for operation of the auto-lube motor is routed from the switched power circuit and fuse B12 (10A) to the auto-lube motor terminal 1. The auto-lube motor is grounded at terminal 2 by a ground circuit from ground splice CH-S17. The battery voltage at terminal 1 and ground circuit at terminal 2 causes the auto-lube circuit to operate (Fig. 36: Auto Lube Circuit).

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 35: Auto Lube Motor and Dispenser

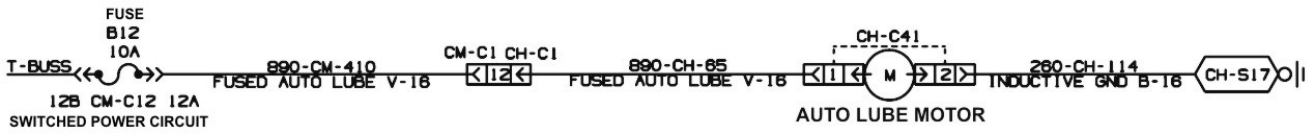

Fig. 36: Auto Lube Circuit

AUXILIARY POWER OUTLET CIRCUIT

The auxiliary power outlet provides power for the operation of external components (Fig. 37: Auxiliary Power Outlet and USB Charger Circuit). The voltage for operation of the outlet is routed from the battery power circuit and fuse A4 (20A) to the power outlet terminal 1. The outlet is grounded by a ground circuit from ground splice CM-37 (Fig. 38: USB Charger and Aux Power Outlet Circuit).

If necessary, see Fuses And Relays on page 19 to locate fuses.

USB CHARGER CIRCUIT

The USB charger provides 5 volts for use in external devices (Fig. 37: Auxiliary Power Outlet and USB Charger Circuit on page 56). The battery voltage for operation of the USB charger is routed from the switched power circuit (Fig. 38: USB Charger and Aux Power Outlet Circuit) and fuse B11 (5A) to the charger CM-C39 terminal 1. The charger is grounded at terminal 4 by a ground circuit from ground splice CM-S37. Using the battery voltage input and ground circuit the USB charger converts the battery voltage to 5 VDC output at two output ports.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 37: Auxiliary Power Outlet and USB Charger Circuit

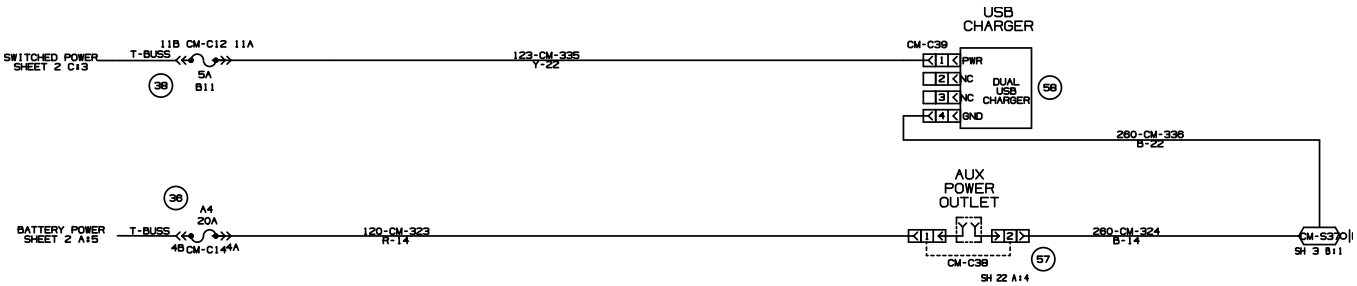

Fig. 38: USB Charger and Aux Power Outlet Circuit

BACKUP ALARM
X0210

Fig. 39: Backup Alarm shows the location of the backup alarm on the sweeper. If the display backup alarm indicator is illuminated (Fig. 40: Backup Alarm Indicator) and displays an amperage draw, one or both of the wheel speed sensors is reporting a reverse direction to the controller and voltage has been routed from controller CR721S CM-C8 pin 7 to the backup alarm terminal EC-T2. If the backup alarm does not sound, check for battery voltage at the alarm terminal 1 and a ground circuit at the alarm terminal EC-T1.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 39: Backup Alarm

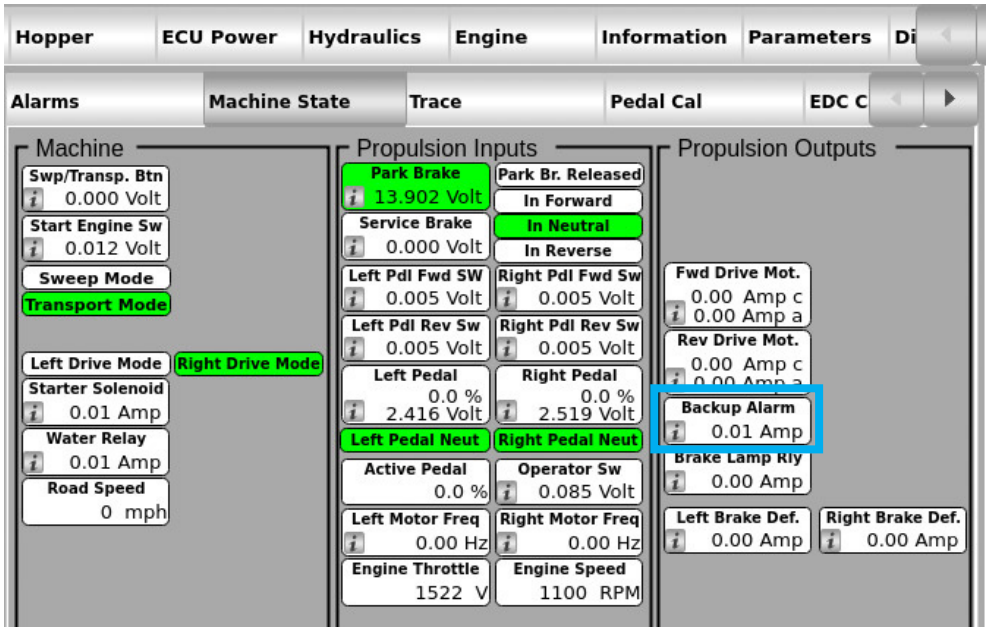

Fig. 40: Backup Alarm Indicator

Fig. 41: Backup Alarm Circuit shows the backup alarm circuit.

The backup alarm is controlled by the electronic control system. When the electronic control system receives the signal that the wheels are rotating in reverse, the backup alarm and camera turn on. This causes the control system to route battery voltage from IFM controller CR721S CM-C8 pin 7 to the backup alarm terminal EC-T2. Because the backup alarm is grounded at terminal EC-T1 by a ground circuit from ground splice EC-S2, the alarm sounds. The alarm warns personnel in the area the sweeper is in reverse.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: See fault codes X0210-05 (Open Circuit), X0210-06 (Short to Ground) and X0210-12 (Unexpected Voltage on Pin). See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check opens, shorts and short to ground between controller CR721S CM-C8 pin 7 and the backup alarm terminal EC-T2. Use a multimeter to check for a ground circuit at the backup alarm terminal EC-T1.

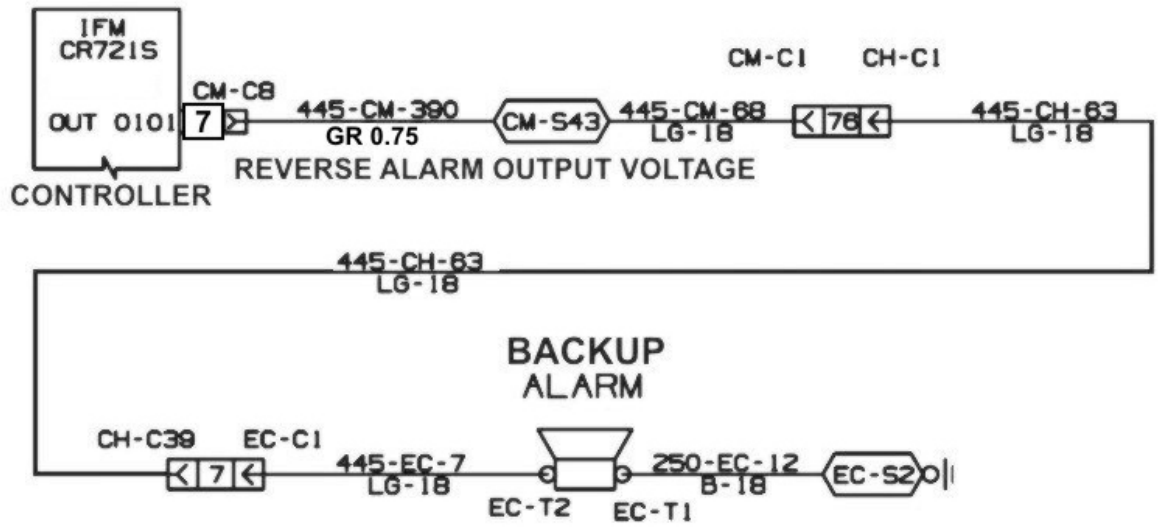

Fig. 41: Backup Alarm Circuit

12 V BATTERY DISCONNECT CIRCUIT

The optional 12 V battery disconnect switch can be used to disconnect 12 V battery power from the sweeper components. The disconnect switch can provide protection against theft when the sweeper is not in use, reliable power shutdown during maintenance and 12 V battery excessive voltage drain. The switch is mounted between the 12 V battery ground post and the frame ground boss 2 (Fig. 42: 12 V Battery Disconnect and Fig. 43: 12 V Battery Disconnect Circuit). The quarter-turn knob allows a ground connection for sweeper circuit operation and removes the ground connection when placed in the disconnect position.

Fig. 42: 12 V Battery Disconnect

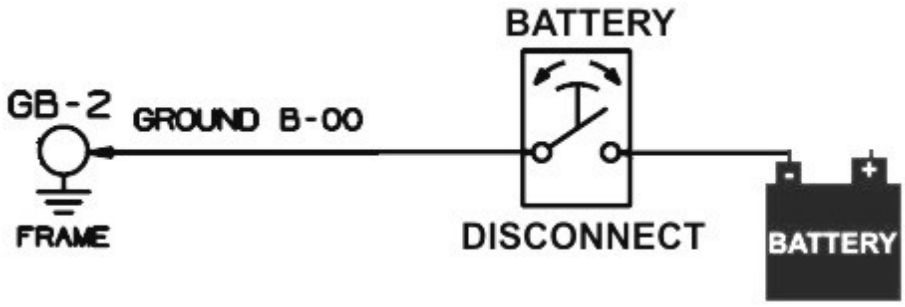

Fig. 43: 12 V Battery Disconnect Circuit

BRAKE DEFEAT AND DRIVE CIRCUIT
P0102, P0112

The motor pilot selectors (brake defeat valves) (Fig. 44: Left-Side Brake Defeat Solenoid) are used in conjunction with a pressure compensator (drive motor shift control) to provide appropriate shifting of the hydrostatic drive motors. The brake defeat valves defeat the severe hydrostatic braking (inappropriate shifting) during deceleration and permit down shift/up shift in the direction selected by the operator. The left brake defeat solenoid valve is activated by a voltage circuit from the controller IFM CR721S CM-C18 pin 24 during forward operation to the left brake defeat solenoid terminal 1. The right brake defeat is activated by a voltage circuit from the controller IFM CR721S CM-C8 pin 81 to the right brake defeat solenoid terminal 1 during reverse operation.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 45: Brake Defeat and Drive Circuit shows the brake defeat and drive circuit.

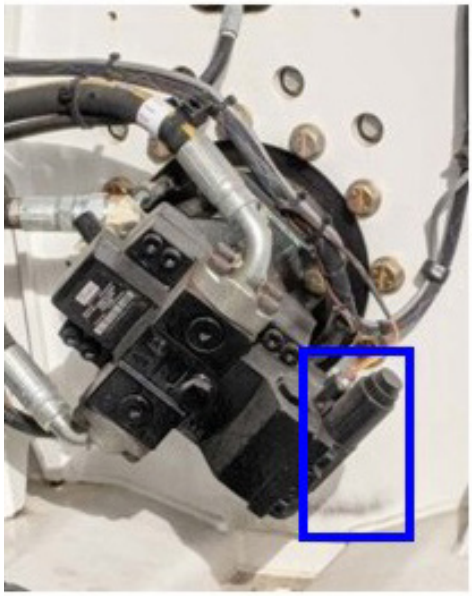

Fig. 44: Left-Side Brake Defeat Solenoid

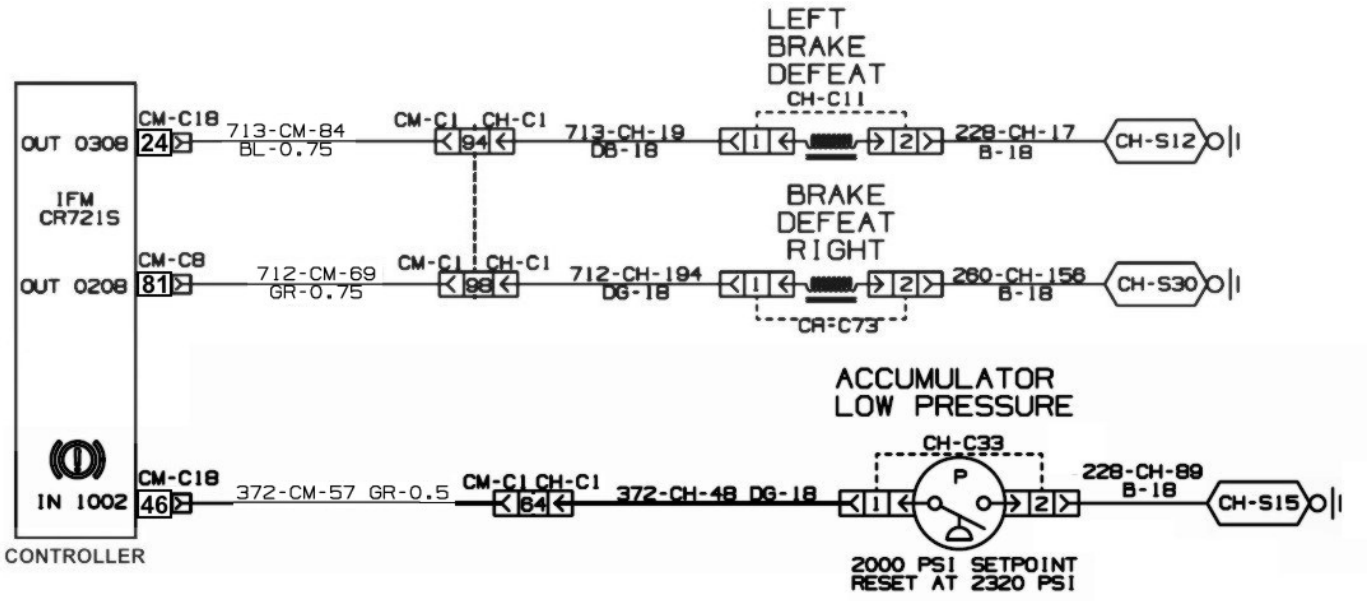

Fig. 45: Brake Defeat and Drive Circuit

When the wheel sensor detects forward motion and the pedal is in the forward position, the Left Brake Defeat is energized. When the wheel sensor detects reverse motion and the pedal is in the reverse position, the Right Brake Defeat is energized.

The left motor direction (from the PPU) is used to determine which brake defeat solenoid to energize when the RPM is less than 1000. In the event of a PPU failure (fault), the operator-intended direction (as determined by the pedal position) is then used. The left/forward brake defeat solenoid is energized when wheel direction, as indicated by the left wheel PPU, is traveling forward (CW drive motor shaft rotation). A voltage circuit is routed from controller IFM CR721S CM-C18 pin 24 to the left brake defeat solenoid.

The left brake defeat solenoid is grounded by a ground circuit from ground splice CH-S12. The right brake solenoid is grounded by a ground circuit from ground splice CH-S30.

See Fig. 46: Brake Defeat Indicators for left-side and right-side brake defeat and left pedal and right pedal information.

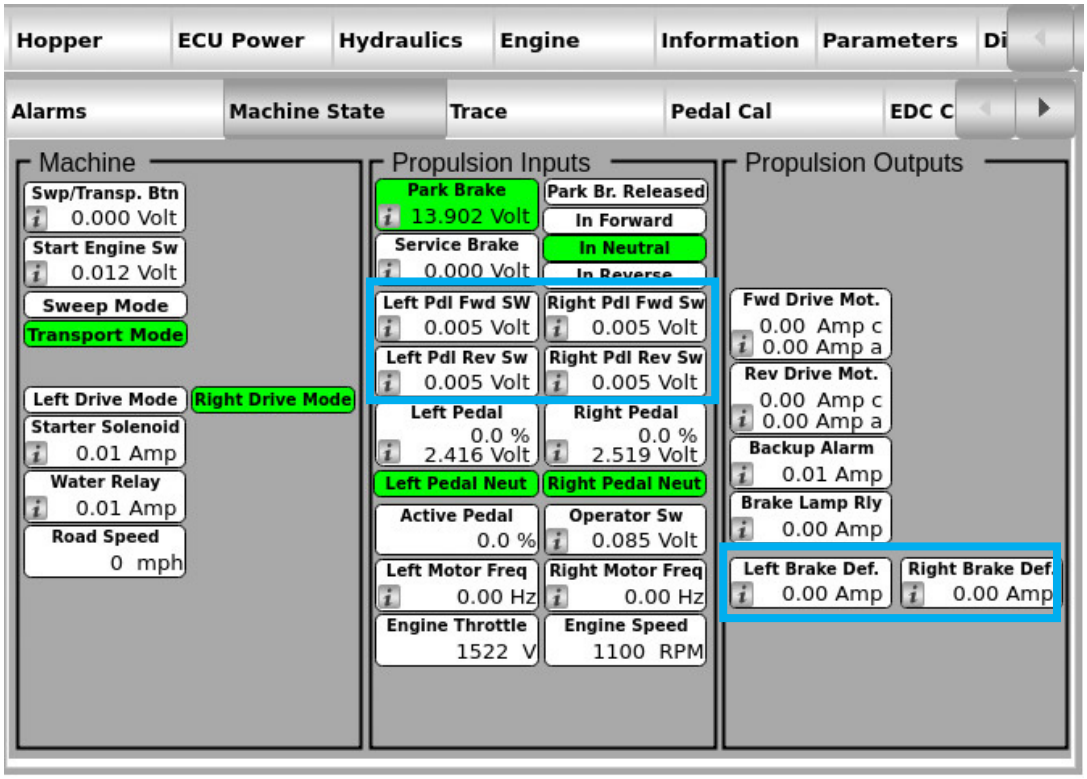

Fig. 46: Brake Defeat Indicators

The left brake defeat illumination indicates the foot pedal is in the forward position, voltage has been routed from the pedal to the controller, and voltage has been routed from controller CR721S CM-C18 pin 24 to the left/forward brake defeat solenoid coil terminal 1. The Left Pedal Fwd (left pedal forward) or Right Pedal Fwd (right pedal forward) indicator should be illuminated. Check for a ground circuit at the solenoid coil terminal 2. Also see Foot Pedal Input Signals Circuit on page 93.

The right brake defeat illumination indicates the foot pedal is in the reverse position, voltage has been routed from the pedal to the controller, and voltage has been routed from controller CR721S CM-C8 pin 81 to the right/reverse brake defeat solenoid coil terminal 1. The Left Pedal Rev (left pedal reverse) or Right Pedal Rev (right pedal reverse) indicator should be illuminated. Check for a ground circuit at the solenoid coil terminal 2. Also see Foot Pedal Input Signals Circuit on page 93.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: Left Brake Defeat – See fault codes P0102-05, 06, 12, 20 and 21.
Right Brake Defeat – See fault codes P0112-05, 06, 12, 20 and 21.
See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 7 and the backup lamps relay terminal 1. Check for connector corrosion and bad relay coil. Use a multimeter to check for a ground circuit at the brake defeat solenoids terminal 2.

DRIVE MOTOR SIGNAL OUTPUT CIRCUIT
P0300, P0305, P0310, P0315

The wheel motors provide a direction of travel signal from the wheel pulse pickup unit (PPU) pin 2 to controller IFM CM-C8 pin 41 (right motor) and IFM CM-C8 pin 26 (left motor). The motors provide a speed signal from the PPU pin 3 to the controller CM-C8 pin 40 (right motor) and controller CM-C18 pin 61 (left motor). The direction of travel and motor speed allow the control system to control drive and brake functions. See Fig. 47: Drive Motor Signal Output Circuit.

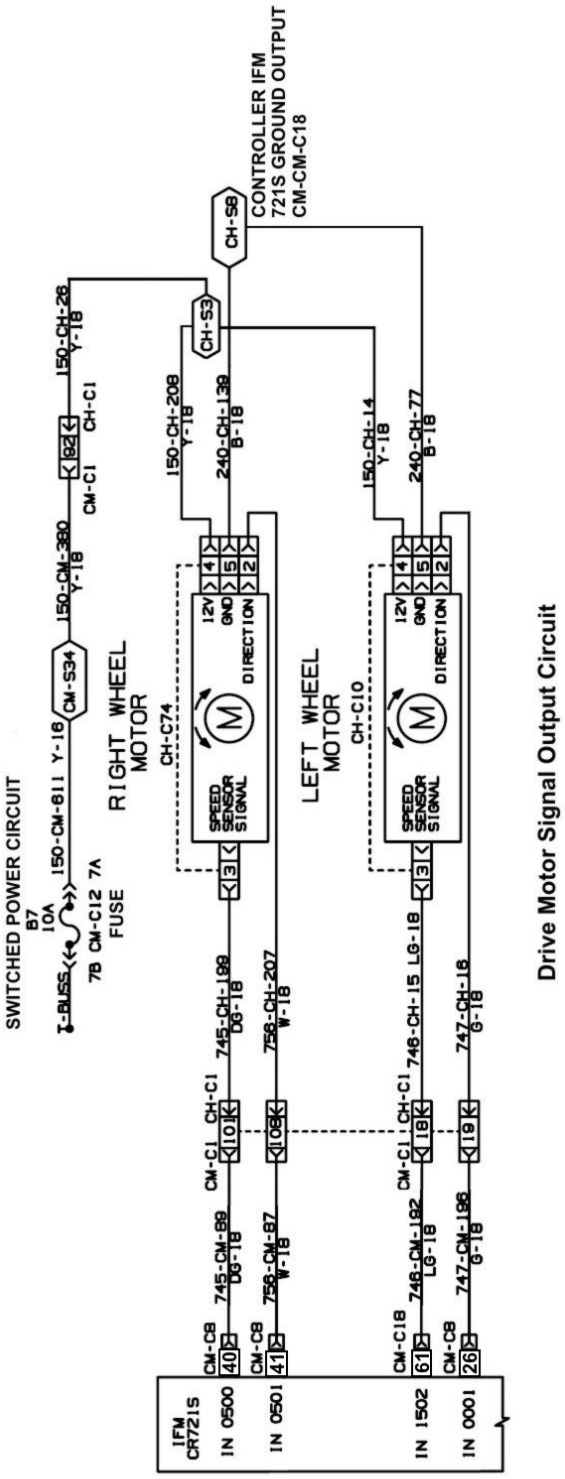

Fig. 47: Drive Motor Signal Output Circuit

The wheel pulse pickup units (PPUs) monitors the left and right wheel rotation speed and direction of rotation (Fig. 48: Pulse Pickup Unit PPU). A magnetic speed pickup ring is pressed onto the left drive motor shaft (Fig. 49: Left Wheel Motor Speed Sensor). The speed sensor is mounted in the drive motor housing. The sensor outputs a digital pulse signal in response to the rotation of the ring. The output changes high to low state as the teeth of the speed ring pass by the face of the sensor. The rotation of the speed pickup ring and output signals allow the controller to determine wheel speed and direction of rotation.

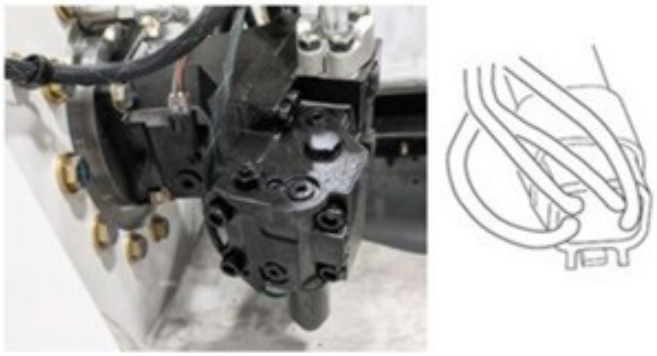

Fig. 48: Pulse Pickup Unit PPU

A four-pin connector supplies battery voltage to the sensor and outputs speed and direction of rotation to the controller. The battery voltage for operation is routed to the PPU connector pin 4 from the switched power circuit and fuse B7 (10A). The PPU connector is grounded at pin 5 by a ground circuit from controller CR721S CM-C18 pin 14. When the drive wheel is in motion, the PPU in conjunction with the speed pick-up ring outputs a speed signal to the controller CM-C18 pin 61 (left motor) CM-C8 pin 40 (right motor) and a direction of rotation signal to controller CR721S CM-C8 pin 26 (left motor) CM-C8 pin 41 (right motor). The input speed and direction of rotation signals are evaluated by the control system and used for sweeper operation.

If necessary, see Fuses And Relays on page 19 to locate fuses.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

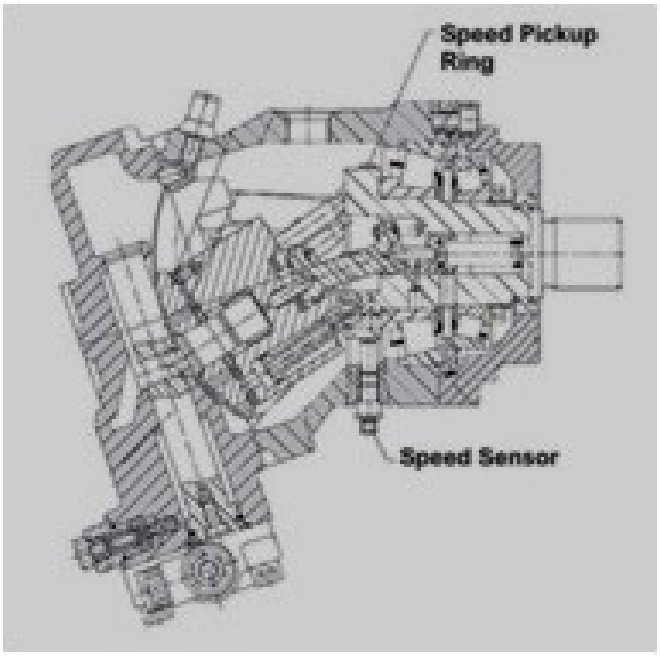

Fig. 49: Left Wheel Motor Speed Sensor

The left and right drive motors illuminate on the display (Left Motor Freq xx HZ) (Right Motor Freq xxx Hz) (Fig. 50: Left And Right Drive Motors). The display illumination indicates the drive motor direction output, operation, and input to the controller pins as shown in the drive motor output signal circuit schematic.

The left and right drive motor speed is illuminated on the display right motor (Right Motor Freq) and left motor (Left Motor Freq) frequency. The display illumination of speed frequency indicates the drive motor speed output, operation and input to the controller pins as shown in the drive motor output signal circuit schematic.

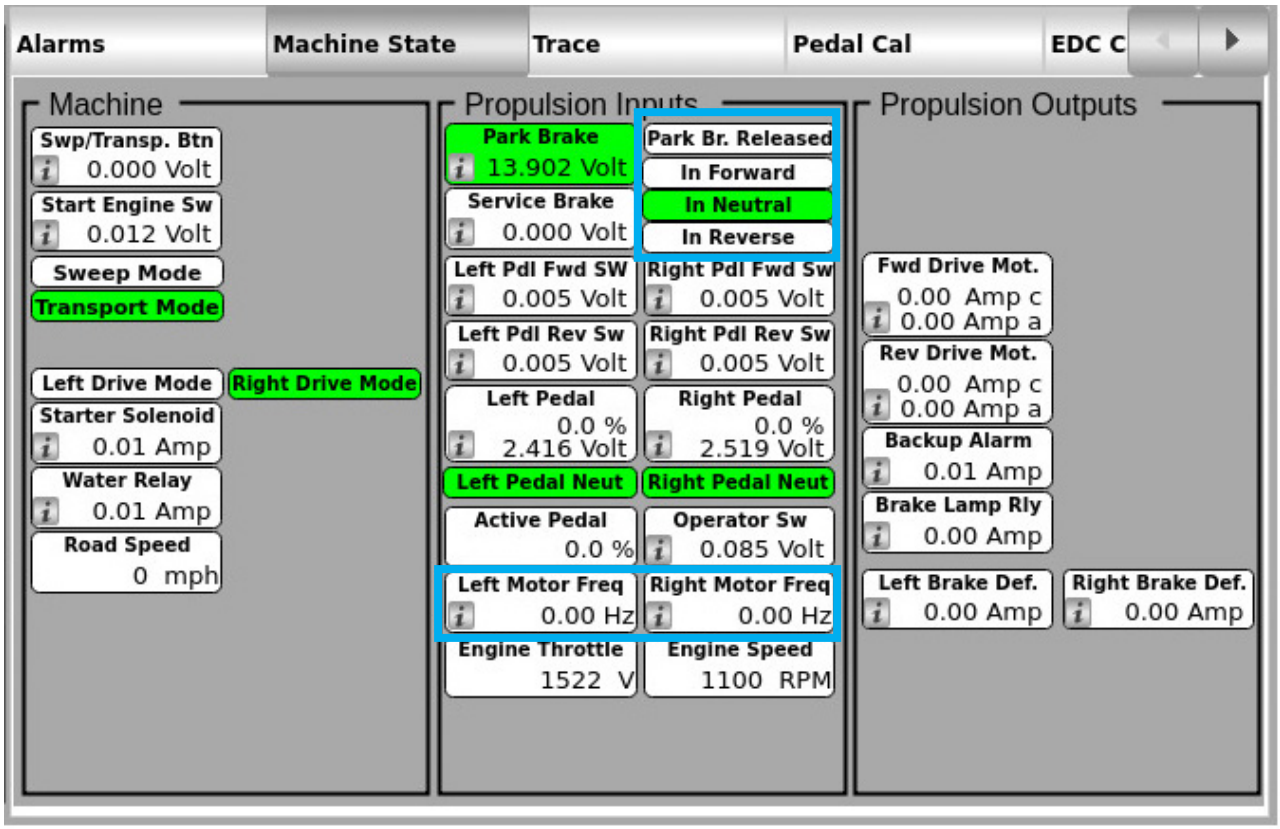

Fig. 50: Left And Right Drive Motors

A changing frequency display in the left motor frequency (Left Motor Freq xxxHZ) indicator (Fig. 51: Left and Right Wheel Sensors) shows that voltage has been routed from the left wheel motor terminal 3 to controller CR721S CM-C18 pin 61 to be used as a motor speed signal input.

A changing frequency display in the right motor frequency (Right Motor Freq xxHZ) indicator shows voltage has been routed from the right wheel motor speed sensor terminal 3 to controller CR721S CM-C8 pin 40 to be used as a motor speed signal input.

A direction signal illuminates as In Forward, In Neutral, or In Reverse.

A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- Left speed sensor - P0300-03 and 04

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C18 pin 61 and left wheel motor terminal 3. Also check the power and ground inputs to the sensor.

- Right speed sensor - P0310-03, 04, 11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 40 and the right wheel motor terminal 3. Use a multimeter to check for input voltage at the right wheel motor terminal 4.

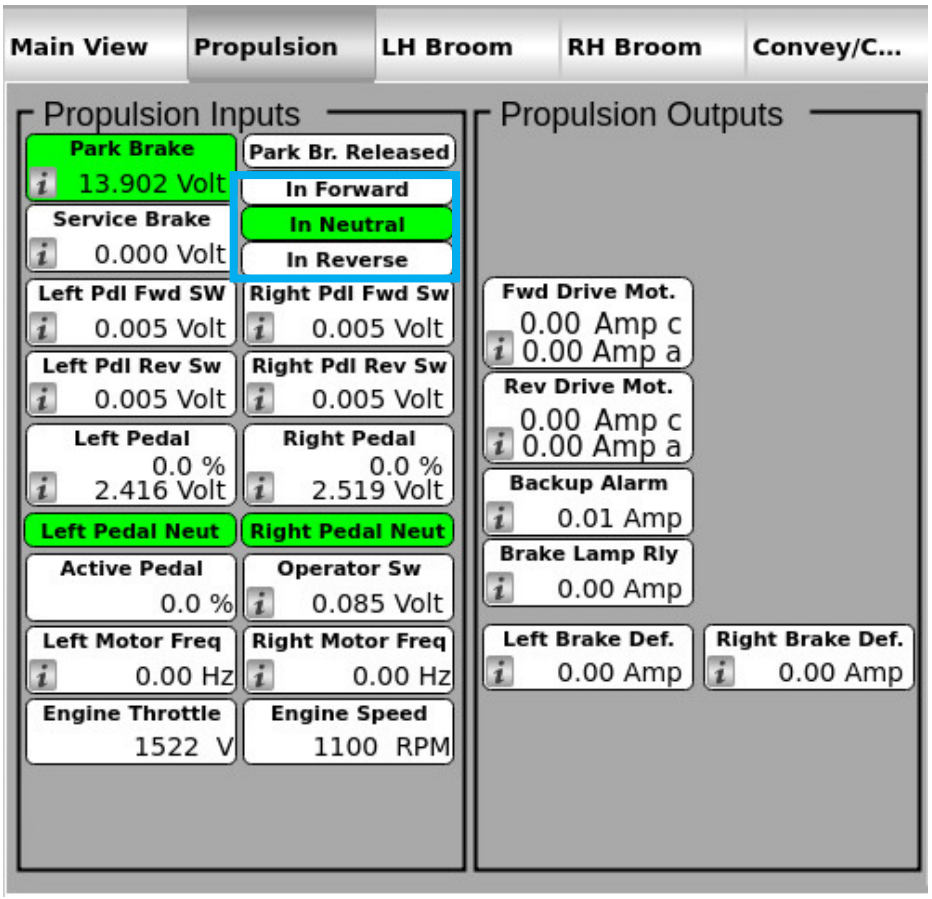

Fig. 51: Left and Right Wheel Sensors

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens and shorts between controller CR721S CM-C8 pin 71 and the right wheel motor terminal 5.

- Left direction sensor - P0305-03, 04 and 11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 26 and the speed sensor terminal 2. Use a multimeter to check for voltage input at the left wheel motor terminal 4. Use a multimeter to check for a ground circuit at the left wheel motor terminal 5 from controller CR721S CM-C18 pin 14.

- Right direction sensor – P0315-03, 04 and 11.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 41 and the speed sensor terminal 2. Use a multimeter to check for voltage input at the right wheel motor terminal 4. Use a multimeter to check for a ground circuit at the left wheel motor terminal 5 from controller CR721S CM-C8 pin 71.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

BRAKE LIGHT CIRCUITS
P0320

The brake lights illuminate when the sweeper brake pedal is depressed or the sweeper is coasting to a stop. The normally open brake pressure switch closes when brake system pressure exceeds 25 psi, routing battery voltage from the switched power circuit and fuse B8 (10A), through the brake switch terminal A and terminal B, to controller IFM CR721S CM-C18 pin 39. The input voltage at CM-C18 pin 39 notifies the control system the brake pedal is depressed. The control system then routes battery voltage from controller IFM CR721S CM-C8 pin 9 to the brake lamps relay terminal 1. Because the brake lamps relay is grounded at terminal 2, the relay is energized. The relay is grounded at terminal 2 by a ground circuit from ground splice S40. The battery voltage for operation of the relay is routed from CM-C12 fuse B8 (10A) to the relay terminal 3. When the relay is energized, the battery voltage is routed from the relay terminal 5 to the brake lights terminal C. Because the brake lights are grounded at terminal A by a ground circuit from ground splice EC-S2 the brake lights illuminate.

NOTICE

The brake lights illuminate during deceleration, even if the brake pedal is not applied.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The illumination of the foot brake indicator (Fig. 52: Brake Lights) indicates the brake pedal has been applied and voltage is present at controller CR721S CM-C18 pin 39. The illumination of the brake lamp power (Brake Lamp Pwr) indicator indicates voltage has been routed from controller CR721S CM-C8 pin 9 to the brake lamps relay terminal 1, causing voltage to be routed from the relay terminal 5 to the brake lamps. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

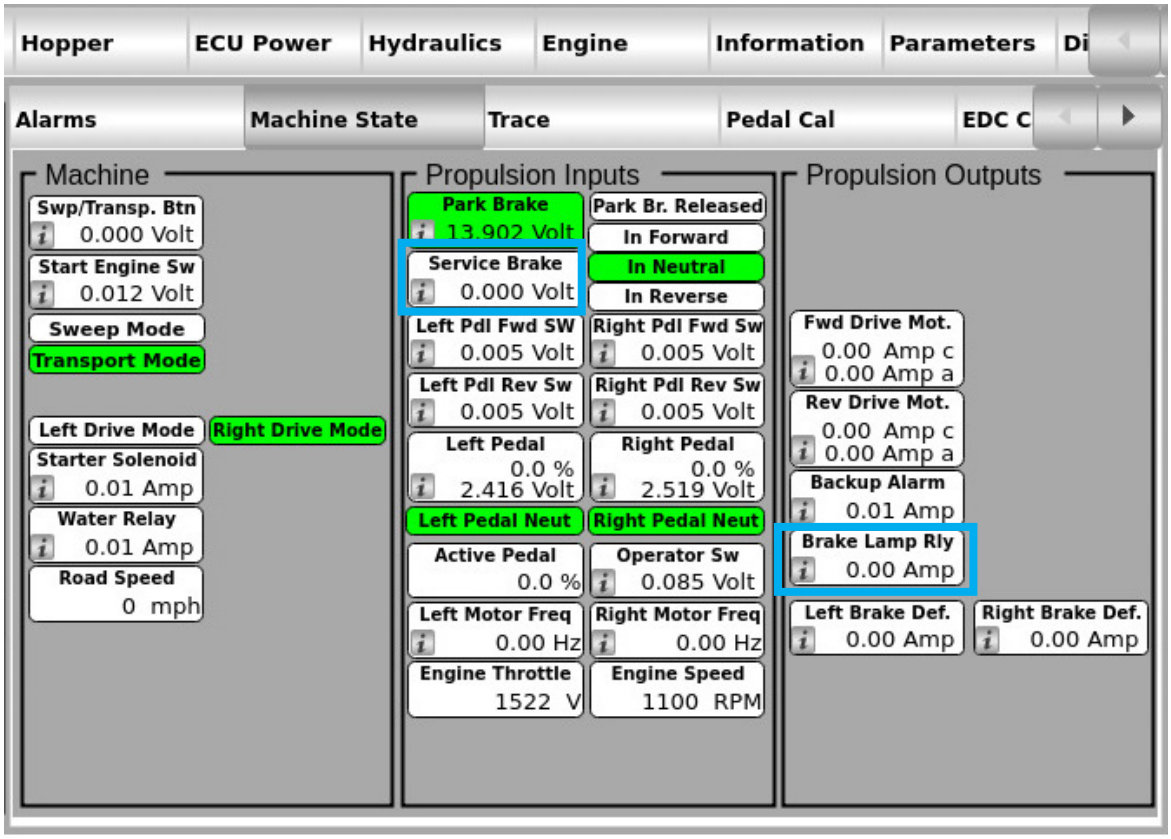

Fig. 52: Brake Lights

Fig. 53: Brake Lamp Circuit shows the brake lamp circuit.

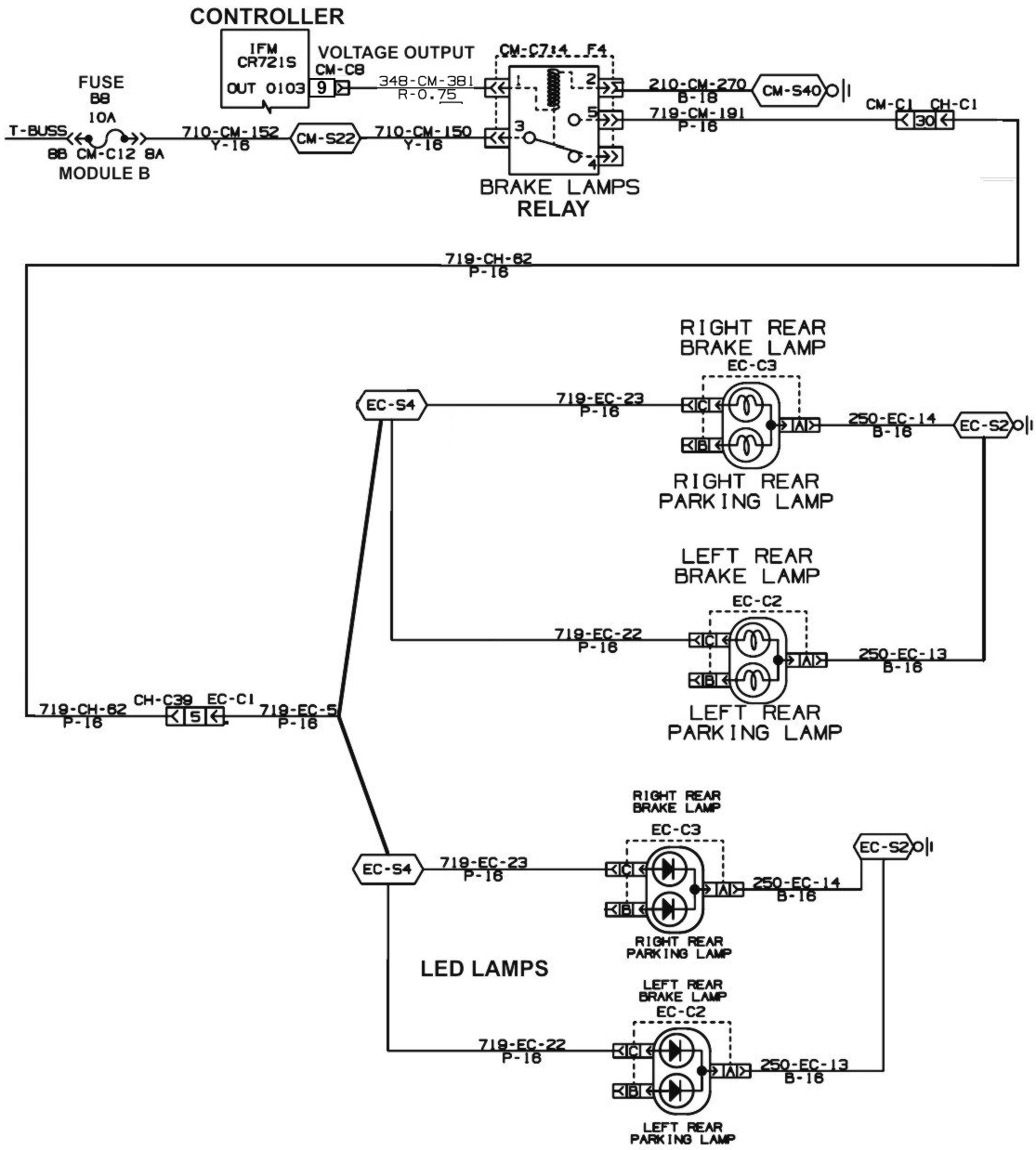

Fig. 53: Brake Lamp Circuit

Fig. 54: Brake Switch Circuit shows the brake switch circuit.

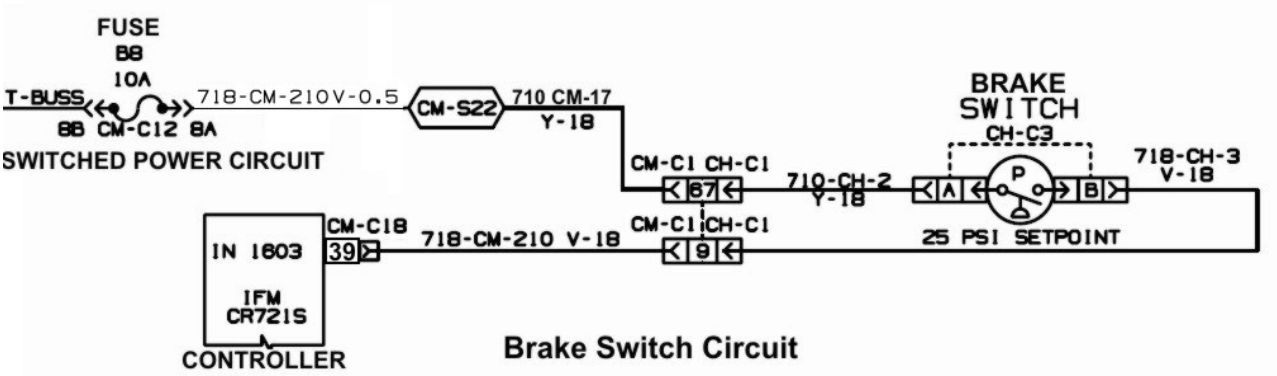

Fig. 54: Brake Switch Circuit

Fault Codes: Brake light relay faults – P0320-05, 06 and 12. No faults for the brake light switch.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to ground to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 9 and the brake lamps relay terminal 1. Use a multimeter to check for a ground circuit at the relay terminal 2. Use a multimeter to check for input voltage at the relay terminal 3. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

CAMERA AND DISPLAY CIRCUIT

The camera is powered by battery voltage from the switched power circuit and fuse B13 (5A). The battery voltage is routed from the fuse to the rear camera CM-C55 pin 1 (yellow wire) (12 V). The reverse camera voltage input at the camera CM-C55 pin 3 is routed from IFM controller CR721S CM-C8 pin 7 and connector CM-S43, activating the camera. The camera is grounded by a ground circuit from splice CM-C28 to the camera CM-C55 pin 4.

The ground circuit for speaker operation is routed from ground splice CM-S28 and ground boss 5 to the speaker XH-C2 pin 2. The battery voltage for speaker operation is routed from the switched power circuit and fuse B13 (5A) to the speaker XH-2 pin 1 (red wire). The audio output ground to the speaker is routed from the display ground side (-) left side CM-C10 pin 105 (light blue wire) to the speaker XH-C1 pin B (white wire) (Fig. 55: IFM CR1203 Display and Fig. 56: Four Pin Ethernet). The audio output power is routed from display power (+) side CM-C10 pin 113 to the speaker XH-C1 pin A (red wire) (Fig. 57: CM-C10). See Fig. 58: Camera and Display Circuit.

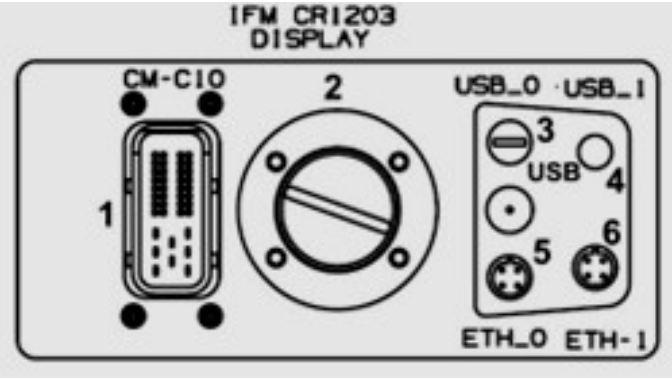

Fig. 55: IFM CR1203 Display

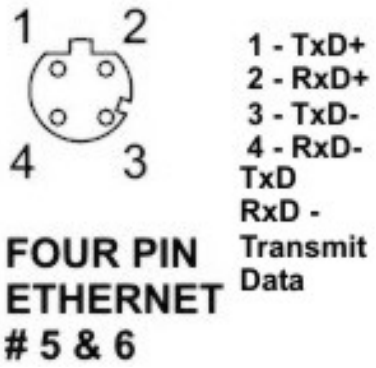

Fig. 56: Four Pin Ethernet

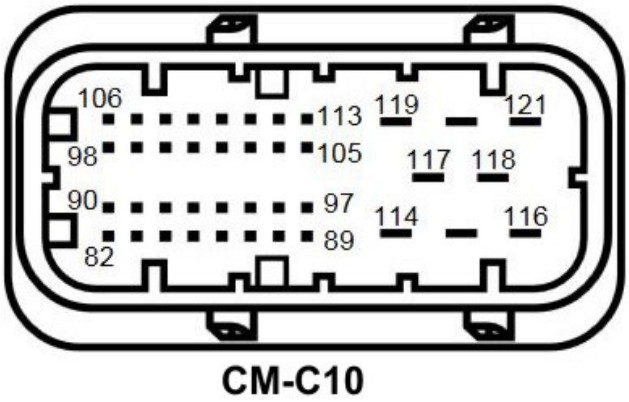

Fig. 57: CM-C10

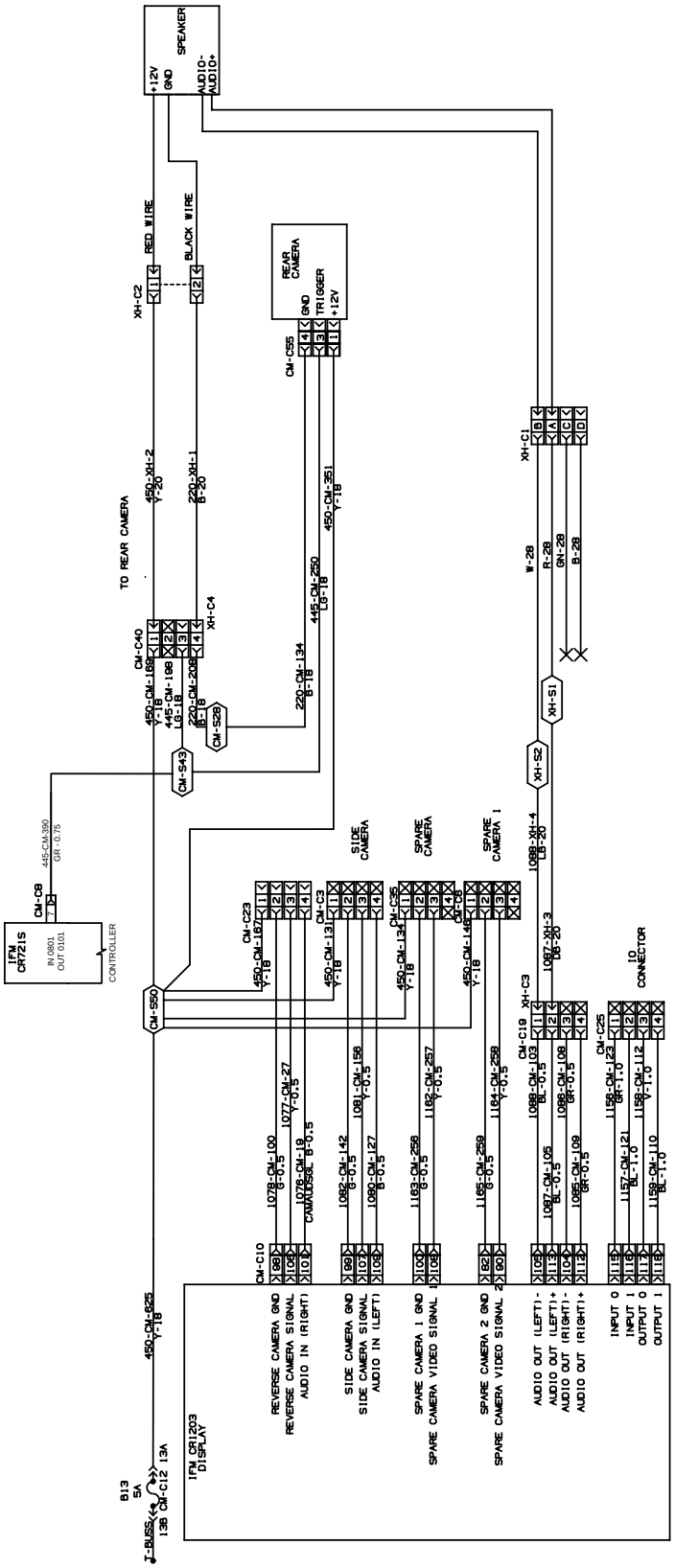

Fig. 58: Camera and Display Circuit

The video from the camera is displayed on the IFM CR1203 display. The camera audio plays through a speaker. See the CR1203 CM-C10 pin locator table pin inputs and outputs (Table 9: CR1203 CM-C10 Display).

Also see Foot Pedal Input Signals Circuit on page 93.

Table 9: CR1203 CM-C10 Display

Pin #	Component	Wire Color
82	Spare Camera Ground	Green
83	IFM 0 CAN0_L	
84	CAN1_High	Yellow
85	CAN2_High	Yellow
86	CAN3_L	¬-
87	IFM1	-
88	IFM1	-
89	Service1	-
90	Spare Camera Signal	Yellow
91	IFM0	-
92	CAN_Low	Green
93	CAN1_Low	Green
94	CAN2_H	-
95	CAN3_H	-
96	IFM1+	-
97	Service0	-
98	Reverse Camera Ground	Green
99	Side Camera Ground	Green
100	Video2 Ground	-
101	Reverse Camera Audio Right In	Black
102	Audio Ground	-
103	Head Out Right	-
104	Audio Out – Right Speaker	Green
105	Audio Out – Left Speaker	-
106	Reverse Camera Signal	Yellow
107	Side Camera Signal	Yellow
108	Spare Camera Signal	Yellow
109	Side Camera Audio IN Left	Black
110	Not Used	-
111	Head Out	
112	Audio Out + Right Speaker	Green
113	Audio Out + Left Speaker	Blue
114	VBB0	-
115	Input0	Green
116	Input 1	Blue
117	Output 0	Violet
118	Output 1	Blue
119	VBB15	-
120	Ground	-
121	VBB30	-

CHARGING CIRCUIT

The alternator recharges the battery (Fig. 59: 12V Battery) and supplies operational voltage to the sweeper electrical system. When the engine runs, the alternator rotates. With the engine running and ignition switch in the ON position, battery voltage is routed from the ignition switch terminal 5 to the alternator terminal D+. The input voltage acts a field connection to determine battery circuit condition. The battery voltage from the ignition switch terminal 5 is routed through a diode before flowing to the alternator. The diode allows voltage to flow through the diode but not back to the ignition switch circuit. The alternator charges the battery and supplies electrical system voltage, as needed, as determined by the input voltage at terminal D+ (Fig. 60: Charging Circuit).

The charge voltage for the battery is routed from the alternator terminal B+ to the battery positive (+) post, charging the battery.

Also, see Ignition Switch Circuit on page 111.

Fig. 59: 12V Battery

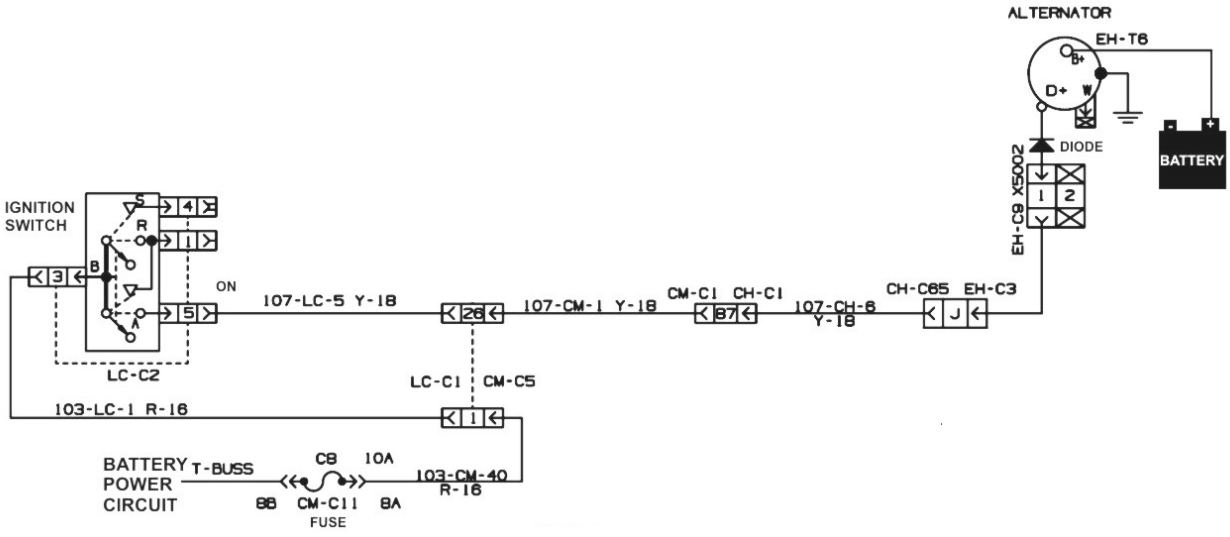

Fig. 60: Charging Circuit

COMMON VALVE CIRCUIT
X0200

The common solenoid valve (Fig. 61: Manifold Common Valve) allows hydraulic oil to flow to the tank until the common valve is energized. When energized, the common valve blocks the flow of hydraulic oil to the tank and allows full hydraulic flow to components.

The following sweeper functions utilize the common valve:

- Conveyor forward circuit
- Conveyor reverse circuit
- Conveyor raise circuit
- All hopper joystick circuits:
  - Hopper raise circuit
  - Hopper dump circuit
  - Hopper lower circuit
  - Hopper return circuit

Fig. 61: Manifold Common Valve

When one of these functions is commanded, the controller energizes the common valve. The control system then routes battery voltage from CR721S CM-C18 pin 18 to the common valve solenoid terminal 1. Because the common valve solenoid is grounded at terminal 2 by a ground circuit from ground splice CH-S14, the solenoid valve shifts position. When shifted, the valve blocks hydraulic oil flow to the tank. See Fig. 62: Common Valve Circuit on page 75.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

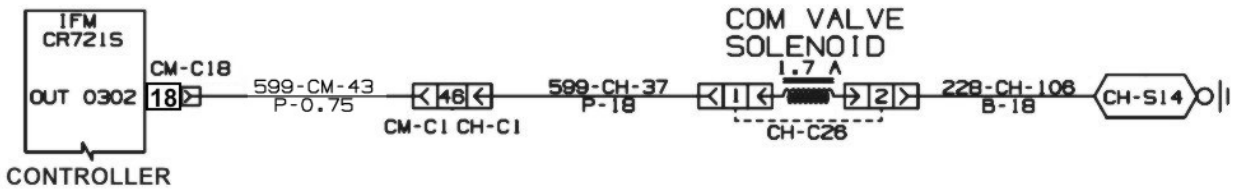

Fig. 62: Common Valve Circuit

The common valve indicator is displayed on more than one screen, such as the hopper screen and conveyor screen (Fig. 63: Common Valve). The illumination of the common valve indicator indicates one of the sweeper components (i.e. hopper components, conveyor) requiring common valve activation has routed a voltage signal to controller CR721S and the control system has routed voltage from controller CR721S CM-C18 pin 18 to the common valve solenoid coil terminal 1. Check for a ground circuit at the common valve solenoid coil terminal 2.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: X0200-05, 06, 12, 20 and 21. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short ground between controller CR721S CM-C18 pin 18 and the common valve solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the common valve solenoid coil terminal 2. Use a multimeter to check the common valve solenoid coil resistance for 6.9 Ω at 68°F (20°C). Check for corrosion at the common valve coil and connectors.

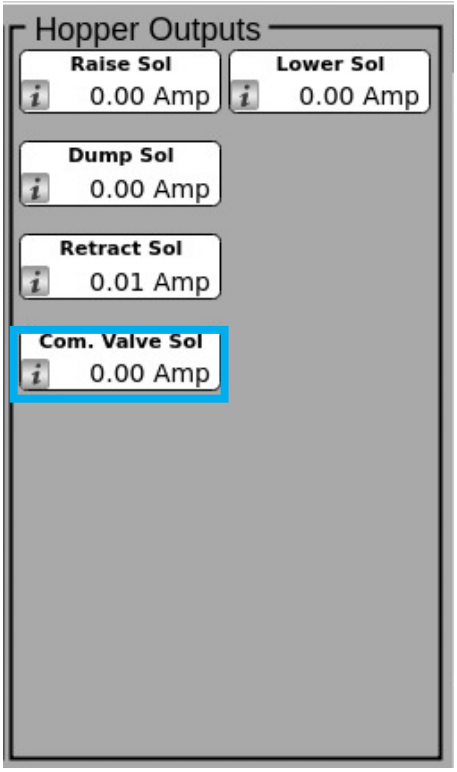

Fig. 63: Common Valve

CONVEYOR FORWARD/REVERSE CIRCUIT S0450, S0455

The conveyor rotation is controlled by the conveyor rotate switch mounted on the cab control panel (Fig. 64: Conveyor Rotate Switch). The sweeper must be in sweep mode for operation of the conveyor forward/reverse switch. The battery voltage for operation of the switch is routed from the sweep power circuit and fuse D10 (10A) to the switch terminal 2.

If necessary, see Fuses And Relays on page 19 to locate fuses.

The common valve must be activated for conveyor rotation forward or reverse. See Common Valve Circuit on page 75.

Fig. 65: Conveyor Drive Motor shows the conveyor drive motor.

Fig. 64: Conveyor Rotate Switch

Fig. 65: Conveyor Drive Motor

Fig. 66: Conveyor Forward Reverse Circuit illustrates the conveyor forward reverse circuit.

When the conveyor switch is placed in the forward position, battery voltage is routed from the switch terminal 3. The battery voltage is routed from the switch terminal 3 to controller CR721S CM-C18 pin 12. When battery voltage is available at the controller pin 12, the control system routes battery voltage from controller CR721S CM-C18 pin 69 to the conveyor forward rotate solenoid valve terminal 1. Because the solenoid valve is grounded by a ground circuit from ground splice CH-S14, the solenoid valve shifts position and allows hydraulic oil to flow to the conveyor drive motor forward side rotating the conveyor in the forward direction.

See the operator's manual for conveyor reverse operation. The conveyor reverse switch is a momentary switch that routes battery voltage only when held in the reverse position. When the conveyor switch is held in the reverse position, battery voltage is routed from the switch terminal 1 to controller CR721S CM-C18 pin 31. When battery voltage is available at the controller pin 31, the control system routes battery voltage from the controller CM-C18 pin 22 to the conveyor reverse rotate solenoid valve terminal 1. Because the solenoid valve is grounded at terminal 2 by a ground circuit from ground splice CH-S14, the solenoid valve shifts position and allows hydraulic oil to flow to the conveyor drive motor reverse side, rotating the conveyor in the reverse direction.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When the conveyor switch is placed in the forward or reverse direction and battery voltage is routed to controller CR721S CM-C18 pins 12 or 31, the control system energizes the common valve. See Common Valve Circuit on page 75 for a description and diagnostics.

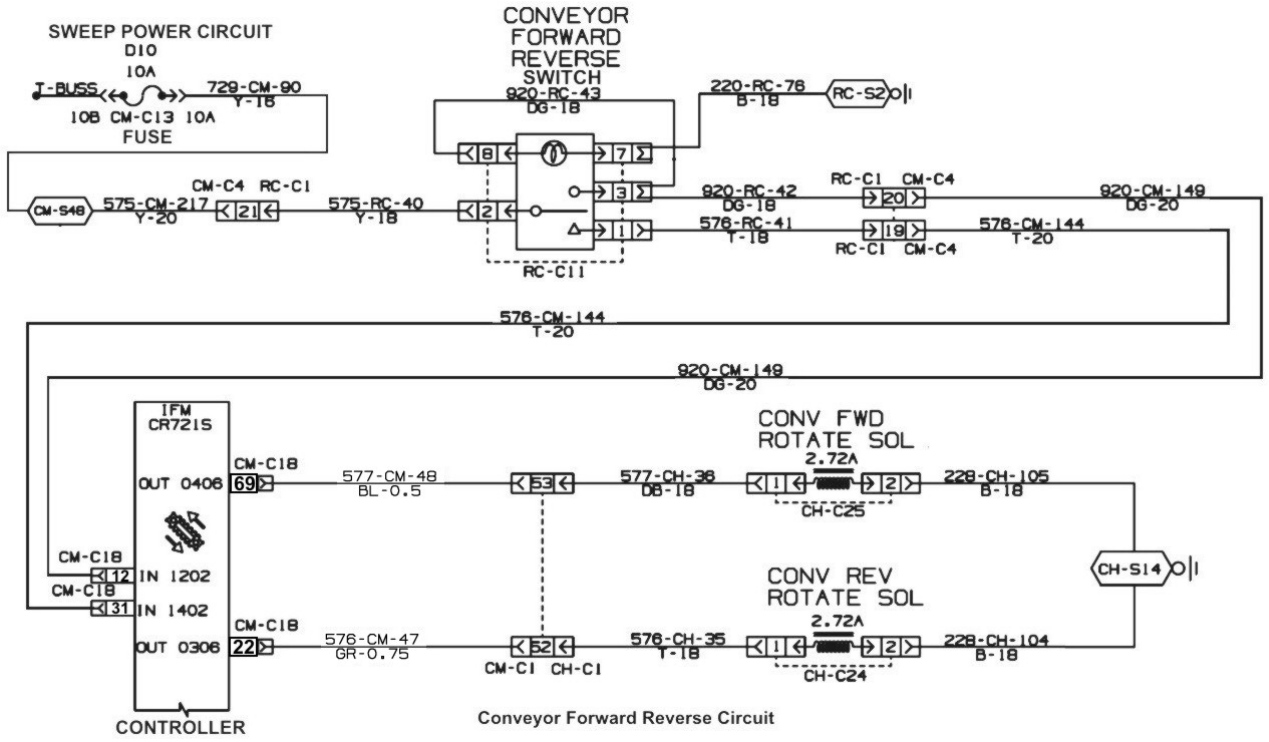

Fig. 66: Conveyor Forward Reverse Circuit

The illumination of the conveyor forward switch (Conveyor Fwd Sw) (Fig. 67: Conveyor) indicates the conveyor forward/reverse switch is in the forward position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 12.

The illumination of the conveyor reverse switch (Conv Rev Sw) indicator indicates the conveyor forward/ reverse switch is held in the reverse ON position. The illumination of the conveyor forward solenoid (Conv Fwd Sol) indicator indicates the control system has routed voltage from controller CR721S CM-C18 pin 69 to the conveyor forward rotate solenoid coil terminal 1. The illumination of the conveyor reverse solenoid (Conv Rev Sol) indicator indicates the control system has routed voltage from controller CR721S CM-C18 pin 22 to the conveyor reverse rotate solenoid coil terminal 1. Check for a ground circuit at the conveyor forward rotate and/or conveyor reverse rotate solenoid coil terminal 2. Fig. 68: Conveyor Hopper Manifold and Fig. 69: Hopper Lift Tilt Manifold show the conveyor solenoid valves.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: Conveyor forward reverse switch – No fault codes.

Conveyor forward solenoid – S0450-05, 06, 12, 20 and 21.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 69 and conveyor forward solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 4.4 Ω at 68°F (20°C). Check for corrosion at the solenoid coil and connectors.

Conveyor reverse solenoid – S0455-05, 06, 12, 20 and 21.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 22 and the conveyor reverse rotate solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 4.4 Ω at 68°F (20°C). Check for corrosion at the solenoid coil and connectors.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

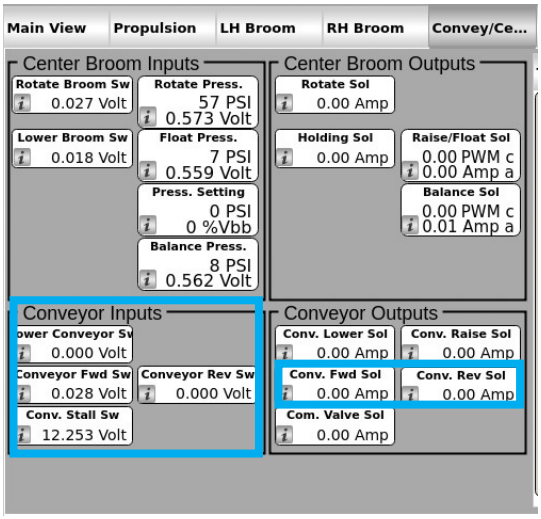

Fig. 67: Conveyor

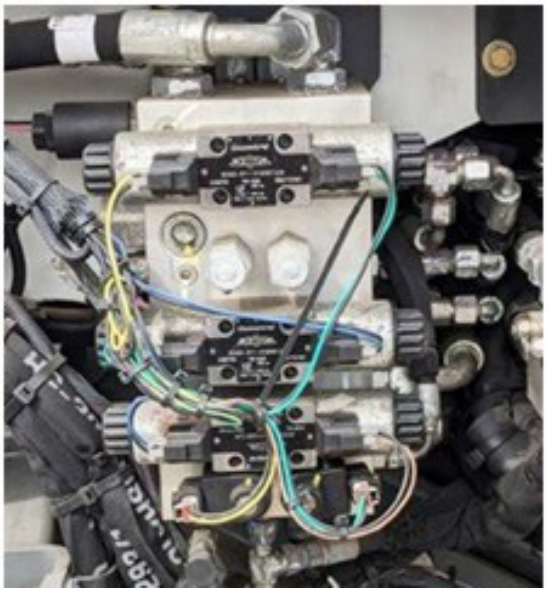

Fig. 68: Conveyor Hopper Manifold

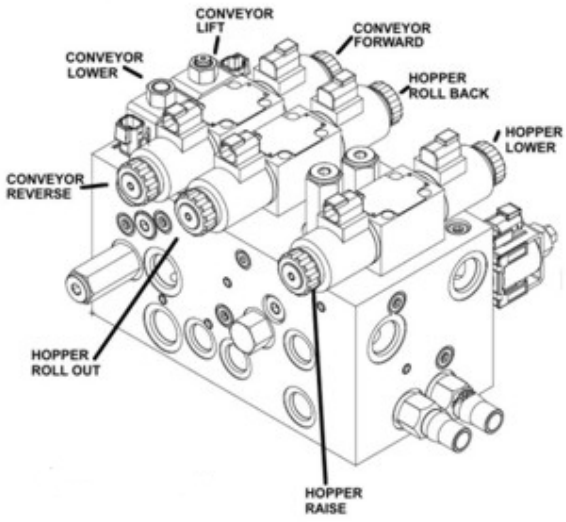

Fig. 69: Hopper Lift Tilt Manifold

CONVEYOR STALL SENSOR CIRCUIT

The conveyor stall sensor uses hydraulic oil pressure generated for the conveyor drive motor to monitor conveyor rotation. The hydraulic oil flows to the conveyor drive motor, as required, rotating the drive motor and conveyor. The hydraulic oil flows past the sensor until the oil pressure reaches 1800 psi. The higher oil pressure is caused by the conveyor stalling. When the conveyor drive stalls due to a blockage, the normally open sensor closes, routing a conveyor stalled signal to controller CR721S CM-C18 pin 60.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The ground circuit for operation of the conveyor stall sensor is routed from ground splice CH-S15 to the sensor terminal 2. When the oil pressure develops, the sensor closes, routing the ground circuit from the sensor terminal 1 to the controller CM-C8 pin 60. See Fig. 70: Conveyor Stall Sensor Circuit.

When signaled by the sensor, the control system causes a message (Conveyor Stall) to appear on the display module. See the operator's manual for information and instructions for a stalled conveyor and display operations.

The illumination of the conveyor stall switch (Conv Stall Sw) indicator indicates the conveyor is stalled and a ground circuit has been routed through the conveyor sensor and terminal 1 to controller CR721S CM-C18 pin 6. See Fig. 71: Conveyor Stall.

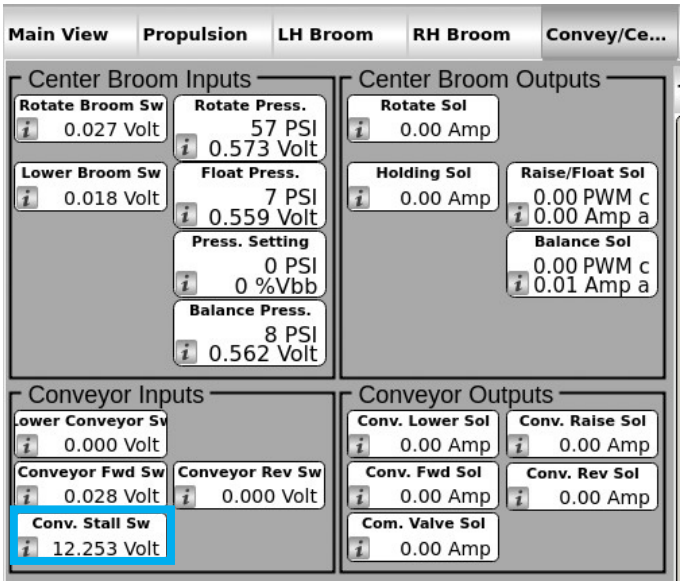

Fig. 71: Conveyor Stall

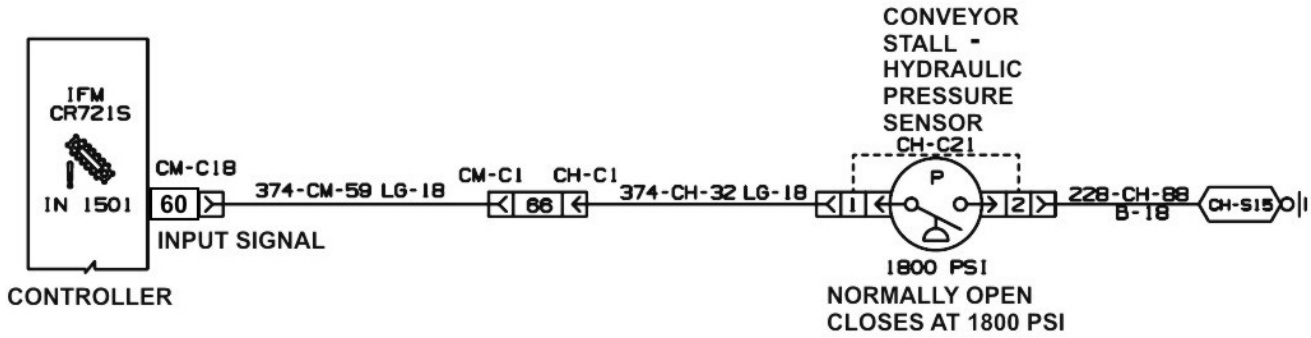

Fig. 70: Conveyor Stall Sensor Circuit

CHARGE AIR COOLER (CAC) FAN CIRCUIT P0440

The electronically commutated cooling fan uses a brushless permanent magnet DC motor for controlling the fan rotor. The charge air cooler (CAC) fan cools charge air to the engine (Fig. 72: Engine Cover Fans). Charge air is the air needed by the engine for operation. The air passes from the turbocharger through a charge air cooler which is cooled by the CAC fan before entering the engine intake. The CAC fan is controlled by a ground circuit output from the CAC fan relay CF-C2 terminal 87. The relay is energized by a battery voltage output from controller CR721S CM-C8 pin 11. The output from the controller CM-C8 pin 11 is generated when the engine ECU starts the fan at engine start up and routes a CANBus signal to the control system to energize the relay.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When the relay is energized, the ground circuit from the relay terminal 87 is routed from the relay terminal 87 to the fan drive motor CF-C4 terminal 2. The battery voltage for operation of the fan motor is routed from a 50A inline fuse to the drive motor CF-C4 terminal 1. The inline fuse is connected to the battery positive (+) post. The battery voltage at the axial fan terminal 1 and ground circuit at terminal 2 causes the fan motor to rotate the fan. The fan motor speed is controlled by the engine ECU pins 32 and 33 at the pin connector EF-C4 pin 3. The fan speed is based on the engine charge air temperature.

A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes: Charge air cooler fan (99HP) is controlled by a relay energized by controller CR721S.

See fault codes P0440-05, 06 and 12 for charge air cooler fan relay.

Use Testing for CAN Shorts on page 28 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 11 and the CAC FAN relay terminal 85. Check for a ground circuit at the relay coil terminal 86. Use a multimeter to check the solenoid coil resistance for 9 Ω at 68°F (20°C). Check for corrosion at the relay coil and connectors.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

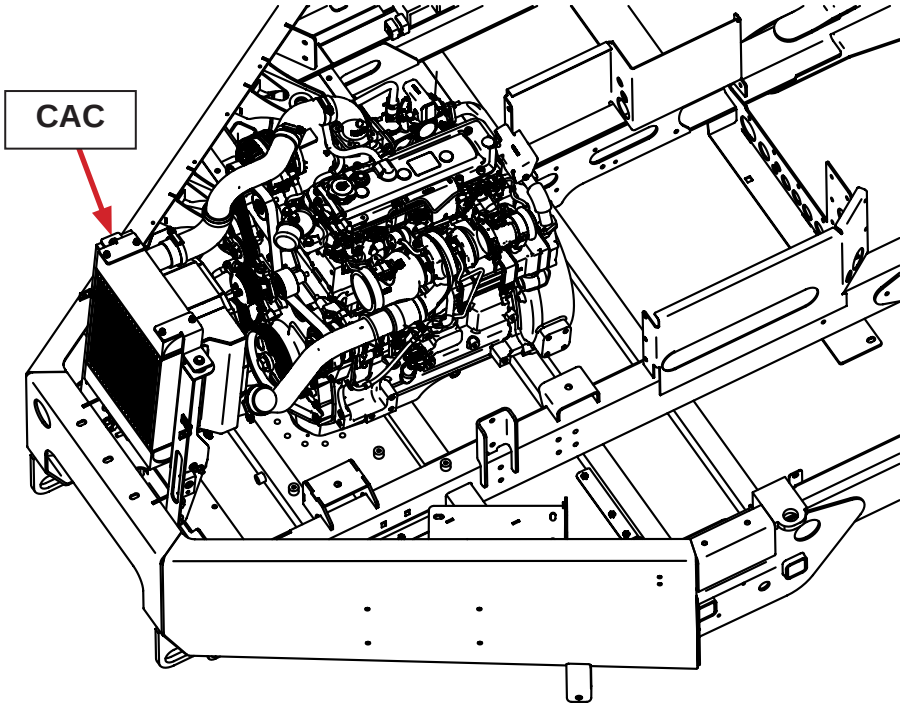

Fig. 72: Engine Cover Fans

The ground circuit for operation of the CAC fan relay is routed from ground CF-T8 and ground splice CF-S2 to the relay CF-T11 terminal 30. The relay is grounded at terminal 86 by a ground circuit from ground splice CF-S2. See Fig. 73: CAC Fan Circuit.

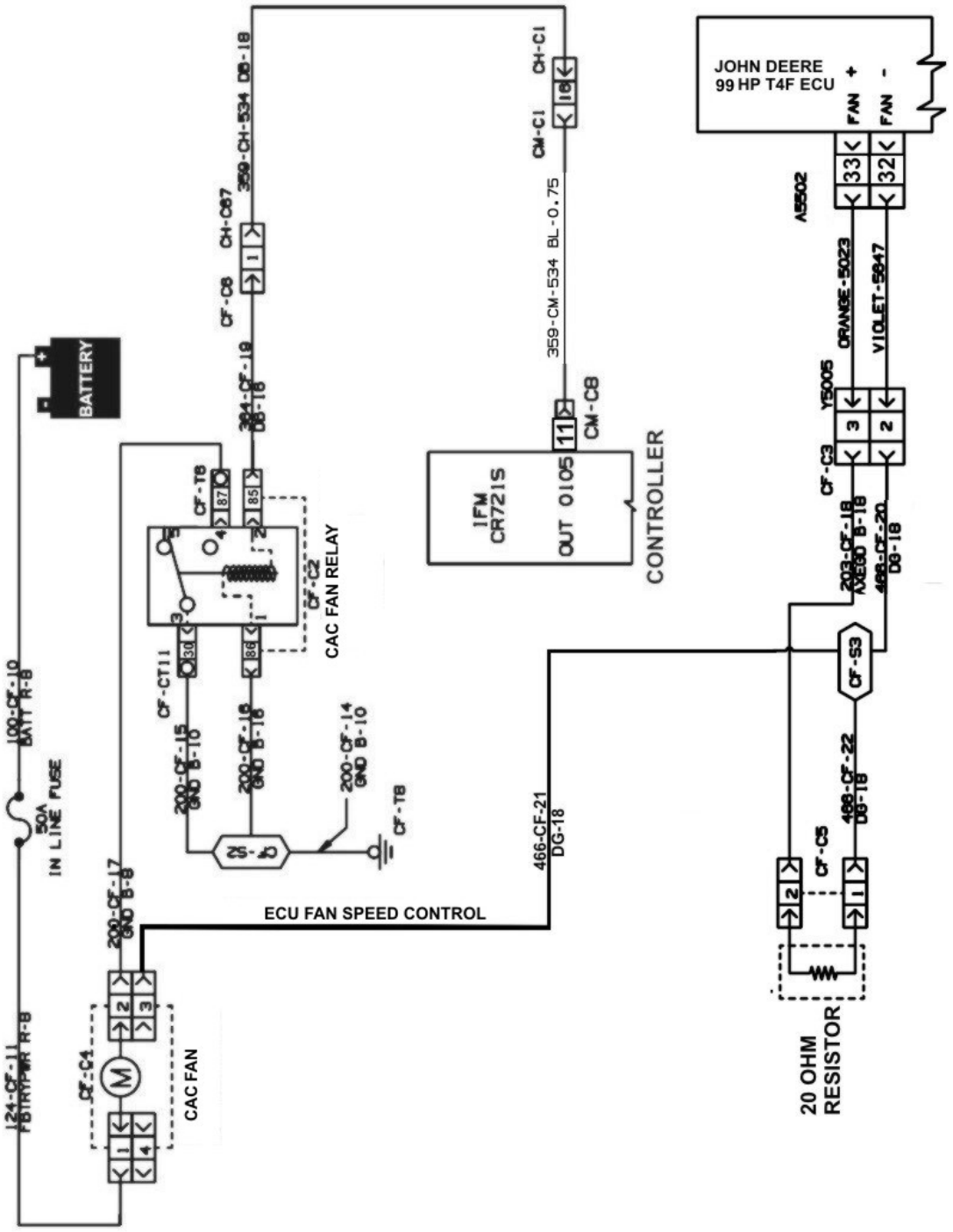

Fig. 73: CAC Fan Circuit

ENGINE AIR FILTER SWITCH CIRCUIT

The engine air filter switch notifies the control system when the engine air filter is blocked and needs replacement. The air filter switch is a vacuum type switch. When the air filter becomes clogged with debris, the engine intake air creates vacuum intense enough to close the normally open air filter switch. The ground circuit for operation of the air filter switch is routed from ground splice CH-S9 to the engine air filter switch terminal CH-T9 (black wire). When the air filter switch closes due excess vacuum, the ground circuit is routed from the switch terminal CH-T9 through the closed switch and terminal CH-T8 to controller CR721S CM-C18 pin 47. The input at the controller pin 47 notifies the control system the air filter is clogged and needs to be replaced. The control system causes an air filter clogged signal/ symbol to appear on the display notifying the operator of air filter maintenance needed.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 74: Engine Air Filter Switch Circuit shows the engine air filter switch circuit.

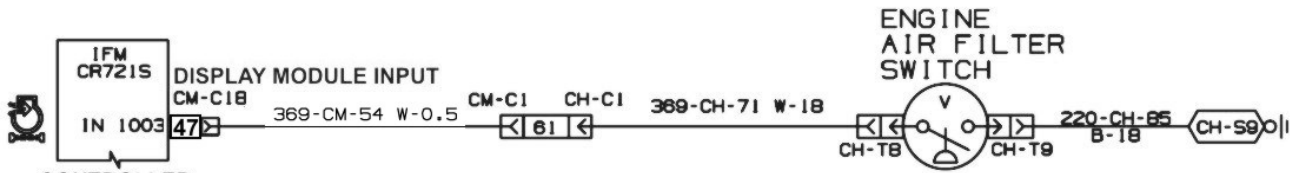

Fig. 74: Engine Air Filter Switch Circuit

ENGINE COOLANT LEVEL CIRCUIT

The engine coolant level is monitored by the coolant level sender. The normally open sender is mounted in the coolant reservoir and checks the coolant level. If the coolant is full, the switch on the sender is closed. The switch opens in the presence of air, when the coolant drops below a safe level. The ground circuit for operation of the sender is routed from ground boss GB5 to the sender terminal A. When the coolant level drops and the sender opens, the ground circuit is removed from the sender and terminal B to the coolant level module terminal B. The coolant level module helps minimize galvanic corrosion by reducing the electrical flow through the coolant level sensor.

The battery voltage for operation of the coolant level module is routed from the battery power circuit and fuse B5 (10A) to the module terminal A. The coolant level module is grounded on pin D through splice CM-S3. The ground at terminal 3 is routed through the de-energized relay and terminal 4 to the John Deere ECU EH-C1 pin 31, notifying the ECU the coolant level is at a proper level (Fig. 75: John Deere ECU). The battery voltage for operation of the relay is routed from the battery power circuit and fuse B5 (10A) to the relay terminal 1.

Fig. 75: John Deere ECU

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

The module routes a ground circuit from terminal C to the coolant level relay terminal 2, energizing the relay. When energized, the relay no longer routes a ground circuit to the relay and from the relay to the ECU. The absence of the ground signal at the ECU pin 31 notifies the control system the coolant level is low.

Fig. 76: Engine Coolant Level Circuit on page 85 shows the engine coolant level circuit.

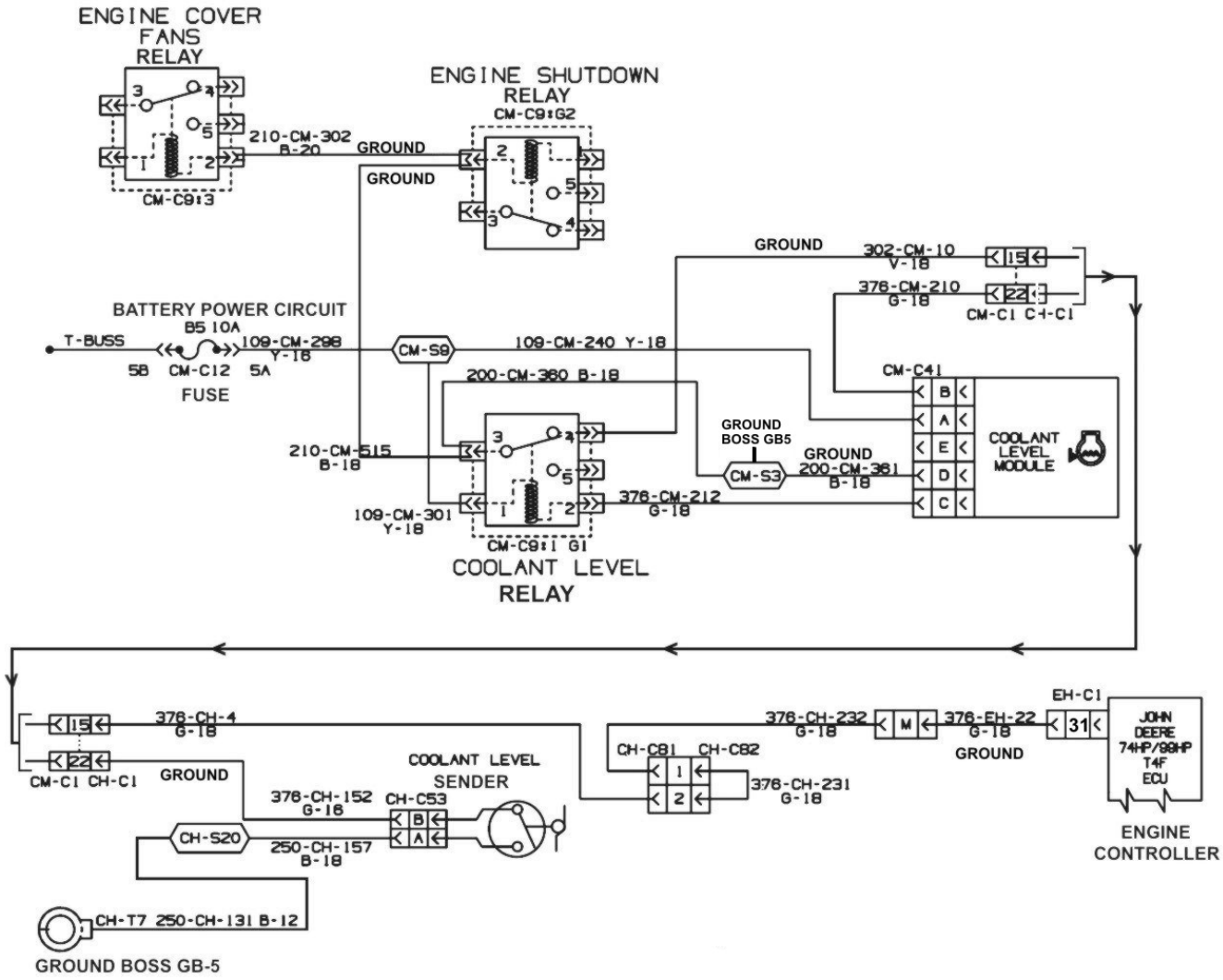

Fig. 76: Engine Coolant Level Circuit

The illumination of the low coolant level indicator (Fig. 77: Coolant Level) indicates the coolant level is low and the coolant level relay has routed a ground signal to the John Deere ECU EH-C1 pin 31.

Fault Codes: The control system causes a low coolant level icon to display notifying the operator of low coolant level.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

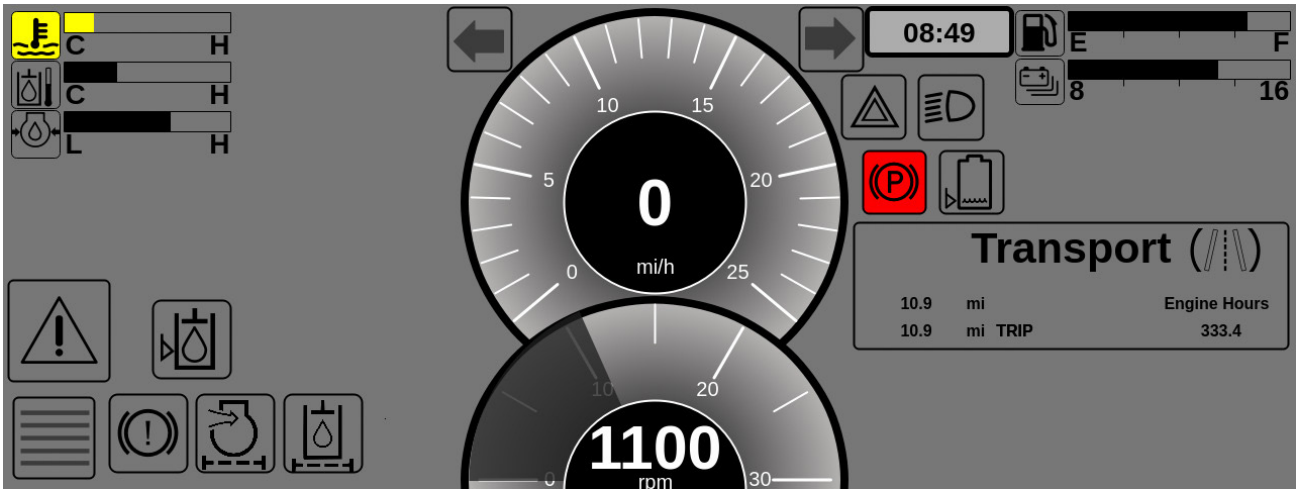

Fig. 77: Coolant Level

ENGINE COVER FANS CIRCUIT (HIGH ALTITUDE PACKAGE)
P0450

The engine cover fans (Fig. 78: Engine Cover Fans on page 87) are used with the Pelican NP high altitude option to cool the engine cover area. The engine cover fans are controlled by the engine cover fans relay. The battery voltage for operation of the relay is routed from the switched power circuit and fuse 3B (20A) to the relay terminal 3. The relay is grounded by a ground circuit at terminal 2 from ground boss GB5. The relay is energized by battery voltage from controller CR721S CM-C8 pin 6 to the relay terminal 1. The fans are also controlled by the engine coolant temperature. The fans start at 88° C and shut off at 85° C. The CANBus input to the control system from the engine ECU causes the control system to route the voltage output from CM-C8 pin 6 energizing the relay.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When the relay is energized, the battery voltage at the relay terminal 3 is routed through the relay and terminal 5 to the engine cover fans EF-C2, EF-C3 and EF-C4 terminals 1. Because the fans are grounded at terminals 2, from ground splice CH-S8, the fan motors rotate. The spinning fan blades cool the engine area. A variation from this description may be displayed as a fault warning. See Table 8: Fault Codes and Descriptions on page 35 for additional information and fault warnings.

Fig. 78: Engine Cover Fans

Fig. 79: Engine Cover Fans Circuit shows the engine cover fans circuit.

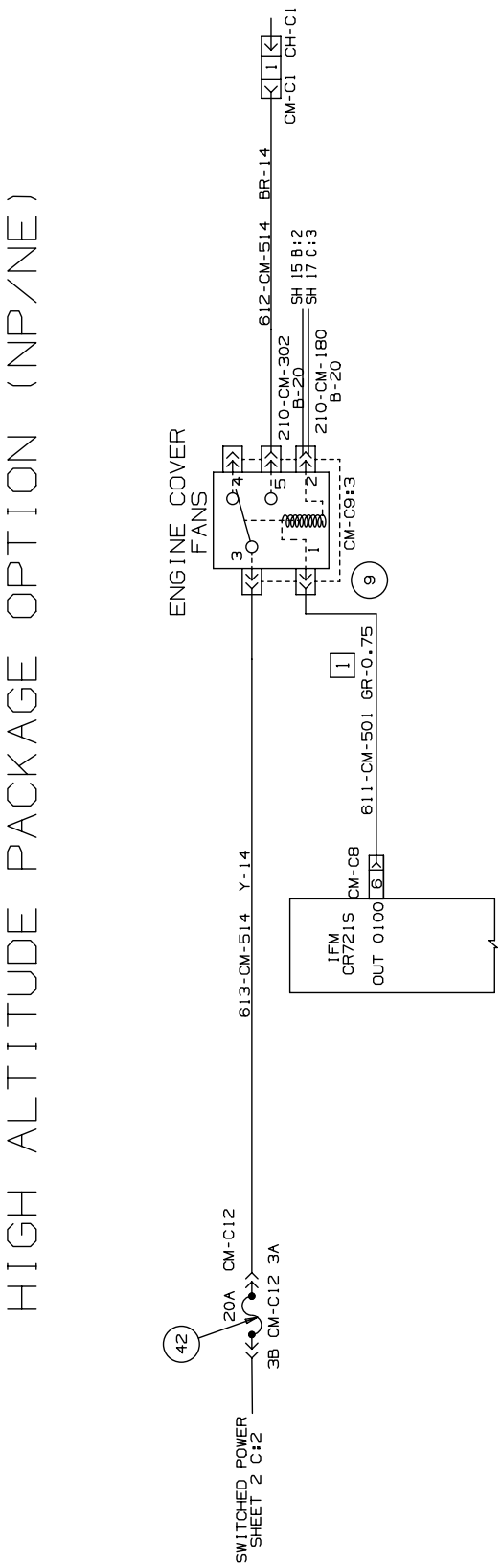

Fig. 79: Engine Cover Fans Circuit

The engine cover fans relay voltage output from controller CR721S CM-C8 pin 6 and will generate a fault warning if there is an open or short on the circuit. The illumination of the fault warning indicator (Fig. 80: Fault Warning on page 89) indicates the fault. The fault displays on the display faults screen (Fig. 81: Display Faults Screen on page 89).

Fault Codes: Engine Cover Fan Relay P0450-05, 06 and 12.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 6 and the engine cover fans relay terminal 1. Check for a ground circuit at the relay coil terminal 2. Use a multimeter to check the solenoid coil resistance for 4.4 Ω at 68°F (20°C). Check for corrosion at the relay coil and connectors.

See Table 8: Fault Codes and Descriptions on page 35.

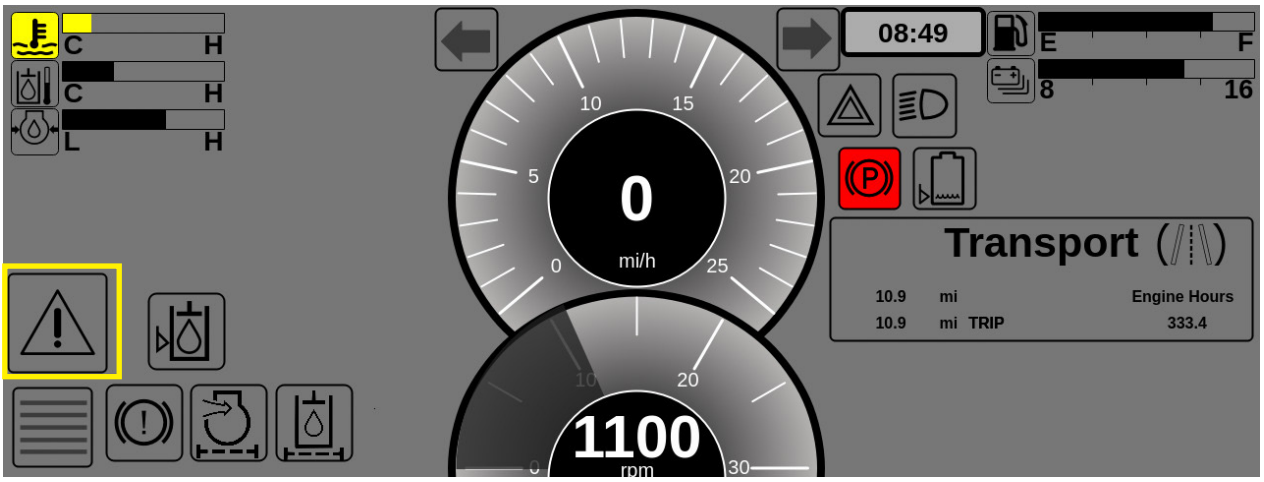

Fig. 80: Fault Warning

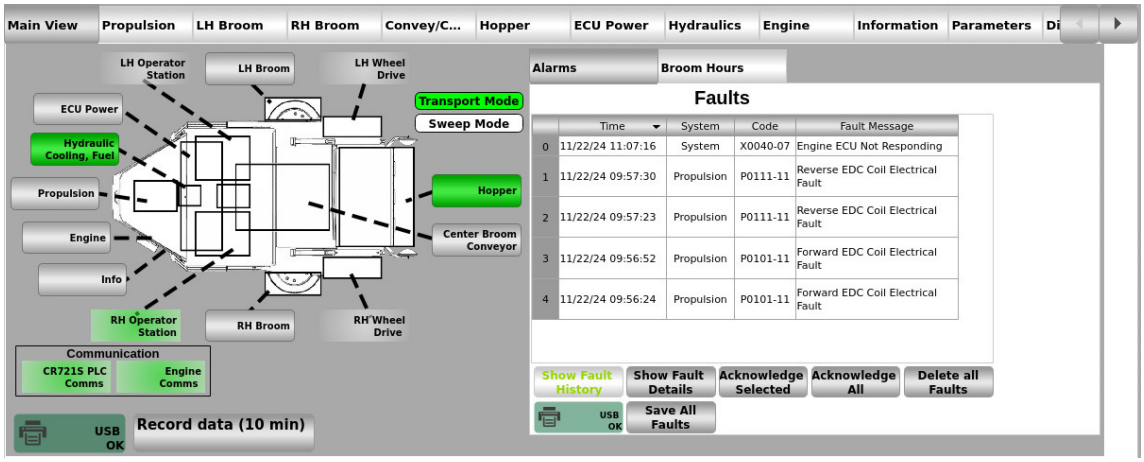

Fig. 81: Display Faults Screen

ENGINE SHUTDOWN CIRCUIT
P0430

The engine shutdown is controlled by the John Deere ECU (Fig. 82: John Deere ECU) and the engine shutdown relay. Battery voltage is routed from the battery power circuit and fuse B5 (5A) to the engine shutdown relay terminal 3. The battery voltage is routed through the de-energized relay and terminal 4 to the John Deere ECU EH-C1 pin 51. The input voltage at pin 51 notifies the ECU the engine is prepared for operation.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

A ground circuit is routed from splice CM-S3 to the engine shutdown relay terminal 2. The relay is energized by battery voltage from controller CR721S CM-C18 pin 74 to the relay pin 1 when a shutdown condition is detected by the CR721S. When the relay is energized, the battery voltage is no longer routed to the John Deere ECU EH-C1 pin 51, notifying the ECU to shut down the engine.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 82: John Deere ECU

Fig. 83: Engine Shutdown Circuit shows the engine shutdown circuit.

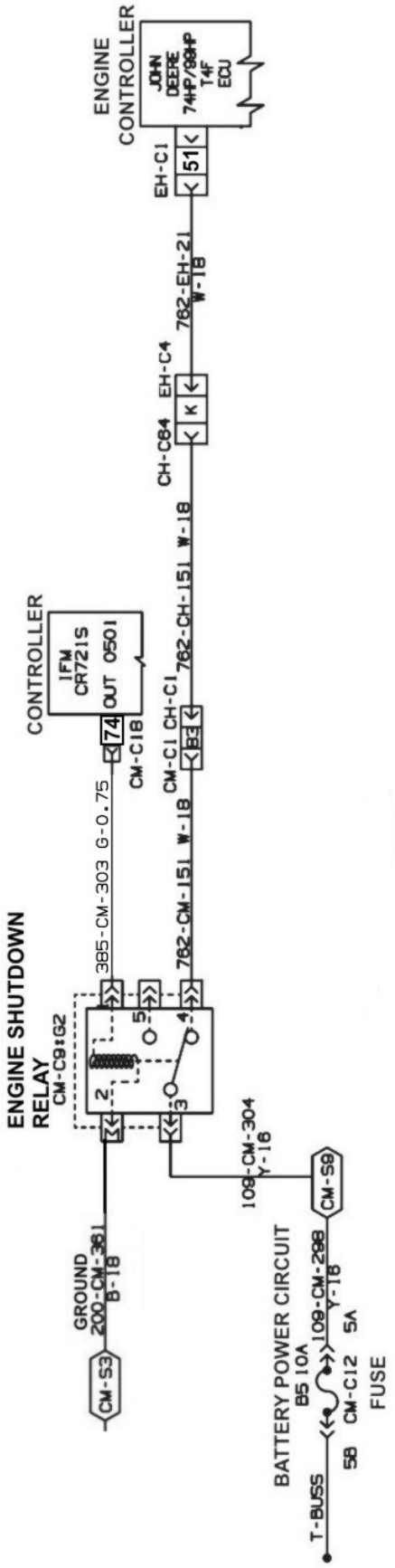

Fig. 83: Engine Shutdown Circuit

ENGINE THROTTLE CIRCUIT
P0200

The sweeper engine speed is controlled by the engine throttle thumb wheel mounted on the cab control panel (Fig. 84: Throttle Thumb Wheel). The rotary thumb wheel is a Hall Effect type. The 5 VDC needed for operation of the thumb wheel is routed from controller CR721S CM-C8 pin 31 to the thumb wheel terminal A. The ground circuit needed for operation of the thumb wheel is routed from controller CR721S CM-C8 pin 71 to the thumb wheel terminal C.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

See the operator's manual for control panel switch operation.

When the thumb wheel is turned in the increase or decrease direction, a partial voltage signal is routed from the thumb wheel terminal B to controller CR721S CM-C18 pin 36. The input voltage is converted to an output signal and routed through the CANBus control system to the John Deere ECU (Fig. 82: John Deere ECU on page 90). The output signal is used by the John Deere control system to increase or decrease engine throttle speed.

Fig. 85: Engine Throttle Circuit shows the engine throttle circuit.

Fig. 84: Throttle Thumb Wheel

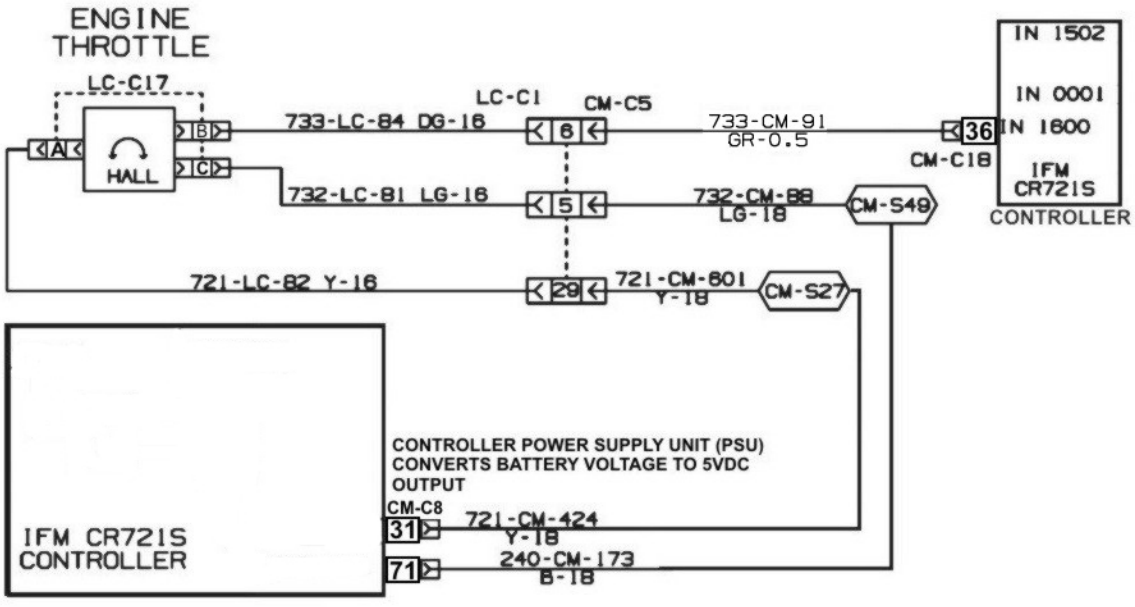

Fig. 85: Engine Throttle Circuit

The display speedometer indicates the sweeper speed while the tachometer displays the engine speed. See Fig. 86: Speedometer Tachometer.

The tachometer indicator displays the engine speed communicated from the John Deere ECU. The throttle voltage is routed from the engine throttle potentiometer to the control system at controller CR721S CM-C18 pin 36, causing a change in engine speed request. Monitor throttle operation by rotating the throttle thumbwheel and observing the display engine speed (Fig. 87: Engine Speed). A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes: Engine throttle potentiometer (POT) voltage faults – P0200-03 and 04.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CM-C18 pin 36 and the engine throttle potentiometer terminal B.

If necessary, see 5 V Sensor Power on page 231 for 5 V sensor feed faults (X0A50-03 and 06).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

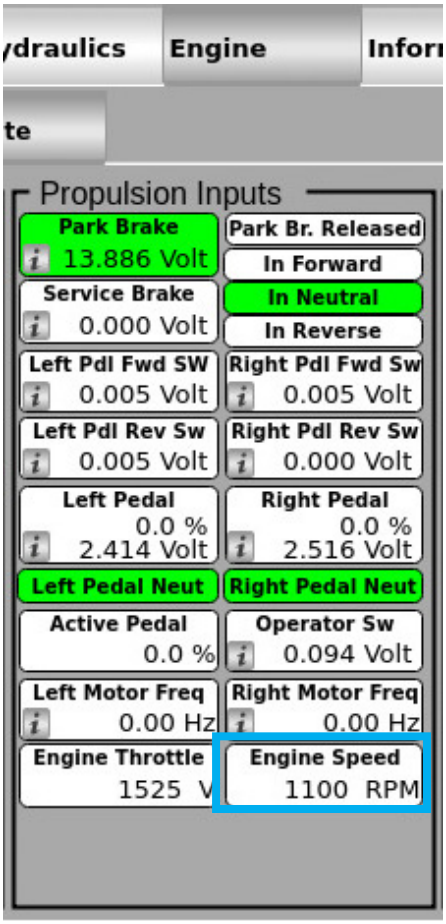

Fig. 87: Engine Speed

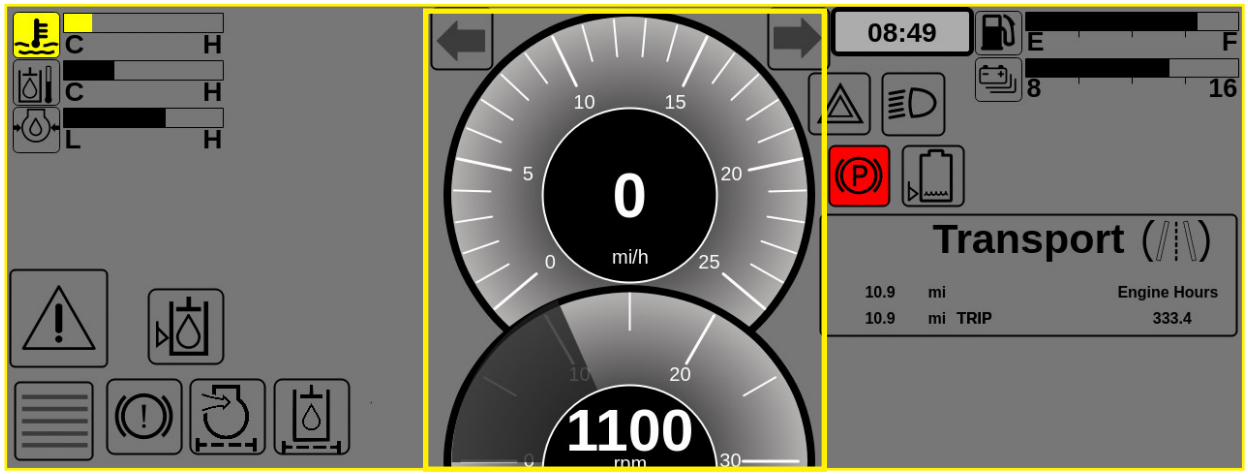

Fig. 86: Speedometer Tachometer

FOOT PEDAL INPUT SIGNALS CIRCUIT (P0210, P0220)

The foot pedals act as sensors with an output signal of approximately 0.5 VDC to 4.5 VDC. The voltage range of approximately 0.5 VDC to 2.2 VDC is sent as a signal to the controller for reverse position. A voltage range of approximately 2.8 VDC to 4.5 VDC is sent as a signal for forward position. The foot pedals send a signal to the controller to control the direction and speed of the hydrostatic transmission operation. Fig. 89: Foot Pedal Input Circuits on page 94 shows the foot pedal input circuits.

The pedal provides a voltage input to the controller, indicating pedal position as forward or reverse and the desired speed. The pedal primary voltage (5 VDC) is routed from the controller CR721S; the power supply unit (PSU) converts battery power to 5 VDC at CM-C8 pin 31 to the pedal connectors pin C and F (Fig. 88: Foot Pedal Connector). When the pedal is placed in the forward or reverse position, a voltage signal is routed from the pedal pin A to controller CM-C8 pin 67 (right pedal) and CM-C8 pin 64 (left pedal). The voltage level is dependent upon the position of the pedal. If the voltage to the controller is less than 0.3 VDC or greater than 4.7 VDC, an error condition exists and must be corrected before the hydrostatic drive can be used effectively.

The foot pedals are grounded at pin B by a ground circuit from controller CR721S pin 71.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

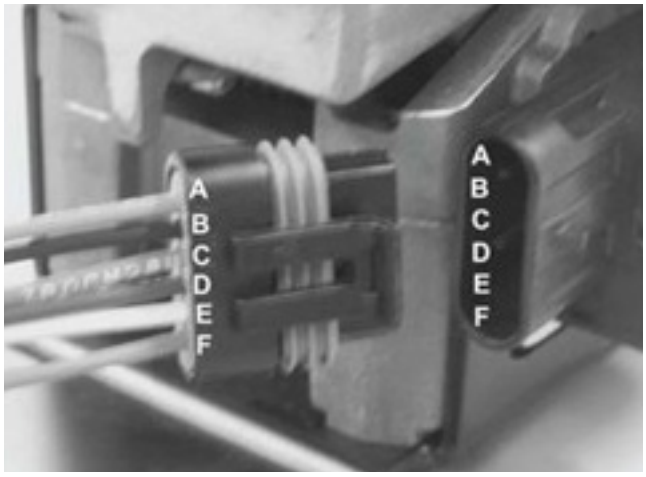

Fig. 88: Foot Pedal Connector

The foot pedal input circuits are shown in Fig. 89: Foot Pedal Input Circuits.

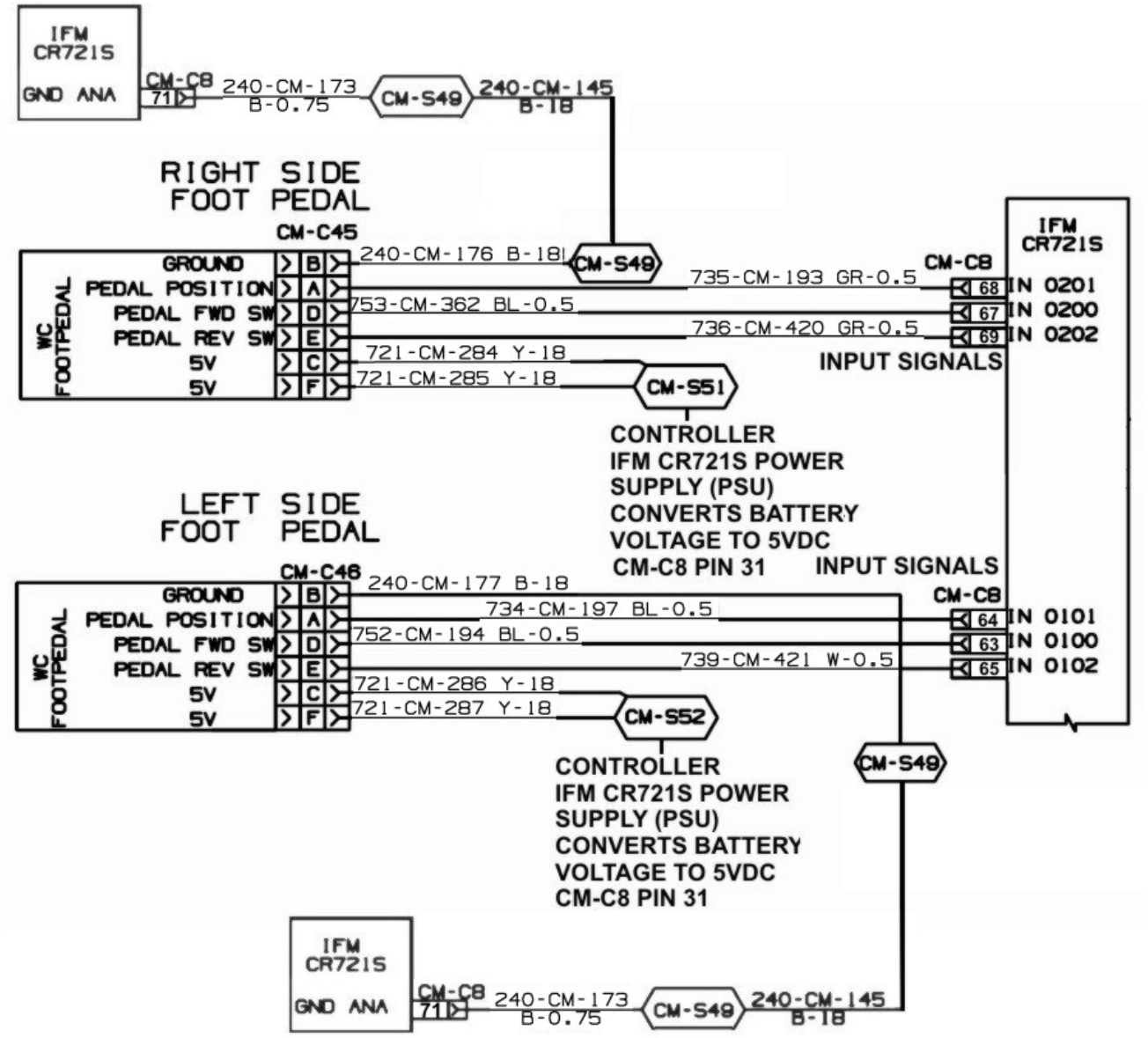

Fig. 89: Foot Pedal Input Circuits

Fig. 90: Foot Pedal Pins shows the foot pedal pins.

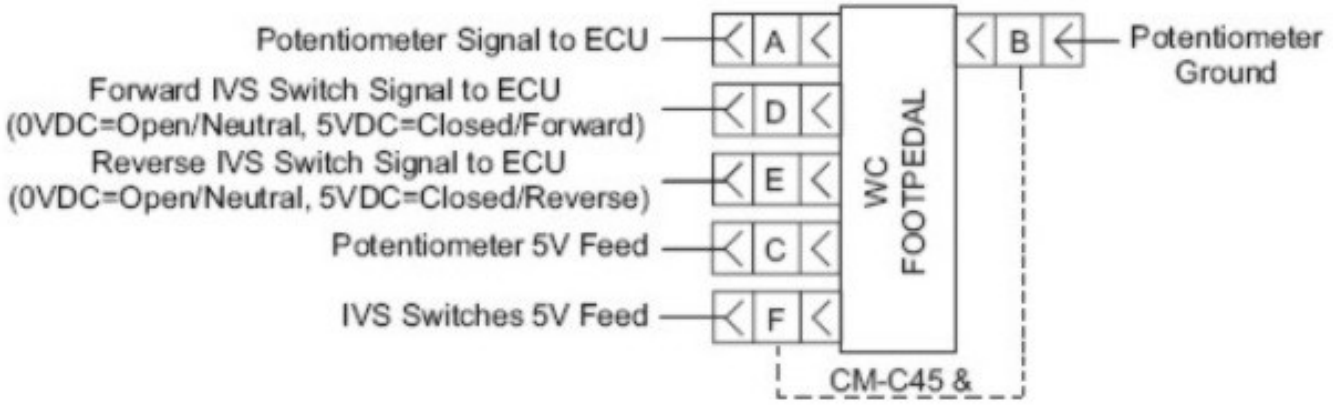

Fig. 90: Foot Pedal Pins

Fig. 91: Foot Pedal Connector Pins illustrates the foot pedal connector pins.

FOOT PEDAL CONNECTOR PINS		
Pin	***Wire***	***Number Purpose***
A	**Green - RH** **Blue - LH**	Potentiometer Signal Output to Controller pin C1-18
B	**Black**	Pedal Ground
C	**Yellow**	5VDC Input Power
D	**Blue**	IVS2 (FWD) Signal Output Controller pin C1-13
E	**Green - RH** **White - LH**	IVS1 (REV) Signal Output Controller pin C1-14
F	**Yellow**	5VDC IVS Switches Input Power

Fig. 91: Foot Pedal Connector Pins

The right and left pedal indicators can be used to monitor foot pedal usage and operation. See Fig. 92: Foot Pedals.

- The illumination of the right pedal reverse (Right Pedal Rev) indicator shows the right foot pedal is in use in the reverse position and voltage has been routed from the foot pedal terminal E to controller CR721S CM-C8 pin 69.
- The illumination of the right pedal forward (Right Pedal Fwd) indicator shows the right pedal is in use in the forward position and voltage has been routed from the foot pedal terminal D to controller CR721S CM-C8 pin 67.
- The illumination of the left pedal reverse (Left Pedal Rev) indicator shows the left foot pedal is in use in the reverse position and voltage has been routed from the pedal terminal E to controller CR721S CM-C8 pin 65.
- The illumination of the left pedal forward (Left Pedal Fwd) indicator shows the left foot pedal is in use in the forward position and voltage has been routed from the pedal terminal D to controller CR721S CM-C8 pin 63.
- The Right Pedal indicator displays the voltage input from the right pedal to the controller.
- The Left Pedal indicator displays the voltage input from the left pedal to the controller.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

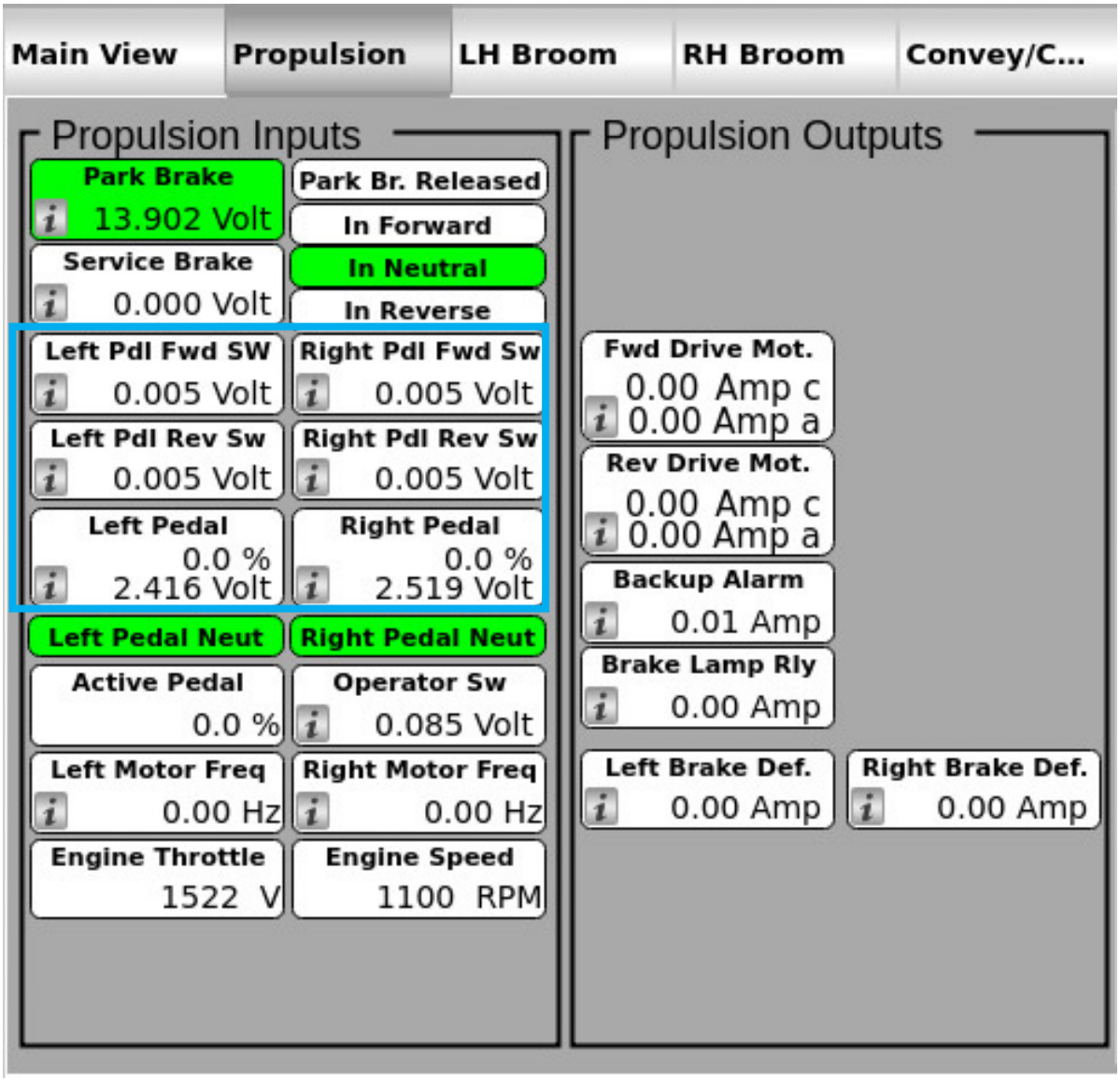

Fig. 92: Foot Pedals

Fault Codes:

- Right and Left Pedal Faults – P0210-03, 04, 11 and 13

  - A fault code of P0210-03 means that the voltage is above the normal range of approximately 0.5 V — 4.5 V.
  - A fault code of P0210-04 means that the voltage is below the normal range of approximately 0.5 V — 4.5 V.
  - A fault code of P0210-11 means that the pedal potentiometer reading does not match the forward and reverse switches; for example, the forward switch is reading, but the pedal voltage is below 2.5 V.
  - A fault code of P0210-13 means that there is a calibration error.

For Right Pedal Faults, perform the following steps:

Use Testing for Opens, Shorts, and Short to Ground on page 50 to test for opens, shorts, and short to ground between controller CR721S CM-C8 pin 68 and the right foot pedal terminal A, between the right foot pedal terminal E and controller CR721S CM-C8 pin 69, between controller CR721S CM-C8 pin 67 and the right foot pedal terminal D, between the right foot pedal terminal C and F and controller CR721S CM-C8 pin 31, and between controller CR721S CM-C8 pin 71 and the right foot pedal terminal B. Recalibrate the right foot pedal.

Use a multimeter to check for a ground circuit at the foot pedals terminal B. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

For Left Pedal Faults, perform the following steps:

Use Testing for Opens, Shorts, and Short to Ground on page 50 to test for opens, shorts, and short to ground between controller CR721S CM-C8 pin 64 and the left foot pedal terminal A, between the left foot pedal terminal E and controller CR721S CM-C8 pin 65, between controller CR721S CM-C8 pin 63 and the right foot pedal terminal D, between the right foot pedal terminal C and F and controller CR712A CM-C8 pin 31 and between the left foot pedal terminal B and controller CR721S CM-C8 pin 71. Recalibrate the left foot pedal.

Use a multimeter to check for a ground circuit at the foot pedals terminal B. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

FUEL LEVEL SENDER CIRCUIT

The fuel level sender monitors the level of fuel in the fuel tank. The ground circuit for operation of the fuel sender is routed from controller CR721S CM-8 pin 52 to the fuel sender terminal CH-T1 (Fig. 93: Fuel Level Sender Circuit). The fuel level sender is a type of variable resistor. The fuel level resistance value is routed from the fuel level sender terminal CH-T2 to controller CR721S CM-C8 pin 38. The resistance input at controller CR721S pin 38 causes the control system to evaluate the input signal and cause the fuel level to appear on the display.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The fuel level indicator (Fig. 94: Fuel Level) displays the fuel level in the fuel tank. The fuel indicator should change position with fuel usage indicating a ground circuit is available at the fuel level sender terminal CH-T1 and a signal has been routed from the sender terminal CH-T2 to controller CR721S CM-C8 pin 38 and from the controller and control system to the display module.

Fault Codes:

- No fault codes for the sender.

The sender voltage (fuel level) is displayed on the diagnostics screens.

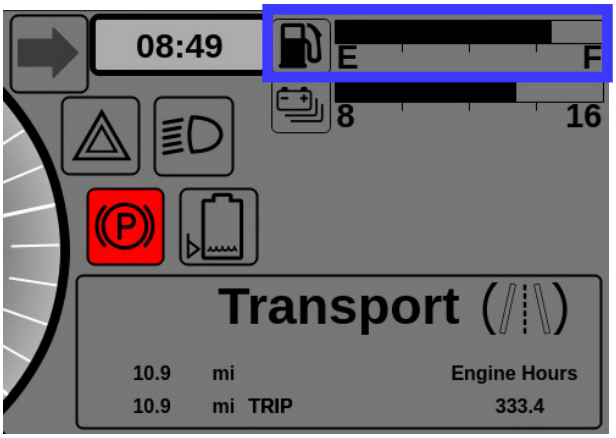

Fig. 94: Fuel Level

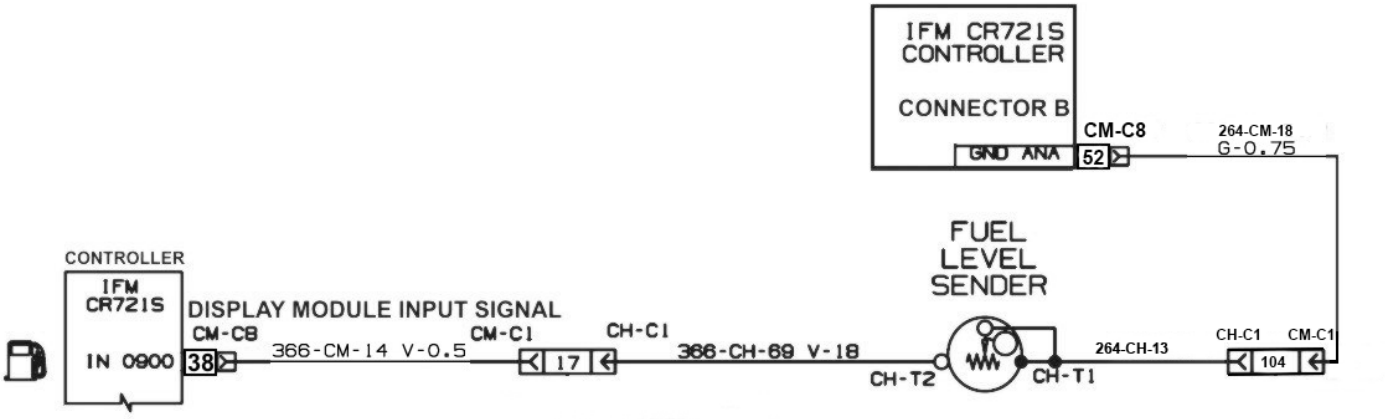

Fig. 93: Fuel Level Sender Circuit

HOPPER JOYSTICK CIRCUIT

The hopper joystick (Fig. 95: Joystick) is used to control hopper functions. The battery voltage for joystick operation is routed from the switched power circuit and fuse B19 (10A) to the joystick LC-C10 terminal 1 (Fig. 96: Hopper Joystick Circuit). When the joystick is placed in the hopper return position, battery voltage is routed from the joystick terminal 5 to controller CR721S CM-C8 pin 44. The voltage input causes the control system to route battery voltage to the hopper return solenoid valve. See Fig. 98: Hopper Return Dump Lower Raise Circuit on page 102.

When the joystick is placed in the hopper dump position, battery voltage is routed from the joystick LC-C10 terminal 6 to controller CR721S CM-C8 pin 45. The input voltage causes the control system to route battery voltage to the hopper dump solenoid valve. See Fig. 98: Hopper Return Dump Lower Raise Circuit on page 102.

When the joystick is placed in the hopper lower position, battery voltage is routed from the joystick LC-C10 terminal 3 to controller CR721S CM-C8 pin 46. If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The input voltage causes the control system to route battery voltage to the hopper lower solenoid valve. See Fig. 98: Hopper Return Dump Lower Raise Circuit on page 102.

When the joystick is placed in the hopper raise position, battery voltage is routed from the joystick LC-C10 terminal 4 to controller CR721S CM-C8 pin 47. The input voltage causes the control system to route battery voltage to the hopper raise solenoid valve. See Fig. 98: Hopper Return Dump Lower Raise Circuit on page 102.

Fig. 95: Joystick

Fig. 96: Hopper Joystick Circuit shows the hopper joystick circuit.

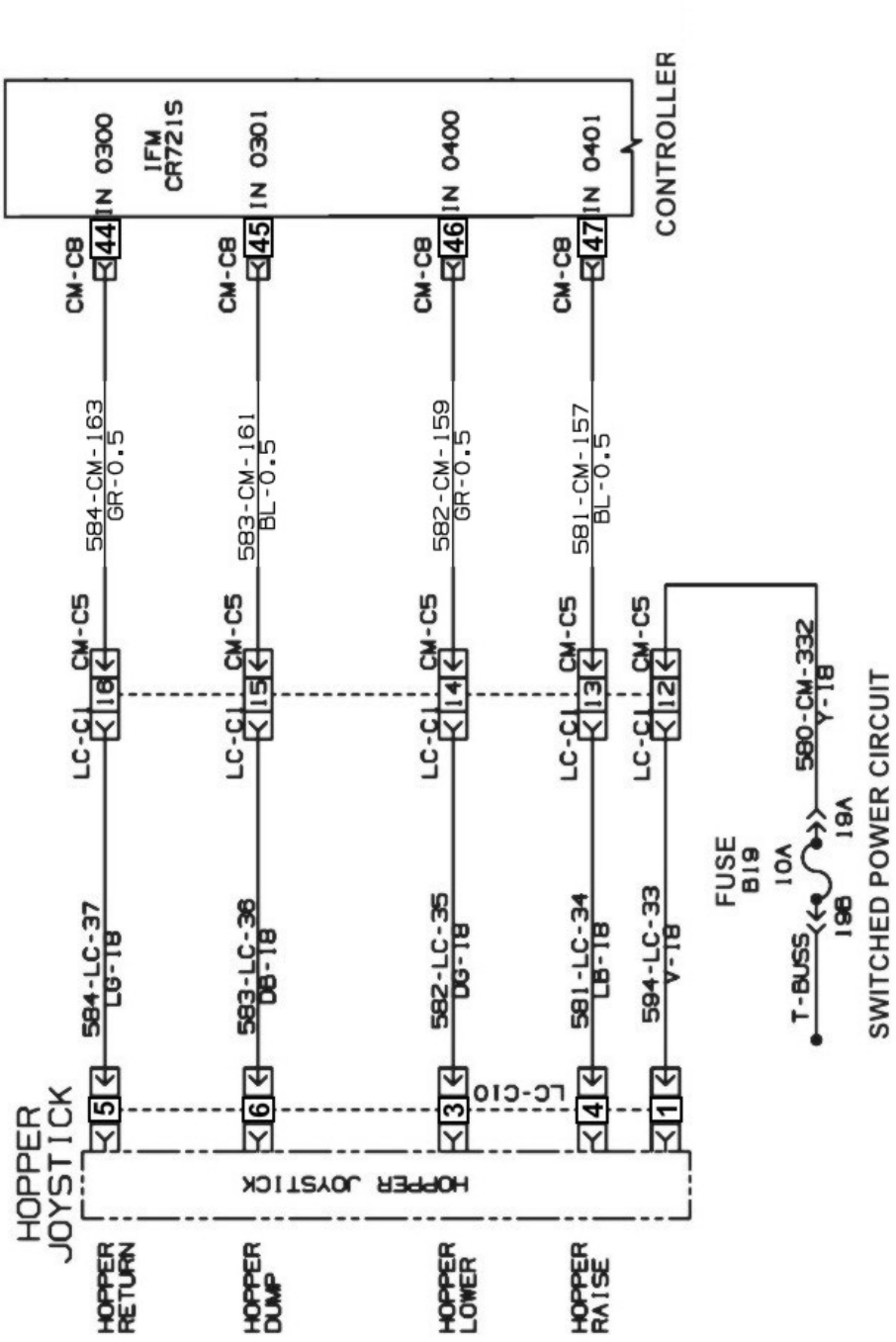

Fig. 96: Hopper Joystick Circuit

HOPPER RETURN DUMP LOWER RAISE CIRCUITS

(H0100, H0110, H0120, H0130)

The hopper hydraulic functions are controlled by the hopper joystick. See Hopper Joystick Circuit on page 99.

Use the operator's manual to prepare the sweeper for hopper controls such as hopper raise, hopper dump, hopper return and hopper lower.

For solenoid locations, see Fig. 97: Hopper Lift Tilt Manifold.

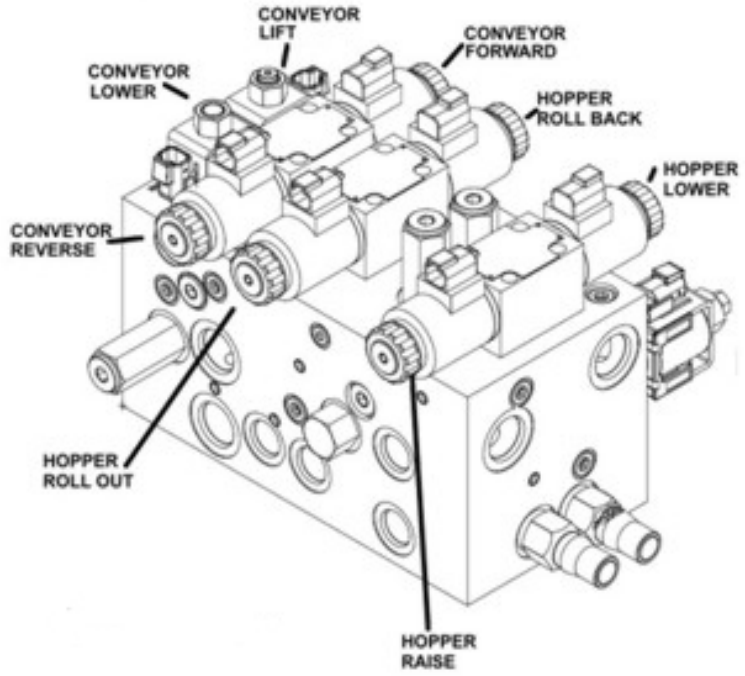

Fig. 97: Hopper Lift Tilt Manifold

Fig. 98: Hopper Return Dump Lower Raise Circuit shows the hopper return dump lower raise circuit.

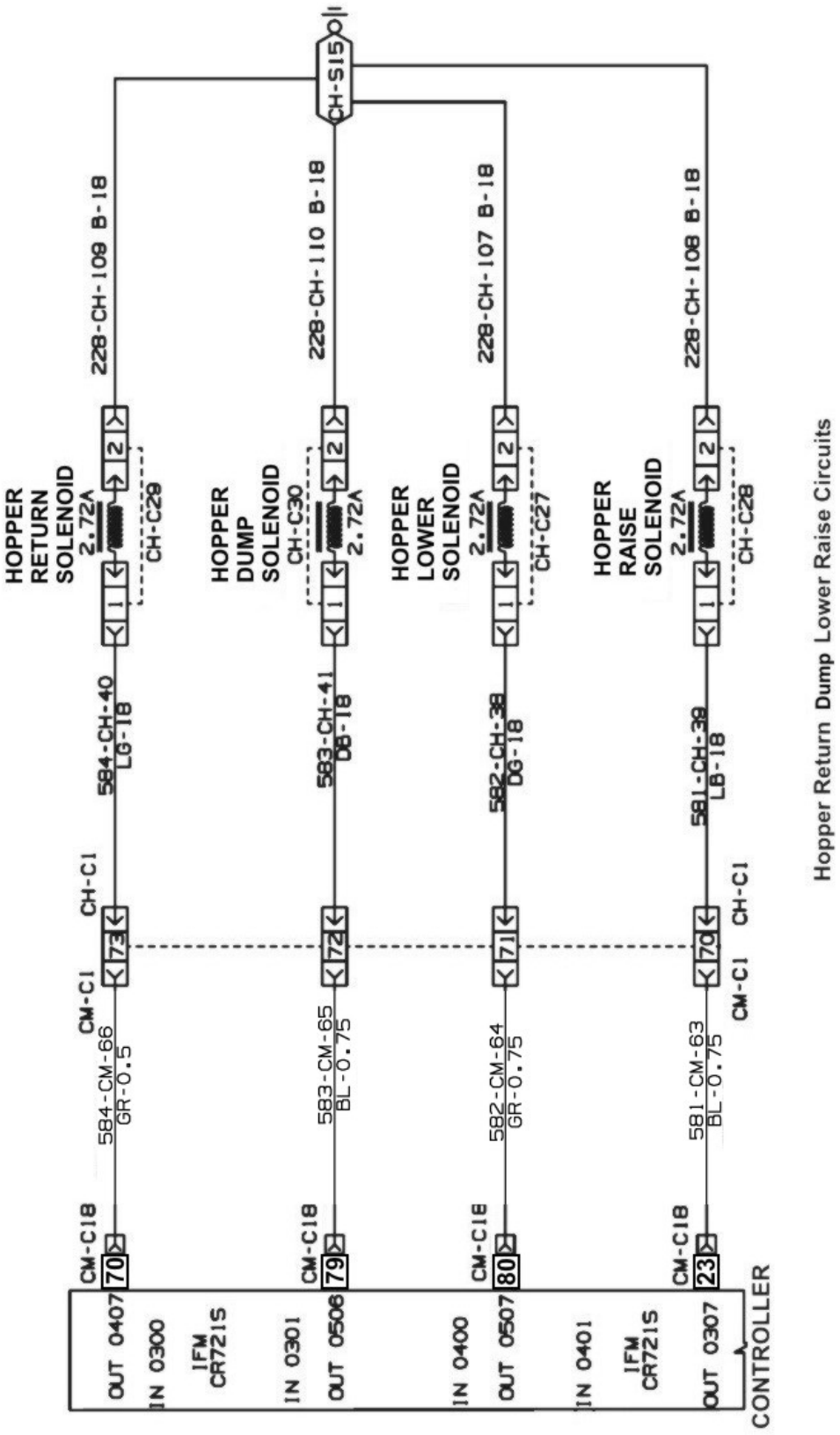

Fig. 98: Hopper Return Dump Lower Raise Circuit

Fig. 99: Hopper shows the status of the hopper:

- The illumination of the hopper raise switch (Raise Sw) indicator indicates the joystick is in the raise position and voltage has been routed from the joystick terminal 4 to controller CR721S CM-C8 pin 47.
- The illumination of the hopper raise sol (Raise Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 23 to the hopper raise solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2.
- The illumination of the hopper lower switch (Lower Sw) indicator indicates the joystick is in the lower position and voltage has been routed from the joystick terminal 3 to controller CR721S CM-C8 pin 46.
- The illumination of the hopper lower solenoid (Lower Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 80 to the hopper lower solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2.
- The illumination of the hopper dump switch (DumpSw) indicator indicates the joystick is in the dump position and voltage has been routed from controller CR721S CM-C8 pin 45.
- The illumination of the hopper dump solenoid (Dump Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 79 to the hopper dump solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2.
- The illumination of the hopper retract switch (Retract Sw) indicator indicates the joystick is in the hopper return position and voltage has been routed from the joystick terminal 5 to controller CR721S CM-C8 pin 44.
- The illumination of the hopper return solenoid (Retract Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 70 to the hopper return (retract) solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2.

NOTE: The common valve is energized when the hopper functions are activated. See Faults Codes, Common Valve – X0200-05, 06, 12, 20 and 21. See Testing for Opens, Shorts, and Short to Ground on page 50 and the cab display module alarms screen. See Common Valve Circuit on page 75.

A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

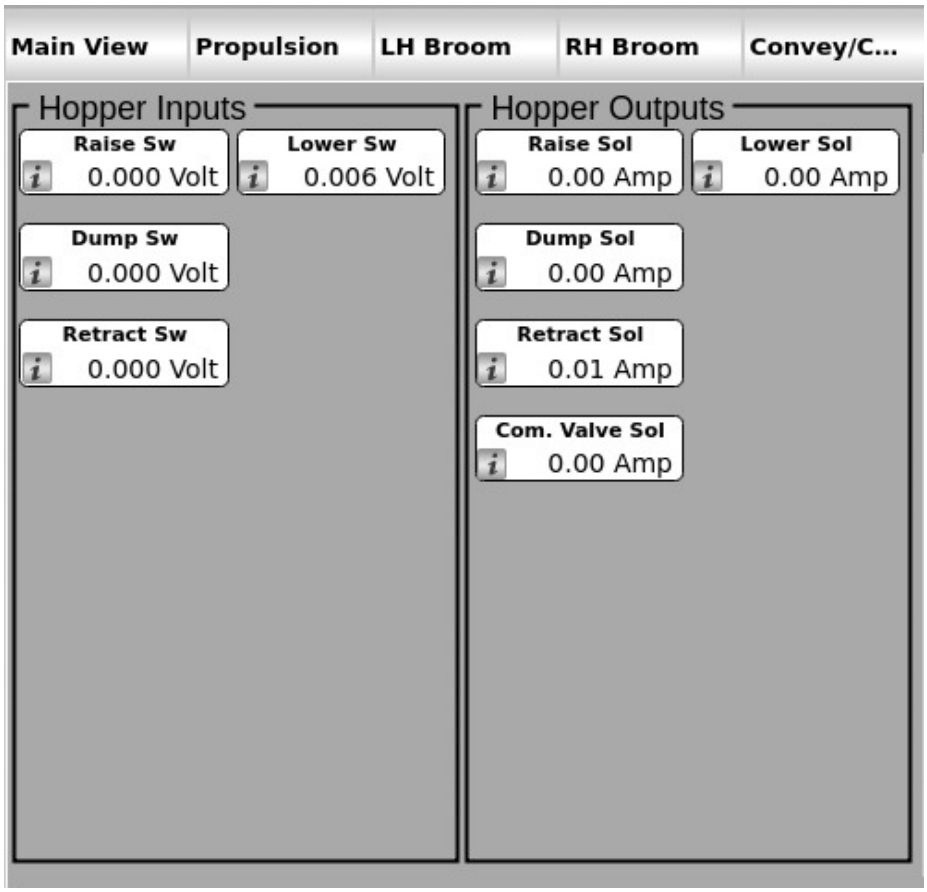

Fig. 99: Hopper

Hopper Raise Circuit

When the joystick is placed in the hopper raise position, the input at controller CR721S CM-C8 pin 47 causes the control system to route battery voltage from controller CR721S CM-C18 pin 23 to the hopper raise solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S15. The battery voltage at terminal 1 and ground circuit at terminal 2 causes the solenoid valve to open, allowing hydraulic oil to flow to the hopper raise/lower cylinder extend port. The hopper is raised to the desired position. The hydraulic oil at the hopper raise/lower cylinder retract port flows back to the hydraulic circuit.

Fault Codes:

- H0100-05, 06, 12, 20 and 21.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 23 and the hopper raise solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the hopper raise solenoid coil resistance for 4.4 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

NOTE: The common valve is energized when the hopper functions are activated. See Faults Codes, Common Valve – X0200-05, 06, 12, 20 and 21. See Testing for Opens, Shorts, and Short to Ground on page 50 and the cab display module alarms screen. See Common Valve Circuit on page 75.

Hopper Lower Circuit

When the joystick is placed in the hopper lower position, the input at controller CR721S CM-C8 pin 46 causes the control system to route battery voltage from controller CR721S CM-C18 pin 80 to the hopper lower solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S15. The battery voltage at terminal 1 and ground circuit at terminal 2 causes the solenoid valve to open, allowing hydraulic oil to flow to the hopper raise/lower cylinder retract port. The hopper retracts to the lowered position. The hydraulic oil in the hopper raise/lower cylinder extend port flows back to the hydraulic circuit.

Fault Codes:

- H0110-05, 06, 12, 20, and 21.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 80 and the hopper lower solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the hopper lower solenoid coil resistance for 4.4 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

NOTE: The common valve is energized when the hopper functions are activated. See Faults Codes, Common Valve – X0200-05, 06, 12, 20 and 21. See Testing for Opens, Shorts, and Short to Ground on page 50 and the cab display module alarms screen. See Common Valve Circuit on page 75.

Hopper Dump Circuit

When the joystick is placed in the hopper dump position,s the input at controller CR721S CM-C8 pin 45 causes the control system to route battery voltage from controller CR721S CM-C18 pin 79 to the hopper dump solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S15. The battery voltage at terminal 1 and ground circuit at terminal 2 causes the solenoid valve to open allowing hydraulic oil to flow to the hopper dump/return cylinder extend port. The hopper extends to the dump position. The hydraulic oil in the hopper dump/return cylinder retract port flows back to the hydraulic circuit.

Fault Codes:

- H0120-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 79 and the hopper dump solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the hopper dump solenoid coil resistance for 4.4 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

NOTE: The common valve is energized when the hopper functions are activated. See Faults Codes, Common Valve – X0200-05, 06, 12, 20 and 21. See Testing for Opens, Shorts, and Short to Ground on page 50 and the cab display module alarms screen. See Common Valve Circuit on page 75.

Hopper Return/Retract Circuit
H0130

When the joystick is placed in the hopper return position, the input at controller CR721S CM-C8 pin 44 causes the control system to route battery voltage from controller CR721S CM-C18 pin 70 to the hopper return solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S15. The battery voltage at terminal 1 and ground circuit at terminal 2 causes the solenoid valve to open allowing hydraulic oil to flow to the hopper dump/return cylinder retract port. The hopper returns to the retracted position. The hydraulic oil in the hopper dump/return cylinder extend port flows back to the hydraulic circuit.

Fault Codes:

- H0130-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 70 and the hopper return solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the hopper return solenoid coil resistance for 4.4 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

NOTE: The common valve is energized when the hopper functions are activated. See Faults Codes, Common Valve – X0200-05, 06, 12, 20 and 21. See Common Valve Circuit on page 75. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

HYDRAULIC FILTER RESTRICTION CIRCUIT

The hydraulic oil filter restriction switch (Fig. 100: Hydraulic Filter Restriction Sensor) monitors the hydraulic oil pressure flowing through the oil filter. The switch is mounted in the filter head. The normally open switch closes when the filter becomes restricted and builds pressure causing oil pressure bypass in the filter head. The ground circuit for operation of the switch is routed from ground splice CH-S9 to the switch terminal B (Fig. 101: Hydraulic Filter Restriction Switch Circuit).

When the hydraulic oil pressure builds to a preset level, the switch closes and routes the ground circuit through the switch and terminal A to controller CR721S CM-C18 pin 59. The ground circuit at CM-C18 pin 59 signals the control system the hydraulic oil filter is restricted and must be changed. The control system causes a filter restricted icon to display on the display screen warning the operator of the hydraulic oil filter restricted condition

When a ground circuit is routed through the hydraulic filter restriction switch to controller CR721S CM-C18 pin 59, a fault condition exists and illuminates the fault warning icon on the display home screen (Fig. 102: Hydraulic Filter Restriction Warning Icon). The fault condition can then be viewed on the Main View tab, Faults pane.

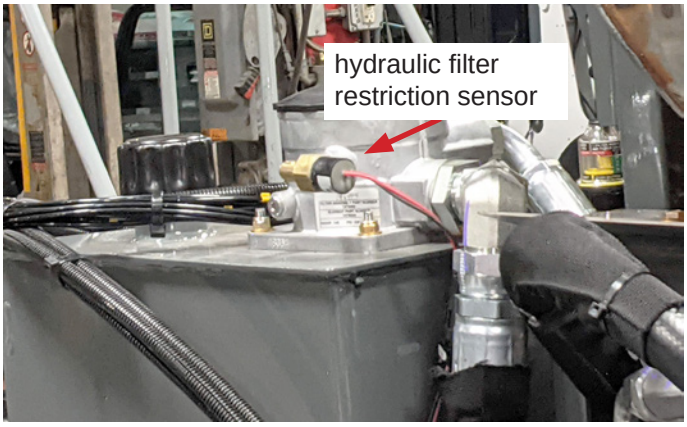

Fig. 100: Hydraulic Filter Restriction Sensor

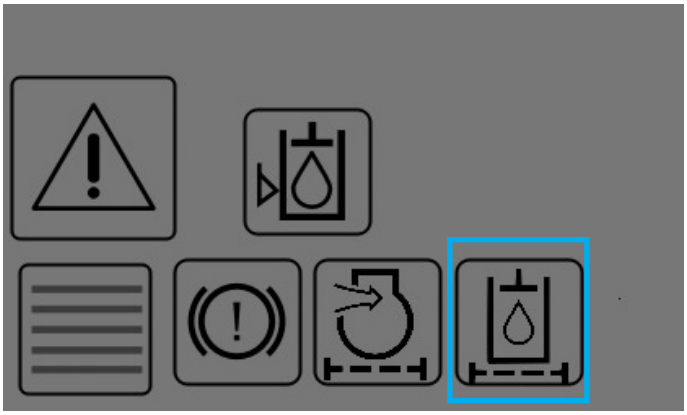

Fig. 102: Hydraulic Filter Restriction Warning Icon

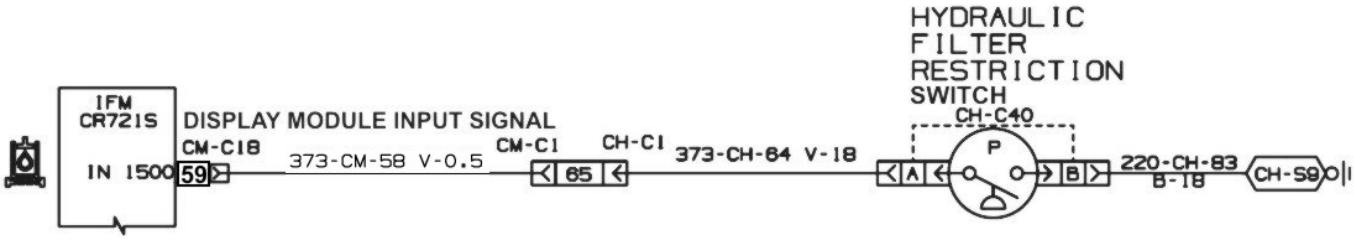

Fig. 101: Hydraulic Filter Restriction Switch Circuit

HYDRAULIC OIL LEVEL SWITCH CIRCUIT
P0401

The normally open hydraulic oil level switch is mounted in the hydraulic reservoir and monitors the level of hydraulic oil in the reservoir. The ground circuit for operation of the oil level switch is routed from ground splice CH-S9 to the oil level switch terminal B (Fig. 103: Hydraulic Level Switch Circuit) The normally open hydraulic oil level switch is mounted in the hydraulic reservoir (Fig. 104: Fuel and Hydraulic Oil Level Indicators) and monitors the level of hydraulic oil in the reservoir. When the reservoir oil level drops below safe operating level, the switch closes and routes the ground circuit from terminal B through the switch and terminal A to controller CR721S CM-C18 pin 44.

The input at CM-C18 pin 44 notifies the control system the hydraulic oil level is low. The control system then causes an oil level low icon to appear on the display screen.) The input at CM-C18 pin 44 notifies the control system the hydraulic oil level is low. The control system then causes an oil level low icon to appear on the display screen.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

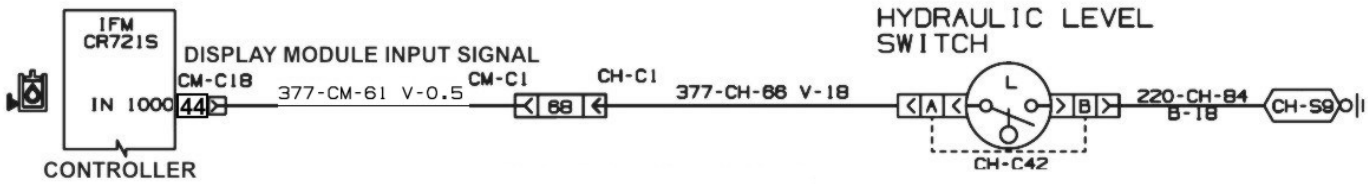

Fig. 103: Hydraulic Level Switch Circuit

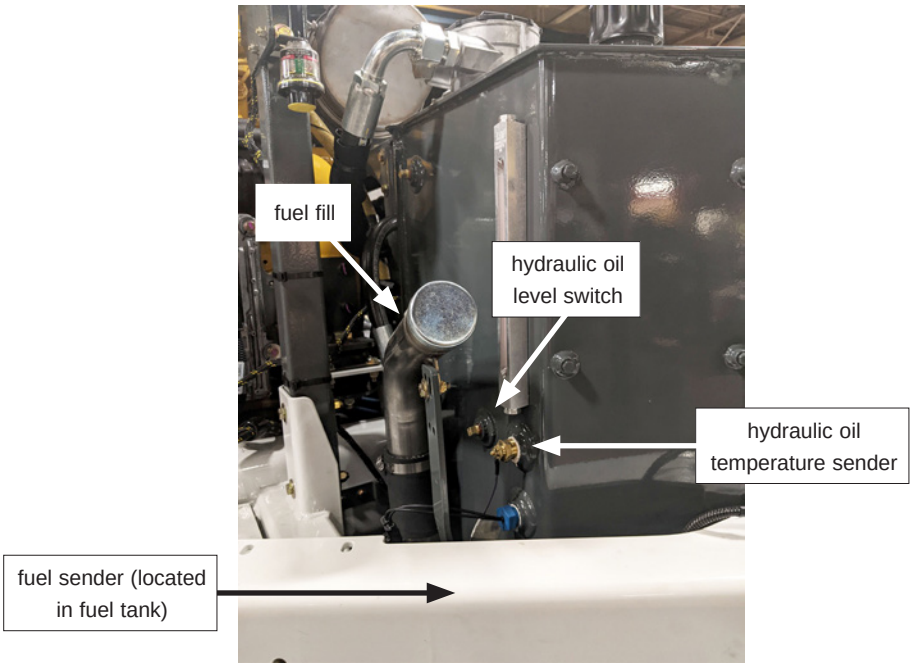

Fig. 104: Fuel and Hydraulic Oil Level Indicators

The illumination of the low hydraulic oil icon and fault warning icon (Fig. 105: Low Hydraulic Oil) indicates a ground circuit has been routed through the hydraulic level switch to controller CR721S CM-C18 pin 44. View the fault on the Main View tab, Faults pane. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- Hydraulic oil level low shutdown – P0401-01

NOTICE

Fault P0401-01 appears if the oil level remains low for 30 seconds.

Hydraulic oil level shutdown is caused by a ground signal at the level input on the controller. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for short to ground between controller CR721S CM-C18 pin 44 and the hydraulic oil level switch terminal A. Check the level of hydraulic oil. Also check for switch stuck in closed position.

No direct fault codes for hydraulic oil level circuit. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

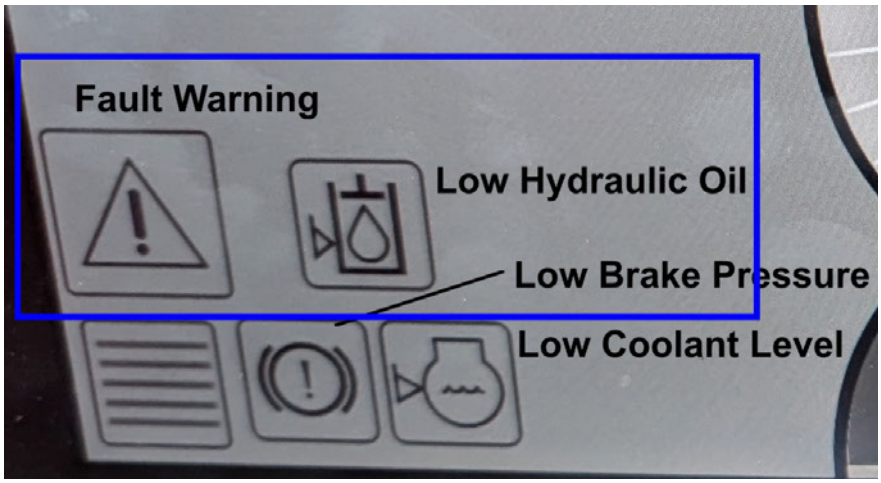

Fig. 105: Low Hydraulic Oil

HYDRAULIC OIL TEMPERATURE SENDER CIRCUIT
P0400

Excessive heat in the system hydraulic oil can cause the oil to break down and lose the ability to effectively drive and lubricate the hydraulic components. The hydraulic oil temperature is monitored by the hydraulic oil temperature sender (Fig. 106: Hydraulic Oil Temperature Circuit). The sender is mounted in the hydraulic reservoir (Fig. 104: Fuel and Hydraulic Oil Level Indicators on page 107). The sender is a variable resistor and is grounded through its own body to the tank. The controller interprets the resistance of the sender as a temperature.

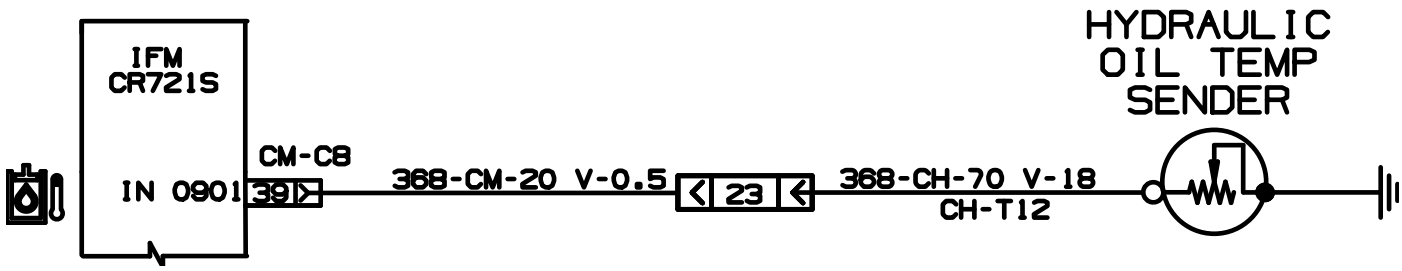

Fig. 106: Hydraulic Oil Temperature Circuit

The resistance of the sender drops as temperature increases. The controller interprets the resistance level as temperature. When the temperature reading rises above a programmed threshold, the high oil temperature warning light illuminates (Fig. 107: Hydraulic Oil Temperature).

The hydraulic oil temperature icon on the display home screen provides a view of the oil temperature. The display indicates a ground circuit is available at the hydraulic oil temperature sender and has routed a temperature signal to controller CR721S CM-C8 pin 39. If the hydraulic oil temperature is high (hot), the display temperature gauge displays the oil temperature level and the fault warning icon illuminates. View the fault warning on the display faults screen. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes:

- Hydraulic oil temperature shutdown – P0400-00

Check the oil temperature and that the hydraulic oil cooler is operational. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for short to ground between controller CR721S CM-C8 pin 39 and the hydraulic oil temperature sender terminal 1.

NOTICE

Fault P0401-01 appears if the oil temperature remains high for 30 seconds.

No direct fault codes for the hydraulic oil temperature sender circuit. See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

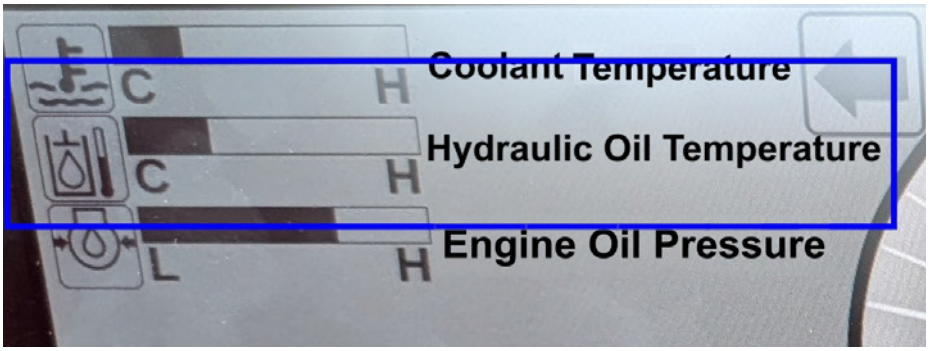

Fig. 107: Hydraulic Oil Temperature

IGNITION SWITCH CIRCUIT

Fig. 108: Ignition Switch Circuit shows the ignition switch circuit.

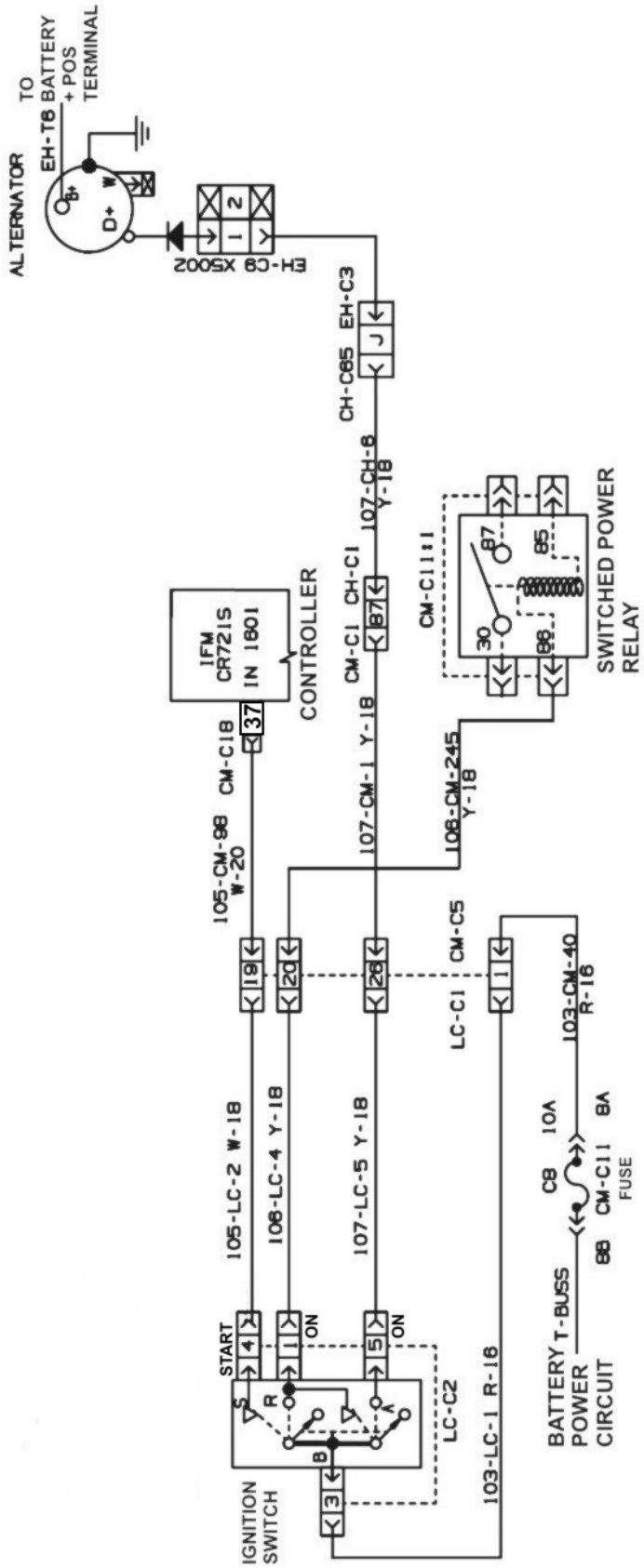

Fig. 108: Ignition Switch Circuit

The voltage for operation of the ignition switch is routed from the battery power circuit and fuse C8 (10A) to the ignition switch terminal 3.

If necessary, see Fuses And Relays on page 19 to locate fuses.

When the ignition switch (Fig. 109: Ignition) is held in the START position, battery voltage is routed from the ignition switch terminal 4 (white wire) to controller CR721S CM-C18 pin 37. The voltage at controller CR721S CM-C18 pin 37 causes the control system to route battery voltage from controller CR721S CM-C8 pin 17 to the start relay. See Starting Circuit on page 206.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When the ignition switch is placed in the ON (IGN) position, battery voltage is routed from the ignition switch terminal 1 to the switched power relay terminal 86 energizing the relay. When energized, the relay routes battery voltage to the circuits using switched power. See Sweep Power Circuit on page 209. The battery voltage is also routed from the ignition switch terminal 5 through a diode to the alternator terminal D+. The battery voltage at the alternator acts as a field connection which determines alternator output. See Charging Circuit on page 74.

The illumination of the start engine switch (Start Engine Sw) indicator (Fig. 110: Ignition Switch) indicates voltage has been routed from the ignition switch to controller CR721S CM-C18 pin 37. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check circuits including opens, shorts, and short to ground between the ignition switch terminal 4 and controller CR721S CM-C18 pin 37.

Fig. 109: Ignition

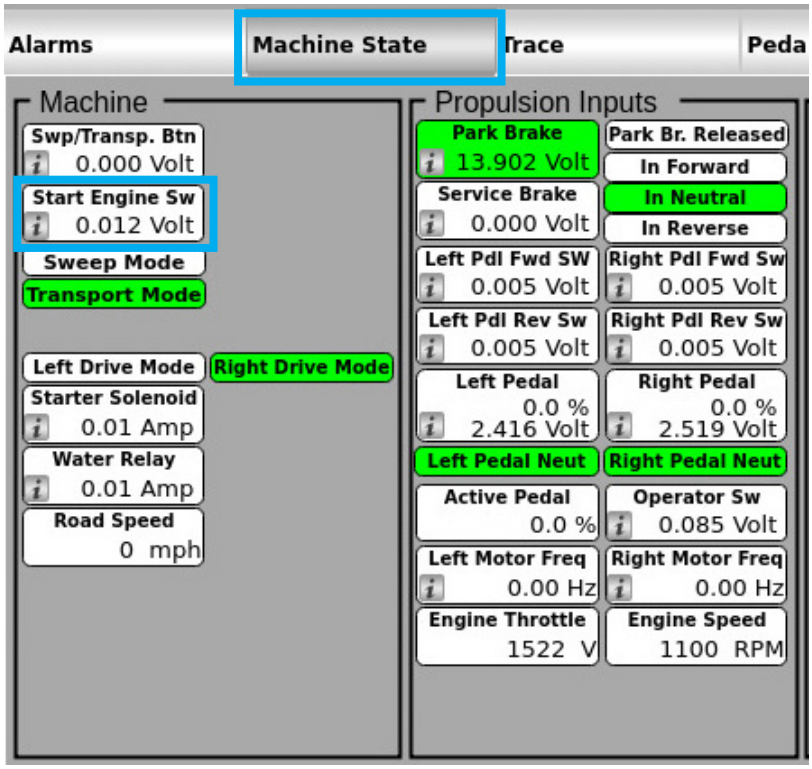

Fig. 110: Ignition Switch

ACCUMULATOR LOW PRESSURE SENSOR CIRCUIT

The braking accumulator maintains, stores, and captures hydraulic pressure for braking. The accumulator also reduces pressure peaks. The accumulator stores a volume of fluid that can be returned to the hydraulic system when needed for proper operation. The accumulator pressure switch monitors the accumulator pressure and routes a signal to the control system when the accumulator pressure drops to a preset level. The input notifies the control system the accumulator pressure is low.

The ground circuit for operation of the accumulator low pressure sensor is routed from ground splice CH-S15 to the sensor terminal 2. The switch is normally open and is closed by pressure above 2000 psi. When pressure drops below 2320 psi, the switch opens and opens the ground from the sensor terminal 2 to controller CR721S CM-C18 pin 46. The input at CM-C18 pin 46 causes the control system to display a low accumulator pressure icon on the display screen. The accumulator sensor resets when the pressure increases to 2320 psi.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 111: Low Pressure Accumulator Circuit shows the low pressure accumulator circuit.

The illumination of the low brake pressure icon (Fig. 112: Low Brake Pressure) indicates the accumulator low pressure switch is open due to low accumulator pressure and a ground circuit has been opened from the sensor terminal 1 to controller CR721S CM-C18 pin 46. For low brake or erratic brake response and no illumination of the icon, check for a ground circuit at the accumulator low pressure sensor terminal 2, accumulator low pressure sensor failure or a short to ground between the sensor and controller CR721S CM-C18 pin 46. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check circuit connections.

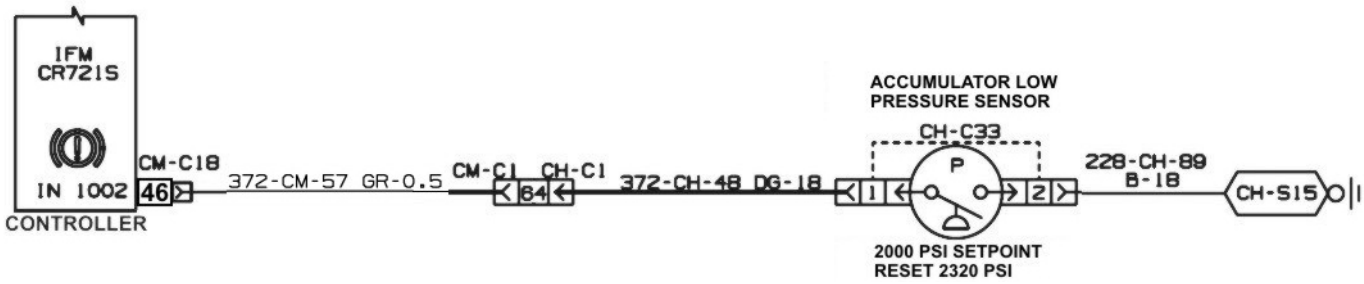

Fig. 111: Low Pressure Accumulator Circuit

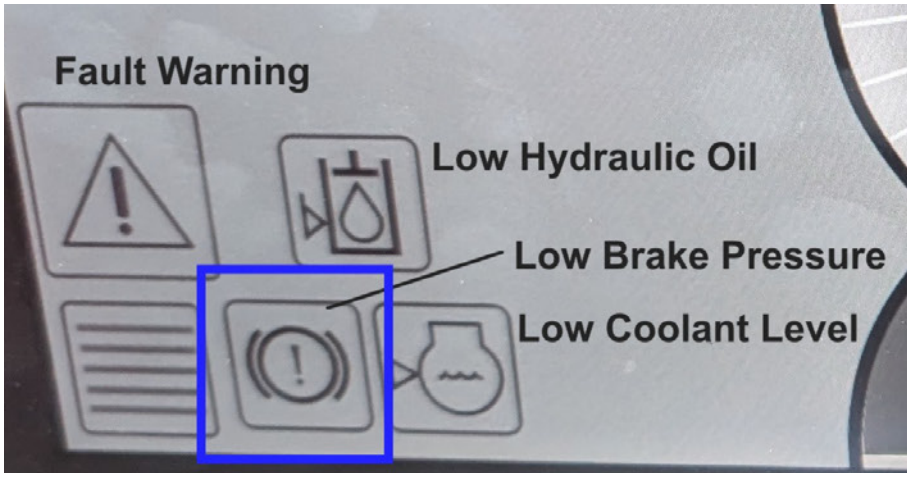

Fig. 112: Low Brake Pressure

MIRROR (HEATED) CIRCUIT

The mirror heating elements are controlled by the heated mirror switch (Fig. 113: Mirror Switches). The battery voltage for operation of the heater switch is routed from the switched power circuit and fuse B20 (15A) to the heater switch terminal 2. When the momentary switch is placed in the ON position, battery voltage is momentarily routed from the switch terminal 1 to a time delay relay coil terminal 86. The relay coil is grounded at terminal 85 by a ground circuit from the cab ground stud. The battery voltage at terminal 86 and ground at terminal 85 energizes the relay for 20 minutes. Battery voltage is also routed from the switched power circuit and fuse B20 to the relay terminals 87A and 30. When the relay is energized, battery voltage is routed from the relay terminal 87 to the heated mirrors elements terminal 2. The heated mirror elements are grounded at terminal 1 by a ground circuit from the cab ground stud.

If necessary, see Fuses And Relays on page 19 to locate fuses.

The time delay relay remains energized for 20 minutes allowing the mirror elements to warm the mirrors. After 20 minutes the relay times out, de-energizes, and battery voltage is no longer routed to the heated mirror elements.

Fig. 113: Mirror Switches

Fig. 114: Heated Mirror Circuit shows the heated mirror circuit.

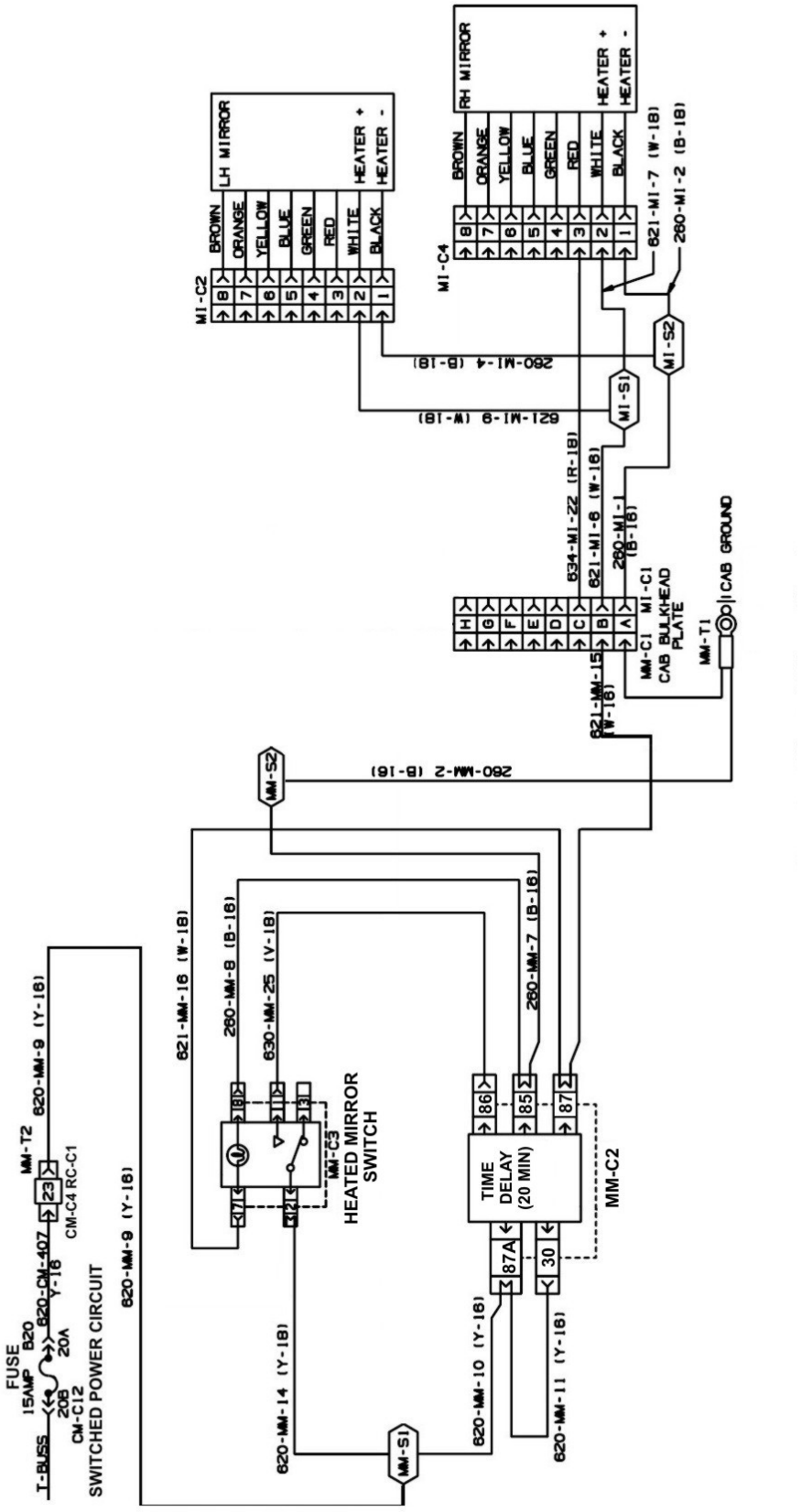

Fig. 114: Heated Mirror Circuit

MIRROR (MOTORIZED) CIRCUIT

The left and right motorized mirrors are controlled by the left-hand and right-hand mirror switches (Fig. 115: Mirror Switches). The battery voltage for operation of the switches is routed from the switched power circuit and fuse B20 (15A) to the mirror switches terminal 1. The mirror switches are grounded at terminals 2 and 9. The mirror motors are powered by a 12 V circuit from the switch terminal 7 to the mirror motors at terminal 3.

If necessary, see Fuses And Relays on page 19 to locate fuses.

The ground for operation of the mirror motors is routed from the mirror switches terminals 3, 4, 5, 6 and 8, depending on the position of the switch. The ground at the mirror pins and power at terminal 3 causes the mirror motor to rotate to the desired position.

Fig. 115: Mirror Switches

Fig. 116: Motorized Mirror Circuit shows the motorized mirror circuit.

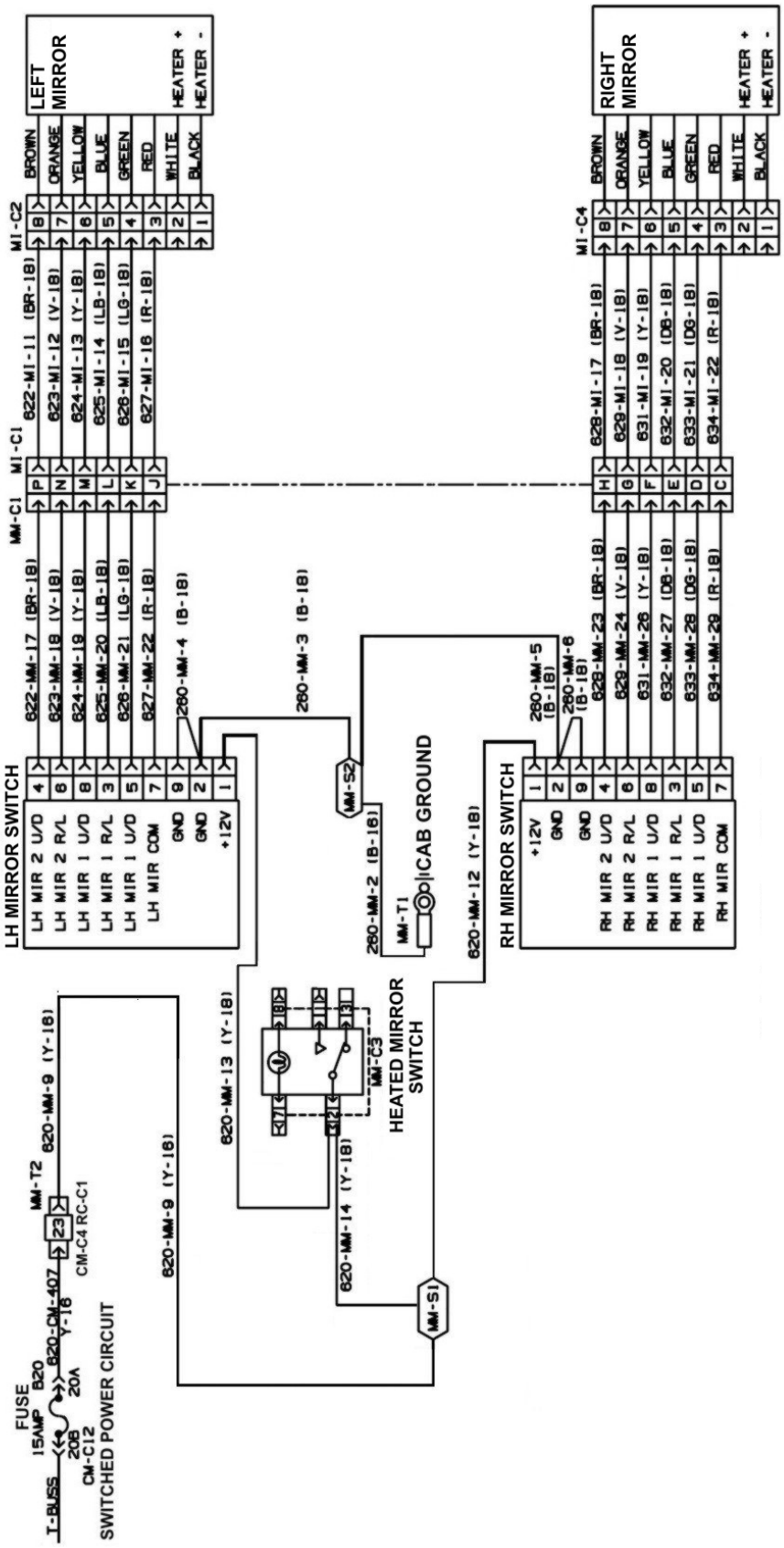

Fig. 116: Motorized Mirror Circuit

PARK BRAKE CIRCUIT

The sweeper park brake is set until hydraulic oil flows to the park brake piston. When hydraulic oil flows to the park brake piston, the park brake releases. When the park brake switch is placed in the ON (applied) position the solenoid is de-energized and closes, preventing hydraulic oil from flowing to the park brake piston. Allowing the internal park brake springs to apply the brake. The park brake pressure switch (Fig. 117: Park Brake Pressure Switch) routes battery voltage to controller CR721S CM-C18 pin 38. The input voltage at CM-C18 pin 38 notifies the control system the park brake is set. The control system causes a park brake set icon to display on the display screen.

The park brake automatically sets when the park brake switch is placed in the ON (applied) position (Fig. 117: Park Brake Pressure Switch). The park brake solenoid is closed (de-energized), blocking the flow of hydraulic oil to the park brake pistons. The park brake also sets when the hydraulic pressure falls below 40 psi.

The park brake releases when the park brake switch is placed in the OFF (released) position. The park brake solenoid energizes and hydraulic oil flows to the park brake pistons overriding the internal springs holding the brake in the applied position.

The battery voltage for operation of the park brake pressure switch is routed from the switched power circuit and fuse B8 (10A) to the park brake pressure switch terminal 1. When the park brake switch is placed in the applied position, the park brake solenoid de-energizes, removing hydraulic pressure from the park brake piston circuit and closing the park brake pressure switch. When closed, battery voltage is routed through the pressure switch and terminal 2 to controller CR721S CM-C18 pin 38.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

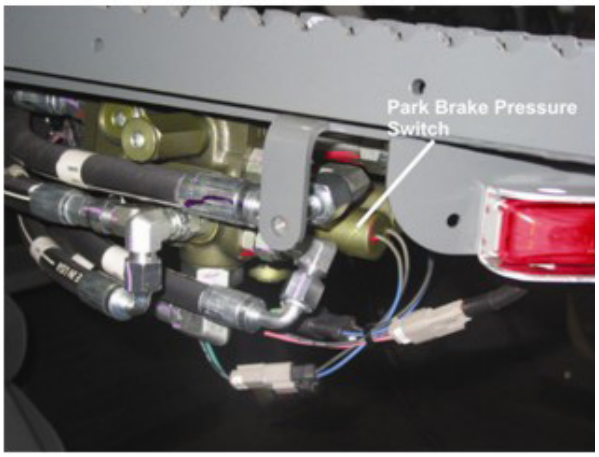

Fig. 117: Park Brake Pressure Switch

Fig. 118: Park Brake Switch

Fig. 119: Park Brake Circuit shows the park brake circuit.

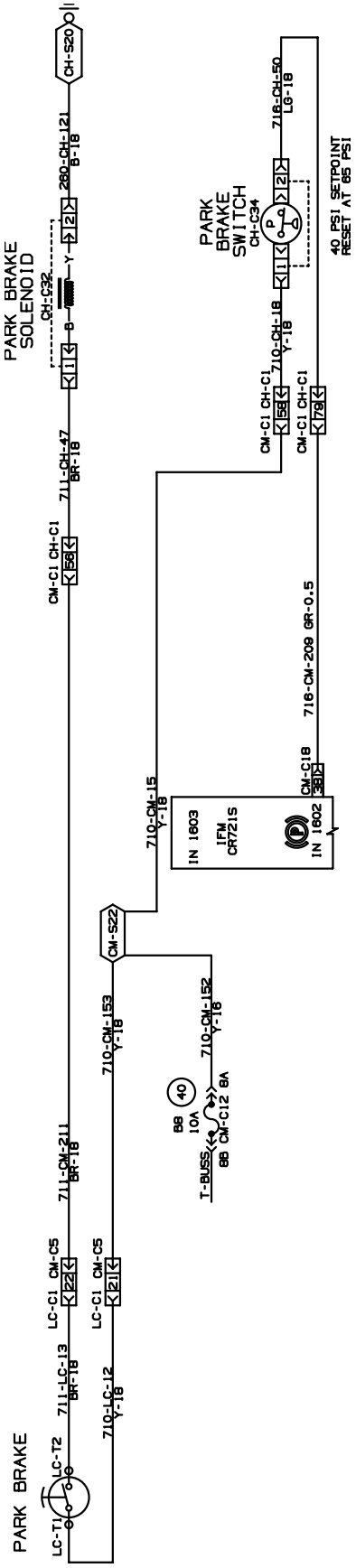

Fig. 119: Park Brake Circuit

The illumination of the parking brake icon (Fig. 120: Park Brake) indicates the parking brake switch is closed and voltage has been routed from the park brake pressure switch terminal 2 to controller CR721S CM-C18 pin 38. If the parking brake icon is not illuminated, with park brake switch ON, check for battery voltage at the park brake switch terminals LC-T1 and LC-T2. Also check for voltage at the park brake pressure switch terminal 1 and terminal 2. Check the operation of fuse B8 (10A). Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between the park brake pressure switch terminal 2 and controller CR721S CM-C18 pin 38.

NOTICE

In order to start the sweeper, the sweeper must detect a park brake signal.

Fig. 120: Park Brake

PROPEL PUMP EDC CIRCUIT
P0101, P0111

Fig. 121: Propel Pump Circuit shows the propel pump circuit.

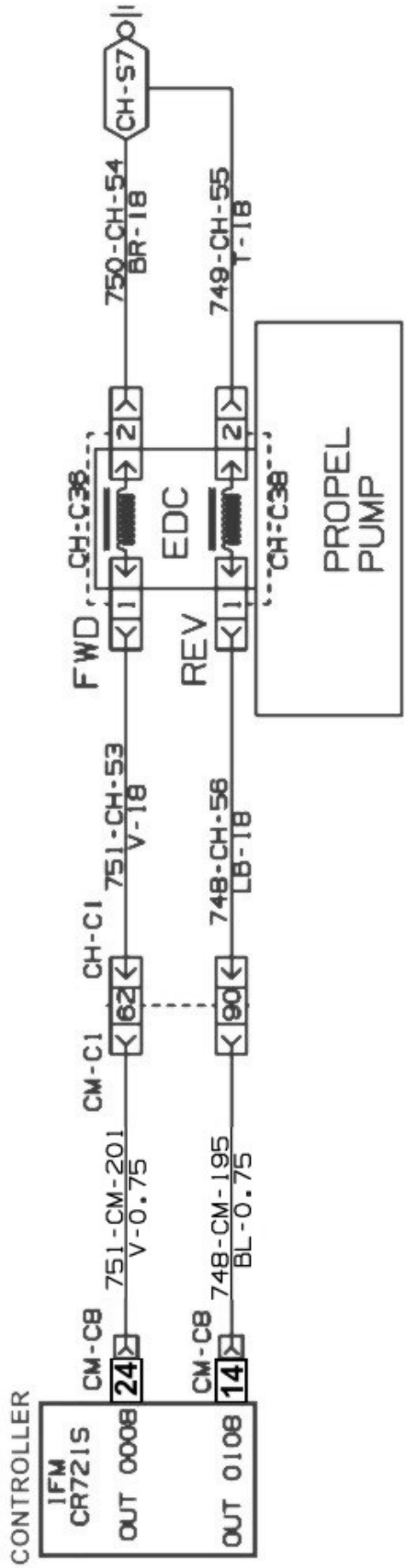

Fig. 121: Propel Pump Circuit

The sweeper drive direction and speed are controlled by the propel pump electronic displacement control (EDC). The EDC is a current-driven control device that uses pulse width modulation (PWM) signal to control current flow to the EDC coils. When the left or right foot pedals are placed in the forward or reverse position, the input to controller CR721S causes the control system to route a PWM output to the forward or reverse EDC solenoid terminal 1. Because the solenoids are grounded at terminal 2, the solenoid pin nudges the porting spool pressurizing one end of the servo piston while draining the other end. The pressure differential at the servo piston moves the swashplate to the appropriate position.

Fig. 122: Wheel Motor shows the wheel motor.

Fig. 123: Foot Pedal Connector shows the foot pedal connector.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

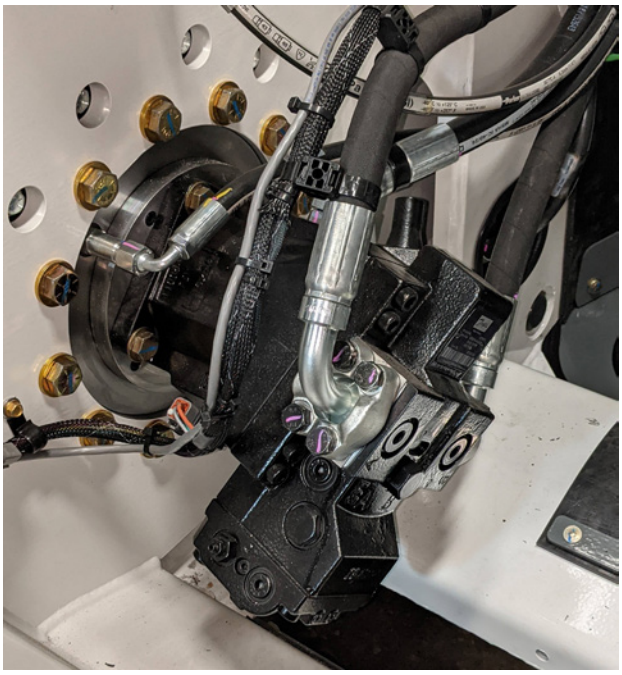

Fig. 122: Wheel Motor

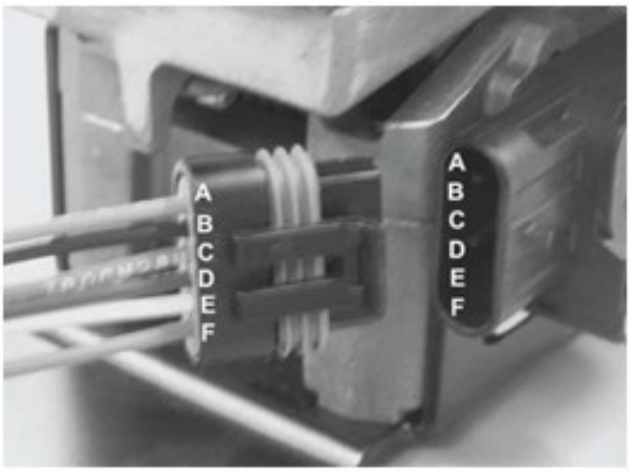

Fig. 123: Foot Pedal Connector

The illumination of the right pedal reverse (Right Pedal Rev), right pedal forward (Right Pedal Fwd), left pedal reverse (Left Pedal Rev) or left pedal forward (Left Pedal Fwd) (Fig. 124: Propel Pump EDC) indicates the foot pedal is in either forward or reverse position. The system uses the pedal position (left/right pedal) input for EDC output. It uses the L/R FWD/REV inputs as safety rationality inputs. In pedal forward position, input has been received from the pedal FWD switch. In pedal reverse position, input has been received from the pedal REV switch. The propulsion screen also displays the forward EDC (Fwd Drive Mot) and reverse EDC (Rev Drive Mot) amperage output. Check for a ground circuit at the forward and reverse EDC coils terminal 2. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- Forward EDC Electrical Fault – P0101-11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 24 and the propel pump EDC coil terminal 1. Use a multimeter to check for a ground circuit at the propel pump EDC coil terminal 2. Check the EDC coil for corrosion and damage. Use a multimeter to check the EDC solenoid coil resistance for 3.66 Ω at 68°F (20°C).

- Reverse EDC Fault – P0111-11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 14 and the propel pump EDC coil terminal 1. Use a multimeter to check for a ground circuit at the propel pump EDC coil terminal 2. Check the EDC coil for corrosion and damage. Use a multimeter to check the EDC solenoid coil resistance for 3.66 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

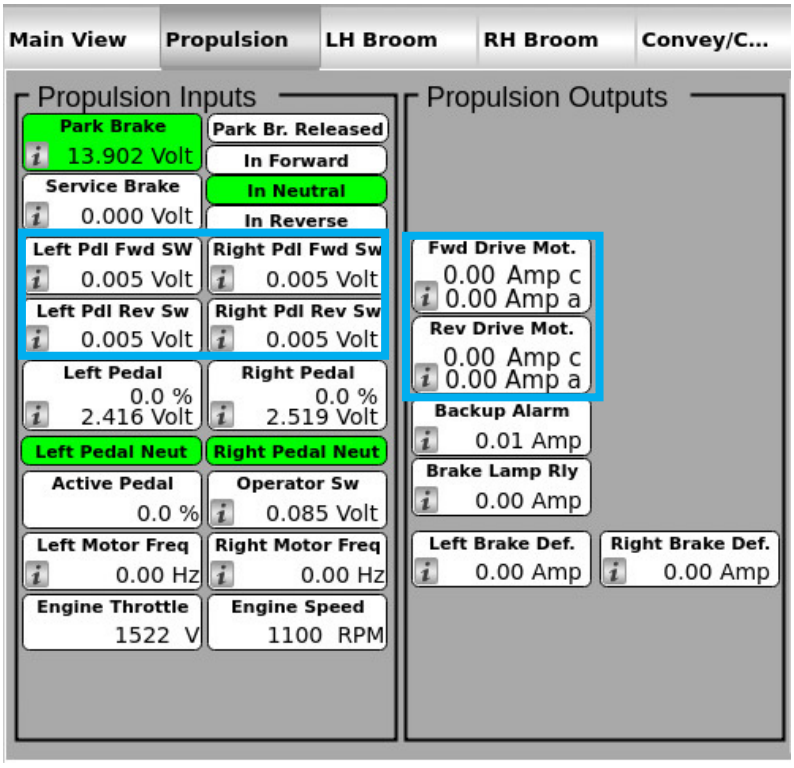

Fig. 124: Propel Pump EDC

OPERATOR POSITION SWITCH CIRCUIT
X0160

The Pelican sweeper can be operated from the left operator position or the right operator position. Some system controls require wiring harness and wiring circuits to be switched from the left operator's position to the right operator's position and back, as needed. The switch is a two-position latching switch. The operator position switch notifies the control system which operator position is selected and in-use.

The operator position switch affects the following functions:

- Turn Signal Circuit (Left and Right Steering Column) on page 126
- Hazard Warning Lights on page 130
- Horn Circuit on page 134
- High/Low Beam function of headlights (see Headlamps and Park Lamps on page 135)

Fig. 125: Operator Position Switch

The battery voltage for operation of the operator position switch (Fig. 125: Operator Position Switch) is routed from the switched power circuit and fuse B7 (10A) to the operator position switch terminal 2. When the operator switch is placed in the LEFT position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C8 pin 37. The input at CM-C8 pin 37 notifies the control system the left-side operator's position has been selected. Selecting the RIGHT position removes power from CM-C8 pin 37.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 126: Operator Position Switch Circuit shows the operator position switch circuit.

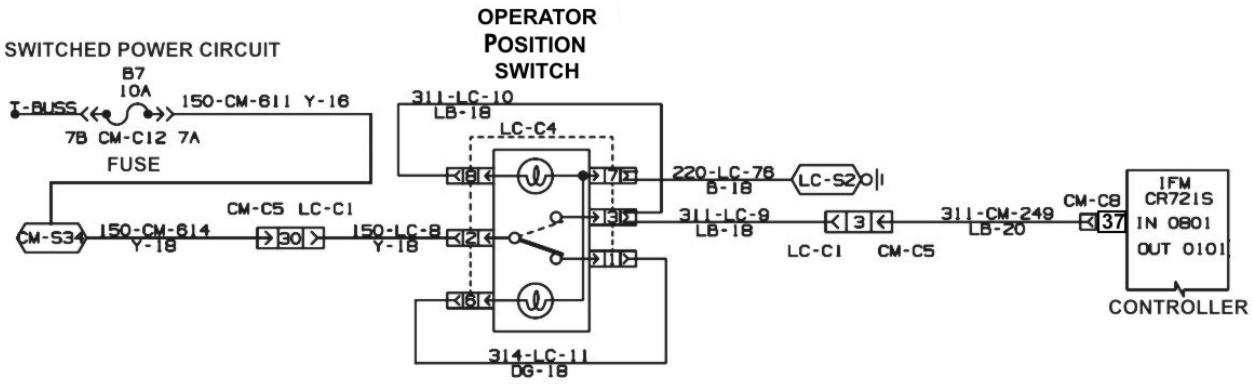

Fig. 126: Operator Position Switch Circuit

The illumination of the left-side drive mode (Left Drive Mode) or right side drive mode (Right Drive Mode) indicator (Fig. 127: Operator Position) shows which operator position is selected.

Check for voltage input at the switch terminal 2 and voltage output at terminal 3 with the switch in the left-side position.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check circuit connections.

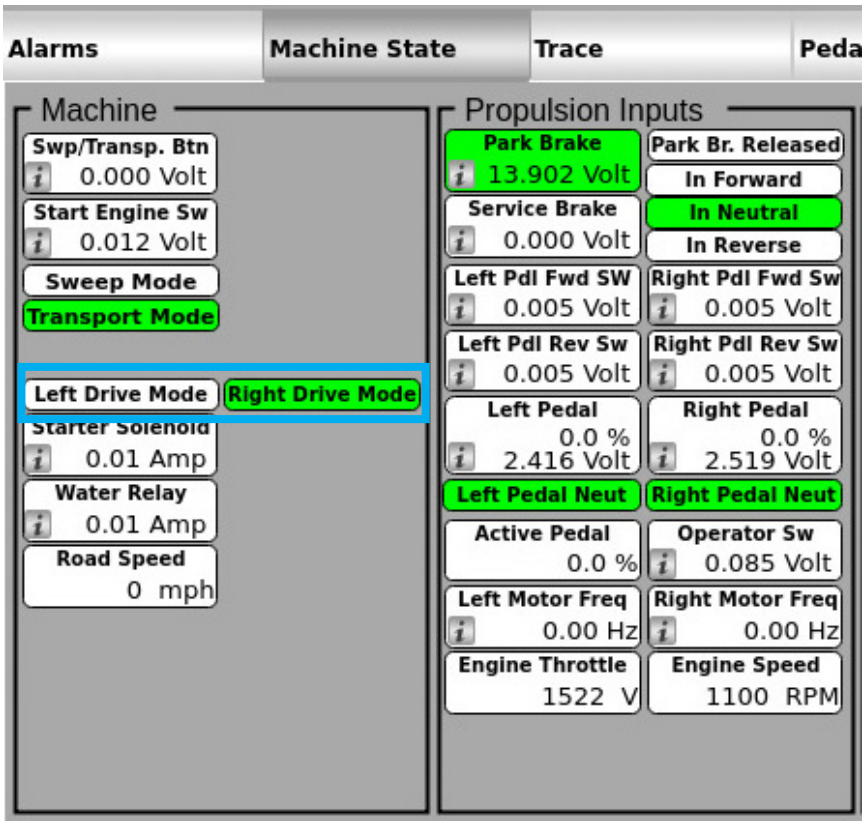

Fig. 127: Operator Position

Turn Signal Circuit (Left and Right Steering Column)

The right and left steering column turn signals are controlled by the right and left steering column turn signal switch, flasher module, and the flashers relay.

See the following:

- Fig. 128: Turn Signal Circuit Sheet 1 on page 127
- Fig. 129: Turn Signal Circuit Sheet 2 on page 128

The battery voltage for operation of the turn signals is routed from the battery power circuit and fuse A3 (20A) to the flasher module terminal 87 through the flasher module terminal 85 to the flasher relay terminal 3. See Operator Position Switch Circuit on page 124.

When a demand for voltage is placed on the flasher module by the turn signal switch (left or right), the flasher module routes intermittent battery voltage from the flasher module terminal 85 through the flasher relay terminals:

- 3 and 4 to the right steering column turn signal switch
- 3 and 5 to the left steering column turn signal switch

Placing the turn signal switch in either the left or right signal position causes the demand on the flasher module. The intermittent battery voltage is routed from the turn signal switch through diodes to the left or right rear turn lamps terminal C and the front turn lamps terminal 5. Because the turn signal lamps are grounded by a ground circuit from ground splice EC-S2 (rear turn signals terminal A) and CH-S24 (front turn signals terminal 1) the turn signals illuminate.

The battery voltage from the turn signal switch is also routed to:

- Controller CR721S CM-C18 pin 25 for the right turn signal. The input at CM-C18 pin 25 causes the control system to display the right turn signal icon on the display screen.
- Controller CR721S CM-C18 pin 26 for the left turn signal. The input at CM-C18 pin 26 causes the control system to display the left turn signal icon on the display screen.

If necessary, see Fuses And Relays on page 19 to locate fuses.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

NOTICE

The right steering column turn signal can operate when the ignition key is on the off position.

Fig. 128: Turn Signal Circuit Sheet 1 shows sheet 1 of the right steering column turn signal circuit.

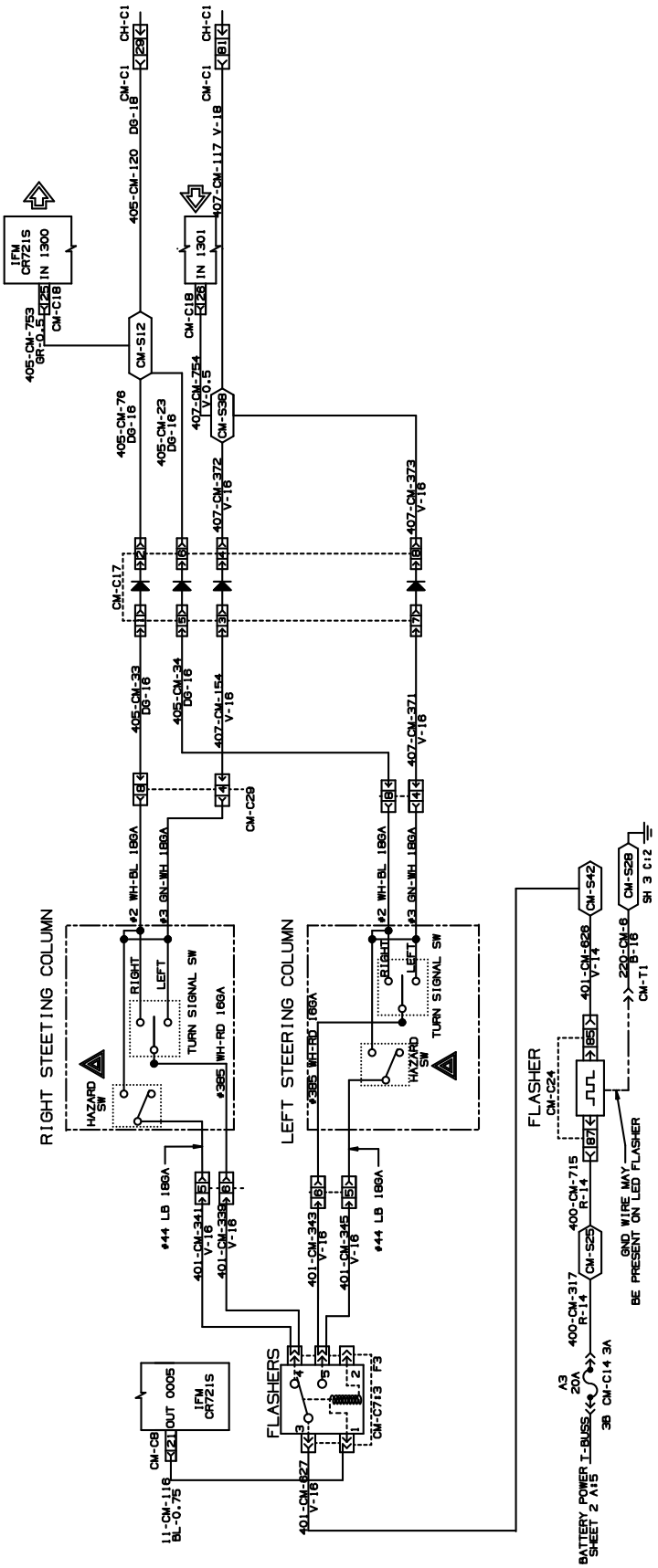

Fig. 128: Turn Signal Circuit Sheet 1

Fig. 129: Turn Signal Circuit Sheet 2 shows sheet 2 of the left and right steering column turn signal circuit.

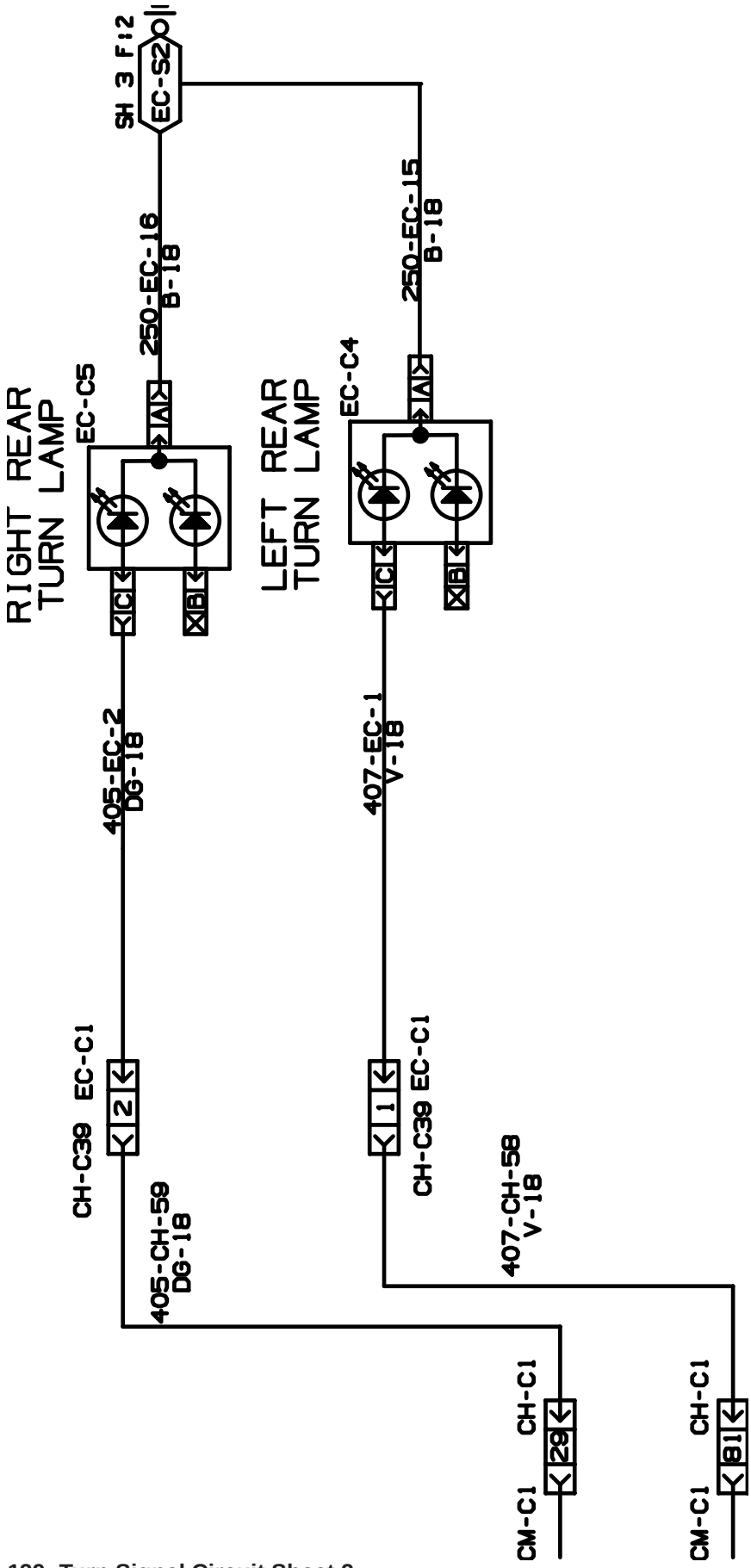

Fig. 129: Turn Signal Circuit Sheet 2

The illumination and flashing of the display right or left turn signal icon indicates the flasher relay, turn signal switch and flasher module are operational and voltage has been routed from the switch to the controller CM-C18 pin 25 (right turn signal) or CM-C18 pin 26 (left turn signal). See Fig. 130: Turn Signals.

Fault Codes:

- Operator Stalk Select relays – X0160-05, 06 and 12

The fault code does not determine which relay has failed.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 21 and the headlamp relay terminal 1. Use a multimeter to check for a ground circuit at the relay terminal 2.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

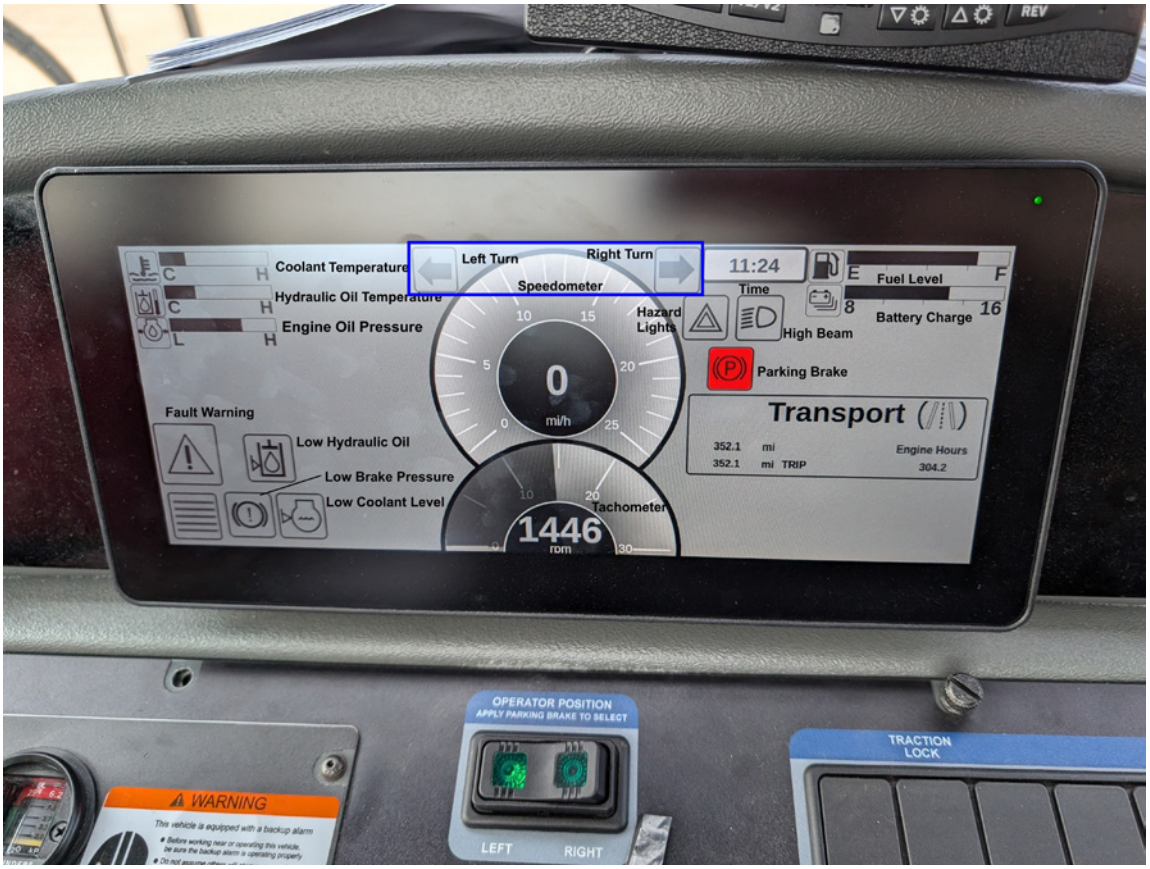

Fig. 130: Turn Signals

Hazard Warning Lights

The hazard warning lights (Fig. 131: Rear Lights and Fig. 132: Headlamp) are controlled by the flashers relay, hazard switch and the flasher module. The position of the flasher relay is controlled by the control system. The default flasher relay de-energized position is the right-side operator position. When the operator position switch is placed in the left position, the control system routes battery voltage from controller CR721S CM-C8 pin 21 to the flashers relay terminal 1, energizing the relay. The intermittent battery voltage for operation of the flashers relay is routed from the flasher module terminal 87 to the flasher relay terminal 3. The battery voltage for operation of the flasher module is routed from the battery power circuit and fuse A3 (20A) to the flasher module terminal 85.

When a voltage demand is placed on the flasher, the intermittent voltage is routed from the flasher module to the flasher relay. When the hazard switch is placed in the ON position, intermittent battery voltage is routed through the de-energized flasher relay terminals 3 and 4 (for the right column) or flasher relay terminals 3 and 5 (for the left column) to pin 5 on the right or left steering column stalk switch. When the hazard switch is ON, power passes out of pin 4 and 8 and through an inline diode to left and right turn lamps terminal C. Because the turn lamps are grounded at terminal A by a ground circuit from ground splice EC-S2, the turn lamps illuminate intermittently. The battery voltage is also routed from the hazard switch to controller CR721S CM-C18 pin 25 and 26. The input voltage at CM-C18 pin 25 and 26 notifies the control system the hazard switch is in the ON position. The controls system then causes a flasher icon to display on the display screen.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 131: Rear Lights

Fig. 132: Headlamp

Fig. 133: Hazard Circuit Sheet 1 on page 131 shows sheet 1 of the hazard circuit.

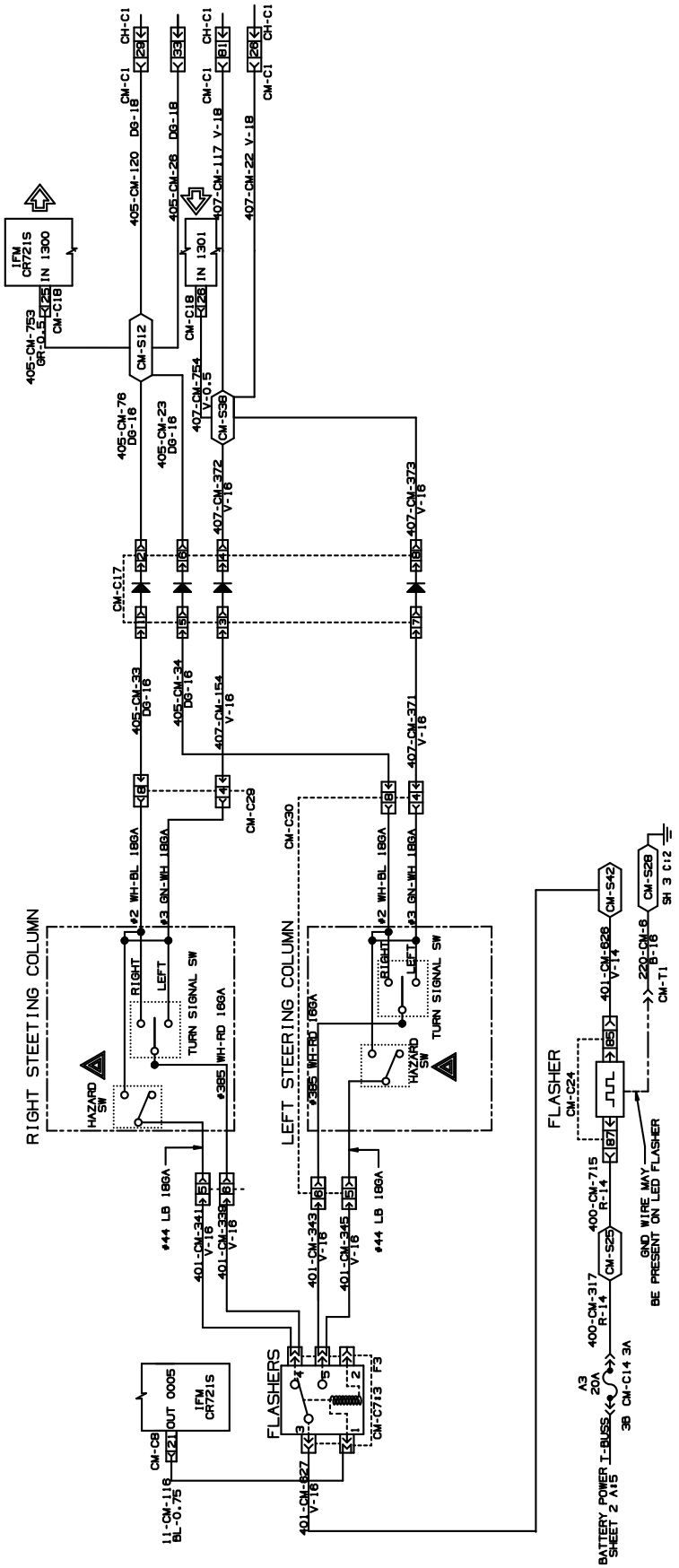

Fig. 133: Hazard Circuit Sheet 1

Fig. 134: Hazard Circuit Sheet 2 shows sheet 2 of the hazard circuit.

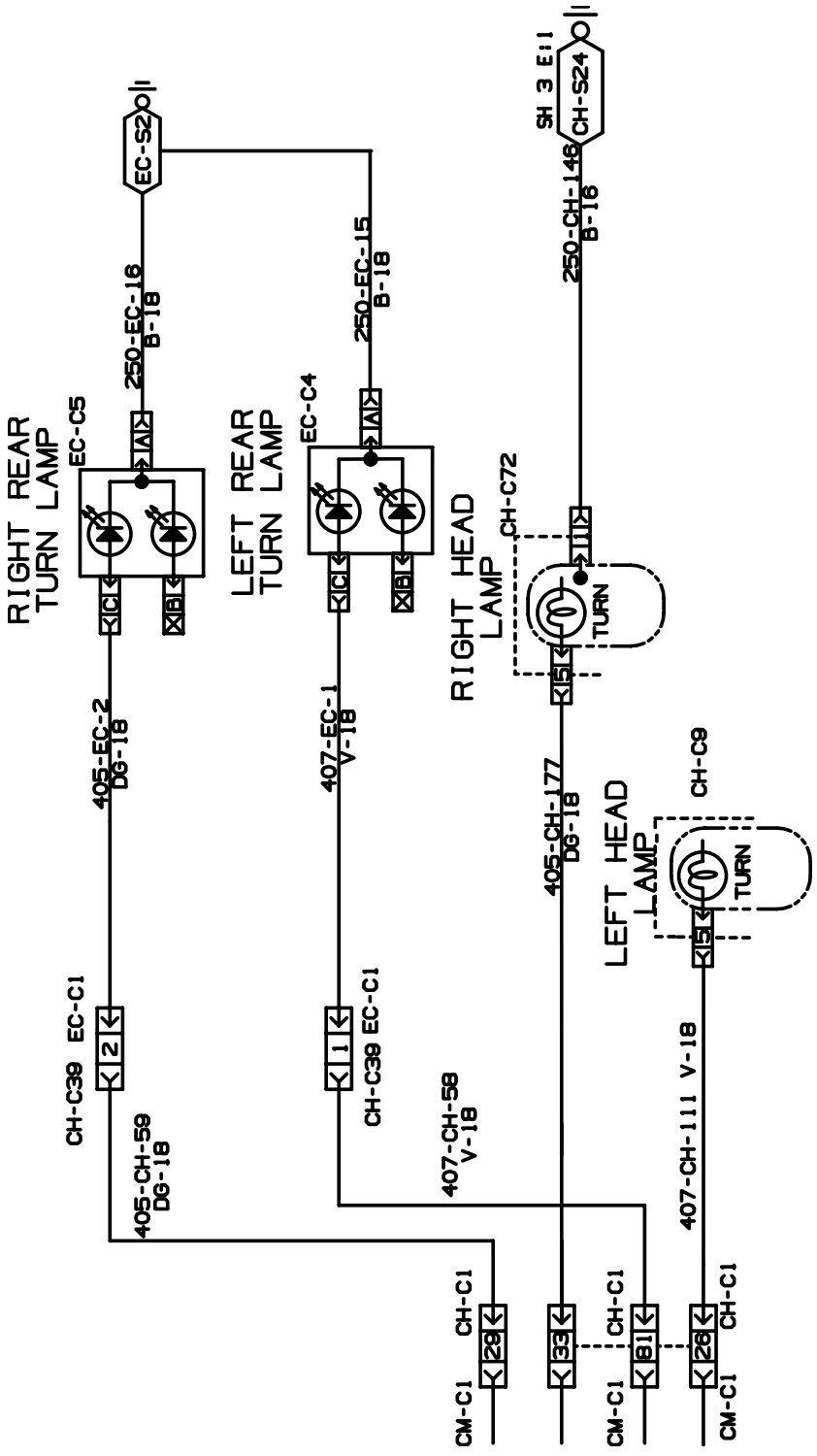

Fig. 134: Hazard Circuit Sheet 2

The illumination of the hazard icon on the display screen (Fig. 135: Hazard Lights) indicates voltage has been routed from the relay routing voltage from the flashers terminal 5 to the hazard switch input terminal. The switch routes voltage from the switch output terminal to controller CR721S CM-C18 pin 25 and 26, notifying the control system the hazard lights are on. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes:

- Operator Stalk Select relays – X0160-05, 06 and 12

The fault code does not determine which relay has failed.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 21 and the headlamp relay terminal 1. Use a multimeter to check for a ground circuit at the relay terminal 2.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

Fig. 135: Hazard Lights

Horn Circuit

The horn is controlled by the left and right steering column horn buttons

The horn relay coil is energized by battery voltage at terminal 86 from fuse 2A (10A). The horn relay coil is grounded by a ground circuit from the normally open right or left horn button:

- When the right switch is pressed (closed) the ground is routed through the switch terminal CM-T6 to the horn relay terminal 85 energizing the horn relay.
- When the switch is pressed (closed) the frame ground is routed through the switch terminal CM-T7 to the horn relay terminal 85 energizing the horn relay.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

See Fig. 136: Horn Circuit.

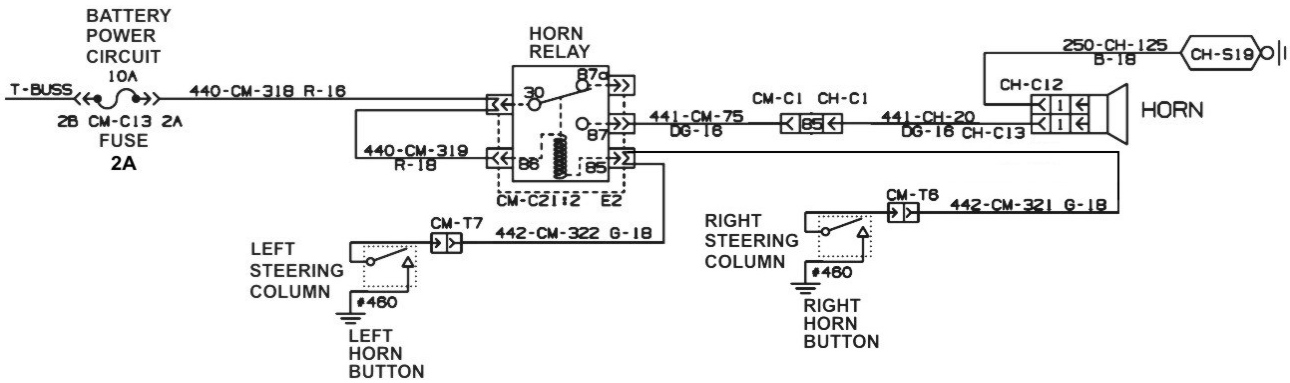

Fig. 136: Horn Circuit

HEADLAMPS AND PARK LAMPS
X0160

The sweeper headlamps (Fig. 137: Headlamps) and park lamps (Fig. 138: Rear Lights and Beacons) are controlled by the headlamps switch. The battery voltage for operation of the headlamps switch is routed from the battery power circuit and fuse B4 (15A) to the headlamps switch terminals 2 and 5.

When the headlamps switch is placed in the PARKING or HEADLAMP position, battery voltage is routed from the switch terminal 3 to the left and right side park-lamps and marker lights. Because the lamps are grounded by a ground circuit from ground splice (CH-S24 right, CH-S19 left) the lamps illuminate.

In the HEADLAMP position, battery voltage is also routed from the headlamps switch terminal 6 to the headlamps relay terminal 3. The relay is controlled by the operator position switch. The default (de-energized) position of the relay is for the right operator position. See Operator Position Switch Circuit on page 124. In the energized position, the battery voltage is routed through the headlamps relay and terminal 5 to the headlamps high/low beam switch on the left column.

In the low beam position, the battery voltage is routed to the left and right low beam headlamps terminal 2.
In the high beam position the battery voltage is routed to the left and right high beam headlamps terminal 3 and controller CR721S CM-C18 pin 27. The input at the controller CM-C18 pin 27 causes the control system to illuminate the high beam icon on the display screen. The battery voltage at the headlamps causes the headlamps to illuminate because the headlamps are grounded by a ground circuit from ground splice (CH-S24 right, CH-S19 left) to the headlamps terminal 1.

When the operator position switch is placed in the right-side position the headlamps relay is de-energized and the headlamps circuits are controlled by the right side steering column and dimmer switch.

The optional ID lights are shown in the ID lights circuit schematic along with wiring circuits:

- Fig. 139: Headlamp Parklamp Switch and Circuit Sheet 1 on page 136
- Fig. 140: Headlamp Parklamp Switch and Circuit Sheet 2 on page 137
- Fig. 141: Park Lamp and I.D. Lights Circuit on page 137

Fig. 137: Headlamps

Fig. 138: Rear Lights and Beacons

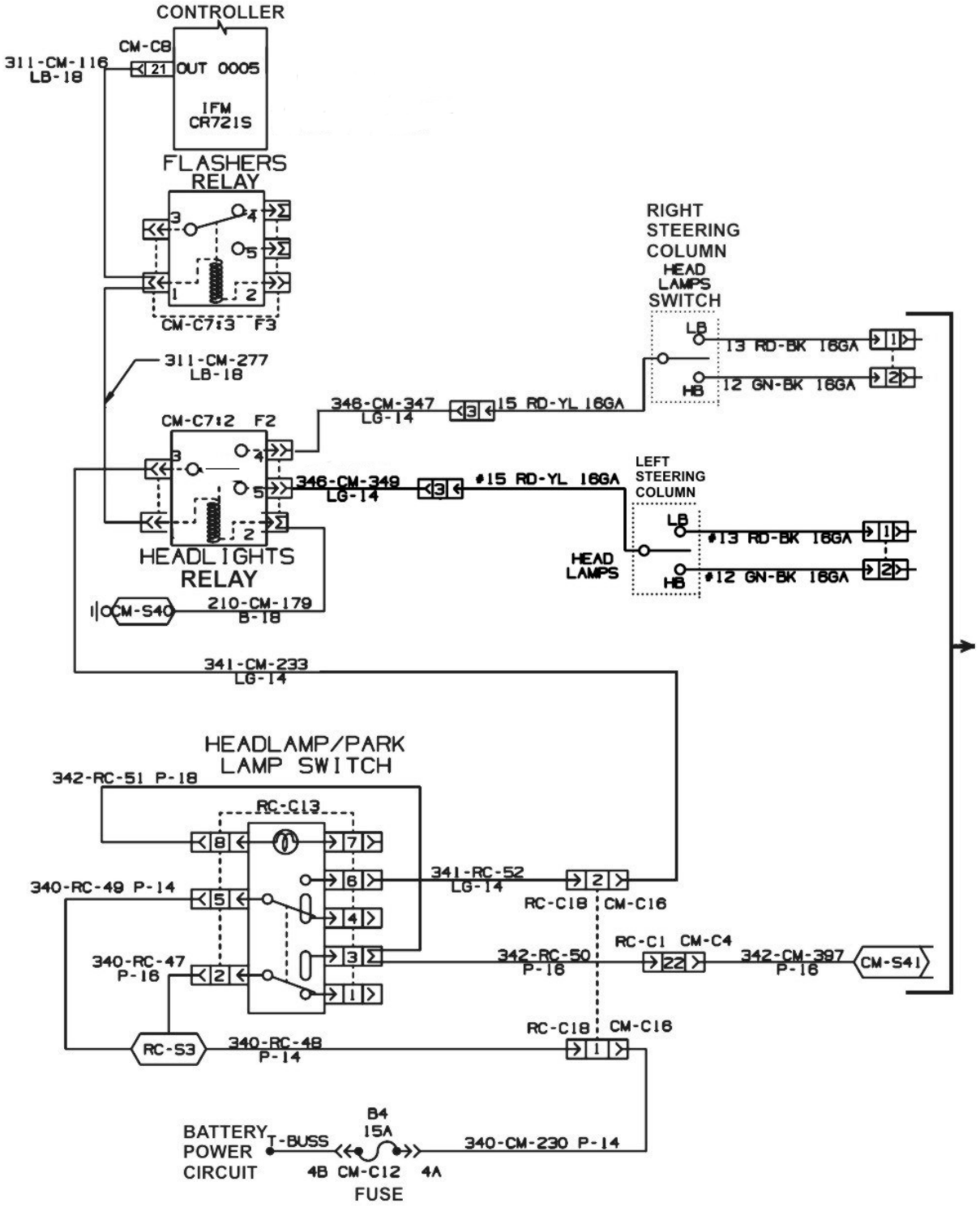

Fig. 139: Headlamp Parklamp Switch and Circuit Sheet 1

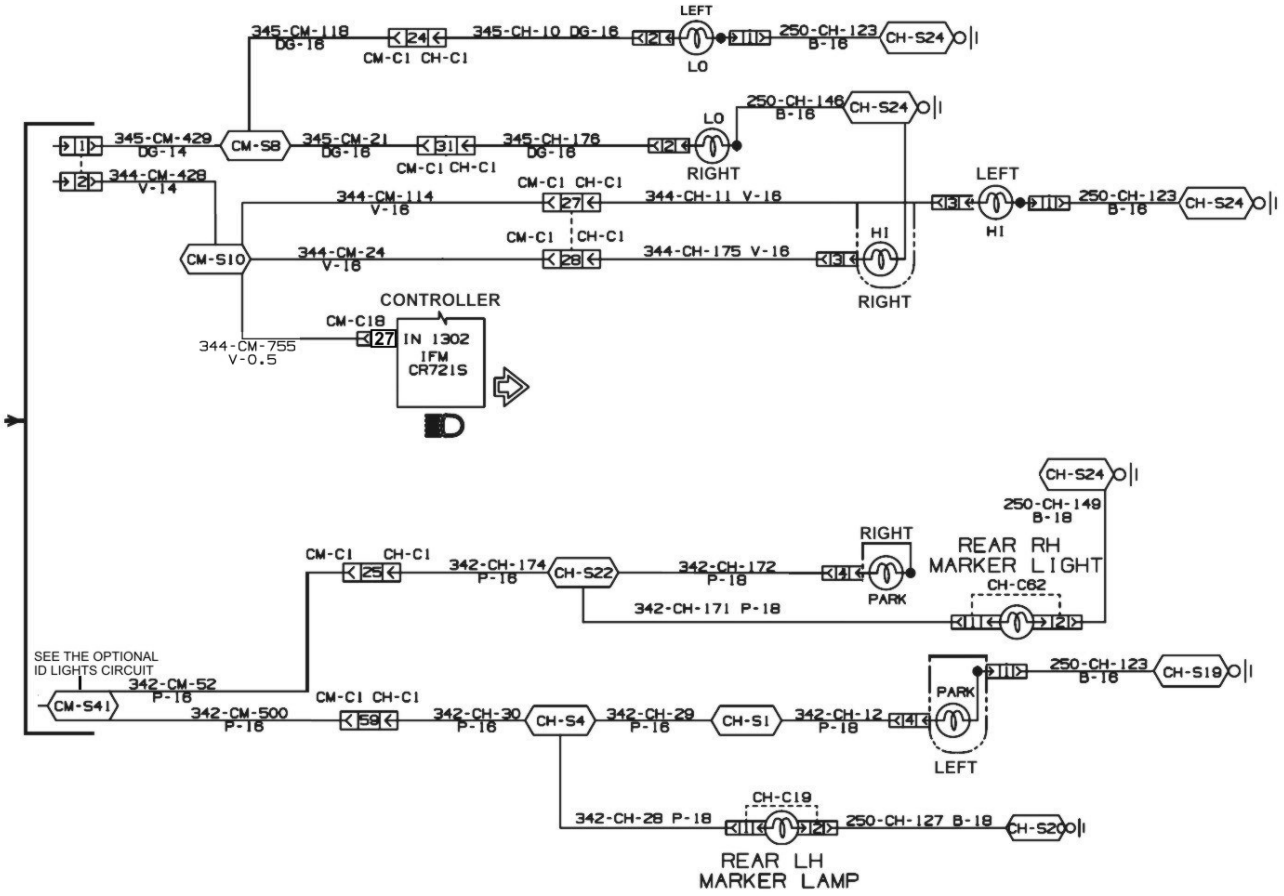

Fig. 140: Headlamp Parklamp Switch and Circuit Sheet 2

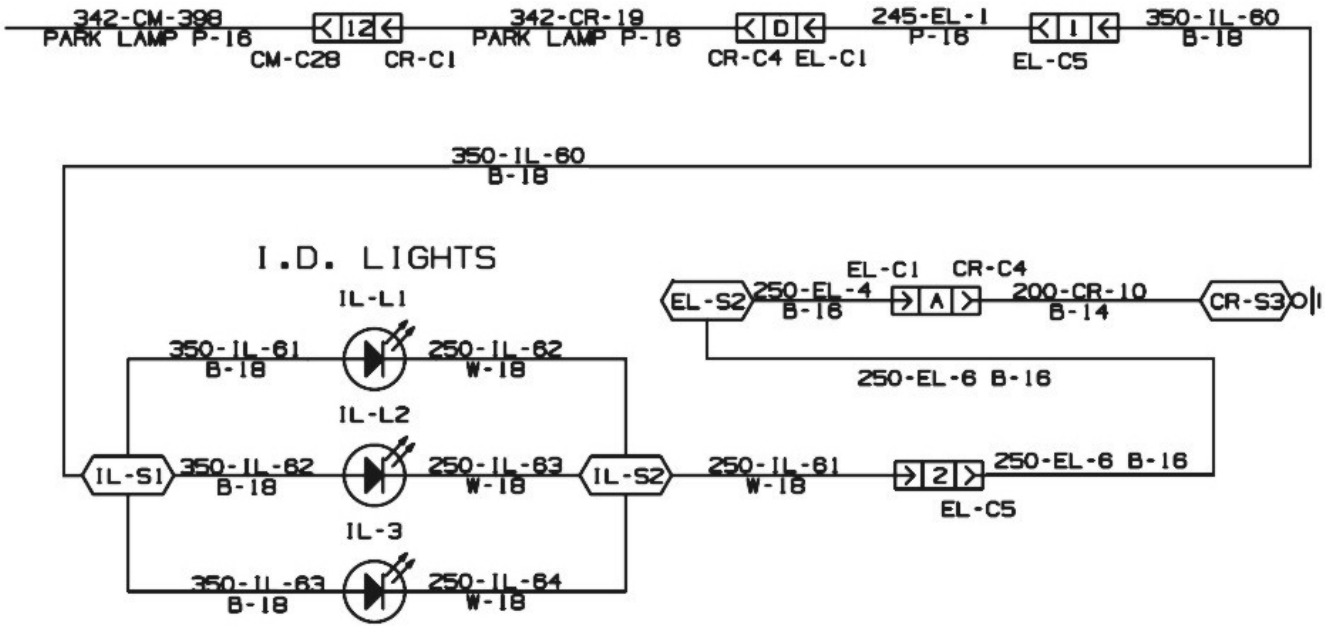

Fig. 141: Park Lamp and I.D. Lights Circuit

The illumination of the high beam icon (Fig. 142: High Beams) indicates the headlamps relay, flashers relay and headlamp/park lamp switch are operational. The output from controller CR721S CM-C8 pin 21 is also routing voltage from the controller pin 21 to the flashers relay terminal 1 and the headlamps relay terminal 1, with the operator position switch in the left side position for left side operation. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- Headlamp/Parklamp two relays – X0160-05, 06 and 12

The fault code does not determine which relay has failed.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 21 and the flashers relay and headlamp relay terminal 1. Use a multimeter to check for a ground circuit at the relays terminal 2 and output voltage at terminal 5.
See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

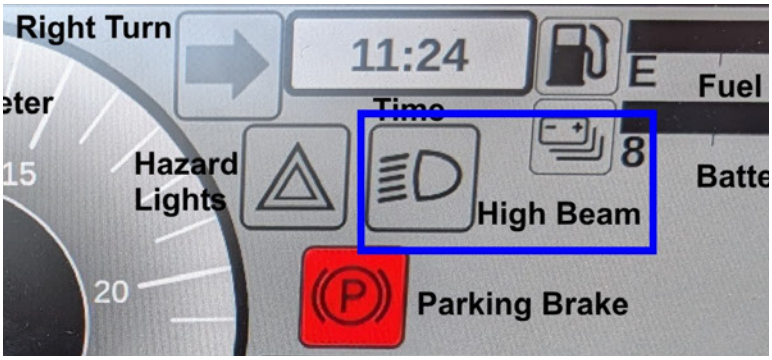

Fig. 142: High Beams

ARROWSTICK CIRCUIT

The arrowstick is controlled by the arrowstick ON/OFF switch. When the ignition switch is placed in the ON position, battery voltage is routed from the ignition switch to the switched power relay, activating the relay. See Ignition Switch Circuit on page 111 and Switched Power Circuit on page 214. The battery voltage is routed from the switched power circuit and fuse C10 (10A) to the ON/OFF switch terminal LA-T1. When the switch is placed in the ON position (Fig. 143: Light Switches), battery voltage is routed through the switch and terminal LA-T2 to a pattern select switch. The operator can use the pattern select switch to select the arrowstick illumination pattern (left, right, or center). The selection causes the arrowstick to illuminate amber. A ground circuit is routed from ground splice LA-S2 to the arrowstick LA-C3 pin 4, completing the circuit.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 144: Arrowstick Circuit shows the arrowstick circuit.

Fig. 143: Light Switches

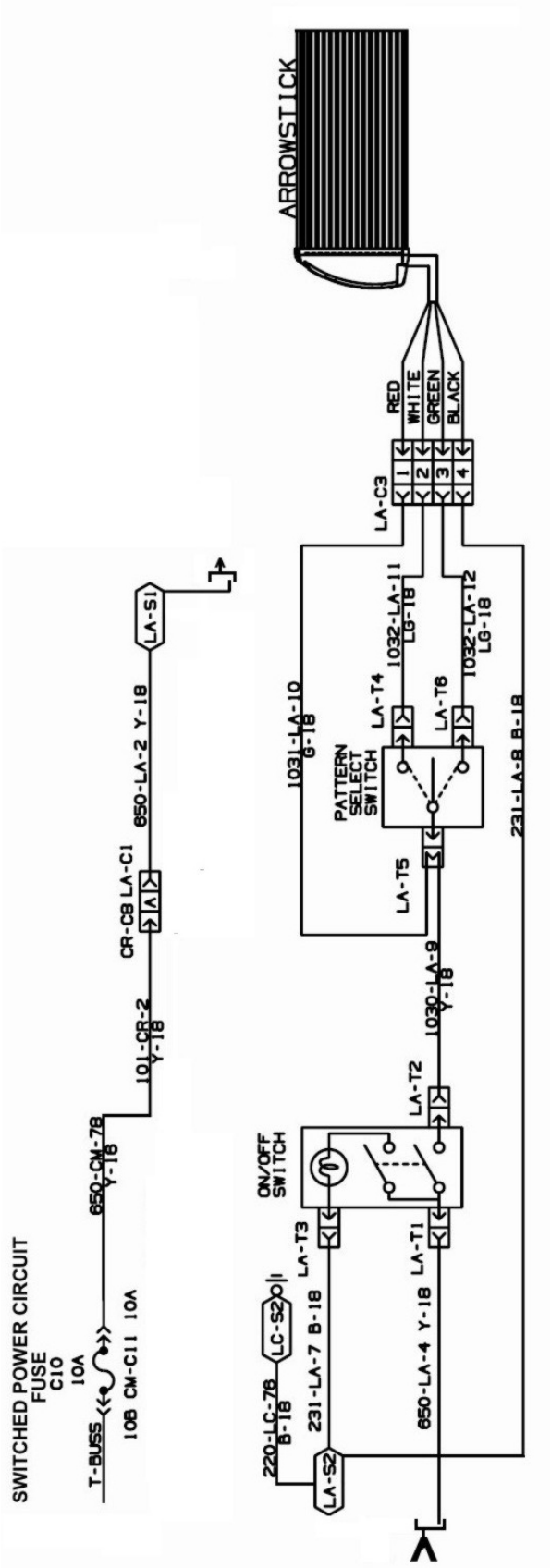

Fig. 144: Arrowstick Circuit

BACKUP/REAR FLOOD LIGHTS CIRCUIT
X0210

The optional backup/rear flood lights circuit provides additional rear lighting when the sweeper travels in the reverse direction. The controller receives a reverse direction signal from the left wheel speed sensor. The input voltage causes the control system to route battery voltage from IFM controller CR721S CM-C8 pin 7 to the backup lamps relay CM C9:5 05 terminal 1. The relay is grounded at terminal 2 by a ground circuit from ground splice CM-C32 and ground boss GB-5. The input voltage at the relay terminal 1 and ground at terminal 2 energizes the relay. When energized, battery voltage routes from the switched power circuit and fuse B17 (10A) to the backup lamps relay terminal 3 through the relay and terminal 5 to the flood lamps terminal 1. The battery voltage at terminal 1 and a ground circuit from ground splice EC-S2 at terminal 2 causes the rear lamps to illuminate.

The backup rear flood lights can also be controlled by the backup rear flood lights switch. The battery voltage for operation of the switch is routed from the switched power circuit and fuse B17 (10A) to the switch terminal 2. When the switch is placed in the ON position, battery voltage is routed from the switch terminal 3 to the rear lamps terminal 1. The battery voltage at terminal 1 and a ground circuit from ground splice EC-S2 at terminal 2 causes the rear lamps to illuminate. See Fig. 145: Backup Rear Flood Lights Circuit.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

If necessary, see Fuses And Relays on page 19 to locate fuses.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: See fault codes X0210-05 (Open Circuit), X0210-06 (Short to Ground) and X0210-12 (Unexpected Voltage on Pin). See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 7 and the backup lamps relay terminal 1. Use a multimeter to check for input voltage at the relay terminal 3. Use a multimeter to check for a ground circuit at the relay terminal 2.

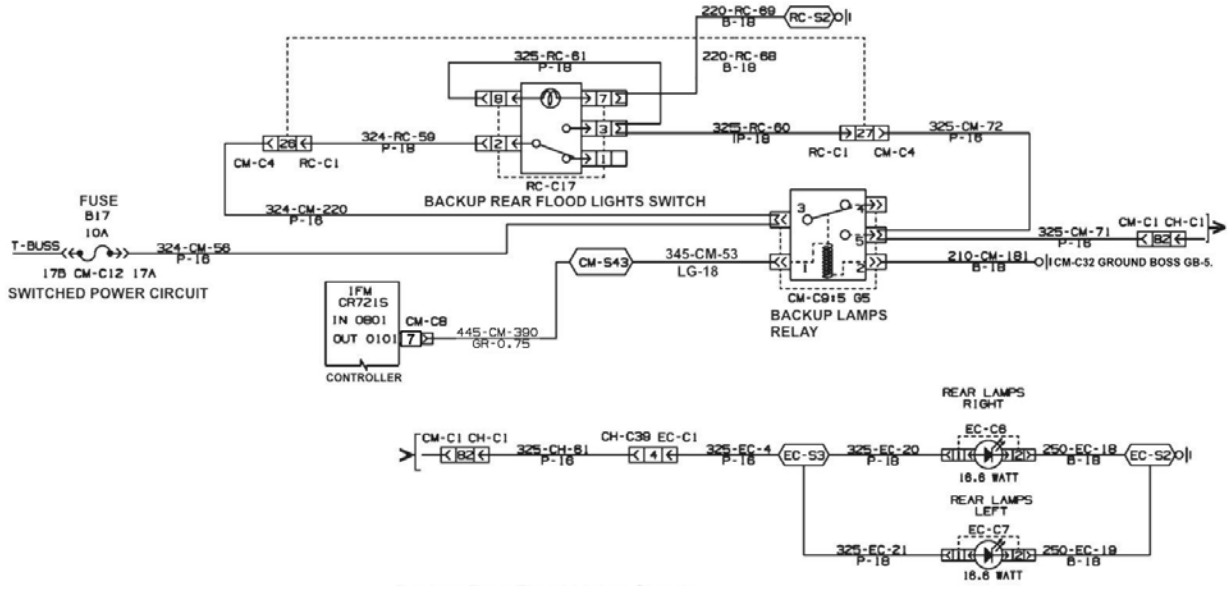

Fig. 145: Backup Rear Flood Lights Circuit

FRONT LED FLOOD LIGHTS CIRCUIT

The LED front flood lights are controlled by the flood light switch (Fig. 147: Light Switches). The battery voltage for operation of the flood lights is routed from the switched power circuit and fuse B16 (10A) to the switch terminal 2. When the switch is placed in the ON position (Fig. 146: Front LED Flood Light Circuit), the battery voltage is routed through the switch and terminal 3 to the LED flood lights terminal 1. Because the flood lights are grounded at terminal 2 by a ground circuit from ground splice CR-S2, the lights illuminate.

Fig. 147: Light Switches

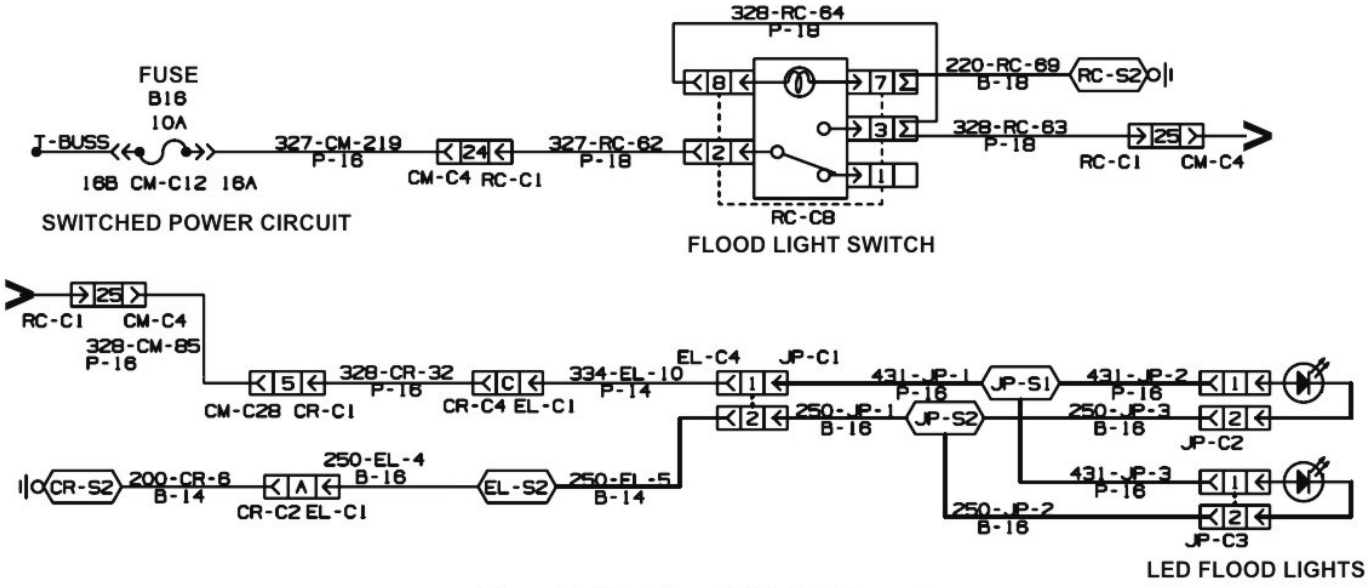

Fig. 146: Front LED Flood Light Circuit

REAR ALTERNATING FLASHING LIGHTS

The optional rear alternating flashing lights (Fig. 148: Rear Lights and Beacons) warn motorized and pedestrian traffic the sweeper is in operation. The lights are controlled by the beacon switch (Fig. 149: Light Switches). The battery voltage for operation of the beacon switch is routed from the battery power circuit and fuse C7 (10A) to the switch terminal 2. When the switch is placed in the ON position, battery voltage is routed through the switch and terminal 3 to the alternating flashing lights terminal 3. The alternating lights are grounded by a ground circuit (Fig. 150: Rear Alternating Flashing Lights Circuit) from ground splice CM-S37 at the lights terminal 1. The ground circuit at terminal 1 and battery voltage at terminal 3 cause the alternating lights to illuminate. The lights are connected at terminal 2 causing the lights to alternate from side to side.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 148: Rear Lights and Beacons

Fig. 149: Light Switches

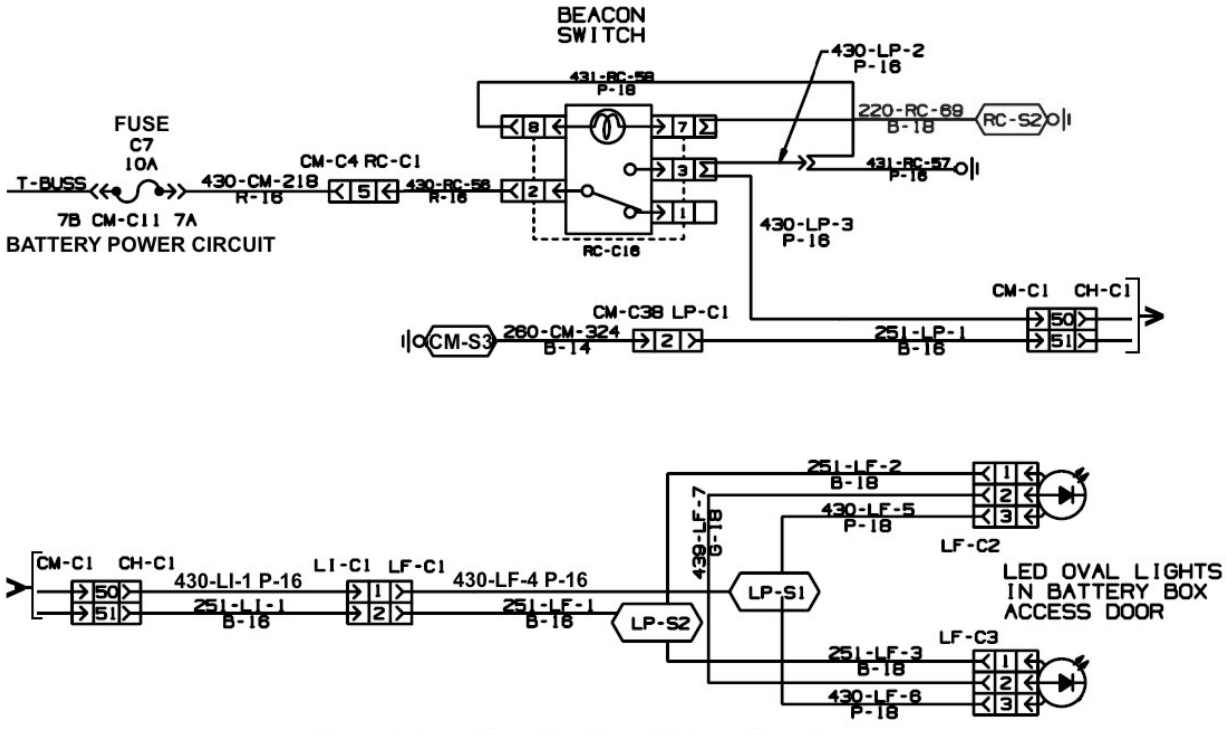

Fig. 150: Rear Alternating Flashing Lights Circuit

BEACON CIRCUIT

The beacons (Fig. 151: Beacons) provide additional notification and protection for traffic and local personnel. The voltage for operation of the beacons is routed from the battery power circuit and fuse C7 (10A) to the beacon switch terminal 2. When the switch (Fig. 152: Light Switches) is placed in the ON position, battery voltage is routed from the switch terminal 3 to the beacons terminal 1. Because the beacons are grounded by a ground circuit at ground splice CR-S2, the beacons illuminate and rotate. See Fig. 153: Beacon Circuit.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 151: Beacons

Fig. 152: Light Switches

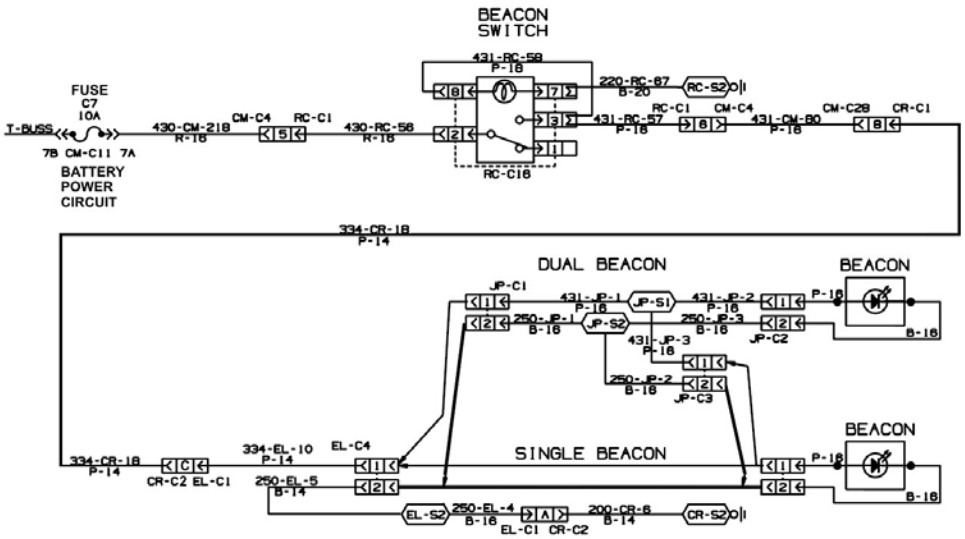

Fig. 153: Beacon Circuit

SWEEP FLASHERS (OPTIONAL) CIRCUIT

The sweep flashers (Fig. 154: Rear Lights) are controlled by the sweep flashers switch (Fig. 155: Light Switches), the sweep flashers relay and the flasher module. The battery voltage for operation of the sweep flashers switch is routed from the battery power circuit and fuse A3 (20A) to the flashers switch terminal 2. When the switch is placed in the ON position battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to the sweep flashers relay terminal 1 energizing the relay.

The intermittent battery voltage for operation of the sweeper flashers relay is routed from the flasher module terminal 85. The relay is grounded at terminal 2. When the relay is energized by voltage from the sweep flashers switch at terminal 1 the intermittent battery voltage at terminal 3 is routed through the relay and terminal 5 to left and right rear sweep lamps and the left and right front sweep lamps terminals 1. Because the sweep lamps are grounded by a ground circuit ground splice CR-S2 (rear lamps) and CR-S3 (front lamps) the sweep flashers illuminate intermittently.

The battery voltage for operation of the flasher module is routed from the battery power circuit and fuse A3 (20A) to the module terminal 87. The flasher module is grounded at terminal CM-T1. When a demand for voltage is made by the sweep flashers circuit the battery voltage is routed intermittently to the sweep lamps.

The output battery voltage from the sweep flashers relay terminal 5 is also routed to controller CR721S CM-C18 pin 28. The input voltage at CM-C18 pin 28 notifies the control system the sweep flashers are operational. The control system causes a flashers icon to appear on the display.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Check for battery voltage at the sweep flashers switch terminal 2. If voltage is not available at the switch terminal 2, check the operation of fuse A3 (20A). Place the switch in the ON position and check for battery voltage at the switch terminal 3. If voltage is available at the switch terminal 3 use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short ground between the switch terminal 3 and the sweep flashers relay terminal 1. Check for a ground circuit at the relay terminal 2. Check for intermittent voltage at the relay terminal 5. If necessary, check for battery voltage from fuse A3 (20A) at the flasher module terminal 67. Check for battery intermittent voltage at the flasher module terminal 65. If voltage is not available at the flasher module, replace the module. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between the flasher module terminal 65 and the flasher relay terminal 3. Check for intermittent battery voltage output from the flasher relay terminal 3 to the flashers and controller CR721S CM-C18 pin 28. If voltage is not available at the relay terminal 3, replace the relay. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between the relay terminal 3 and controller CR721S CM-C18 pin 28 and between the relay terminal 3 and the sweep flasher lamps.

Fig. 154: Rear Lights

Fig. 155: Light Switches

Fig. 156: Sweep Flashers Circuit Sheet 1 on page 145 shows sheet 1 of the sweep flashers circuit.

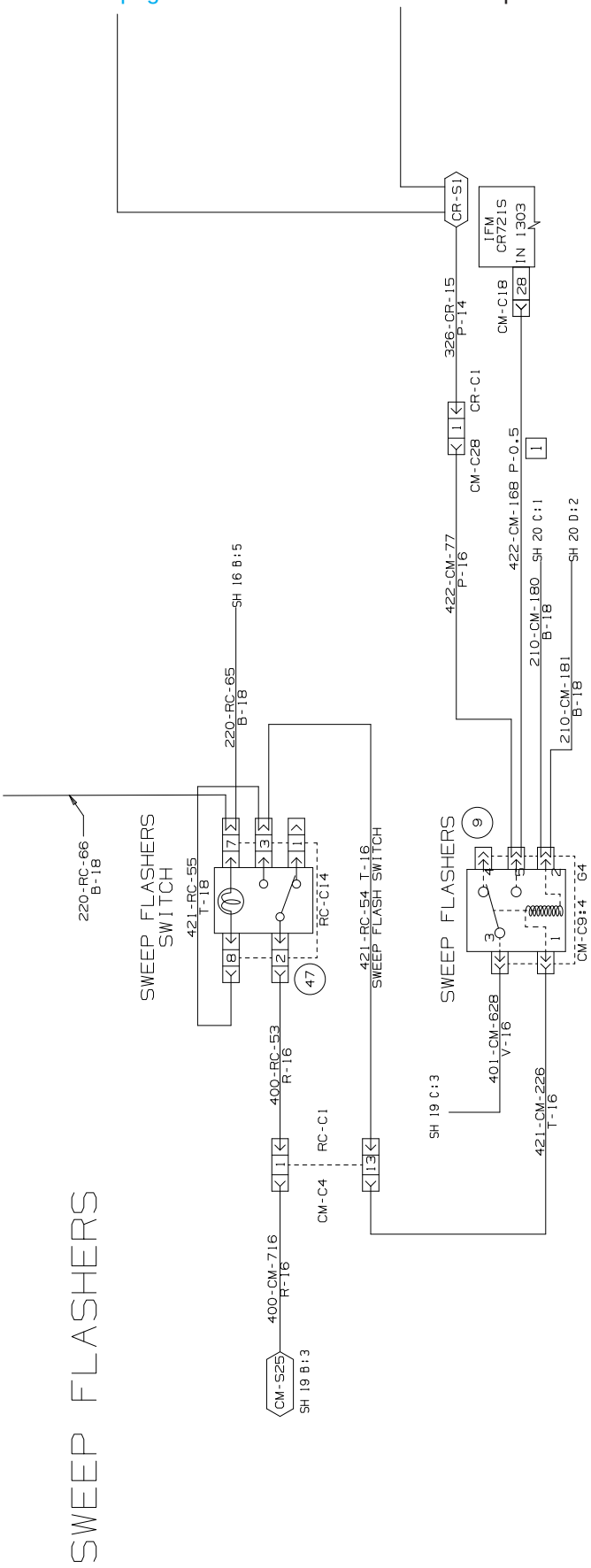

Fig. 156: Sweep Flashers Circuit Sheet 1

Fig. 157: Sweep Flashers Circuit Sheet 2 on page 146 shows sheet 2 of the sweep flashers circuit.

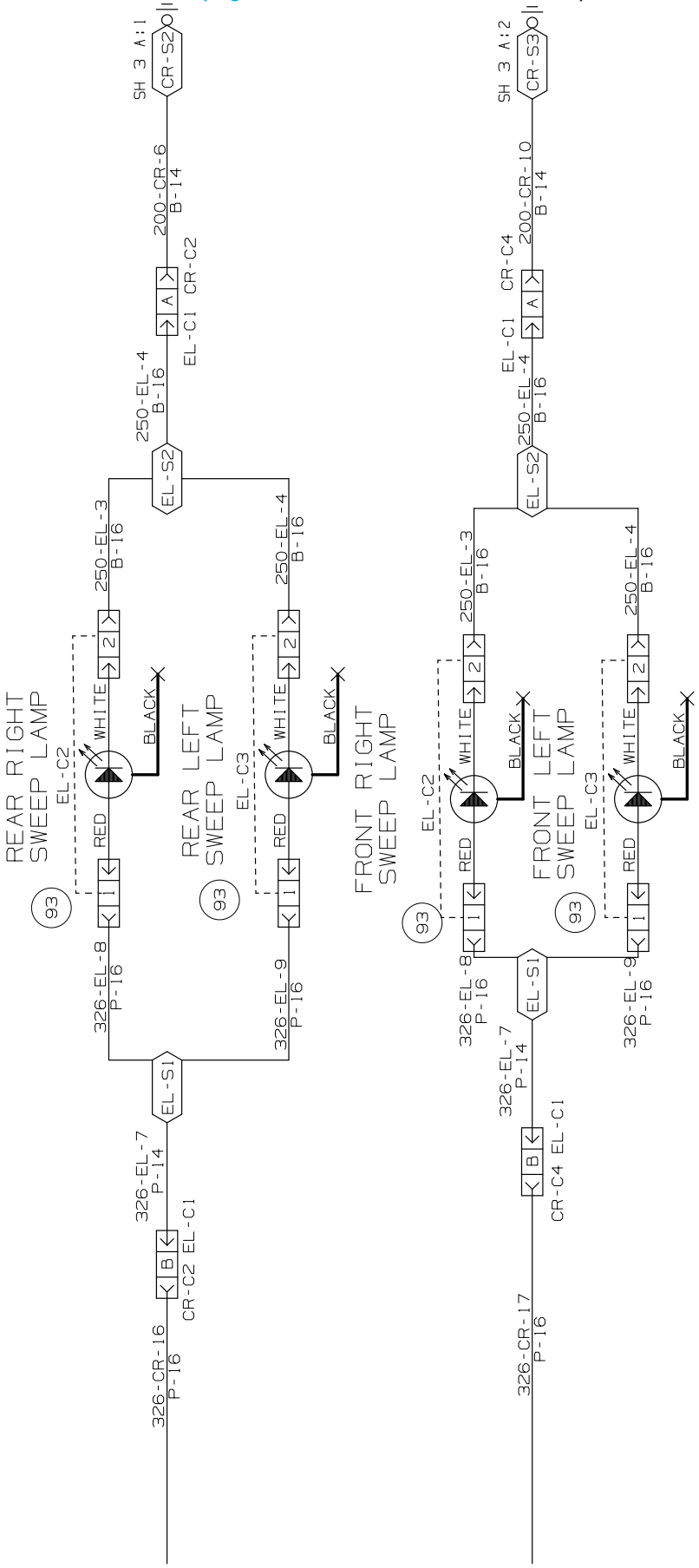

Fig. 157: Sweep Flashers Circuit Sheet 2

LICENSE PLATE LIGHT CIRCUIT

The license plate light (Fig. 158: License Plate Light) is controlled by the headlamp/parklamp switch (Fig. 159: Light Switches). The battery voltage for operation of the headlamp/parklamp switch is routed from the battery power circuit and fuse B4 (15A) to the switch terminal 2. When the switch is placed in the PARK or ON position, the battery voltage is routed through the switch and terminal 3 to the license place light terminal LP-T1. Because the license plate light is grounded at terminal LP-T2 by a ground circuit from ground splice EC-S2, the license plate light illuminates.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 158: License Plate Light

Fig. 159: Light Switches

Fig. 160: License Plate Light Circuit shows the license plate light circuit.

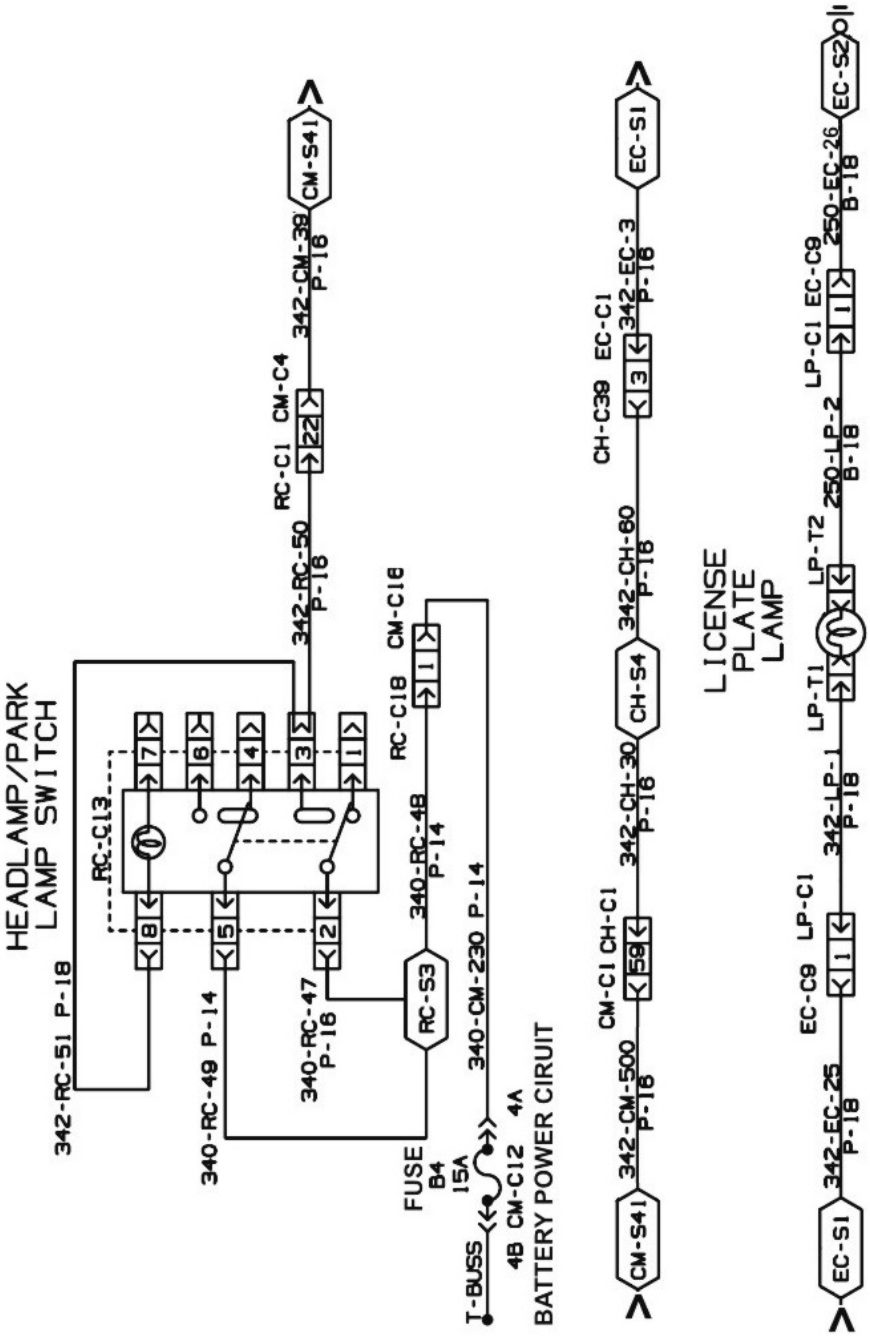

Fig. 160: License Plate Light Circuit

CONSOLE LIGHT CIRCUIT

The console light is controlled by a separate switch (Fig. 161: Console Light). The battery voltage for operation of the lights is routed from the switched power circuit and fuse C10 (10A) to one side of the light terminal 1. The light is grounded by a ground circuit from ground slice CR-S2 at terminal 2. When the light switch is placed in the ON position, the battery voltage at terminal 1 and ground circuit at terminal 2 cause the light to illuminate.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 162: Console Light Circuit shows the console light circuit.

Fig. 161: Console Light

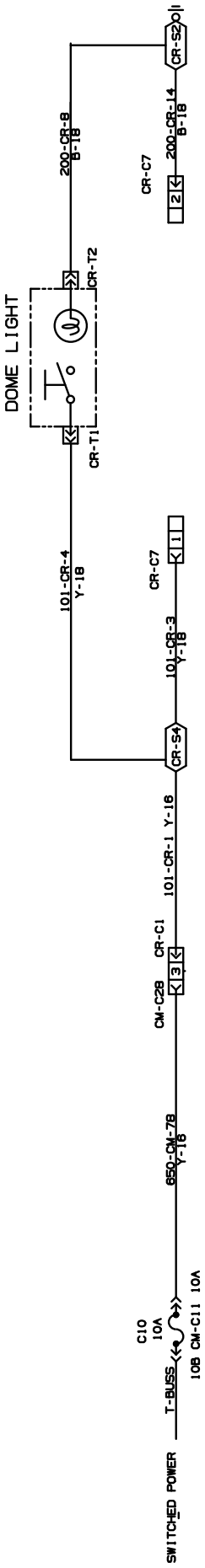

Fig. 162: Console Light Circuit

CENTER BROOM CONVEYOR LOWER RAISE CIRCUIT
S0140, S0145, S0440, S0445

The input at controller CR721S CM-C18 pin 40 also causes the control system to route battery voltage from controller CR721S CM-C18 pin 67 to the conveyor lower solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S14. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve and allows hydraulic oil to flow out of the conveyor cylinders extend side, lowering the conveyor. When the switch is placed in the RAISE position, battery voltage is routed from controller CR721S CM-C18 pin 20 to the conveyor raise solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S14. The battery voltage at the solenoid coil terminal 1 and ground circuit at terminal 2 allows hydraulic oil to flow to the conveyor cylinders extend side, raising the conveyor.
Fig. 163: Center Broom Conveyor Raise Lower Circuit shows the center broom conveyor lower raise circuit.

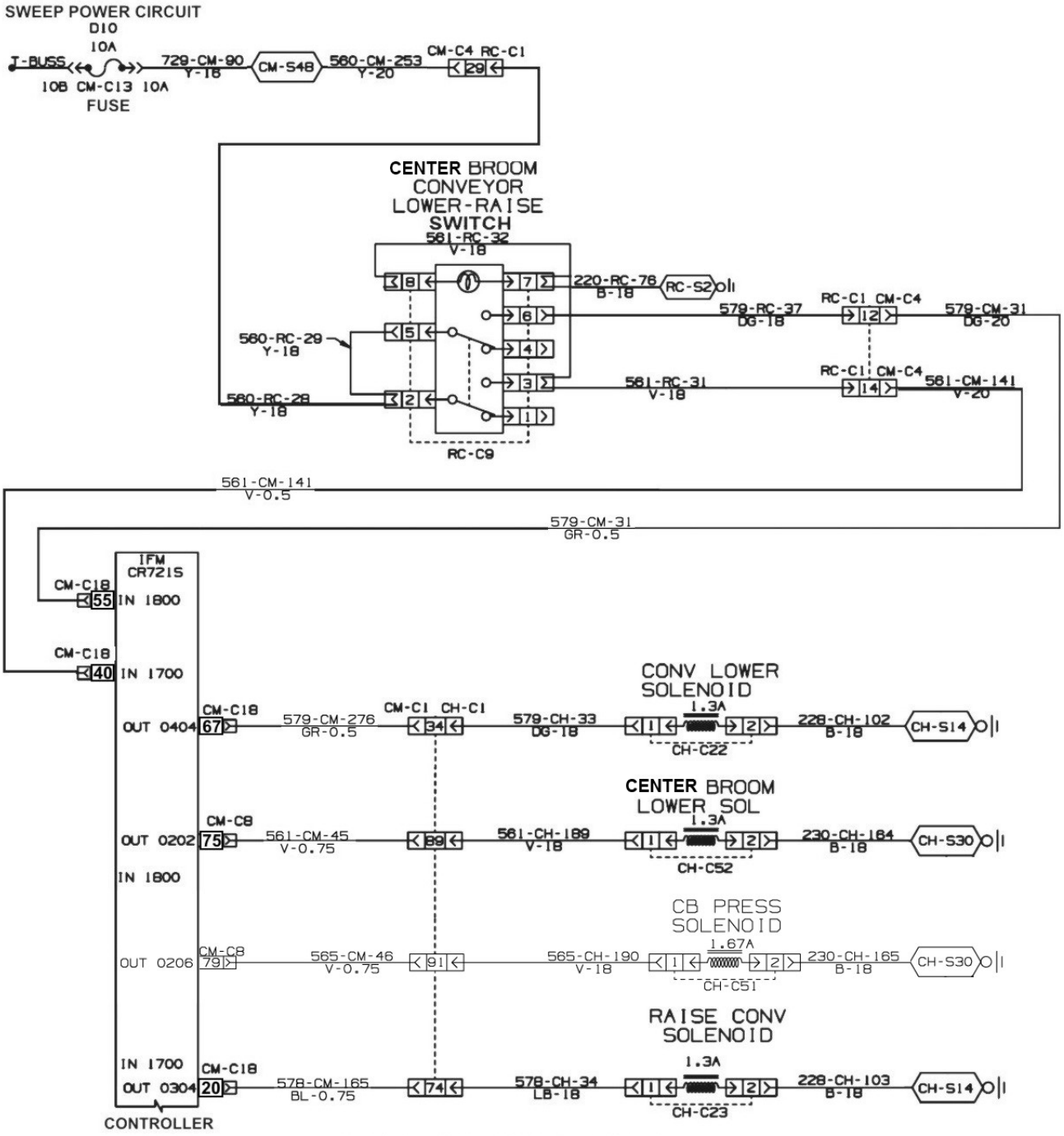

Fig. 163: Center Broom Conveyor Raise Lower Circuit

The center broom and conveyor lower and raise functions are controlled by the center broom conveyor lower raise switch (Fig. 164: Center Broom Switches). The battery voltage for operation of the switch is routed from the sweep power circuit and fuse D10 (10A) to the switch terminals 2 and 5. When the switch is placed in the LOWER position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C18 pin 40. The input at CM-C18 pin 40 notifies the control system that the center broom/ conveyor raise/lower switch is in the LOWER position and the center broom should be lowered.

The input at controller CR721S CM-C18 pin 40 causes the control system to route battery voltage from controller CR721S CM-C8 pin 75 to the center broom lower solenoid coil terminal 1. The solenoid coil (Fig. 165: Broom Raise Manifold) is grounded at terminal 2 by a ground circuit from ground splice CH-S30. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve and allows hydraulic oil to flow out of the center broom cylinders extend side, lowering the center broom. When the switch is placed in the RAISE position, the CB Press solenoid is energized by voltage from CR721S CM-C8 pin 79, raising the center broom.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 164: Center Broom Switches

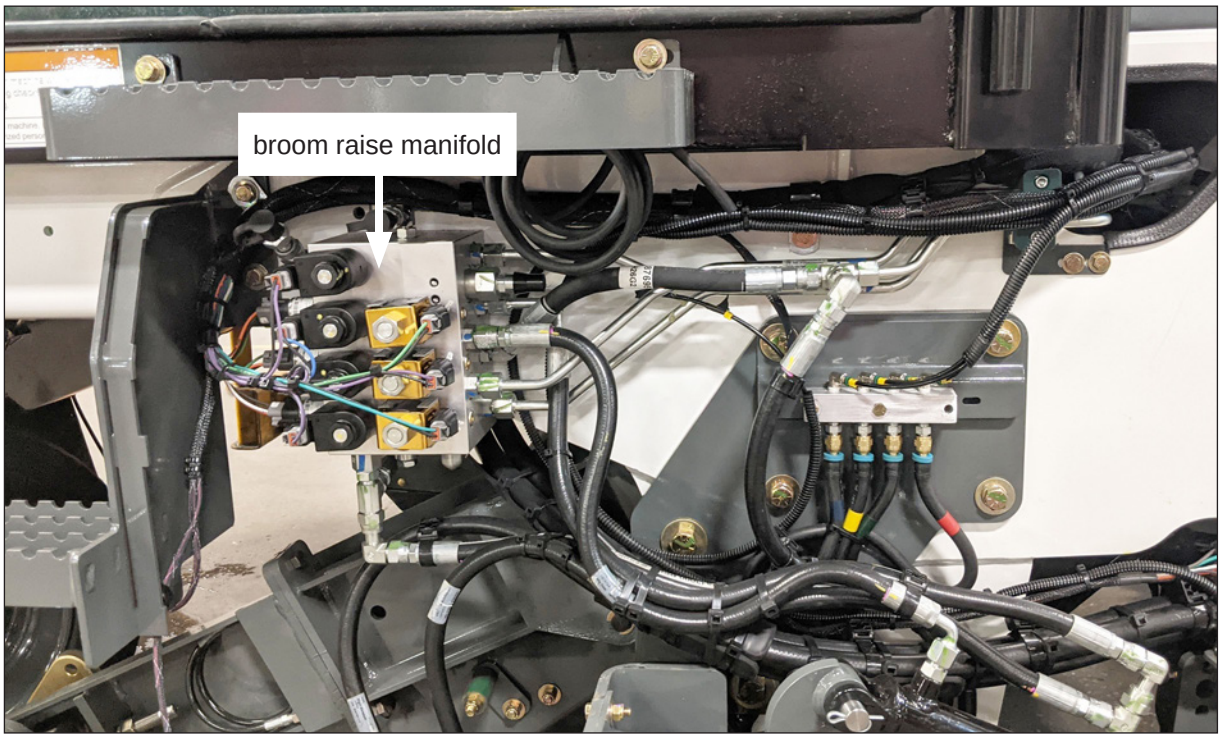

Fig. 165: Broom Raise Manifold

The illumination of the center broom/conveyor lower/raise switch (Lower Broom Sw) indicator (Fig. 166: Conveyor Lower Raise) indicates the switch is in the on position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 40. The illumination of the conveyor lower solenoid (Conv Lower Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 67 to the conveyor lower solenoid coil terminal 1. The raise solenoid only illuminates for a set amount of time. Check for a ground circuit at the lower solenoid coil terminal 2.

The illumination of the conveyor raise solenoid (Conv Raise Sol) indicates the enter broom/conveyor lower/ raise switch (Lower Swt) is in the off position (Lower Swt not illuminated) and voltage has been routed from controller CR721S CM-C18 pin 20 to the raise conveyor solenoid coil terminal 1. Check for a ground circuit at the solenoid coil terminal 2.

A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- CB lower solenoid – S0145-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 75 and center broom lower solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the center broom lower solenoid coil terminal 2. Check for solenoid coil corrosion and damage. Use a multimeter to check the solenoid coil resistance for 9 Ω at 68°F (20°C).

- Conveyor raise solenoid – S0440-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 20 and conveyor raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the conveyor raise solenoid coil terminal 2. Check for solenoid coil corrosion and damage. Use a multimeter to check the solenoid coil resistance for 9 Ω at 68°F (20°C).

- Conveyor lower solenoid – S0445-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 67 and conveyor lower solenoid coil terminal 1. Check for solenoid coil corrosion and damage. Use a multimeter to check for a ground circuit at the conveyor lower solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 9 Ω at 68°F (20°C).

- Center broom raise solenoid – S0140-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 79 and the center broom raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the center broom raise solenoid valve coil terminal 2. Use a multimeter to check the center broom raise solenoid coil resistance for 7.2 Ω at 68°F (20°C). Check the solenoid coil for corrosion and damage.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

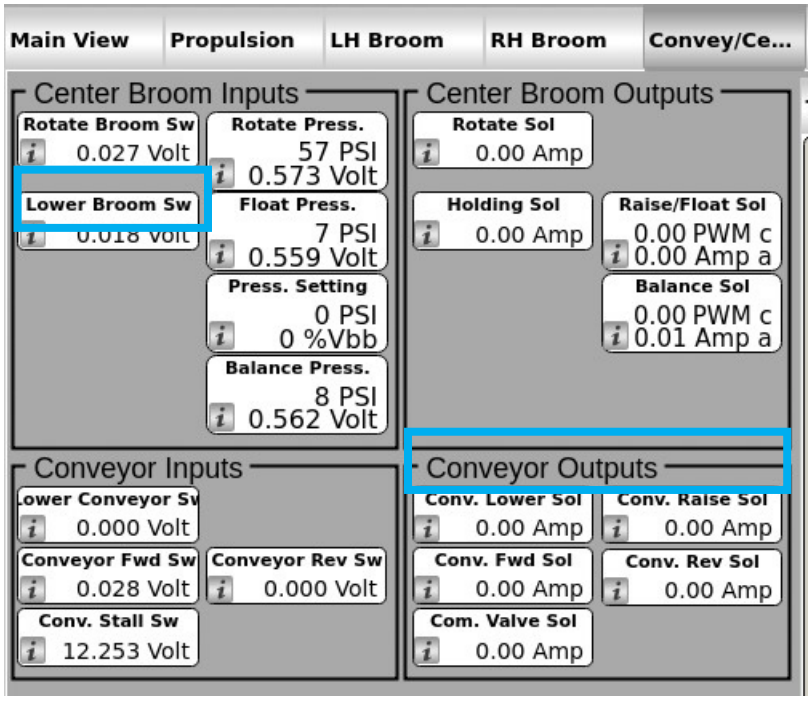

Fig. 166: Conveyor Lower Raise

CENTER BROOM DOWN PRESSURE CIRCUIT
S0100, S0110, S0140

Fig. 167: Center Broom Down Pressure Circuit, Sheet 1 shows sheet 1 of the center broom down pressure circuit

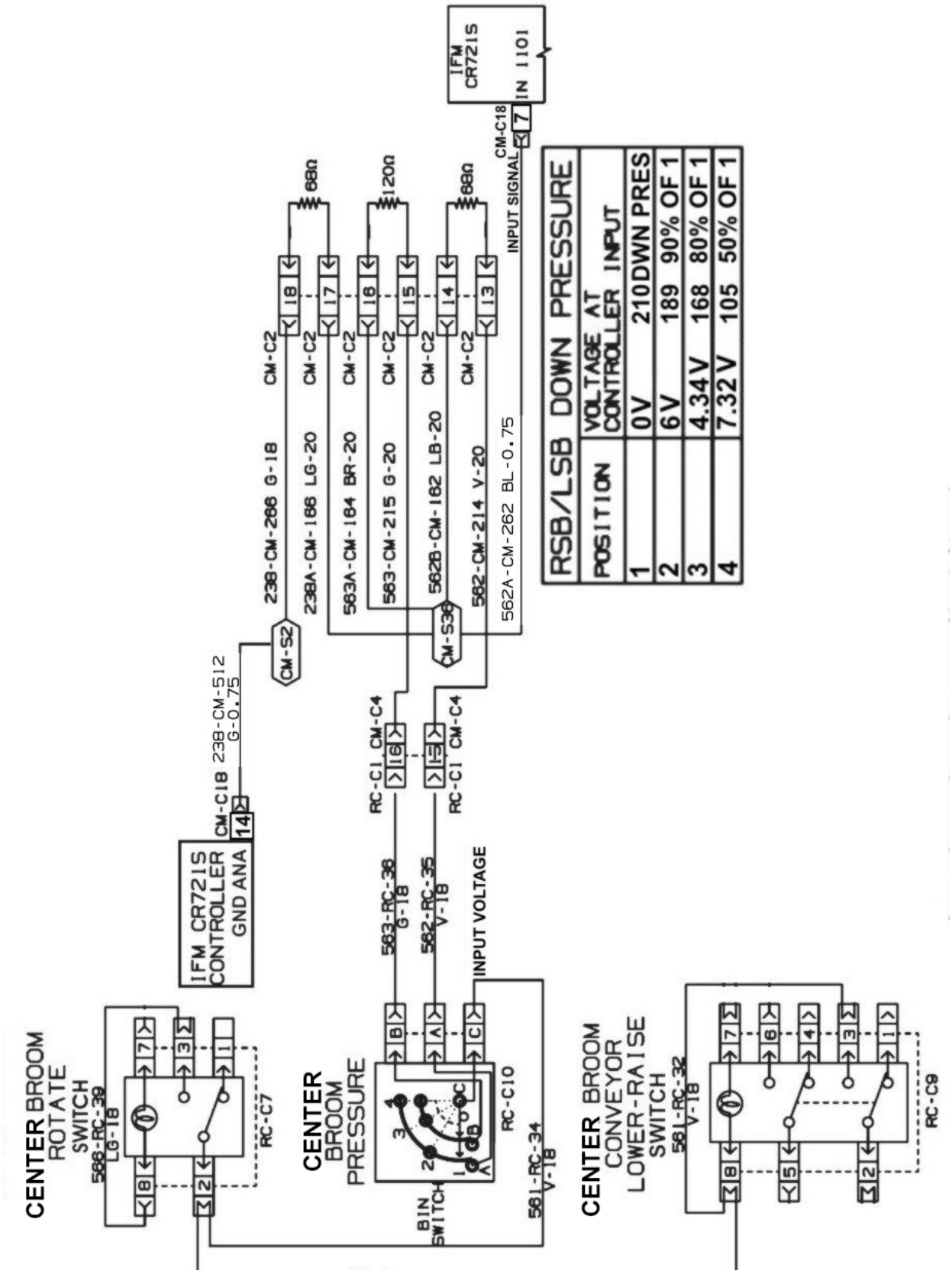

Fig. 167: Center Broom Down Pressure Circuit, Sheet 1

Fig. 168: Center Broom Down Pressure Circuit, Sheet 2 shows sheet 2 of the center broom down pressure circuit.

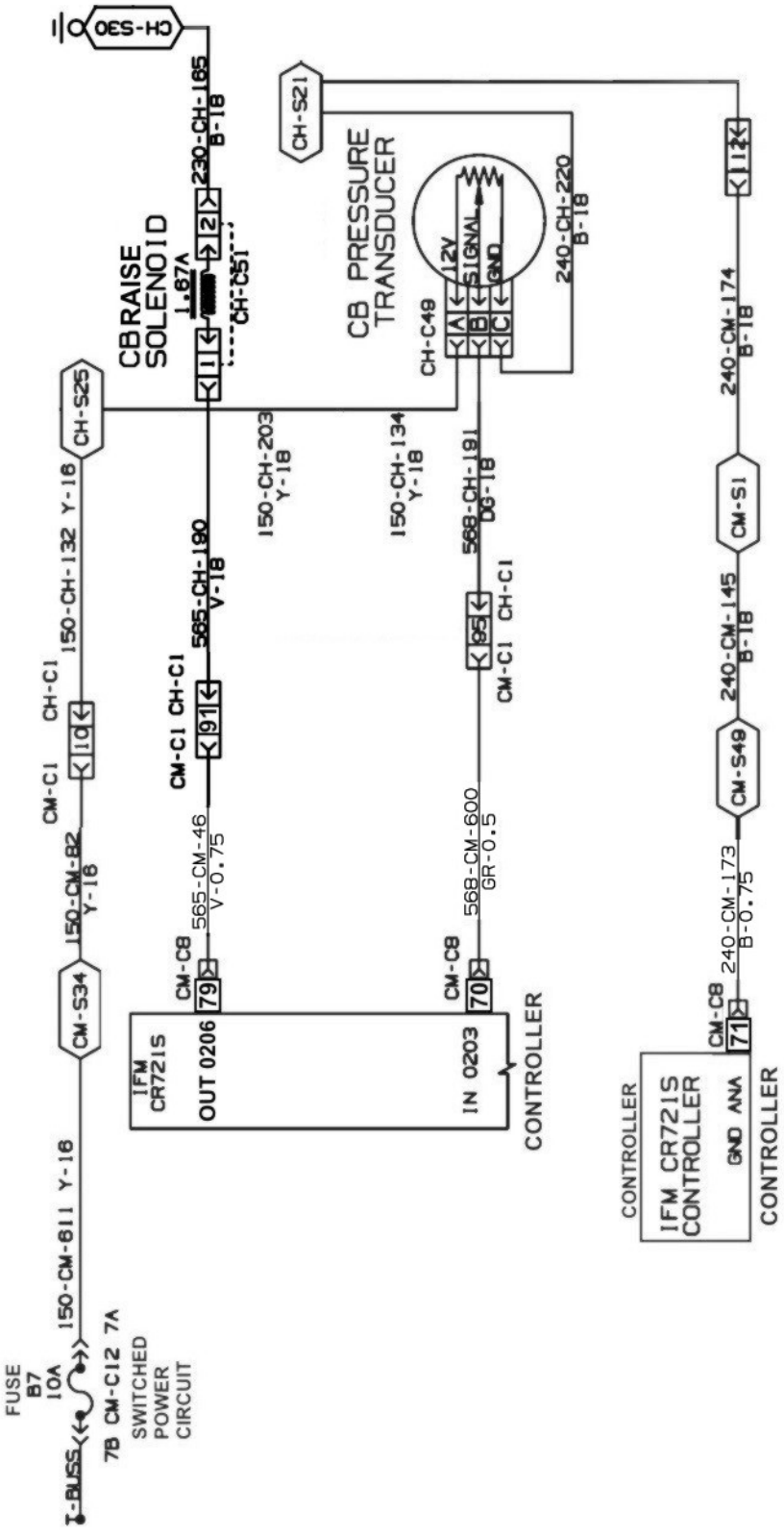

Fig. 168: Center Broom Down Pressure Circuit, Sheet 2

The center broom is controlled by the center broom/conveyor lower/raise switch (Fig. 169: Center Broom Switches). See Fig. 163: Center Broom Conveyor Raise Lower Circuit on page 150. When the switch is placed in the lower position, battery voltage is routed from the switch terminal 3 to controller CR721S CM-C18 pin 40. The input at CM-C18 pin 40 notifies the control system the center broom is active.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The center broom pressure switch controls the center broom down pressure (Fig. 169: Center Broom Switches on page 155). The battery voltage for operation of the switch is routed from the center broom/conveyor lower/raise switch terminal 3, when the switch is in the LOWER position, to the center broom pressure switch terminal C. The amount of pressure applied to the center broom is controlled by the sweeper control system. The position of the down pressure switch determines the center broom down pressure. The four position pressure (BIN) switch routes voltage from switch terminal C through terminal A and B based on the position of the switch. The resulting voltage is routed from terminal A to a resistor tree terminal 15 and from terminal B to the resistor tree terminal 16. The combination of resistance values determines the voltage input at controller CR721S CM-C18 pin 7.

Fig. 169: Center Broom Switches

The center broom pressure solenoid is controlled by controller CR721S CM-C8 pin 79. When the control system is signaled that the center broom is to be lowered, the controller routes pulse width controlled battery voltage from CM-C8 pin 79 to the center broom pressure solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S30. The voltage and ground circuit at the solenoid are current-controlled to adjust the pressure holding up the broom to create the correct down pressure on the broom. Fig. 170: Broom Raise Manifold shows the side broom raise manifold.

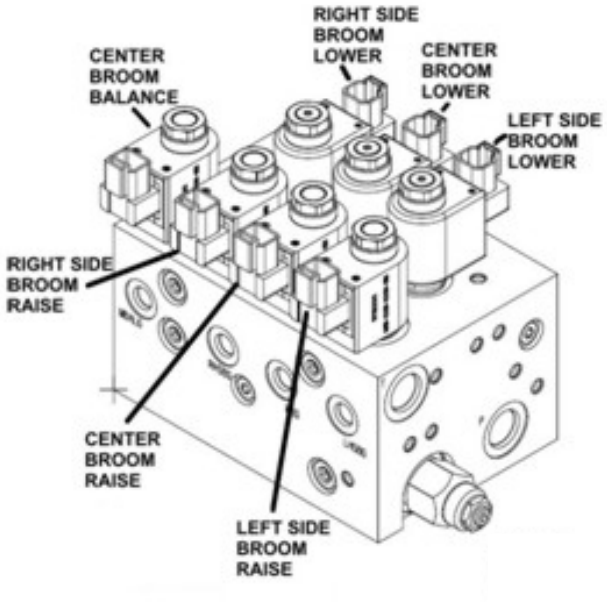

Fig. 170: Broom Raise Manifold

The center broom pressure transducer monitors the center broom down pressure and signals controller CR721S CM-C8 pin 70. The input signal from the transducer allows the control system to position the center broom pressure valve based on the position of the down pressure BIN switch. When the transducer signals a need for more or less pressure, the control system routes voltage from CM-C8 pin 79 shifting the solenoid valve allowing oil to flow from the extend side of the center broom cylinders until the transducer indicates the desired pressure. The solenoid valve is constantly moving back and forth to maintain the down pressure selected using the center broom pressure (BIN) switch.

The center broom float pressure feedback (Float Press xxxx Volt) controller CR721S CM-C8 pin 70, center broom pressure BIN switch (Press Setting – xxx Volt), CR721S CM-C18 pin 7, and main broom raise solenoid valve output (Raise/Float Sol) controller CR721S CM-C8 pin 79 can be monitored by observing the indicators during main broom operation. See Fig. 171: Center Broom Down Pressure. Variations or lack of controller system signals indicates down pressure control problems. A variation from this description may be displayed as a fault warning. See Table 8: Fault Codes and Descriptions on page 35 for additional information and fault warnings.

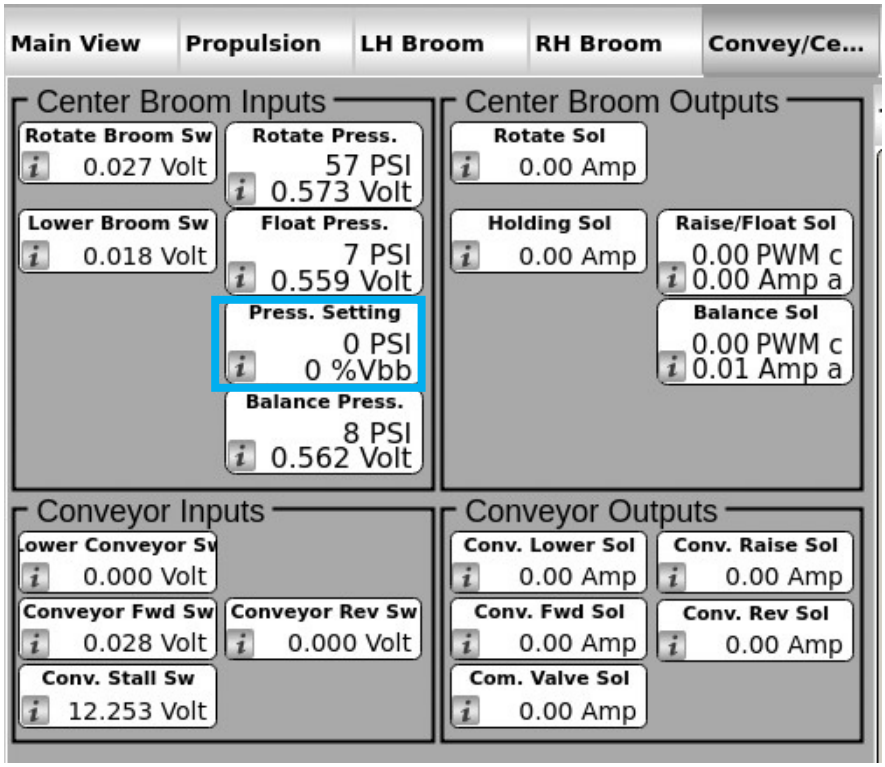

Fig. 171: Center Broom Down Pressure

Fault Codes:

- Center broom pressure switch voltage out of normal range – S0110-11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between CR721S CM-C8 pin 7 and controller CR721S controller CM-C18 pin 14 and the center broom down pressure switch terminals A and B. Use a multimeter to check the resistor pack resistance values. Use a multimeter to check for voltage input at the center broom down pressure switch terminal C. Check for voltage at the center broom raise/lower switch terminal 3. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between the center broom raise/lower switch terminal 3 and the center broom down pressure switch terminal C.

- Center broom pressure transducer – S0100-03 and 04

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 70 and the center broom pressure transducer terminal B. Use a multimeter to check for input voltage at the center broom pressure transducer terminal A. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 71 and the center broom pressure transducer terminal C.

- Center broom raise solenoid – S0140-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 79 and the center broom raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the center broom raise solenoid valve coil terminal 2. Use a multimeter to check the center broom raise solenoid coil resistance for 7.2 Ω at 68°F (20°C). Check the solenoid coil for corrosion and damage.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

CENTER BROOM ROTATE CIRCUIT
S0150

The Pelican NP uses a separate center broom rotate switch to control center broom rotation (Fig. 172: Center Broom Switches). The battery voltage for operation of the center broom rotate switch is routed from the center broom/conveyor lower/raise switch terminal 3 when the center broom/conveyor lower/raise switch is placed in the ON position. The battery voltage is routed to the center broom rotate switch terminal 2.

When the center broom rotate switch is placed in the ON position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C18 pin 41. The input voltage at CM-C18 pin 41 causes the control system to route battery voltage from the controller CM-C18 pin 81 to the center broom rotate solenoid coil terminal 1. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S13. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve allowing hydraulic oil to flow through the valve to one side of the center broom drive motor. The hydraulic oil flows through the drive motor rotating the drive motor and center broom.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 173: Broom Rotate Manifold shows the broom rotate manifold.

Fig. 172: Center Broom Switches

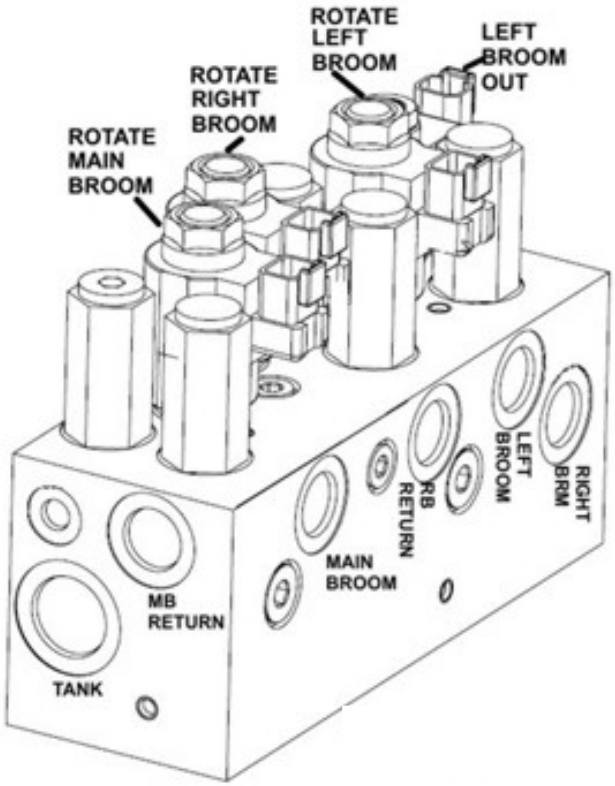

Fig. 173: Broom Rotate Manifold

Fig. 174: Center Broom Rotate Circuit shows the center broom rotate circuit.

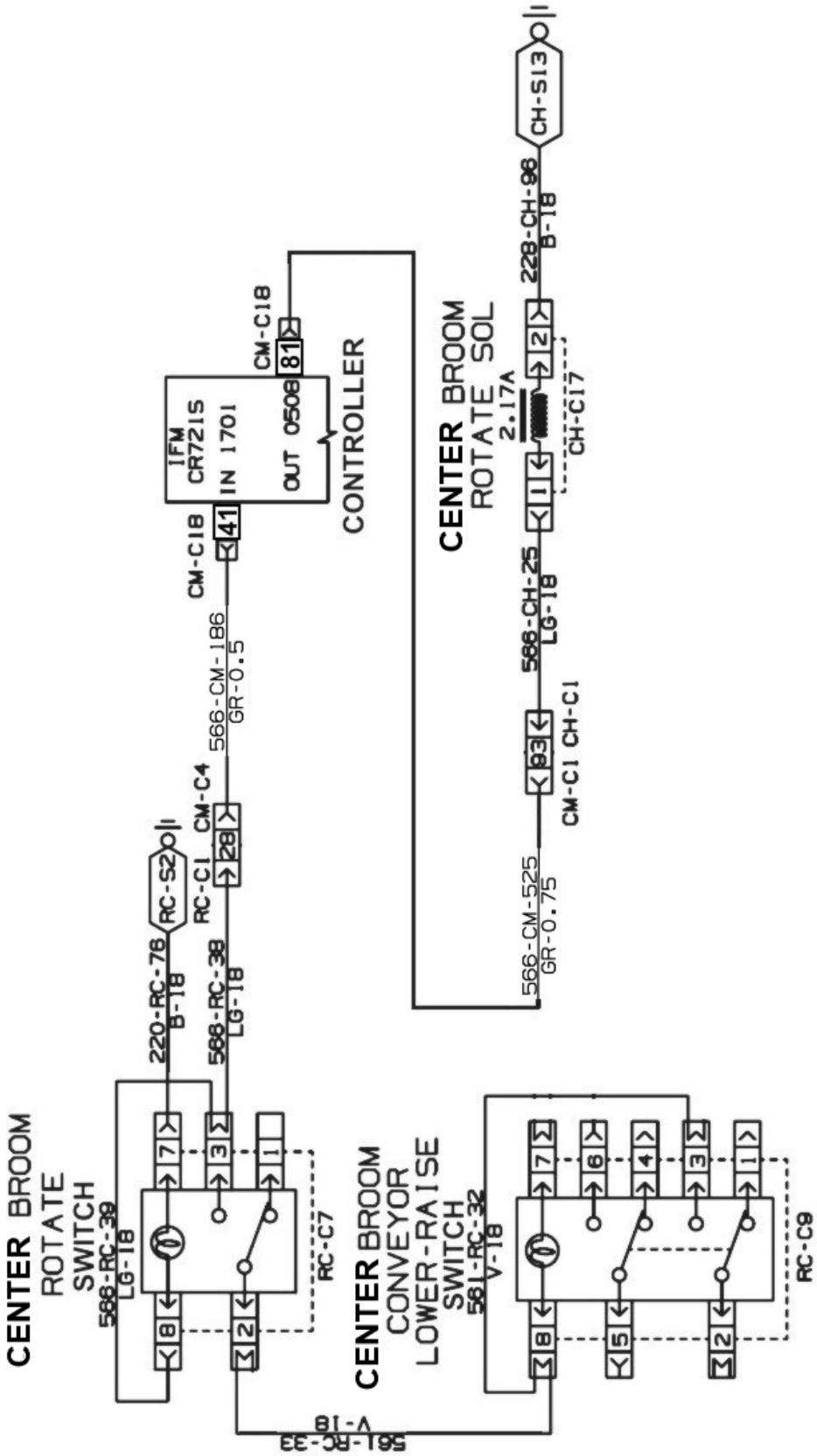

Fig. 174: Center Broom Rotate Circuit

The illumination of the main broom rotate forward switch (Rotate Broom Sw) (Fig. 175: Center Broom Rotate) indicates the main broom rotate switch is in the ON position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 41. The rotate solenoid (Rotate Sol) indicates output to the broom rotate solenoid. Check for a ground circuit at the main broom rotate solenoid coil terminal 2. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes:

- Center broom rotate solenoid – S0150-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between the center broom rotate solenoid coil terminal 1 and controller CR721S CM-C18 pin 81. Use a multimeter to check for a ground circuit at the solenoid coil terminal 2. Use a multimeter to check the solenoid resistance for 5.6 Ω at 68°F (20°C). Check the solenoid coil for corrosion and damage.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

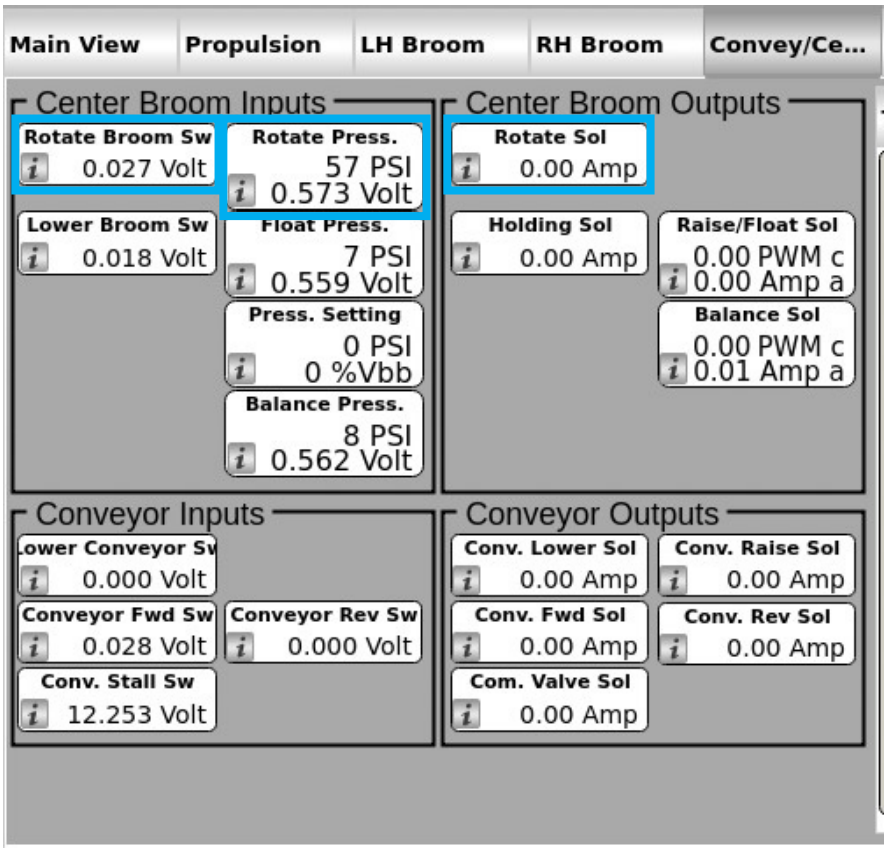

Fig. 175: Center Broom Rotate

CENTER BROOM BALANCE CIRCUIT
S0102, S0104, S0130

When the center broom drive is rotating, additional down pressure is applied to the left side of the center broom to counteract the imbalance caused by the main broom rotate motor's torque.

The CB balance feedback transducer is connected to the switched power circuit (battery voltage) at the transducer connector CH-C75 pin A. The transducer is grounded at CM-C75 pin C by a ground circuit routed from IFM controller CR721S CM-C8 pin 71. The center broom balance feedback transducer routes a pressure signal to the IFM controller CR-721S CM-C8 pin 66.

The center broom rotate transducer senses the hydraulic pressure applied to the drive motor for rotation and signals for pressure compensation from the left side center broom balance circuit.

The center broom rotate transducer is connected to the switched power circuit CM-C12 fuse B7 (10A) at CM-C18 terminal A. The transducer is grounded at CH-C18 terminal C by a ground circuit from controller CR721S CM-C18 pin 14. The center broom rotate transducer routes a signal to controller CR721S CM-C18 pin 6. The signal at controller CR721S CM-C18 pin 6 indicates how difficult it is to rotate the center broom. The input determines the broom balance pressure.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

If necessary, see Fuses And Relays on page 19 to locate fuses.

When the center broom is in operation, the balance transducer senses broom operation at CR721S CM-C8 pin 66. The controller routes voltage from the CR721S CM-C8 pin 13 to the center broom balance solenoid. The controller output is pulse width modulation (PWM) voltage needed to open the center broom balance solenoid. The solenoid allows hydraulic oil to flow to the left center broom retract side enough to balance the center broom operation and prevent broom coning and damage. The PWM voltage routed to the balance solenoid will read less than battery voltage on a DVOM.

Fig. 176: Center Broom Balance Circuit shows the center broom balance circuit.

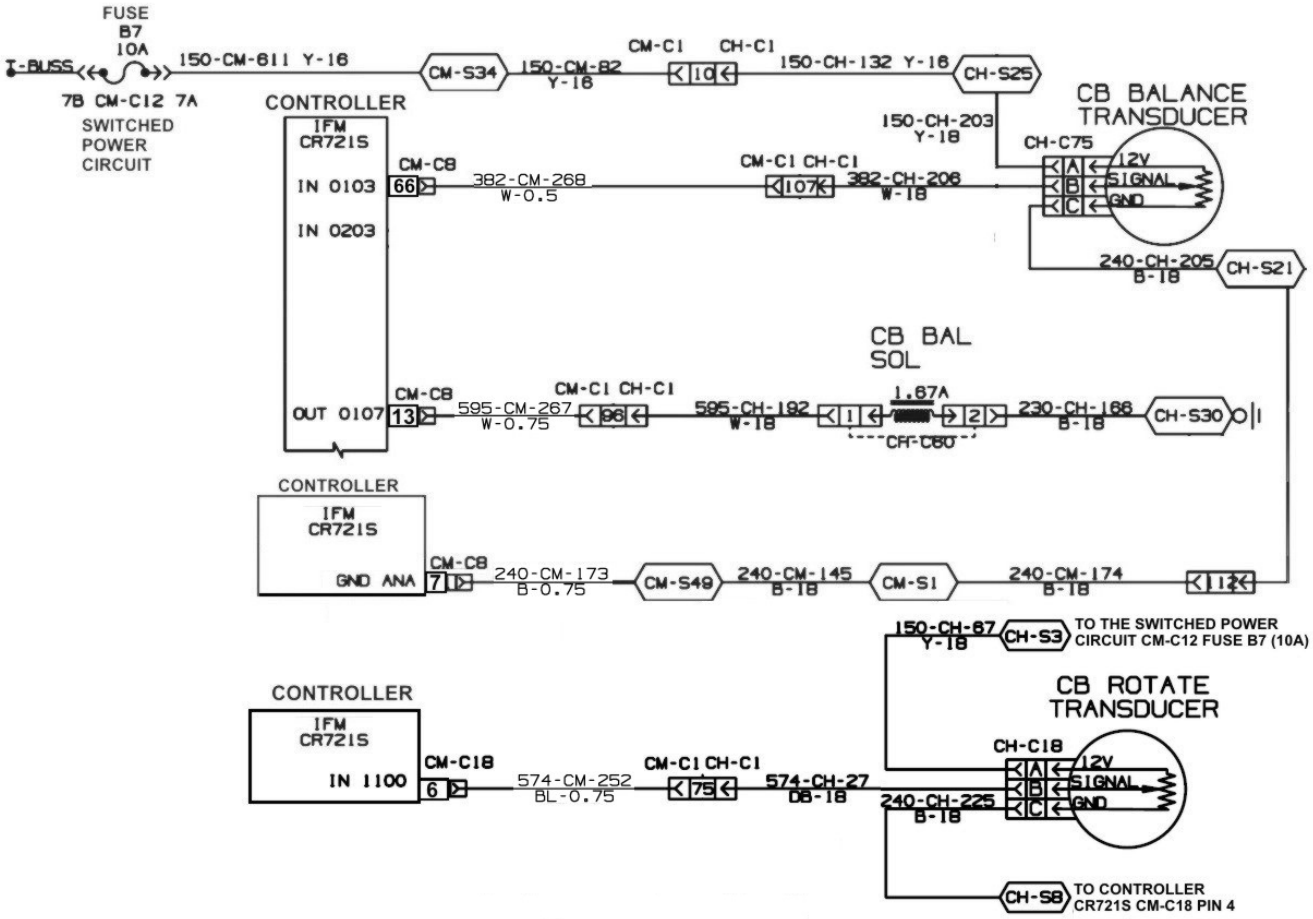

Fig. 176: Center Broom Balance Circuit

During normal operation, the float pressure (Float Press), rotate pressure (Rotate Press) and balance pressure (Balance Press) feedback displays the operational status of the center broom transducer, center broom rotate transducer and center broom balance. The float valve and balance valve indicators provide an operational status of the components during operation. Observing the indicators during operation provides an indication of the balance transducer, rotate transducer and the controller inputs and solenoid outputs as shown in the center broom balance circuit schematic. See Fig. 177: Balance Pressure.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: Center broom rotate transducer – S0104-03 and 04.

Center broom balance transducer – S0102-03 and 04.
See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 6 and the CB transducer pin B. Use a multimeter to check voltage input at the CB rotate transducer terminal 6 and ground circuit at terminal C.

Center broom balance solenoid – S0130-05, 06, 12, 20, and 21.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 13 and the center broom balance solenoid terminal 1. Use a multimeter to check for a ground circuit at the center broom balance solenoid terminal 2. Use a multimeter to check the solenoid resistance for 7.2 Ω at 68°F (20°C).

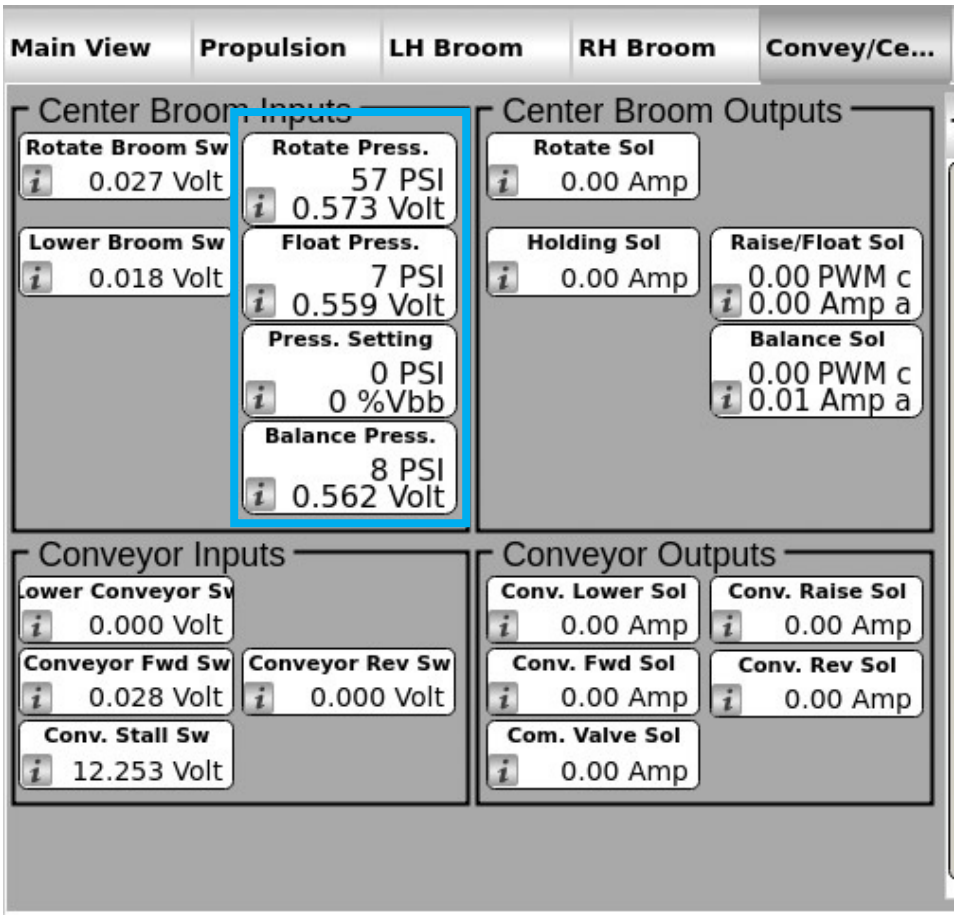

Fig. 177: Balance Pressure

When the CB rotate transducer senses hydraulic pressure, output voltage is routed from the transducer pin B to controller IFM CR721S CM-C18 pin 6 (Fig. 178: Center Broom Rotate Transducer). The voltage input acts as a signal that the left center broom pressure needs to compensate for center broom drive motor operation; the higher the pressure, the higher the voltage on the signal circuit. A calculation is performed based on the transducer input and PWM voltage is routed to the center broom balance solenoid (Fig. 179: Center Broom Balance Solenoid) causing the solenoid valve to open. This allows hydraulic oil to flow to the extend side of the left side center broom cylinder, pushing down on that side to compensate for the drive motor operation. The CB balance transducer relays the CB balance solenoid pressure to the module using CR721S CM-C8 pin 66.

Also see Center Broom Down Pressure Circuit on page 153.

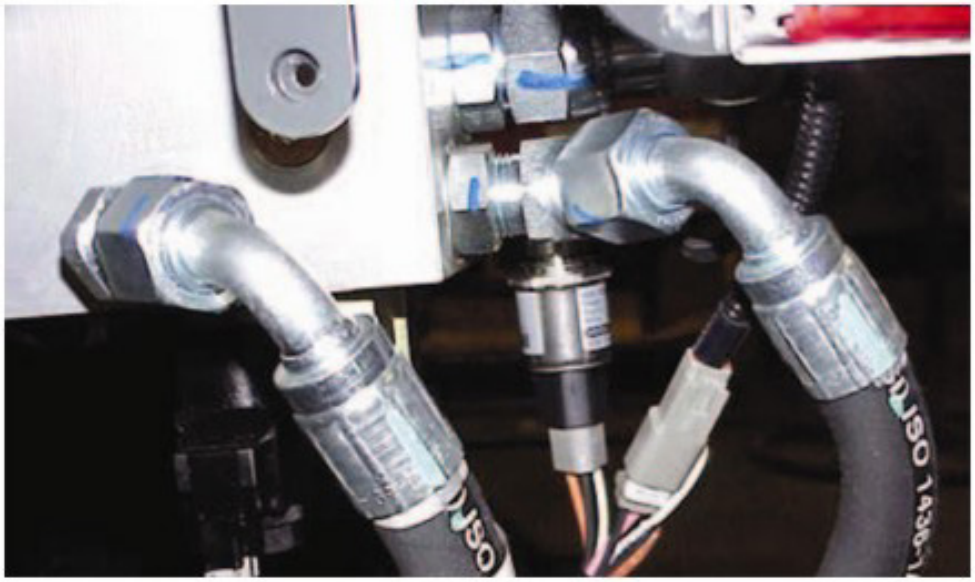

Fig. 178: Center Broom Rotate Transducer

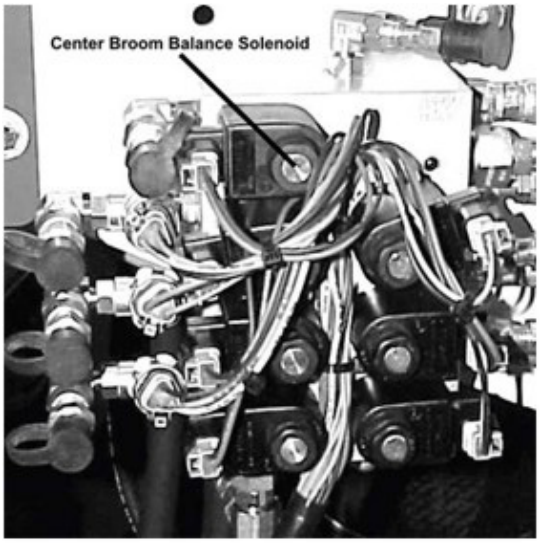

Fig. 179: Center Broom Balance Solenoid

LEFT SIDE BROOM DOWN PRESSURE CIRCUIT
S0300, S0310, S0340

Refer to Fig. 180: Left Side Broom Down Pressure Circuit, Sheet 1 for information on the broom circuit.

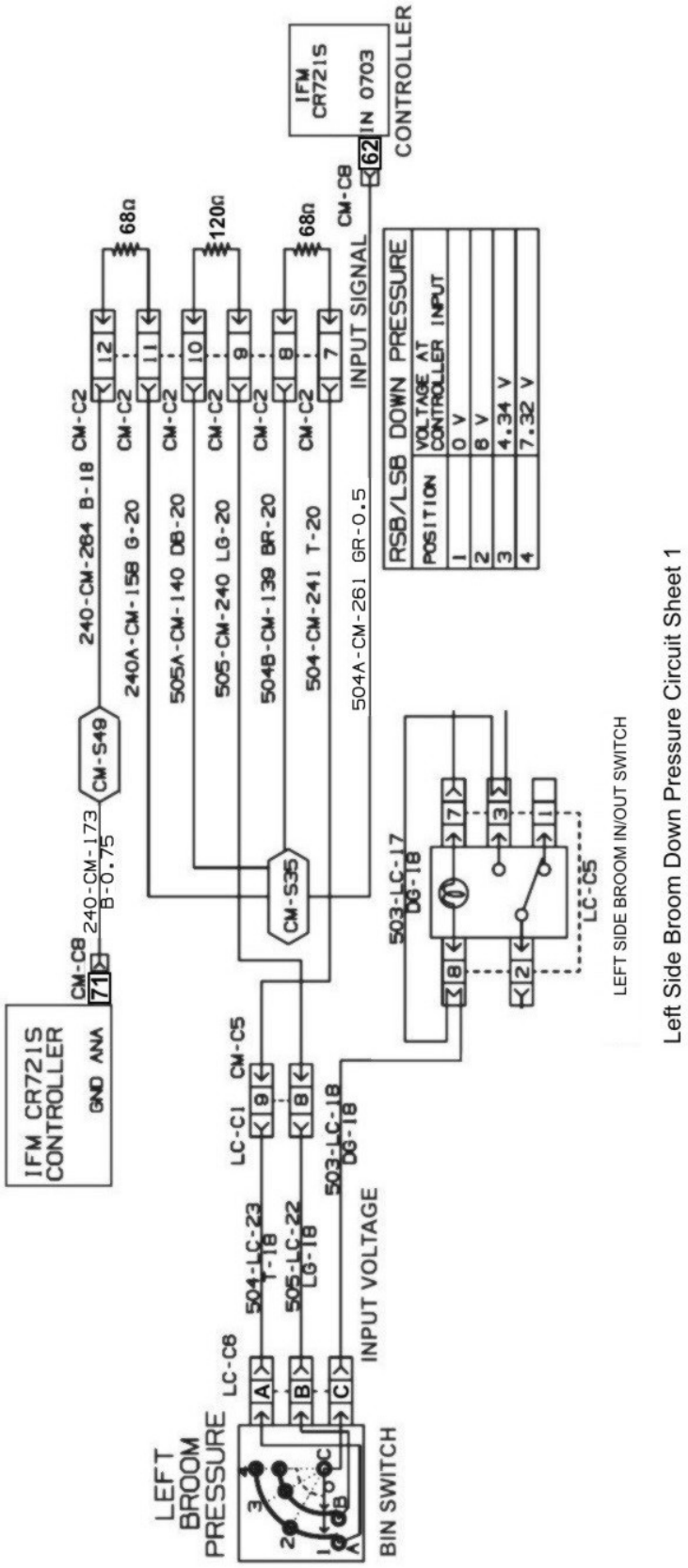

Fig. 180: Left Side Broom Down Pressure Circuit, Sheet 1

Fig. 181: Left Side Broom Down Pressure Circuit, Sheet 2 shows sheet 2 of the left side broom down pressure circuit.

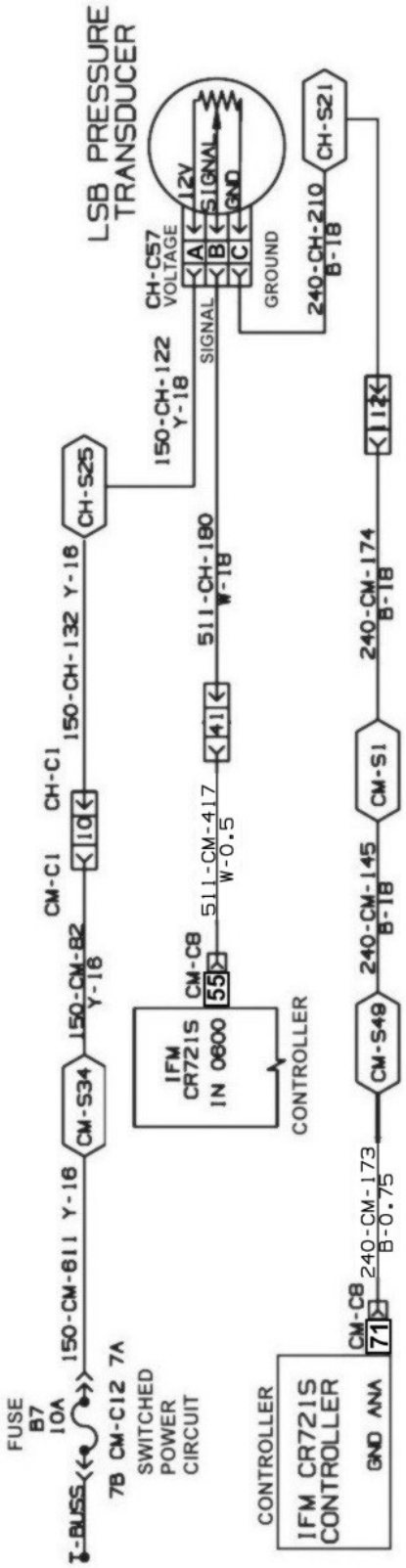

Fig. 181: Left Side Broom Down Pressure Circuit, Sheet 2

Fig. 182: Left Side Broom Down Pressure Circuit, Sheet 3 shows sheet 3 of the left side broom down pressure circuit.

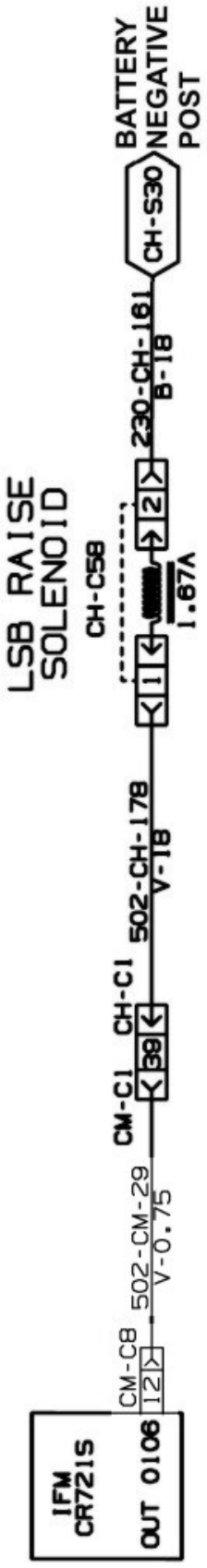

Fig. 182: Left Side Broom Down Pressure Circuit, Sheet 3

The left side broom is controlled by the left side broom UP/DOWN switch (Fig. 183: Left Side Broom UP/DOWN Switch). The battery voltage for operation of the left side broom UP/DOWN switch is routed from the sweep power circuit and fuse D10 (10A) to the left broom switch terminal 2. When the switch is placed in the ON position, battery voltage is routed through the switch and terminal 3 to the left side broom down pressure BIN switch terminal C.

The left side broom down pressure BIN switch (Fig. 183: Left Side Broom UP/DOWN Switch) controls the broom down pressure. The position of the down pressure switch determines the left side broom down pressure. The switch varies from 0 V output to 7.32 V at controller CR721S CM-C8 pin 62. See the circuit schematic. The battery voltage at the down pressure BIN switch terminal C is routed proportionally by switch position to a resistor pack containing three resistors (2) 68 Ω and (1) 120 Ω. The resistors are grounded by a ground circuit to the resistor pack terminal 12 by a ground circuit from controller CR721S CM-C8 pin 71. The routing through the resistor pack results in a position signal at controller CR721S CM-C8 pin 62. The input at the controller CM-C8 pin 62 is used by the control system to calculate the desired side broom down pressure.

The selected down pressure is monitored by a hydraulic pressure transducer (Fig. 184: Side Broom Raise Manifold). The transducer converts the hydraulic pressure input into an analog output signal. The signal is then routed to controller CR721S CM-C8 pin 55. The input signal is analyzed by the control system. A broom raise solenoid valve blocks the flow of hydraulic oil to the left broom lift cylinder (retract side) until the solenoid is actuated. The controller input signals from the transducer allow the controller to position the solenoid valve based on the BIN switch and transducer input signals. When the transducer voltage does not match the pressure requested by the BIN switch, the controller acts to adjust the current to the raise solenoid to provide the correct up pressure.

The battery voltage for operation of the left side broom down pressure transducer is routed from the switched power circuit and fuse B7 (10A) to the down pressure transducer terminal A. The down pressure transducer is grounded at terminal C by a ground signal from controller CR721S CM-C8 pin 71. As the down pressure increases or decreases, the transducer sends a signal from terminal B to controller CR721S CM-C8 pin 55. The input signal is used by the control system to continually apply left broom raise pressure, based on the down pressure bin switch output, to the controller CR721S CM-C8 pin 62.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

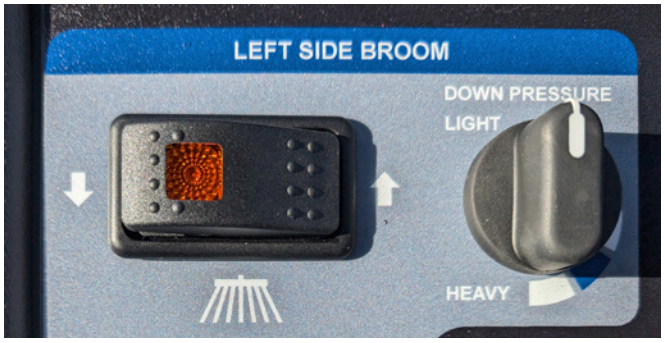

Fig. 183: Left Side Broom UP/DOWN Switch

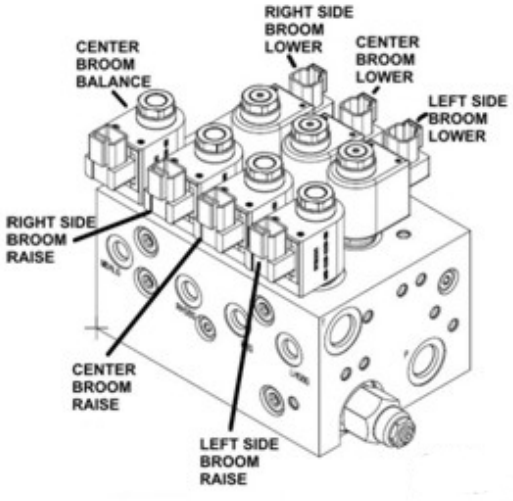

Fig. 184: Side Broom Raise Manifold

The left broom float pressure voltage (Float Press), float pressure setting (Press Setting) and float pressure (psi) (Float Psi) indicators can be used to monitor the overall operation of the left side broom down pressure circuit (Fig. 185: Left Broom Down Pressure. By observing the left broom indicators and using the left broom pressure switch to change down pressure selections the operation of the left down pressure components can be evaluated. The output results shown on the indicators indicate the operation of the down pressure switch, resistor pack, down pressure transducer, raise solenoid, and controller CR721S inputs and outputs. A variation from this description may display as a fault warning. See the fault code descriptions for additional information and fault warnings.

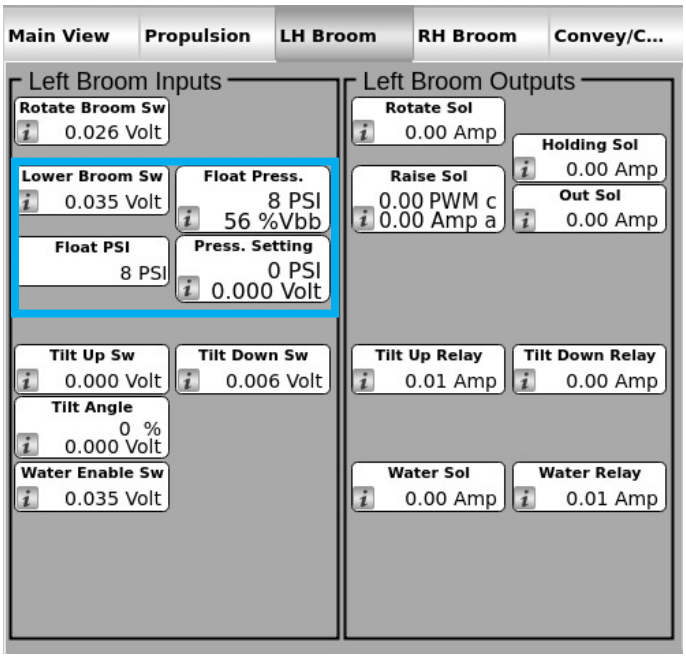

Fig. 185: Left Broom Down Pressure

Fault Codes:

- Left down pressure switch voltage out of normal range – S0310-11

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between CR721S CM-C8 pin 62 and the BIN switch controller CR721S CM-C8 pin 71 and the resistor pack terminal 12. Use a multimeter to check the resistor pack resistance values. Use a multimeter to check for voltage input at the left side broom down pressure BIN switch terminal C. Check for voltage at the left side broom UP/DOWN switch terminal 3. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between the left side broom UP/DOWN switch terminal 3 and the left side broom down pressure BIN switch terminal C.

- Left broom transducer – S0300-03 and 04

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 55 and the left side broom pressure transducer terminal B. Use a multimeter to check for input voltage at the left side broom pressure transducer terminal A. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 71 and the left side broom transducer terminal C.

- Left broom raise solenoid – S0340-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 12 and the left side broom raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the left side broom raise solenoid coil terminal 2. Use a multimeter to check the left side broom raise solenoid coil resistance for 7.2 Ω at 68°F (20°C).
See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

LEFT SIDE BROOM UP/DOWN AND ROTATE CIRCUIT
S0345, S0350, S0355

Fig. 186: Left Side Broom Up, Down, and Rotate Circuit, Sheet 1 on page 170 shows sheet 1 of the left side broom up, down, and rotate circuit.

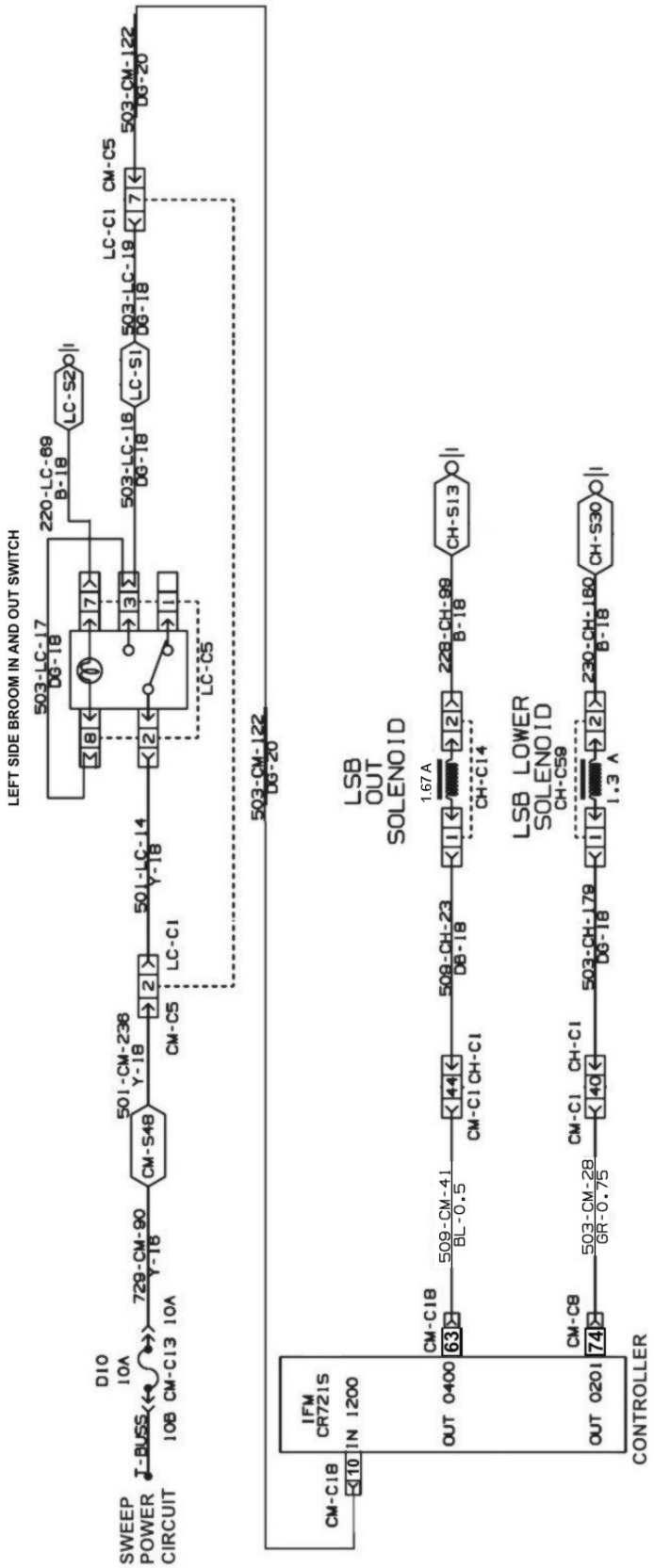

Fig. 186: Left Side Broom Up, Down, and Rotate Circuit, Sheet 1

Fig. 187: Left Side Broom Up, Down, and Rotate Circuit, Sheet 2 on page 171 shows sheet 2 of the left side broom up, down and rotate circuit.

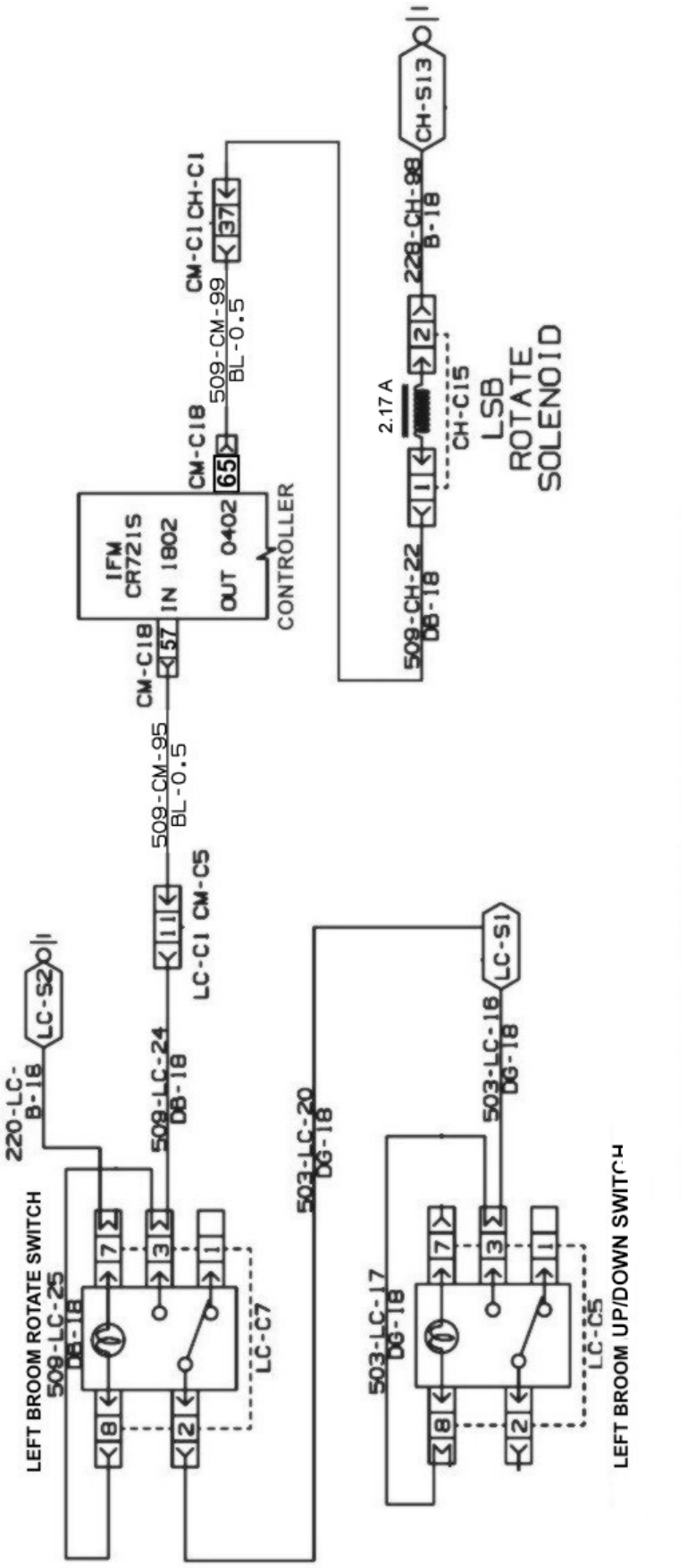

Fig. 187: Left Side Broom Up, Down, and Rotate Circuit, Sheet 2

The left side broom up and down functions are controlled by the left side broom UP/DOWN switch (Fig. 188: Left Side Broom Switches). The battery voltage for operation of the left side broom UP/DOWN switch is routed from the sweep power circuit and fuse D10 (10A) to the switch terminal 2. When the switch is placed in the DOWN position, battery voltage routes through the switch and terminal 3 to controller CR721S CM-C18 pin 10. The input at the controller CM-C18 pin 10 causes the control system to route battery voltage to the left side broom out solenoid coil terminal 1 from controller CR721S CM-C18 pin 63 to the left side broom out solenoid coil terminal 1. The solenoid coil is grounded by a ground circuit from ground splice CH-S13 at terminal 2. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve and allows the hydraulic oil to flow to the left side broom out cylinder forcing the left broom outward.

The input at controller CR721S CM-C18 pin 10 also causes the control system to route battery voltage to the left side broom lower solenoid coil terminal 1 from controller CR721S CM-C8 pin 74. The solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S30. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve and allows hydraulic oil to flow out of the left side broom raise cylinder retract side, lowering the left broom to the sweep surface.

When the left side broom switch is placed in the UP position, the input signal is no longer at controller CR721S CM-C18 pin 10. The battery voltage is no longer available at the left side broom out solenoid coil and hydraulic oil no longer flows to the left side broom out cylinder, causing the broom to return. The battery voltage is no longer available at the left broom lower solenoid coil, trapping oil in the broom raise cylinder retract side. Broom raise pressure is also tied to the broom swing cylinder. When the broom raises, this pressure swings the broom in.

The left side broom rotation is controlled by the left side broom rotate switch. The battery voltage for operation of the switch is routed from the left side broom UP/DOWN switch terminal 3 to the left broom rotation switch terminal 2. When the left side broom UP/DOWN switch and left broom rotation switches are placed in the ON position, battery voltage is routed through the switch and terminal 3 to controller CR721S CM-C18 pin 57. The input at controller CM-C18 pin 57 causes the control system to route battery voltage from the controller CM-C18 pin 65 to the left side broom rotate solenoid coil terminal 1. The rotate solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S13. The battery voltage at terminal 1 and ground circuit at terminal 2 opens the solenoid valve, allowing hydraulic oil to flow to one side of the side broom drive motor rotating the left side broom. When the switch is placed in the OFF position, battery voltage no longer flows to controller CR721S CM-C18 pin 57, causing the control system to stop output from the controller CR721S CM-C18 pin 65 to the left broom solenoid coil. This closes the solenoid valve, stopping the flow of hydraulic oil to the drive motor and stopping broom rotation.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

Fig. 188: Left Side Broom Switches

Fig. 189: Broom Rotate Manifold shows the broom rotate manifold.

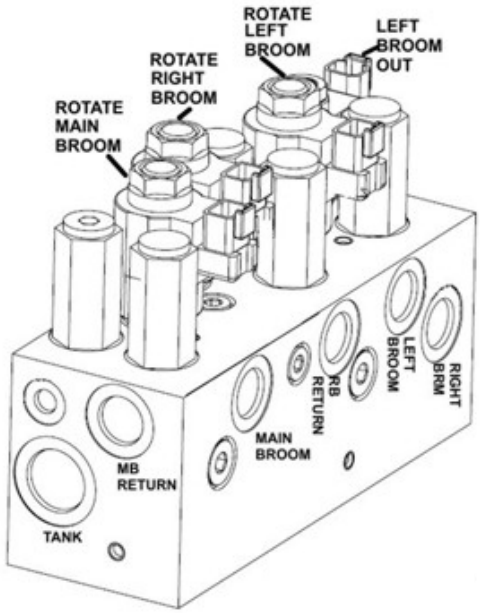

Fig. 189: Broom Rotate Manifold

Fig. 190: Side Broom Raise Manifold shows the side broom raise manifold.

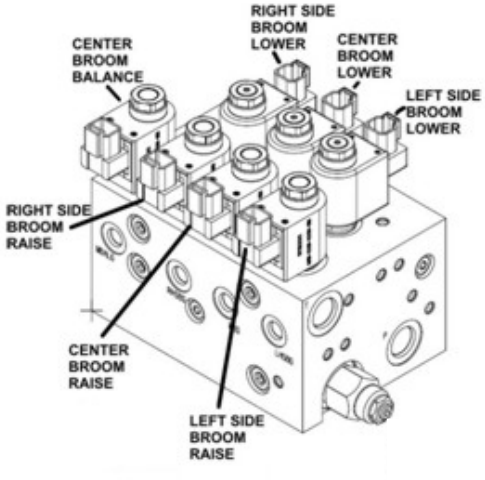

Fig. 190: Side Broom Raise Manifold

The illumination of the left broom rotate switch (Rotate Broom Sw) (Fig. 191: Left Side Broom) indicates the rotate switch is in the ON position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 57.

The illumination of the left broom lower switch (Lower Broom Sw) indicator indicates the left broom UP/DOWN switch is in the DOWN position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 10.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes:

- LSB out solenoid – S0355-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C18 pin 63 and the left side broom out solenoid coil terminal 1. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check for a ground circuit at the left side broom out solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 7.2 Ω at 68°F (20°C).

- LSB rotate solenoid – S0350-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C18 pin 65 and the left side broom rotate solenoid coil terminal 1. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check for a ground circuit at the left side broom rotate solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 5.6 Ω at 68°F (20°C).

- LSB lower solenoid – S0345-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 74 and the left side broom lower solenoid coil terminal 1. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check for a ground circuit at the left side broom lower solenoid coil terminal 2. Use a multimeter to check the solenoid coil resistance for 9.0 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

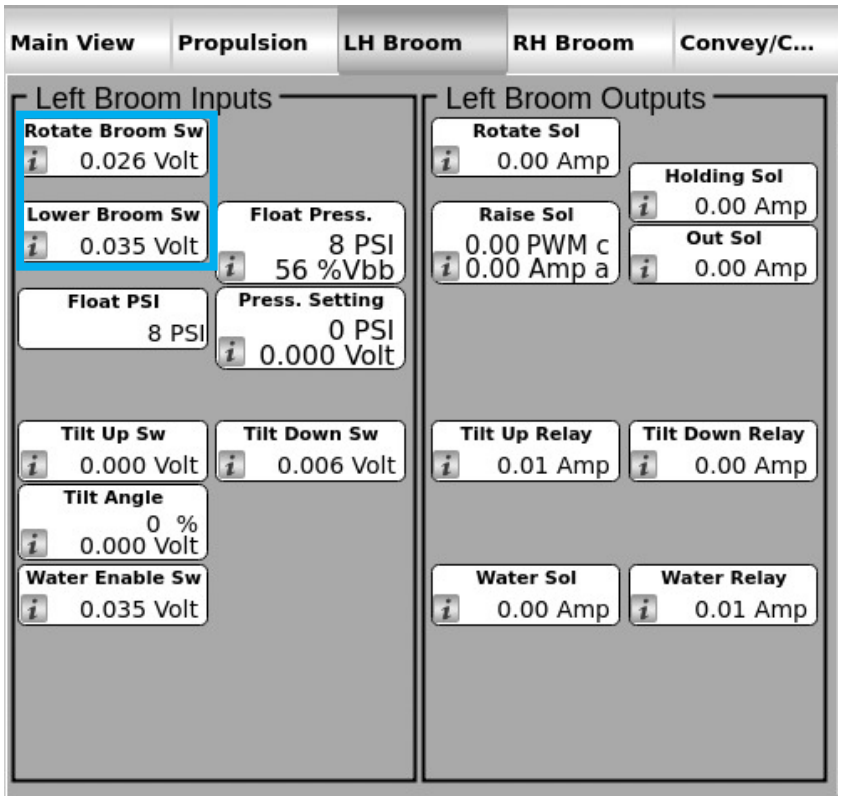

Fig. 191: Left Side Broom

LEFT SIDE BROOM TILT CIRCUIT
S0320, S0330, S0370, S0375

Fig. 192: Left Side Broom Tilt Circuit, Sheet 1 shows sheet 1 of the left side broom tilt circuit.

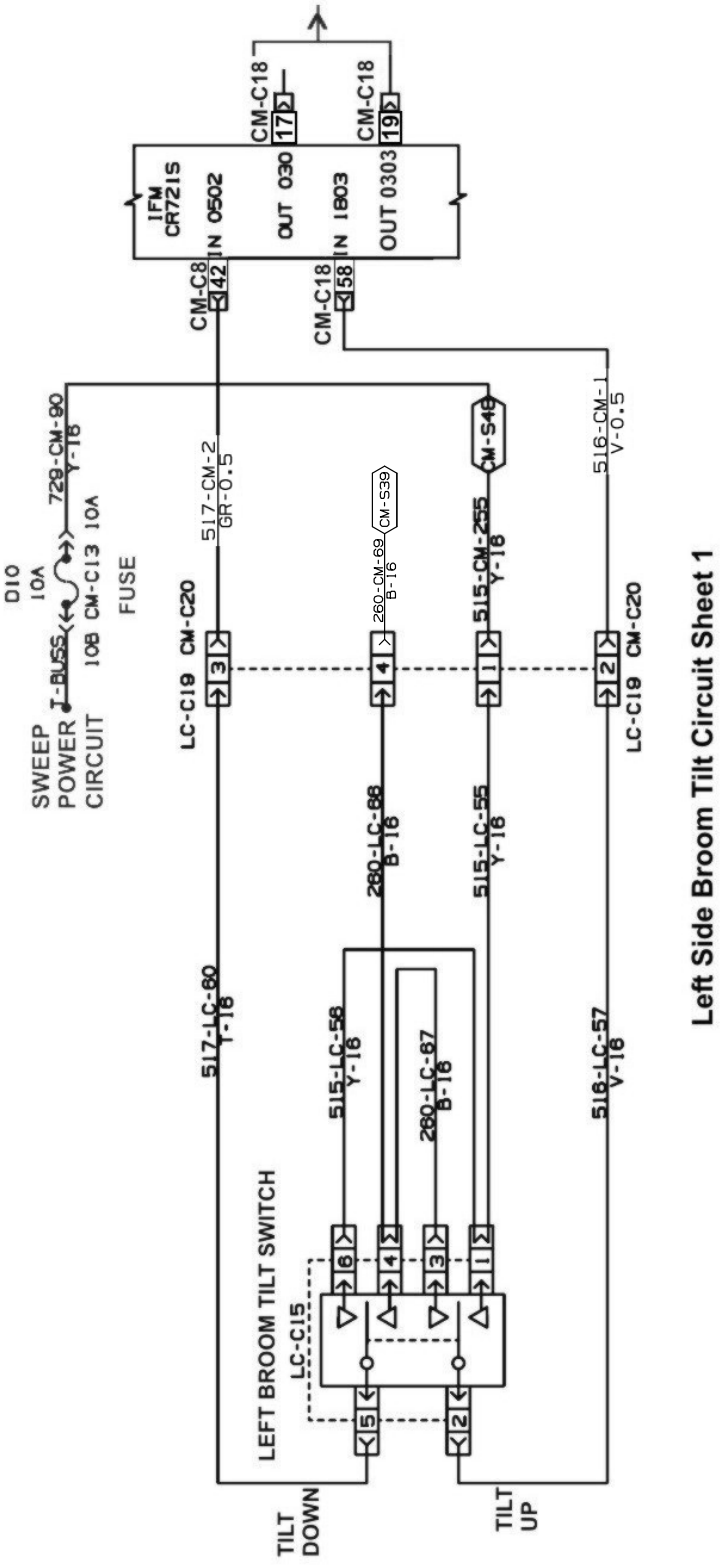

Fig. 192: Left Side Broom Tilt Circuit, Sheet 1

Fig. 193: Left Side Broom Tilt Circuit, Sheet 2 shows sheet 2 of the left side broom tilt circuit.

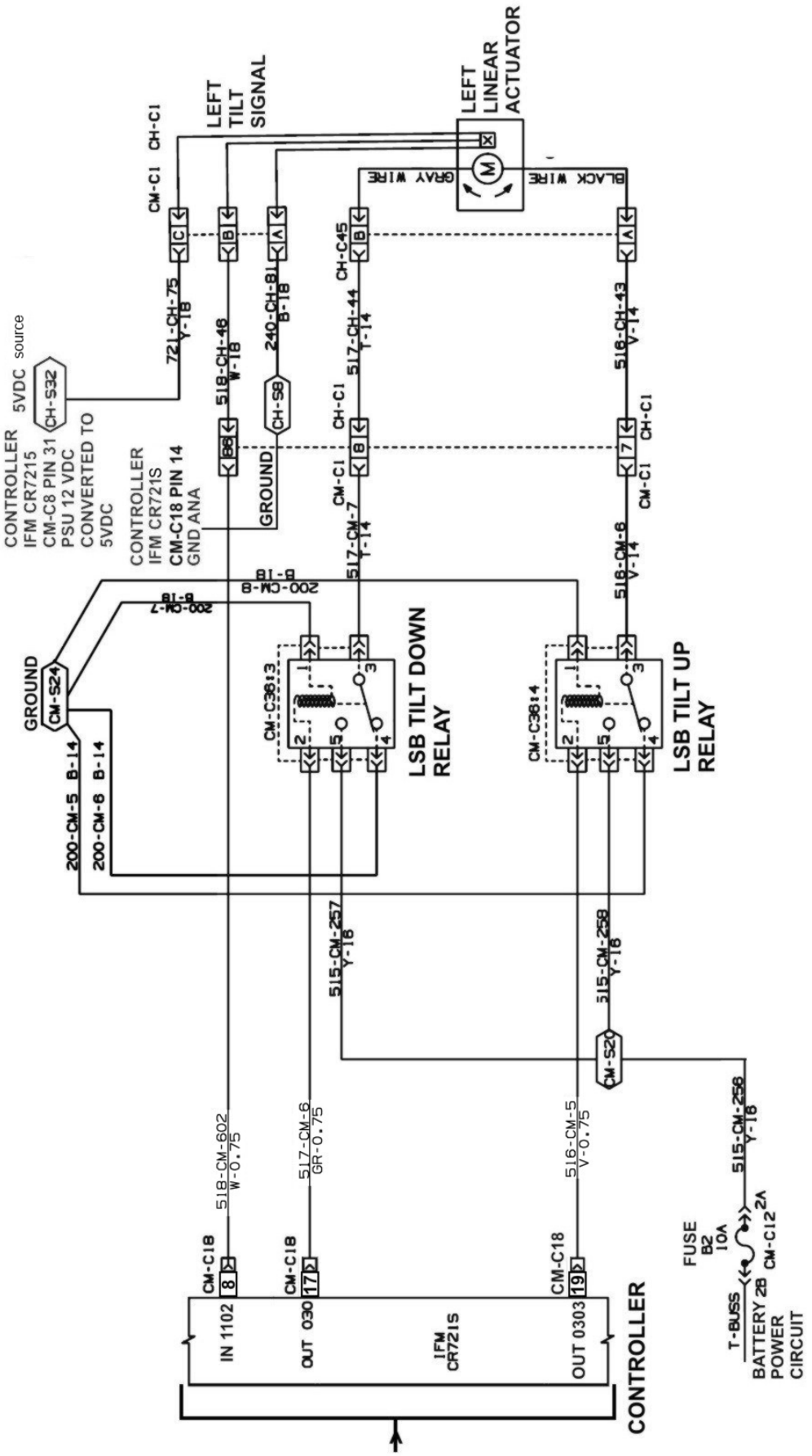

Fig. 193: Left Side Broom Tilt Circuit, Sheet 2

The left broom tilt circuit routes a ground circuit through a tilt relay to one side of the linear actuator motor (Fig. 194: Side Broom Linear Actuator) while battery voltage is routed to the other side of the linear actuator motor by the other tilt relay. The circuit is reversed to tilt the linear actuator in the opposite direction.

Left Broom Tilt Down Circuit

The battery voltage is routed from fuse D10 (10A) to the left side broom tilt switch terminals 1 and 6. When the switch is placed in the DOWN position, (Fig. 195: Left Broom Tilt Switch) the ground is routed from switch terminal 2 to CM-C18 pin 58 and power to CM-C18 pin 42 simultaneously. The ground at CM-C18 pin 58 and power at CM-C18 pin 42 notify the controller that the left broom should be tilted down. The relay coil is grounded at terminal 1. The relay is energized by battery voltage routed to the relay terminal 2 from controller CR721S CM-C18 pin 17.

When energized, the relay routes battery voltage from the battery power circuit and fuse B2 (10A) from terminal 5 through terminal 3 to the linear actuator terminal B. The other side of the linear actuator is grounded at terminal A by a ground circuit from the left broom tilt up relay terminal 3.

The battery voltage at the linear actuator terminal B and ground at terminal A cause the actuator motor to retract the actuator shaft, tilting the left broom to the desired DOWN position.

Left Broom Tilt Up Circuit

When the switch is placed in the UP position, the battery voltage is routed from the switch terminal 2 to CM-C18 pin 58 and ground to CM-C18 pin 42 simultaneously. The voltage at CM-C18 pin 58 and ground at CM-C18 pin 42 notify the controller that the left broom should be tilted up. The other side of the relay coil is grounded at terminal 1. The relay is energized by battery voltage routed to the relay terminal 2 from controller CR721S CM-C18 pin 19.

When energized, the relay routes battery voltage from terminal 5 through terminal 3 to the linear actuator terminal A.

The other side of the linear actuator is grounded at terminal B by a ground circuit from the left broom tilt down relay terminal 3. The battery voltage at the linear actuator terminal A and ground at terminal B cause the actuator motor to extend the actuator shaft, tilting the left broom to the desired UP position.

Left Broom Tilt Feedback Circuit

The left broom tilt feedback circuit notifies the control system of the left broom tilt position. The linear actuator feedback circuit is connected to the left broom linear actuator by connector CH-C1 pin B. The 5 VDC used by the feedback circuit is routed from controller CR721S CM-C68 pin 31 to the feedback potentiometer connector terminal C.

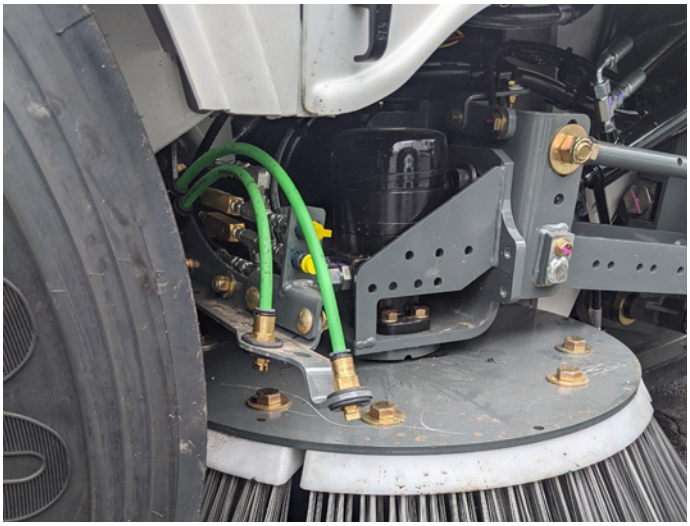

Fig. 194: Side Broom Linear Actuator

Fig. 195: Left Broom Tilt Switch

The feedback potentiometer is grounded at terminal A by a ground circuit from controller CR721S CM-C18 pin 14. When the linear actuator is moved in the up or down position a third point on the potentiometer routes voltage from the potentiometer terminal B to controller CR721S CM-C18 pin 8. The control system uses the input at the CM-C18 pin 8 to determine the linear actuator tilt position. The input also causes the display to show the broom tilt position.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The illumination of the left broom tilt down switch (Tilt Down Sw) indicator (Fig. 196: Left Broom Tilt) shows that the left broom tilt switch is in the tilt down position and voltage has been routed from the switch terminal 5 to controller CR721S CM-C8 pin 42 and ground to CM-C8 pin 58. The illumination of the left broom tilt up switch (Tilt Up Sw) indicator indicates the left broom tilt switch is in the tilt up position and voltage has been routed from the switch terminal 2 to controller CR721S CM-C18 pin 58 and ground to CM-C18 pin 42.

The illumination of the left broom tilt down relay (Tilt Down Relay) indicator shows that voltage has been routed from controller CR721S CM-C18 pin 17 to the left broom tilt down relay terminal 2 energizing the relay. The illumination of the left broom tilt up relay (Tilt Up Relay) indicator indicates voltage has be routed from controller CR721S CM-C18 pin 19 to the left broom tilt up relay terminal 2, energizing the relay.

The tilt angle percentage (Tilt Angle -xxx%) indicates the tilt position output voltage to the controller CR721S CM-C18 pin 8 from the linear actuator terminal B sensor. The signal is converted from a voltage to a tilt percentage.

A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

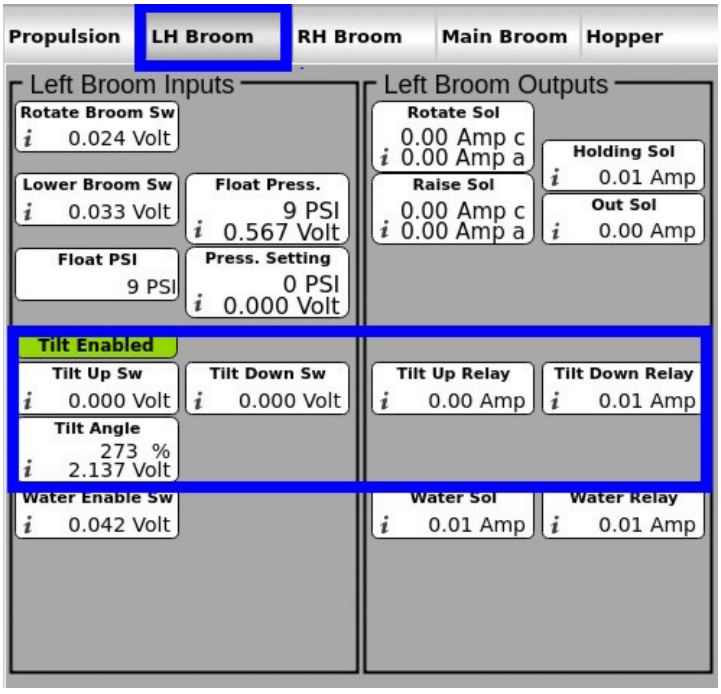

Fig. 196: Left Broom Tilt

Fault Codes:

- Tilt switch – S0320-11

Code S0320-11 means that both tilt switch inputs have power to them at the same time. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 58 and the tilt switch terminal 5. Use a multimeter to check for 12 V on switch terminal 5 and ground on switch terminal 2 and 12 V on switch terminal 2 and ground on terminal 5.

- Tilt sensors – S0330-03 and 04

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C18 pin 8 and the left side broom left side broom linear actuator terminal B. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 31 and the left side broom linear actuator terminal C. Use a multimeter to check for a ground circuit from controller CR721S CM-C18 pin 14 and the left side broom linear actuator terminal A.

- Tilt up relay – S0375-05, 06 and 12

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short ground between controller CR721S CM-C18 pin 19 and the left side broom tilt up relay terminal 2. Use a multimeter to check for a ground circuit at the relay terminal 1.

- Tilt down relay – S0370-95, 06 and 12

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short ground between controller CR721S CM-C18 pin 17 and the left side broom tilt down relay terminal 2. Use a multimeter to check for a ground circuit at the relay terminal 1.

LEFT SIDE BROOM LIGHT CIRCUIT

The left side broom light (Fig. 197: Left Side Broom Light) is controlled by the left side broom light switch. The battery voltage for operation of the left broom light switch is routed from the switched power circuit and fuse B15 (10A) to the left broom light switch terminal 2 (Fig. 198: Left Side Broom Light Circuit). When the light switch (Fig. 199: Light Switches) is placed in the ON position, battery voltage is routed through the switch and terminal 3 to the left side broom light terminal 1. The broom light is grounded by a ground circuit from ground splice CH-S20 at terminal 2. The battery voltage at terminal 1 and ground circuit at terminal 2 cause the broom light to illuminate.

Fig. 197: Left Side Broom Light

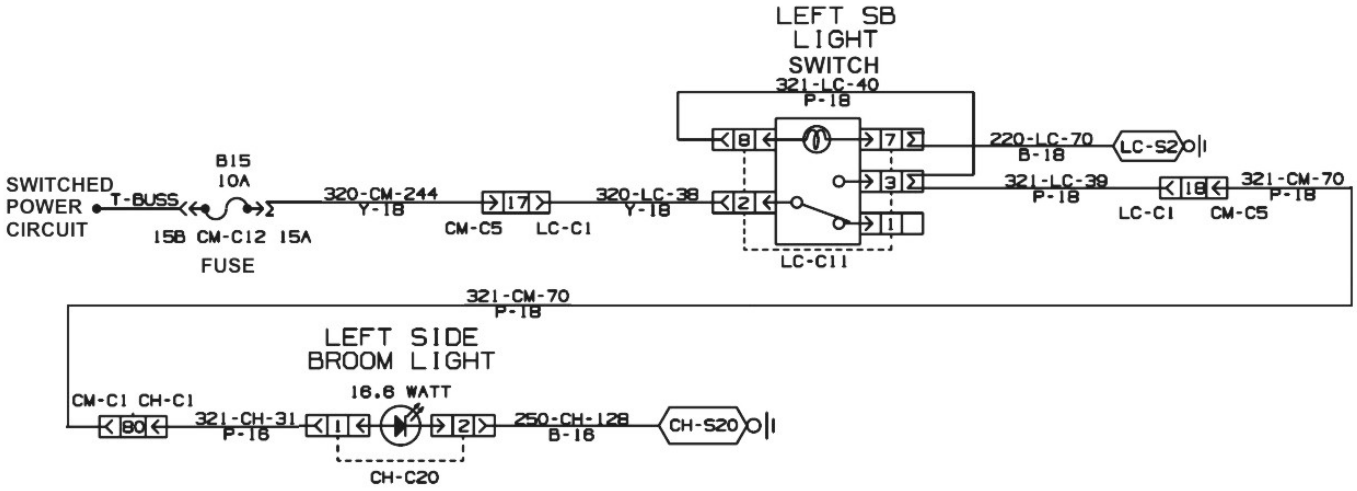

Fig. 198: Left Side Broom Light Circuit

Fig. 199: Light Switches

LEFT SIDE BROOM WATER CIRCUIT
S0360

Fig. 200: Left Side Broom Water Circuit shows the left side broom water circuit.

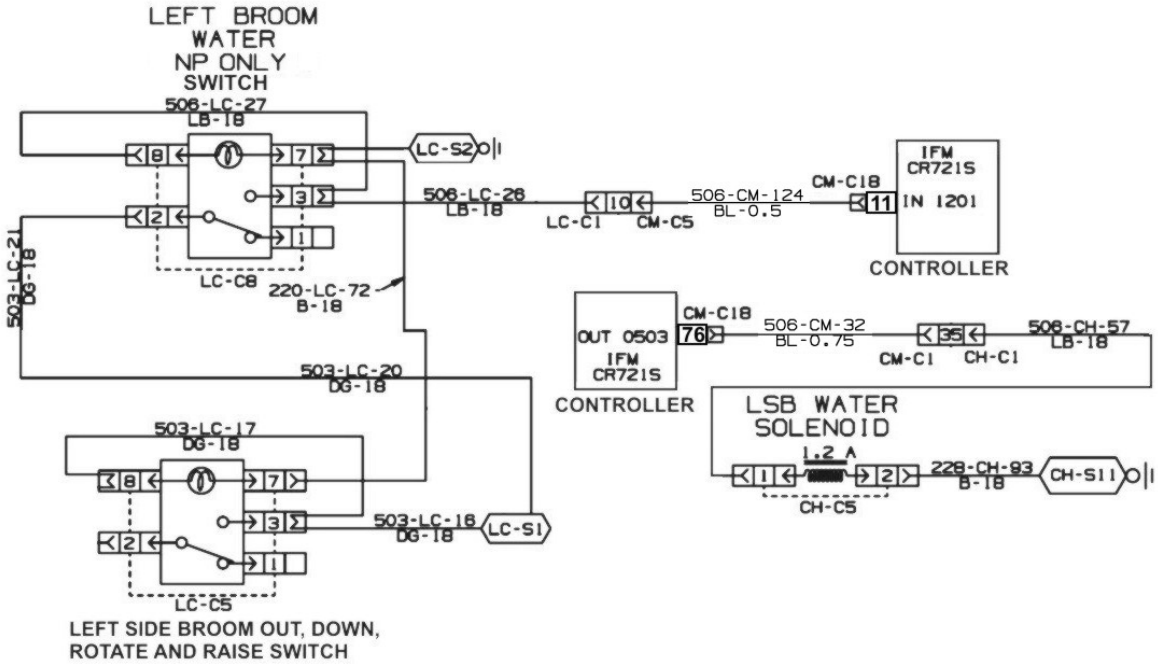

Fig. 200: Left Side Broom Water Circuit

Fig. 201: Left Side Broom Switches shows the broom switches for the left side.

Fig. 201: Left Side Broom Switches

The left side broom water solenoid is controlled by the sweeper water system and the left broom water switch. See Water System Circuit on page 216. When the water system is activated, and the left side broom UP/DOWN switch is placed in the DOWN position, battery voltage is routed from the left side broom switch terminal 3 to the left side broom water switch terminal 2. See Left Side Broom Up/Down And Rotate Circuit on page 170.

When the left side broom water switch is placed in the ON position, battery voltage is routed from the switch terminal 3 to controller CR721S CM-C18 pin 11. The input at CM-C18 pin 11 causes the control system to energize the water pump relay and the water pump. See Fig. 200: Left Side Broom Water Circuit on page 181. The input at CM-C18 pin 11 also causes the control system to route battery voltage from controller CR721S CM-C18 pin 76 to the left side broom water solenoid terminal 1. Because the water solenoid is grounded at terminal 2 by a ground circuit from ground splice CH-S11, the solenoid valve opens allowing water to flow through the solenoid valve to the left side broom water nozzle.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The illumination of the left broom water enable switch (Water Enable Sw) (Fig. 202: Left Broom Water) indicates the switch is active and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 11. The illumination of the water solenoid (Water Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 76 to the left broom water solenoid coil terminal 1. Check for a ground circuit at the water solenoid coil terminal 2. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes:

- LSB water solenoid faults S0360-05, 06, 12, 20 and 21

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 76 and the left side broom water solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the solenoid coil terminal 2. Check for solenoid coil and connectors for corrosion and damage. Use a multimeter to check the left side broom water solenoid coil resistance for 11.3 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

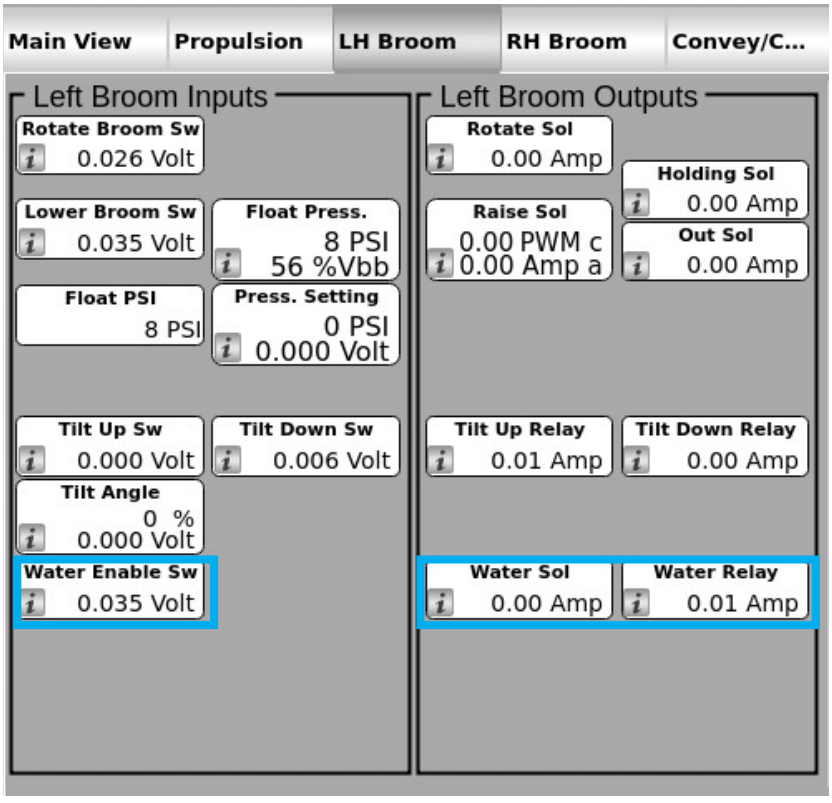

Fig. 202: Left Broom Water

RIGHT SIDE BROOM DOWN PRESSURE CIRCUIT

S0200, S0210, S0240

The right side broom is controlled by the right side broom UP/DOWN switch (Fig. 203: Right Side Broom UP/DOWN Switch). The battery voltage for operation of the right side broom is routed from the sweep power circuit and fuse D10 (10A) to the right broom switch terminal 2. When the switch is placed in the UP position, battery voltage is routed through the switch and terminal 3 to the right side broom down pressure BIN switch terminal C. See the circuit entitled right side broom out down rotate and raise circuit.

The right side broom down pressure BIN switch controls the broom down pressure. The position of the down pressure switch determines the right side broom down pressure. The switch varies from 0V output to 7.32V at controller CR721S CM-C8 pin 61. See the circuit schematic. The battery voltage at the down pressure BIN switch terminal C is routed proportionally by switch position to a resistor pack containing three resistors (3) 68 Ω and (1) 120 Ω. The resistors are grounded by a ground circuit to the resistor pack terminal 6 by a ground circuit from controller CR721S CM-C8 pin 71. The routing through the resistor pack results in a position signal at controller CR721S CM-C8 pin 61. The input at the controller CM-C8 pin 61 is used by the control system to calculate the desired side broom down pressure.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The selected down pressure is monitored by a hydraulic pressure transducer. The transducer converts the hydraulic pressure input to an analog output signal. The signal is then routed to controller CR721S CM-C8 pin 59. The input signal is analyzed by the control system. A solenoid valve blocks the flow of hydraulic oil to the right broom lift cylinder (retract side) until the solenoid is actuated. The controller input signals from the transducer allow the controller to position the solenoid valve based on the BIN switch and transducer input signals. When the transducer signals the need for a change in the pressure holding the broom, the control system adjusts the current flow to the RSB Raise cylinder to adjust that pressure to the amount requested by the BIN switch.

The battery voltage for operation of the right side broom down pressure transducer (Fig. 204: Side Broom Raise Manifold) is routed from the switched power circuit and fuse B7 (10A) to the down pressure transducer terminal A. The down pressure transducer is grounded at terminal C by a ground signal from controller CR721S CM-C8 pin 71. As the down pressure increases or decreases the transducer sends a signal from terminal B to controller CR721S CM-C8 pin 59. The input signal is used by the control system to continually apply right broom down pressure based on the down pressure bin switch output to the controller CR721S CM-C8 pin 61.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 203: Right Side Broom UP/DOWN Switch

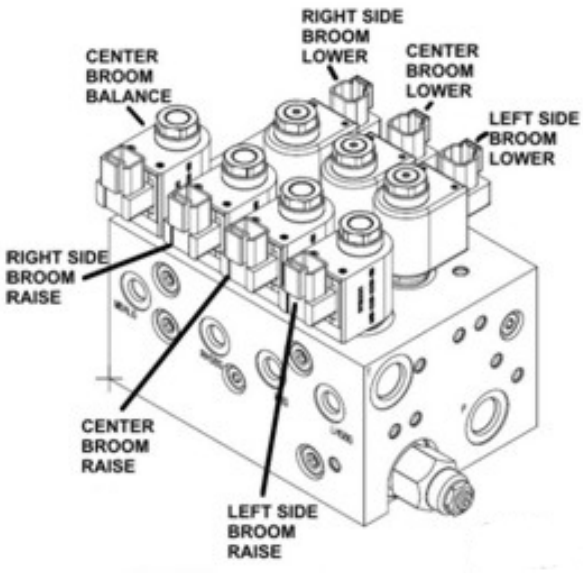

Fig. 204: Side Broom Raise Manifold

Fig. 205: Right Side Broom Down Pressure Circuit Sheet 1 shows sheet 1 of the right side broom down pressure circuit.

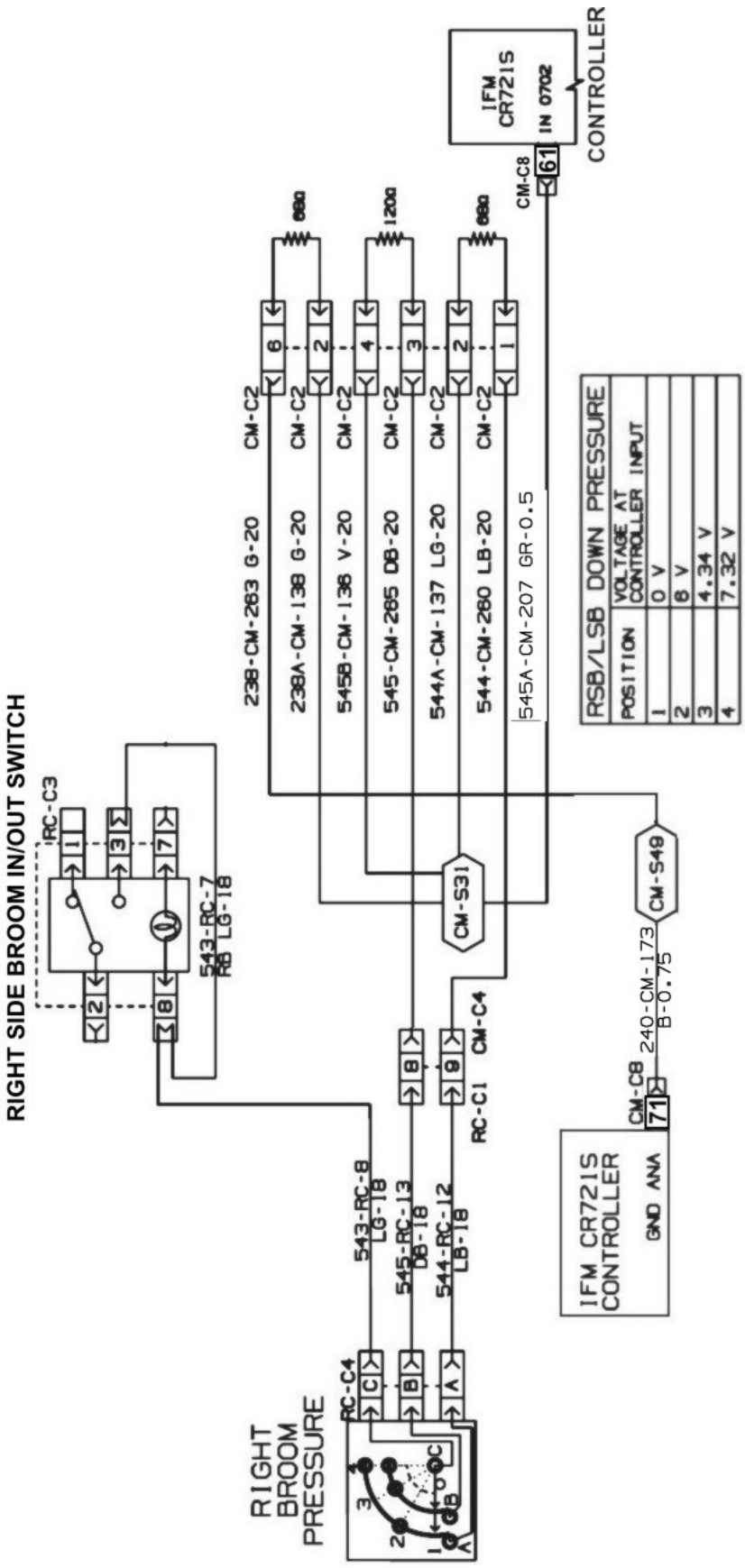

Fig. 205: Right Side Broom Down Pressure Circuit Sheet 1

Fig. 206: Right Side Broom Down Pressure Circuit Sheet 2 shows sheet 2 of the right side broom down pressure circuit.

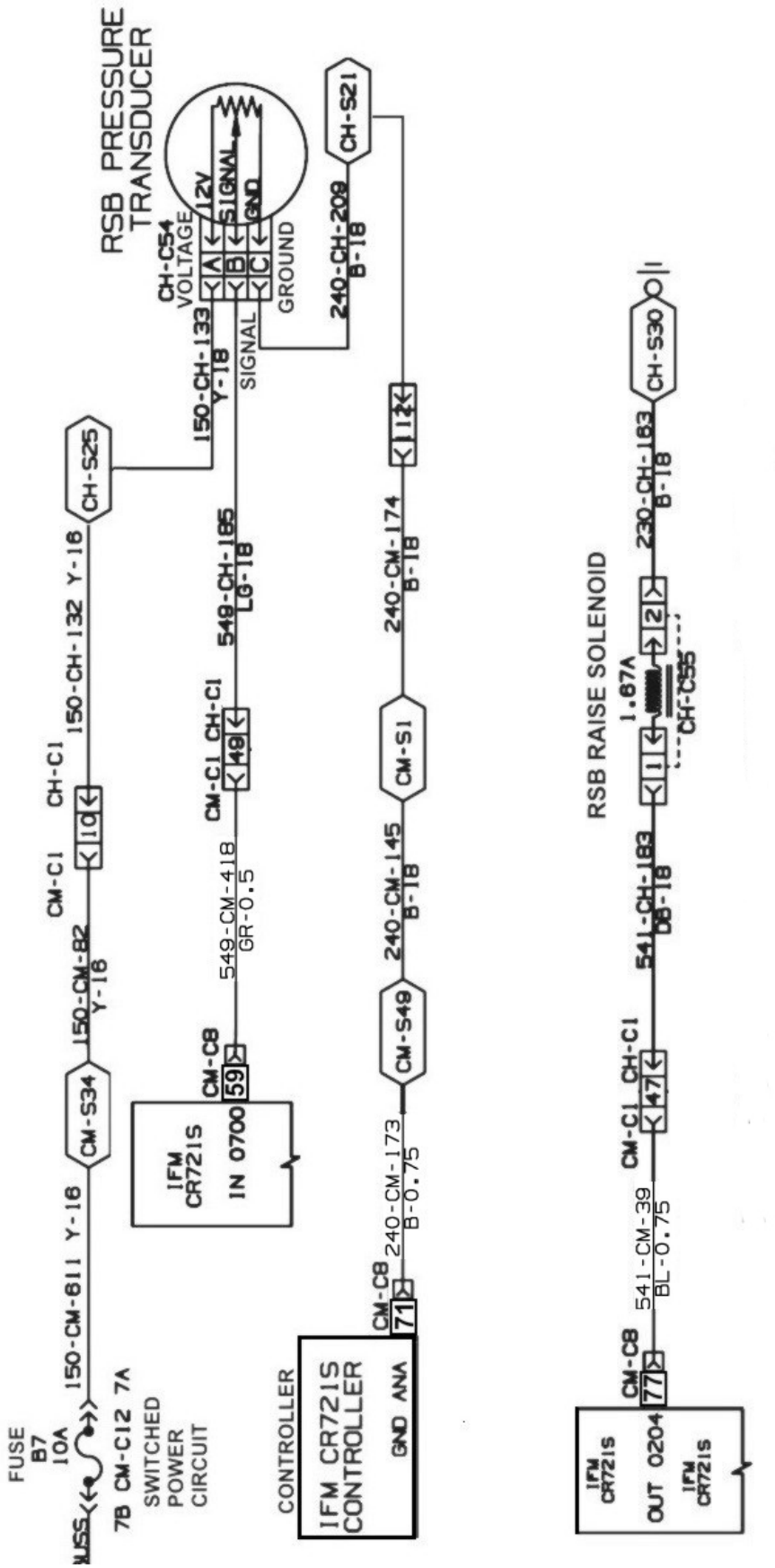

Fig. 206: Right Side Broom Down Pressure Circuit Sheet 2

The right broom float pressure voltage (Float Press- xxxx), float pressure select voltage (Press Setting- xxxx) and float pressure (psi) (Float Psi- xxx) indicators can be used to monitor the overall operation of the right side broom down pressure circuit. By observing the right broom indicators and using the right broom pressure switch to change down pressure selections the operation of the right down pressure components can be evaluated. The output results shown on the indicators show the operation of the down pressure switch, resistor pack, down pressure transducer, raise solenoid, and controller CR721S inputs and outputs. See Fig. 207: Right Broom Down Pressure. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: RSB down pressure switch voltage out of normal range – S0210-11.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between CR721S CM-C8 pin 61 and controller CR721S controller CM-C8 71 and the right side broom down pressure switch terminals A and B. Use a multimeter to check the resistor pack resistance values. Use a multimeter to check for voltage input at the right side broom down pressure switch terminal C. Check for voltage at the right side broom UP/DOWN switch terminal 3. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for ground for opens, shorts and short to ground between the right side broom UP/DOWN switch terminal 3 and the right side broom down pressure switch terminal C.

RSB down pressure transducer – S0200-03 and 04.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 59 and the right side broom pressure transducer terminal B. Use a multimeter to check for input voltage at the right side broom pressure transducer terminal A. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 71 and the right side broom transducer terminal C.

Right broom raise solenoid – S0240-05, 06, 12, 20 and 21.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 77 and the right side broom raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the right side broom raise solenoid valve coil terminal 2. Use a multimeter to check the right side broom raise solenoid coil resistance for 7.2 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

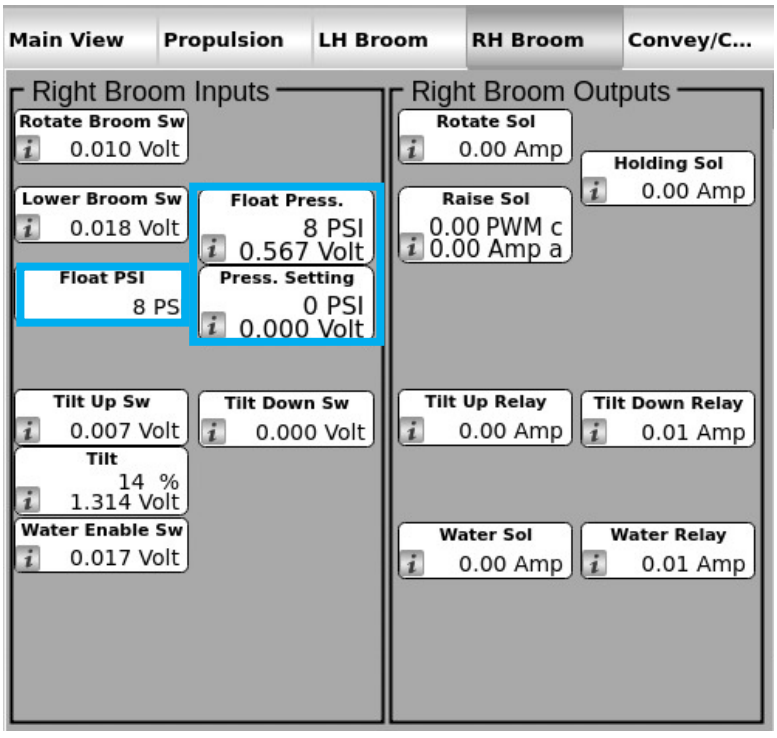

Fig. 207: Right Broom Down Pressure

RIGHT SIDE BROOM LIGHT

The right side broom light (Fig. 208: Right Side Broom Light) is controlled by the right side broom light switch (Fig. 209: Light Switches). The battery voltage for operation of the right broom light switch is routed from the switched power circuit (Fig. 210: Switched Power Circuit) and fuse B15 (10A) to the right broom light switch terminal 2. When the light switch is placed in the ON position, battery voltage is routed through the switch and terminal 3 to the right side broom light terminal 1. The broom light is grounded by a ground circuit from ground splice CH-S24 at terminal 2. The battery voltage at terminal 1 and ground circuit at terminal 2 illuminate the broom light.

If necessary, see Fuses And Relays on page 19 to locate fuses.

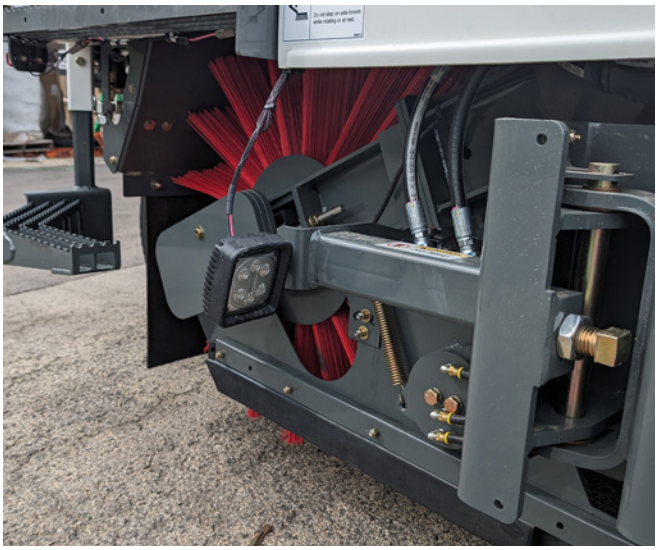

Fig. 208: Right Side Broom Light

Fig. 209: Light Switches

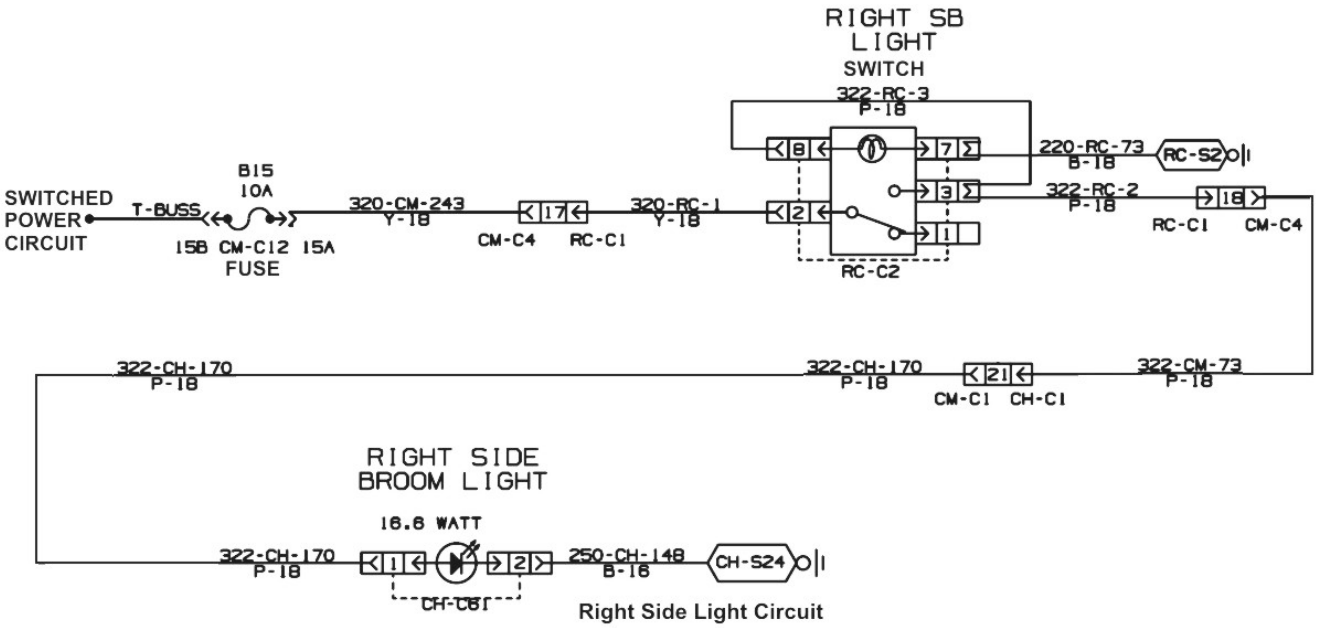

Fig. 210: Switched Power Circuit

RIGHT BROOM SIDE WATER
S0260

The water for the right side broom is supplied by the water pump to the right side broom water solenoid. See Fig. 212: Right Side Broom Water Circuit on page 190. The right side broom water solenoid is controlled by the right side broom water switch (Fig. 211: Right Side Broom Switches). The battery voltage for operation of the water switch is routed from the right side broom UP/DOWN switch when the switch is in the DOWN position. The voltage is routed from the right side broom UP/DOWN switch terminal 3 to the water switch terminal 2. When the switch is placed in the ON position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C18 pin 30. The input voltage at CM-C18 pin 30 causes the control system to route battery voltage from the controller CR721S CM-C18 pin 16. The battery voltage at CM-C18 pin 16 is routed to the right side broom water solenoid coil terminal 1. The water solenoid is grounded at terminal 2 by a ground circuit from ground splice CH-S11 to the water solenoid coil terminal 2. The ground circuit at terminal 2 and battery voltage at terminal 1 opens the solenoid valve allowing water to flow through the solenoid valve to the right side broom water nozzle.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The illumination of the right broom water enable switch (Water Enable Sw) (Fig. 213: Right Broom Water on page 190) on the display indicates the right broom water switch is in the on position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 30. The illumination of the water solenoid (Water Sol) indicator with amperage draw (x.xx Amp) indicates the water solenoid is activated by voltage from controller CR721S CM-C18 pin 16. Check for a ground circuit at the right water solenoid coil terminal 2. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: RSB water solenoid – S0260-05, 06, 12, 20 and 21.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between CR721S CM-C18 pin 16 and the right side broom water solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the right side broom water solenoid coil terminal 2. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check the right side broom water solenoid coil resistance for 11.3 Ω at 68° F.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

Fig. 211: Right Side Broom Switches

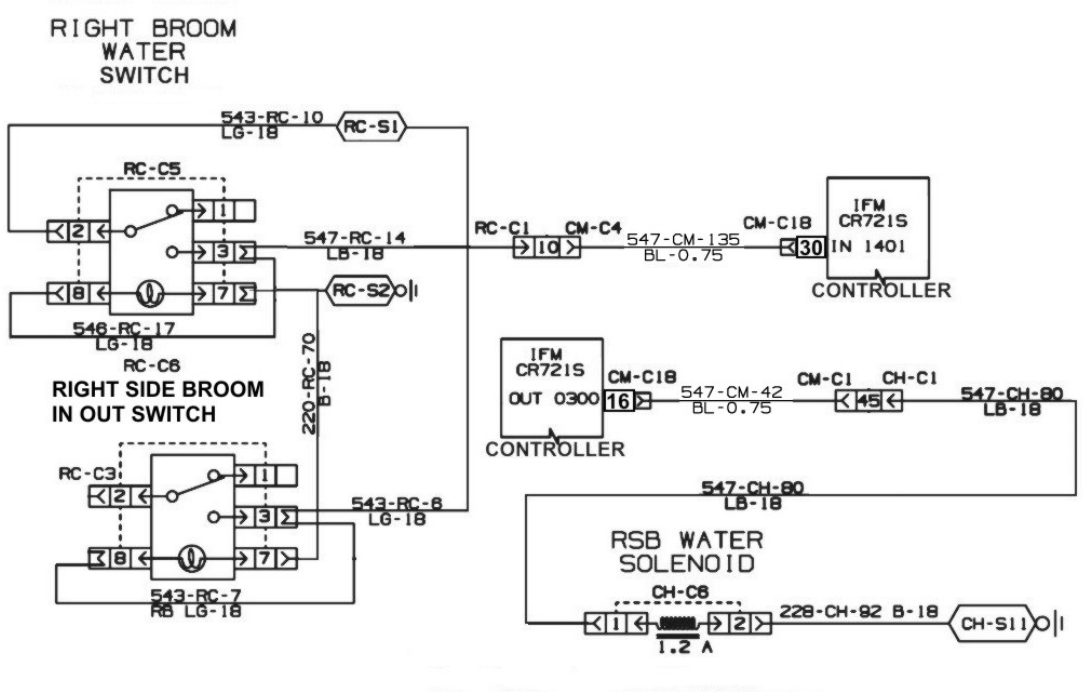

Fig. 212: Right Side Broom Water Circuit

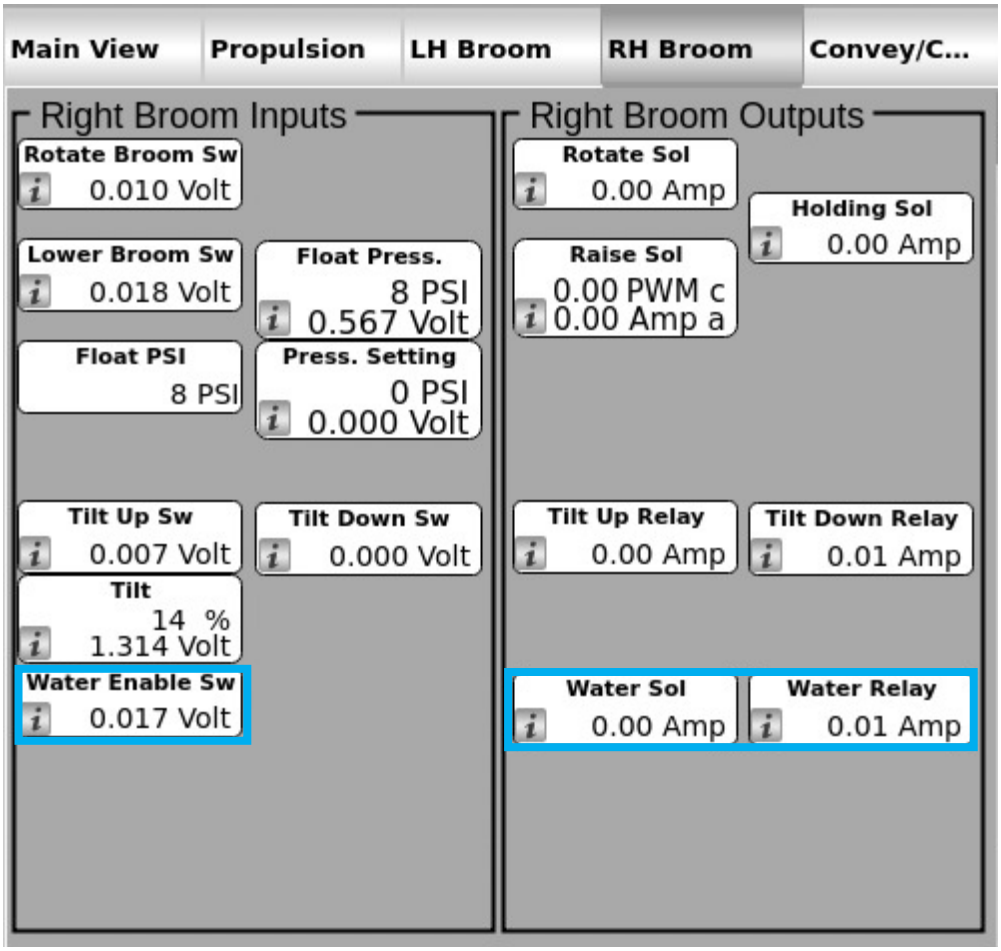

Fig. 213: Right Broom Water

RIGHT SIDE BROOM ROTATE
S0250

The right side broom drive motor rotation is controlled by the right side broom rotate forward solenoid valve. The solenoid valve supplies hydraulic oil to the right side broom drive motor. When the right side broom UP/DOWN switch is placed in the DOWN position, battery voltage is routed from the switch terminal 3 to the right broom rotation switch terminal 2. See Fig. 214: Right Side Broom Rotation Circuit.

When the right broom rotation switch is placed in the ON position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C18 pin 42. The input voltage at CM-C18 pin 42 causes the control system to route battery voltage from the controller CM-C18 pin 71 to the right side broom forward rotate solenoid valve terminal 1. The solenoid valve is grounded at terminal 2 by a ground circuit from ground splice CH-S13. The battery voltage at terminal 1 and ground circuit terminal 2 opens the solenoid valve allowing hydraulic oil to flow through the solenoid valve to the right side broom drive motor, rotating the right side broom in the forward direction.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

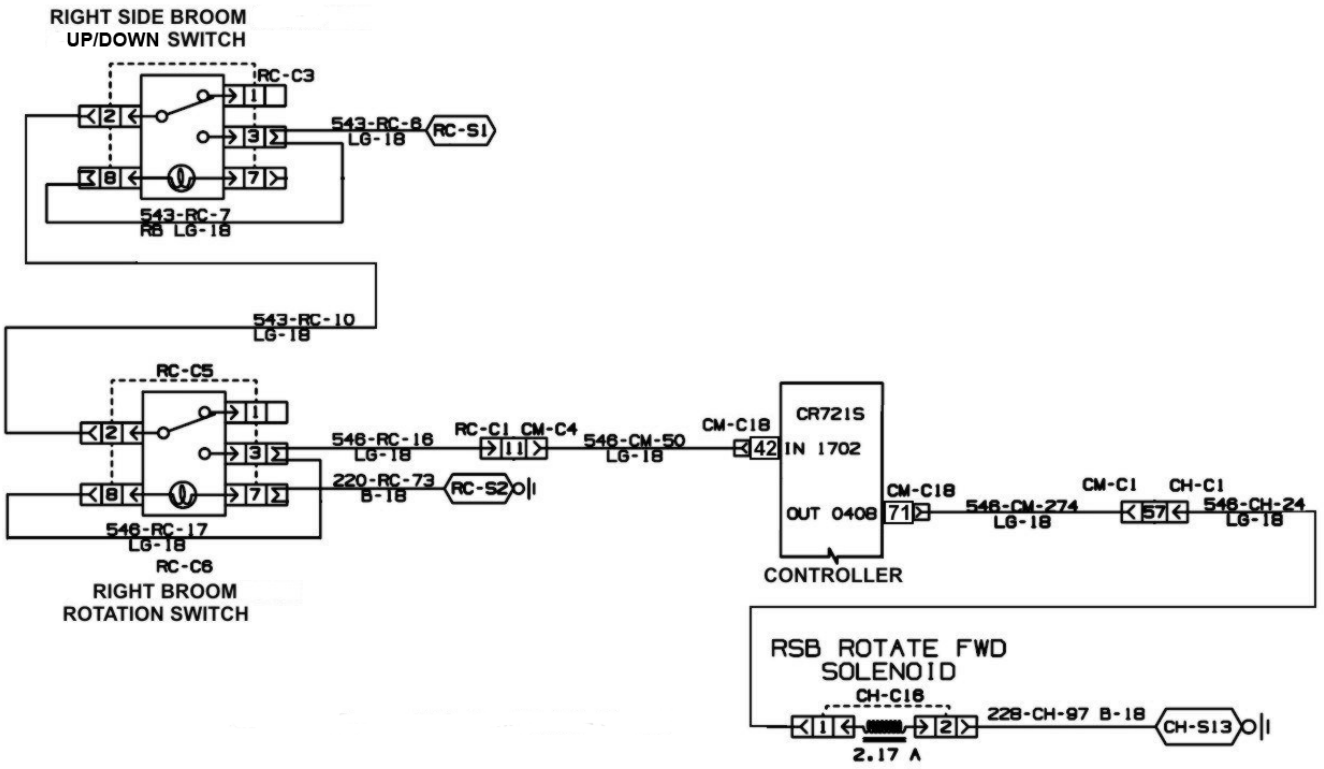

Fig. 214: Right Side Broom Rotation Circuit

When the right side broom rotate switch is placed in the OFF position (Fig. 215: Right Side Broom Switches) battery voltage no longer flows to the right side broom rotate solenoid coil terminal 1 and right broom stops rotating. See Fig. 216: Broom Rotate Manifold.

The illumination of the right broom rotate switch (Rotate Broom Sw) (Fig. 217: Right Broom Rotate) on the display indicates the right broom rotation switch is in the on position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 42. The illumination of the rotate solenoid (Rotate Sol) indicator indicates voltage has been routed from controller CR721S CM-C18 pin 71 to the right broom rotate solenoid coil. Check for a ground circuit at the solenoid coil terminal 2. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: RSB rotate solenoid – S0250-05, 06, 12, 20 and 21.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C18 pin 71 and the right side broom rotate forward solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the right side broom rotate forward solenoid coil terminal 2. Check the solenoid coil for corrosion and damage. Use a multimeter to check the solenoid coil resistance for 5.6 Ω at 68°F (20°C).

Fig. 215: Right Side Broom Switches

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

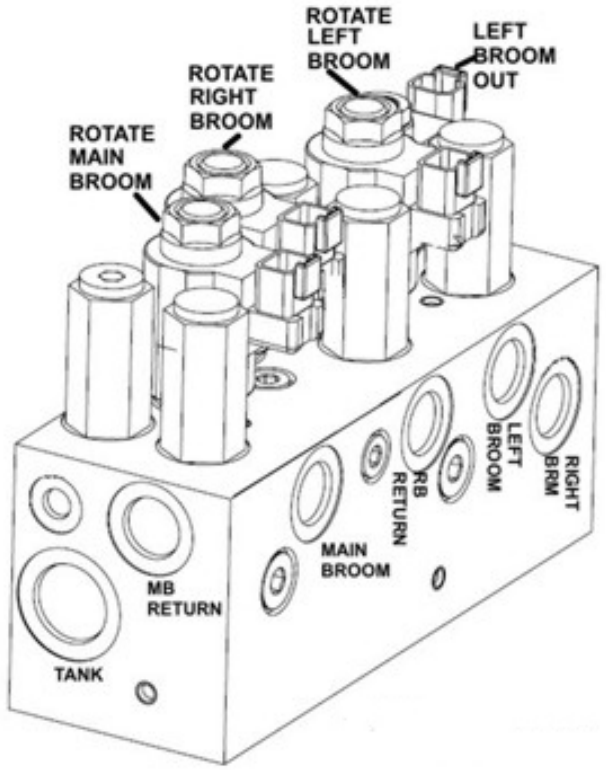

Fig. 216: Broom Rotate Manifold

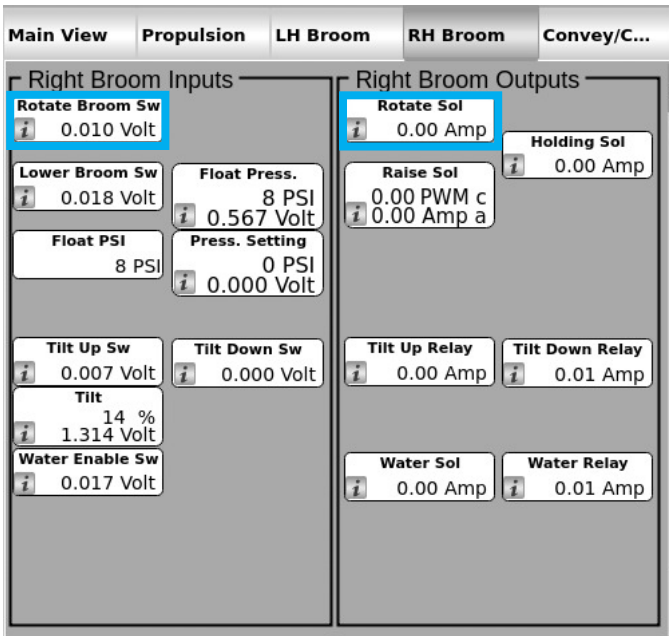

Fig. 217: Right Broom Rotate

RIGHT SIDE BROOM UP/DOWN CIRCUIT
S0240, S0245

The right side broom is controlled by the right side broom UP/DOWN switch (Fig. 218: Right Side Broom Switches) and the right side rotate switch. The battery voltage for operation of the UP/DOWN switch is routed from the sweep power circuit and fuse D10 (10A) to the UP/DOWN switch terminal 2. When the switch is placed in the DOWN position, battery voltage is routed from the switch terminal 2 through the switch and terminal 3 to controller CR721S CM-C18 pin 29. The input voltage at CM-C18 pin 29 causes the control system to route battery voltage from the controller to the right side broom lower solenoid coil (Fig. 219: Side Broom Raise Manifold).

If necessary, see Fuses And Relays on page 19 to locate fuses.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The battery voltage for operation of the right side broom lower solenoid valve is routed from the controller CR721S CM-C8 pin 10 to the right side broom lower solenoid coil terminal 1. The right side broom lower solenoid coil is grounded at terminal 2 by a ground circuit from ground splice CH-S30. The battery voltage at terminal 1 and a ground circuit at terminal 2 opens the solenoid valve allowing hydraulic oil to flow to the right side broom cylinder retract side, lowering the right side broom.

The controller also starts controlling the raise valve PWM to maintain down pressure. See the section entitled Right Side Broom Down Pressure.

When the right side broom UP/DOWN switch is placed in the raise position, battery voltage no longer flows to controller CR721S CM-C18 pin 29, causing the system to remove voltage from the right side broom lower solenoid coil closing the right side broom lower valve, trapping oil in the retract side. The controller also outputs battery voltage to the raise solenoid to raise the broom.

Fig. 218: Right Side Broom Switches

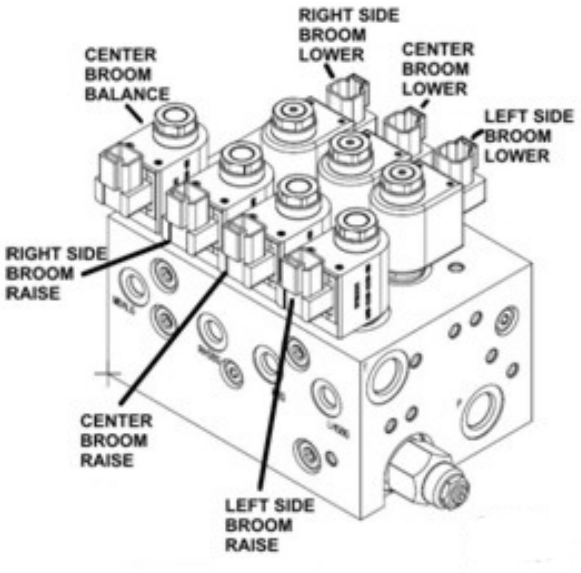

Fig. 219: Side Broom Raise Manifold

The illumination of the right broom in and out switch indicator and voltage (Lower Broom Sw xxxx Volt) shows that the switch is in the on position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C18 pin 29. See Fig. 220: Right Broom. Check for a ground circuit at the solenoid coil terminal 2. The illumination of the right broom raise solenoid (Raise Sol xxxx Amp) indicates that the solenoid is active. Check for ground circuit at the solenoid coil terminal 2. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes: RSB lower solenoid – S0245-05, 06, 12, 20 and 21.

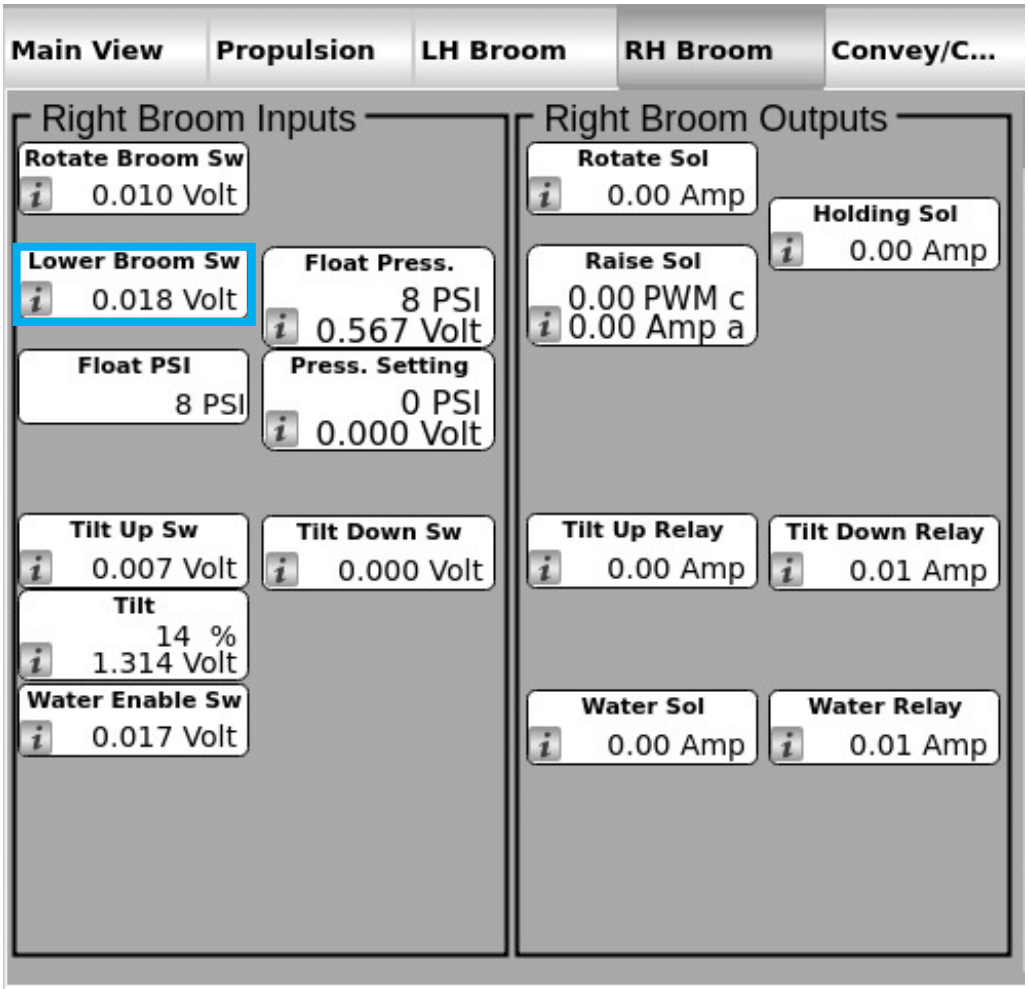

Fig. 220: Right Broom

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 10 and the right side broom lower solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the right side broom lower solenoid coil terminal 2. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check the solenoid coil resistance for 9 Ω at 68°F (20°C).

RSB raise solenoid – S0240-05, 06, 12, 20 & 21.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 77 and the right side broom raise solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the right side broom raise solenoid coil terminal 2. Check the solenoid coil and connectors for corrosion and damage. Use a multimeter to check the solenoid coil resistance for 7.2 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

Fig. 221: Right Side Broom Up/Down Circuit on page 196 shows the right side broom up/down circuit.

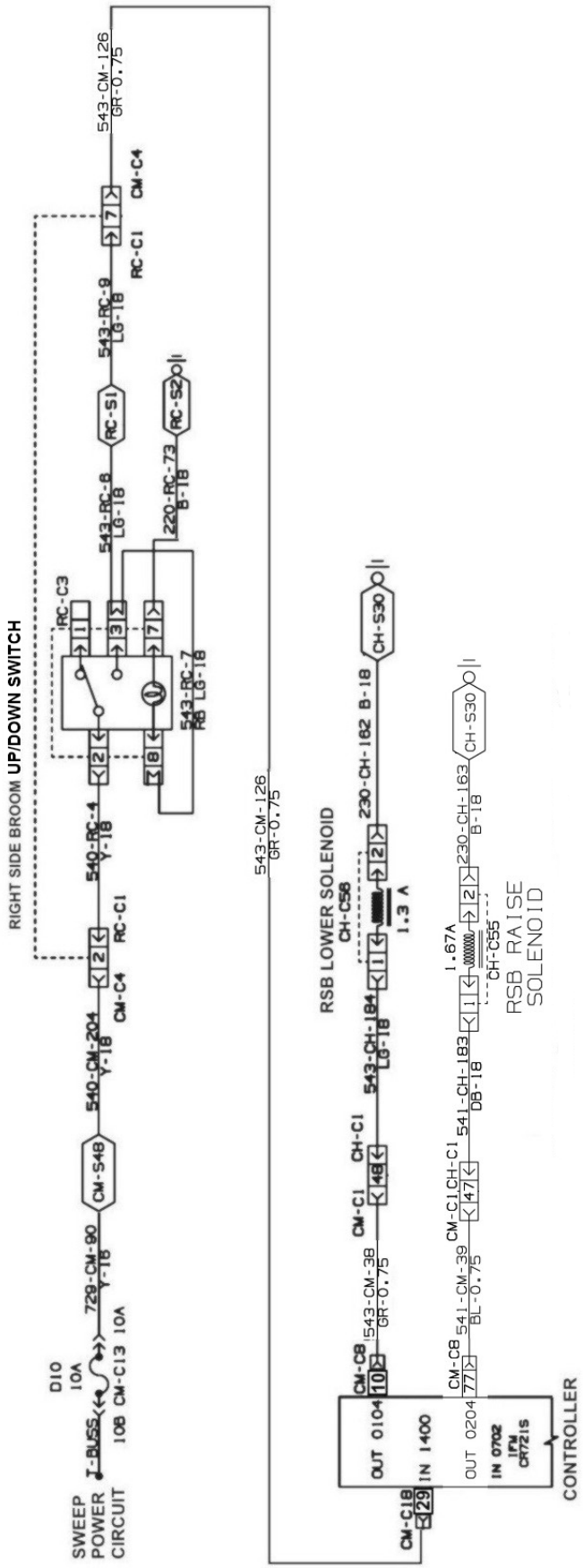

Fig. 221: Right Side Broom Up/Down Circuit

RIGHT BROOM TILT CIRCUIT
S0220, S0230, S0270, S0275

The right broom tilt circuit routes a ground circuit through a tilt relay to one side of the linear actuator motor (Fig. 222: Side Broom Tilt Actuator) while battery voltage is routed to the other side of the linear actuator motor by the other tilt relay. The circuit is reversed to tilt the linear actuator in the opposite direction.

Right Broom Tilt Down Circuit

The battery voltage is routed from fuse D10 (10A) to the right side broom tilt switch terminals 1 and 6. When the switch is placed in the DOWN position (Fig. 223: Right Side Broom Controls), the battery voltage is routed through the switch terminal 5 to controller CR721S CM-C8 pin 27 and ground to pin 28. The voltage at CM-C8 pin 27 and the ground to pin 28 notifies the controller that the right broom should be tilted down. The right tilt down relay normally routes a ground circuit from terminal 4 through terminal 3 to the linear actuator terminal B. The relay coil is grounded at terminal 1. The relay is energized by battery voltage routed to the relay terminal 2 from controller CF721S CM-C18 pin 21.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When energized the relay routes battery voltage from the battery power circuit and fuse B1 (10A) from terminal 5 through terminal 3 to the linear actuator terminal B. The other side of the linear actuator is grounded at terminal A by a ground circuit from the right broom tilt up relay terminal 3.

The battery voltage at the linear actuator terminal B and ground at terminal A cause the actuator motor to retract the actuator shaft, tilting the right broom to the desired DOWN position.

Fig. 222: Side Broom Tilt Actuator

Fig. 223: Right Side Broom Controls

Right Broom Tilt Up Circuit

When the switch is placed in the UP position, the battery voltage is routed from the switch terminal 2 to controller CR721S CM-C18 pin 28 and ground to CM-C18 pin 27. The voltage at CM-C18 pin 28 and ground to CM-C18 pin 27 notify the controller that the right broom should be tilted up. The right tilt up relay normally routes a ground circuit from terminal 4 through terminal 3 to the linear actuator terminal A until energized. The other side of the relay coil is grounded at terminal 1. The relay is energized by battery voltage routed to the relay terminal 2 from controller CR721S CM-C18 pin 64.

When energized, the relay routes battery voltage from terminal 5 through terminal 3 to the linear actuator terminal A.

If necessary, see Fuses And Relays on page 19 to locate relays.

The other side of the linear actuator is grounded at terminal B by a ground circuit from the right broom tilt down relay terminal 3. The battery voltage at the linear actuator terminal A and ground at terminal B cause the actuator motor to extend the actuator shaft, tilting the right broom to the desired UP position.

Right Broom Tilt Feedback Circuit

The right broom tilt feedback circuit notifies the control system of the right broom tilt position. The linear actuator feedback circuit is connected to the right broom linear actuator by connector CH-C68 pin B. The 5VDC voltage used by the feedback circuit is routed from controller CR721S CM-C8 pin 71 to the feedback potentiometer connector terminal C.

The feedback potentiometer is grounded at terminal A by a ground circuit from controller CR721S CM-C18 pin 31. When the linear actuator is moved in the up or down position a third point on the potentiometer routes a voltage range from the potentiometer terminal B to controller CR721S CM-C8 pin 60. The input at the CM-C8 pin 60 is routed to the control system notifying the system of the linear actuator tilt position. The input volt range also causes the display to show the broom tilt position on the display for the operator’s use.

Fig. 224: Right Side Broom Tilt Circuit Sheet 1 shows sheet 1 of the right-side broom tilt circuit.

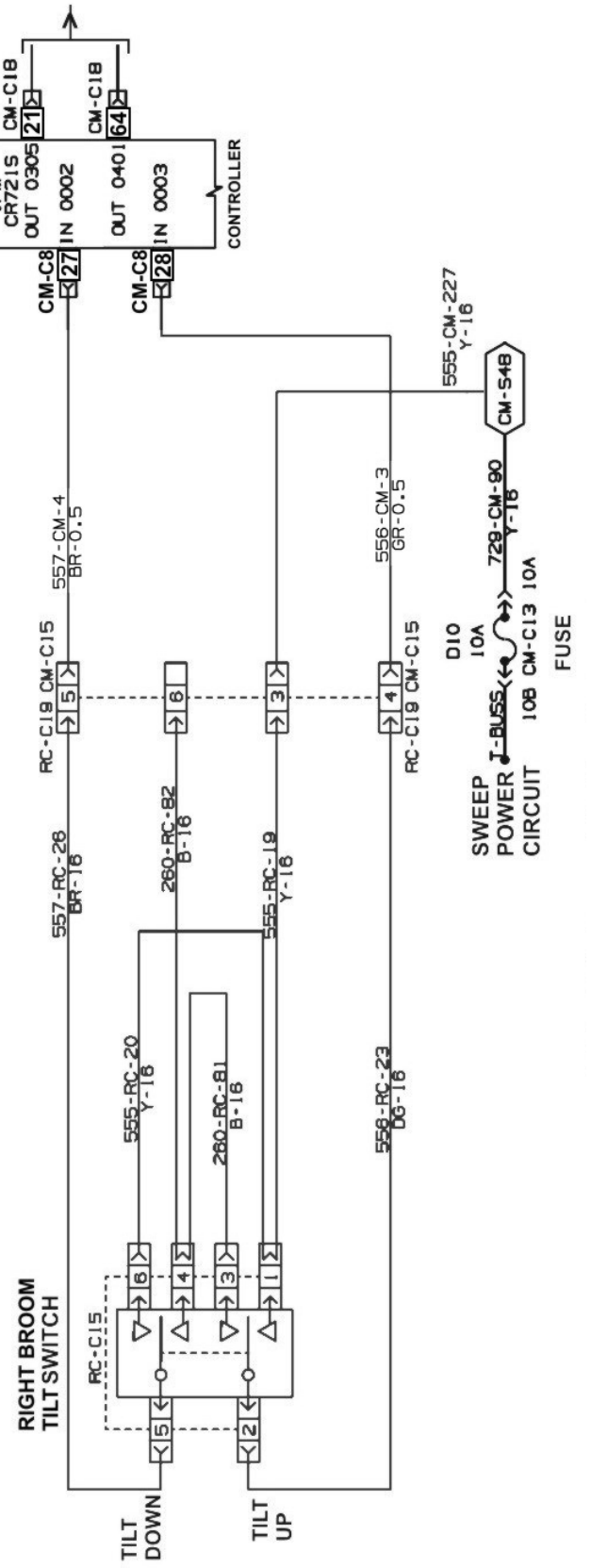

Fig. 224: Right Side Broom Tilt Circuit Sheet 1

Fig. 225: Right Side Broom Tilt Circuit Sheet 2 shows sheet 2 of the right-side broom tilt circuit

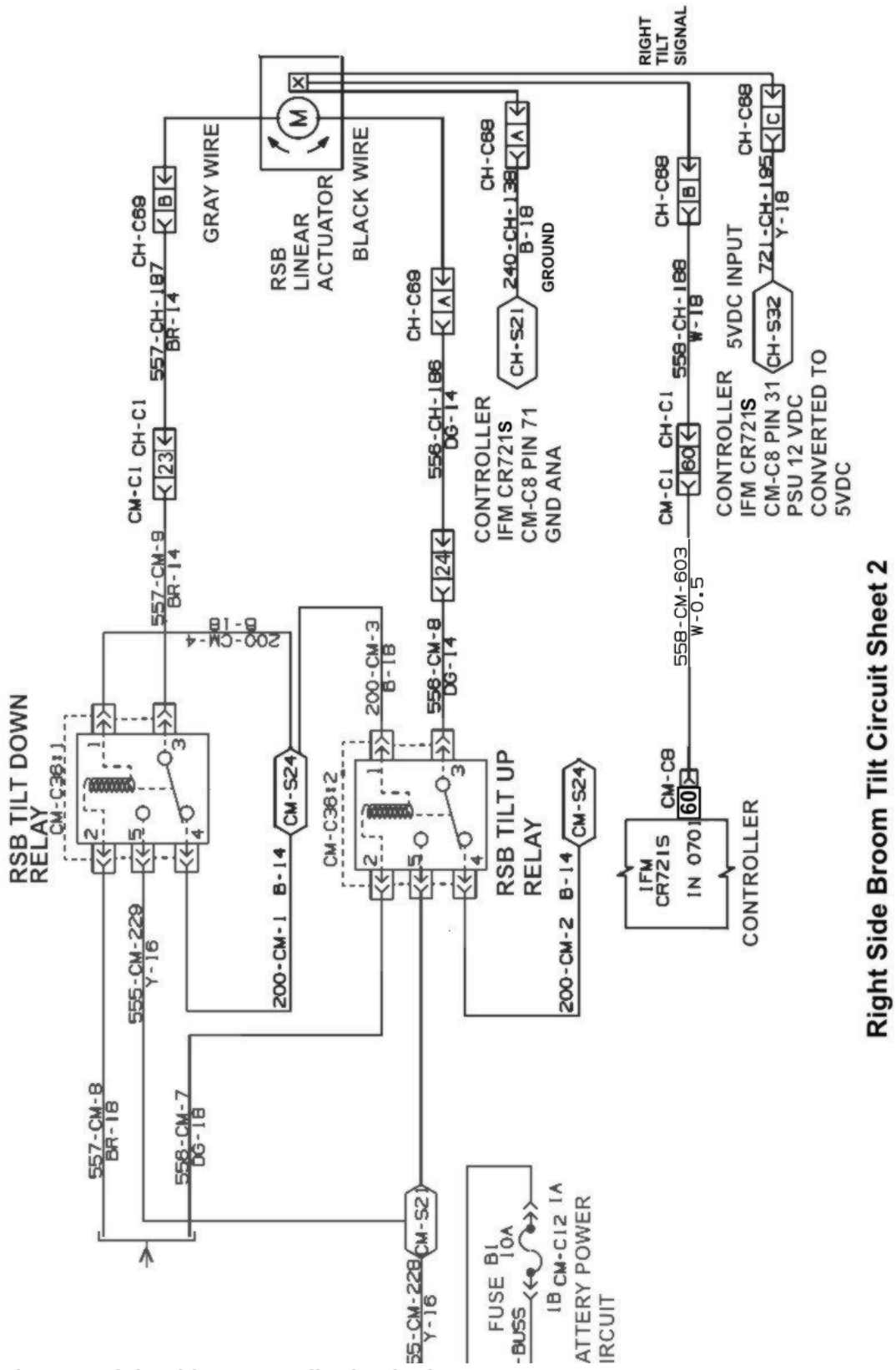

Fig. 225: Right Side Broom Tilt Circuit Sheet 2

The illumination of the right broom tilt down switch (Tilt Down Sw) indicator indicates the right broom tilt switch is in the tilt down position and voltage has been routed from the switch terminal 5 to controller CR721S CM-C8 pin 27 and ground to CM-C8 pin 28. The illumination of the right broom tilt up relay (Tilt Up Relay) indicator indicates the right broom tilt switch is in the tilt up position and voltage has been routed from the switch terminal 2 to controller CR721S CM-C8 pin 28 and ground to CM-C8 pin 27. See Fig. 226: Right Broom Tilt.

The illumination of the right broom tilt down relay (Tilt Down Relay) indicator shows that voltage has been routed from controller CR721S CM-C18 pin 21 to the right broom tilt down relay terminal 2. The illumination of the right broom tilt up relay (Tilt Up Relay) indicator shows that voltage has be routed from controller CR721S CM-C18 pin 64 to the right broom tilt up relay terminal 2.

The tilt percentage (Tilt %- xx) indicates the tilt position (in percent) based on the output voltage signal to the controller CR721S CM-C8 pin 60 from the linear actuator position sensor terminal B.

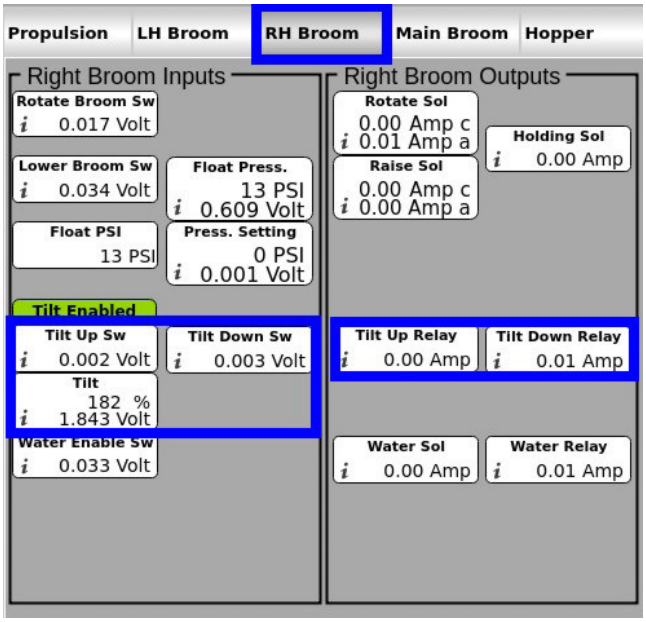

Fig. 226: Right Broom Tilt

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.
Fault Codes: Tilt switch – S0220-11.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 27 and the tilt switch terminal 5. Use a multimeter to check for input voltage at the tilt switch terminal 2. Use a multimeter to check for output voltage at the tilt switch terminal 5.

RSB tilt sensor – S0230-03 and 04.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 60 and the right side broom linear actuator terminal B. Also check for opens and shorts on the 5 V power and ground wires to the actuator position potentiometer.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 31 and the right side broom linear actuator terminal C. Use a multimeter to check for a ground circuit from controller CR721S CM-C8 pin 71 and the right side broom linear actuator terminal A.

RSB tilt up relay – S0275-05, 06 and 12.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short ground between controller CR721S CM-C18 pin 64 and the right side broom tilt up relay terminal 2. Use a multimeter to check for a ground circuit at the relay terminal 1.

RSB tilt down relay – S0270-05, 06 and 13.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short ground between controller CR721S CM-C18 pin 21 and the right side broom tilt down relay terminal 2. Use a multimeter to check for a ground circuit at the relay terminal 1.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

RADIATOR COOLING FAN
P0410

The radiator cooling fan is rotated by a hydraulically driven fan motor. The radiator hydraulic fan motor proportional fan bypass is a normally closed solenoid valve on the cooling fan motor. The solenoid allows hydraulic oil to bypass the fan motor, slowing the motor down. When the bypass solenoid is closed by decreased PWM voltage from controller CR721S CM-C8 pin 22 to the solenoid valve terminal 1, the solenoid bypass is closed, forcing full hydraulic oil flow through the fan motor increasing fan motor to maximum speed. Increased PWM voltage at the solenoid valve opens the valve further, slowing the fan rotation. If a wiring or circuit fault exist the valve will remain closed causing the fan to spin constantly at maximum speed.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The controller output PWM signal is controlled by a coolant temperature signal from the engine ECU through the CANBus to the control system. The control system then routes the PWM signal from controller CR721S CM-C8 pin 22 as needed to control the solenoid valve bypass position.

Fig. 227: Radiator Cooling Fan Hydraulic Motor Circuit shows the radiator cooling fan motor circuit.

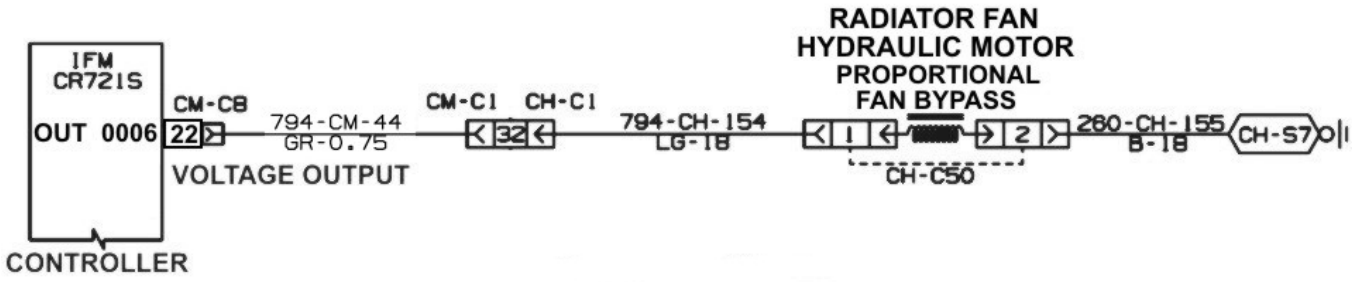

Fig. 227: Radiator Cooling Fan Hydraulic Motor Circuit

The coolant temperature icon and coolant (Fig. 228: Coolant Temperature) indicator display the coolant temperature. A high coolant temperature may indicate radiator fan solenoid valve problems.

The fan pulse width modulation (Fig. 229: Coolant Fan PWM) indicator displays the amperage routed from controller CR721S CM-C8 pin 22 to the radiator fan hydraulic motor proportional fan bypass solenoid valve coil. Variations in the fan PWM amperage indicate that amperage has been routed from the controller CM-C8 pin 22 to the bypass valve.

NOTICE

Cooling Outputs displays the commanded (c) PWM and actual (a) Amp of the cooling fan. A deviation between commanded and actual values indicates a problem.

A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: Radiator Fan solenoid – P0410-05, 06, 12, 20 and 21.

Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 22 and the radiator hydraulic motor proportional fan bypass solenoid coil terminal 1. Use a multimeter to check for a ground circuit at the solenoid coil terminal 2. Check the solenoid coil for corrosion and damage. Use a multimeter to check the solenoid coil resistance for 11 Ω at 68°F (20°C).

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

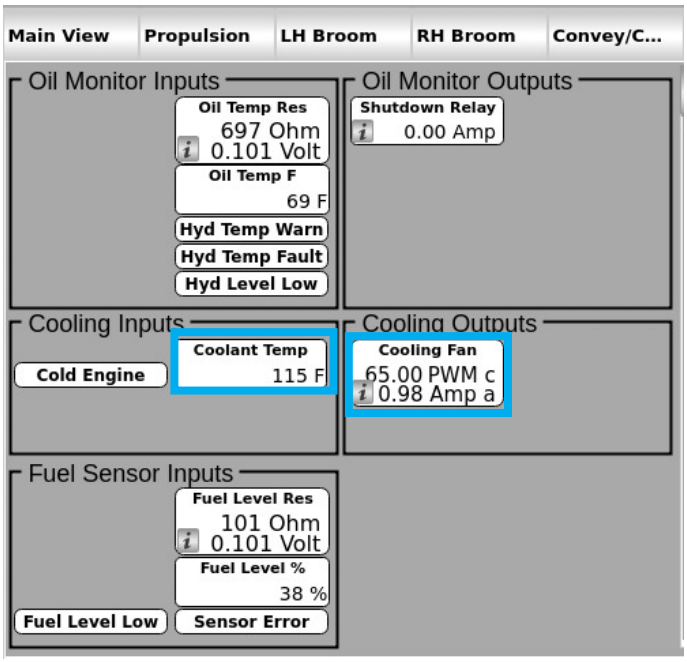

Fig. 229: Coolant Fan PWM

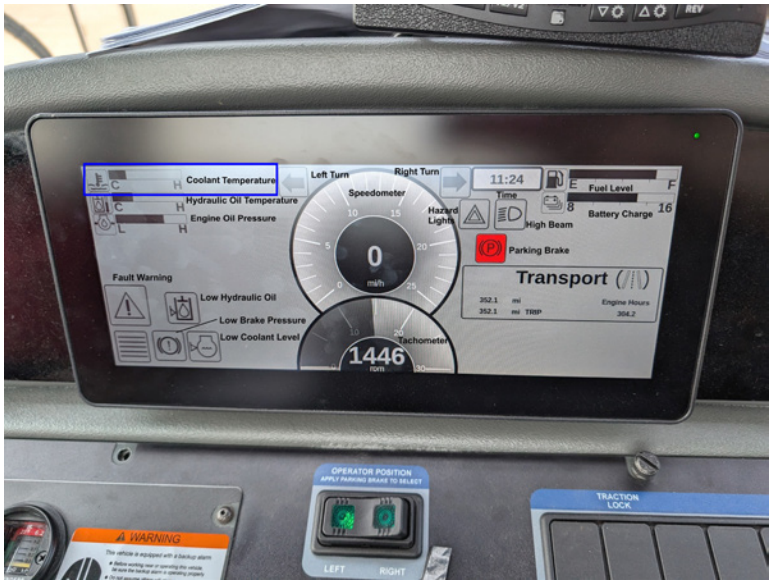

Fig. 228: Coolant Temperature

RADIO

The radio (Fig. 230: Radio) is controlled by ignition key ON accessory voltage input (red) wire. The voltage is only available when the ignition switch is in the ON (accessory) position. The battery voltage is routed from switched power circuit and fuse C10 (10A) to the radio CR-C8 pin A.

The radio is grounded at CR-C8 pin C by a ground circuit from ground splice CR-S3 (black wire).

The left speaker input power is routed from the radio (spliced) white wire to the speaker (+) connection. The left speaker is grounded by a ground circuit from the radio (spliced) white/black stripe wire to the speaker (-) connection.

The right speaker input power is routed from the radio (spliced) gray wire to the speaker (+) connection. The right speaker is grounded by a ground circuit from the radio (spliced) gray/black stripe wire to the speaker (-) connection.

The radio accessory/auxiliary IN power is routed from the key ON switched power circuit (Fig. 231: Radio Circuit) and fuse B14 (15A) to the radio CR-C8 pin B. This wire on some radios/stereo radio would be used to maintain radio memory, position, accessory and auxiliaries and would be connected to a constant voltage source.

If necessary, see Fuses And Relays on page 19 to locate fuses.

Fig. 230: Radio

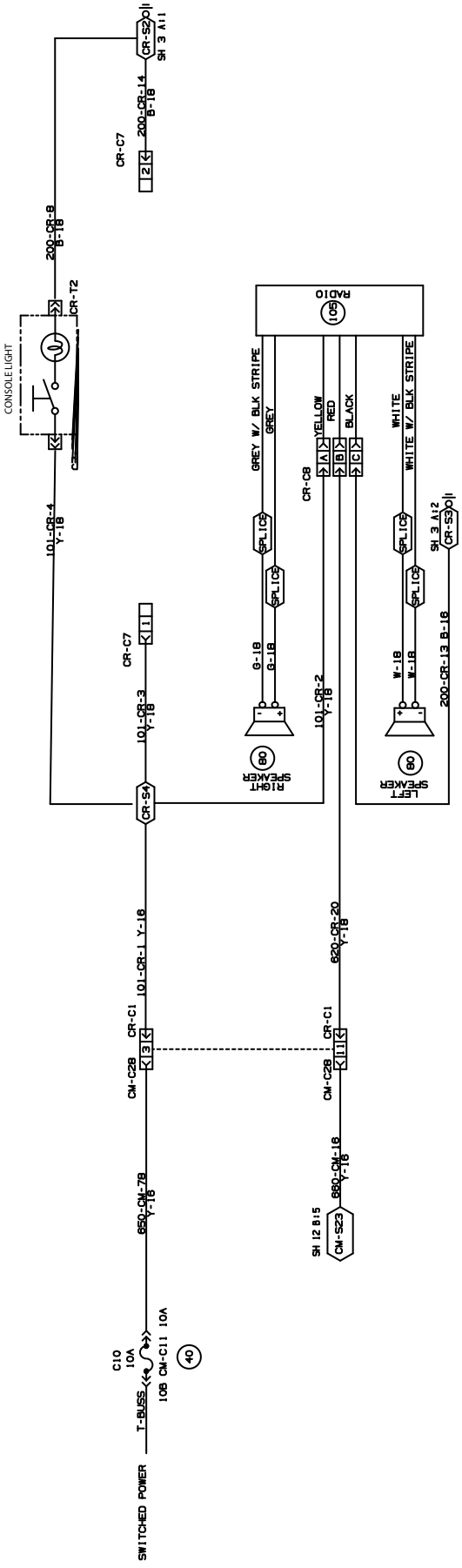

Fig. 231: Radio Circuit

STARTING CIRCUIT
P0420

The starting circuit (Fig. 235: Starting Circuit on page 207) is controlled by the ignition switch, controller CR721S and the starter relay. The battery voltage for operation of the ignition switch (Fig. 232: Ignition is routed from the battery power circuit and fuse C8 (10A) to the ignition switch terminal 3. When the ignition switch is placed in the start position, battery voltage is routed from the ignition switch terminal 3 through the switch and terminal 4 to controller C721S CM-C18 pin 37. The input voltage at CM-C18 pin 37 notifies the control system the ignition switch is in the start position. The controller then routes battery voltage from controller CR721S CM-C8 pin 17 to the starter relay terminal 86.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The battery voltage for operation of the starter relay is routed from the battery positive post to the relay terminal 30 (Fig. 233: 12 V Battery). The relay is grounded at terminal 85 by a ground circuit from the battery negative post and ground splice EH-S2. When the battery voltage is routed to the relay terminal 86, from the controller, the relay is energized and battery voltage is routed through the relay and terminal 87 to the starter solenoid (Fig. 234: Starter and Solenoid) terminal EH-T5. The battery voltage at EH-T5 energizes the starter solenoid.

The battery voltage for operation of the starter solenoid is routed from the battery positive post to the starter solenoid terminal EH-T4. When energized the solenoid closes. When closed the solenoid routes the voltage from terminal EH-T4 to one side of the starter motor. Because the other side of the starter motor is grounded by a ground at the frame, the motor rotates until the engine starts.

Fig. 232: Ignition

Fig. 233: 12 V Battery

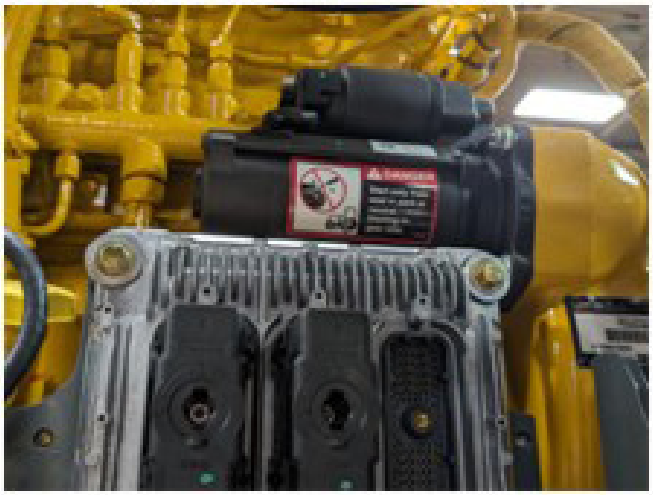

Fig. 234: Starter and Solenoid

Fig. 235: Starting Circuit shows the starting circuit.

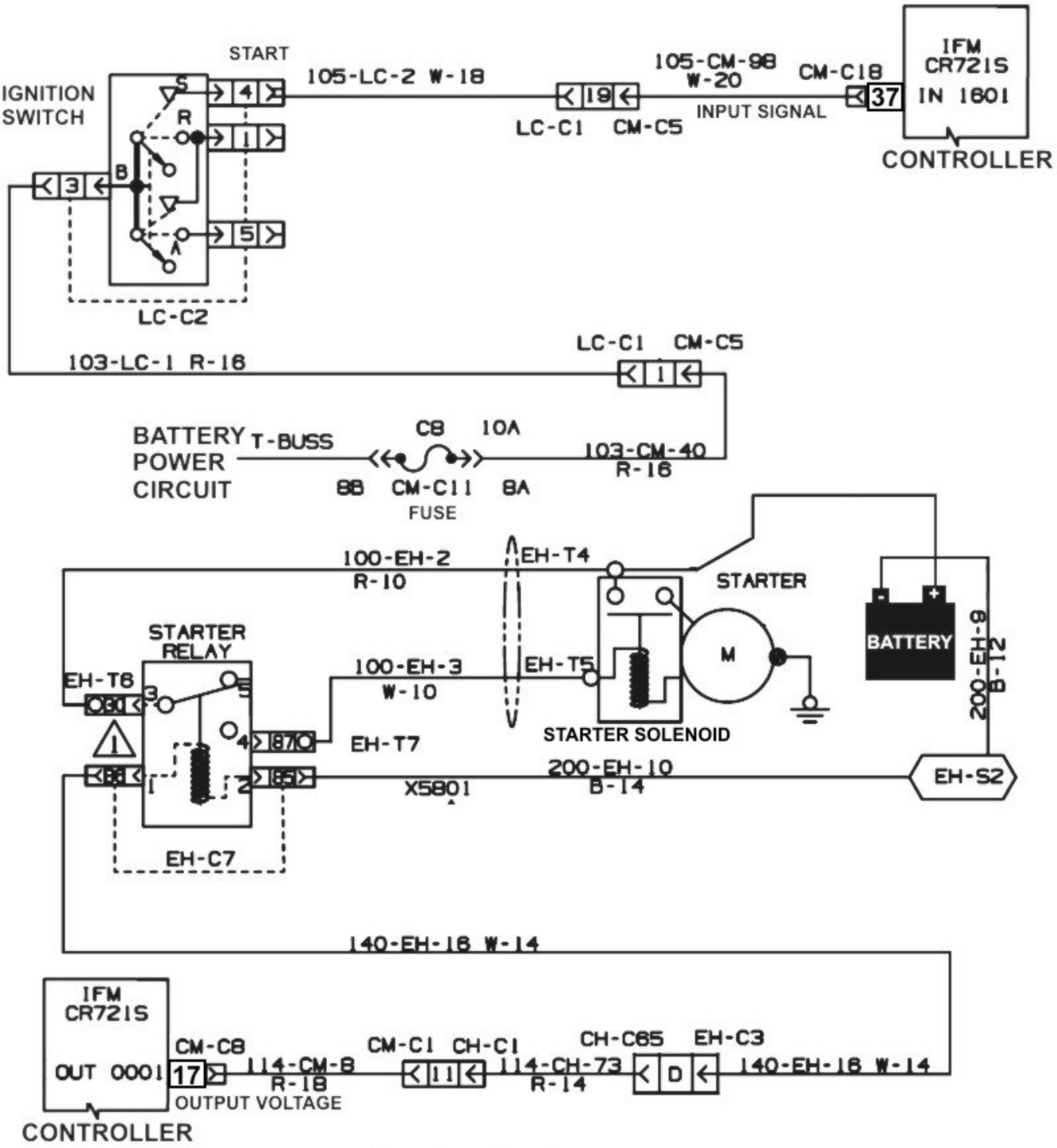

Fig. 235: Starting Circuit

The illumination of the Start Engine Switch (Fig. 236: Starter Solenoid) indicator shows the ignition switch (Start Engine Sw xxxx Volt) is in the start position and voltage has been routed from the ignition switch terminal 4 to controller CR721S CM-C18 pin 37. The illumination of the Starter Solenoid indicator indicates amperage has been routed from controller CR721S CM-C8 pin 17 to the starter relay terminal 86 energizing the relay. The voltage is routed from the starter relay terminal 87 to the starter solenoid terminal EH-T5 energizing the solenoid routing voltage to the starter motor. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

Fault Codes: Starter relay – P0420-05, 06 and 12.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to ground to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 17 and the starter relay terminal 86. Use a multimeter to check for a ground circuit at the starter relay terminal 85. Use a multimeter to check for battery voltage at the starter relay terminal 30. Place the ignition switch in the start position and use a multimeter to check for voltage at controller CR721S CM-C18 pin 37.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

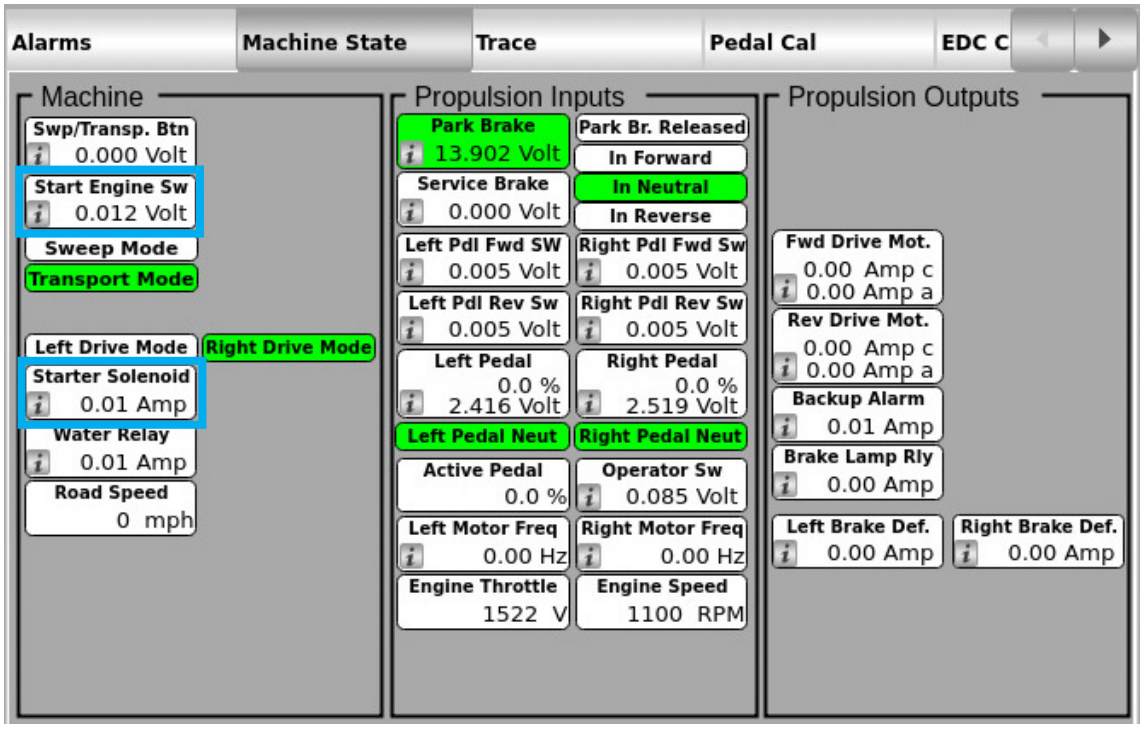

Fig. 236: Starter Solenoid

SWEEP POWER CIRCUIT
X0150

The sweep power circuit (Fig. 237: Sweep Power Circuit) is controlled by the control system and controller CR721S CM-C8 pin 19. When Sweep Mode is commanded, battery voltage is routed from controller CR721S CM-C8 pin 19 to the Sweep Power Relay terminal. The sweep power relay is grounded at terminal 85. The output voltage at CM-C8 pin 19 energizes the relay. The battery voltage for operation of the sweep power relay is routed from fuse module A CM-C14 fuse A2 (50A) to the relay terminal 30. When energized, the relay routes battery voltage from the relay terminal 30 through the relay and terminal 87 to provide power for fuses D6 through D10 on CM-C13 Module D. The battery voltage is routed through these fuses to the sweep components as needed for circuit operation. The sweep components include but are not limited to side broom operation and center broom operation.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

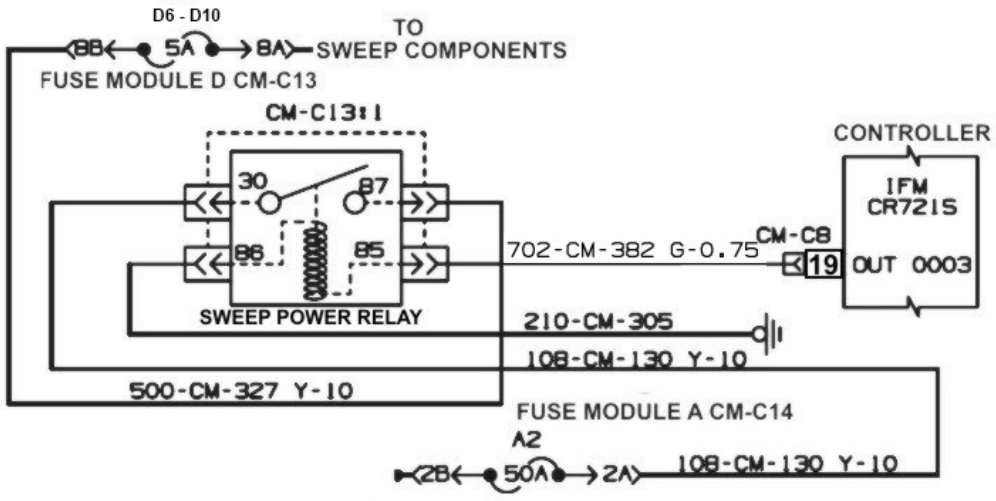

Fig. 237: Sweep Power Circuit

The illumination of the sweep mode (Sweep Mode) indicator (Fig. 238: Transport/Switch Mode Switch) indicates the momentary sweep/transport mode switch (Fig. 240: Transport/Switch Mode Switch on page 211) was placed in the sweep position and voltage has been routed from the switch terminal 3 to controller CR721S CM-C8 pin 36 and voltage has been routed from controller CR721S CM-C8 pin 19 to the sweep power relay terminal 85 energizing the relay. The operation of the component indicates the relay is energized and voltage has been routed from the relay terminal 87 to fuses D8 through D10 and the sweep components. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes: Sweep power relay – X0150-05, 06, and 12. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CM-C8 pin 19 and the sweep power relay terminal 86. Use a multimeter to check for a ground circuit at the sweep power relay terminal 86. Use a multimeter to check for input voltage at the sweep power relay terminal 30.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

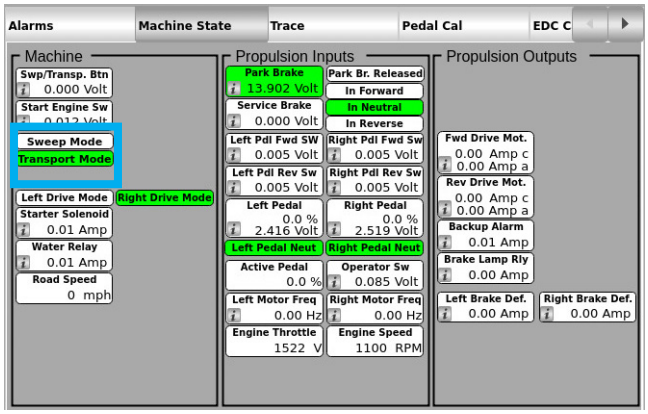

Fig. 238: Transport/Switch Mode Switch

SWEEP/TRANSPORT MODE CIRCUIT X0100

Sweep Mode

The sweep mode circuit (Fig. 239: Sweep Mode Circuit) controls the output of voltage from the sweep power circuit to the sweep components requiring sweep power voltage. The sweep power voltage is provided by the sweep power circuit. See Sweep Power Circuit on page 209.

The transport/sweep mode circuits are controlled by the transport/sweep mode switch (Fig. 240: Transport/Switch Mode Switch). The battery voltage for operation of the transport/sweep mode switch is routed from the switched power circuit and fuse B7 (10A) to the transport/sweep mode switch terminal 2. When the momentary switch is pressed, battery voltage is routed from the switch terminal 3 to controller CR721S CM-C8 pin 36. The input voltage notifies the control system the momentary switch has toggled to SWEEP mode. (When the momentary switch is pressed again, the sweeper transitions to TRANSPORT mode. See Transport Mode on page 213.)

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

The sweep mode switch activation causes the control system to route battery voltage from controller CR721S CM-C8 pin 19 to the sweep power relay, energizing the relay. When energized the sweep power relay routes battery voltage to the sweep power circuit. See Sweep Power Circuit on page 209.

Fig. 240: Transport/Switch Mode Switch

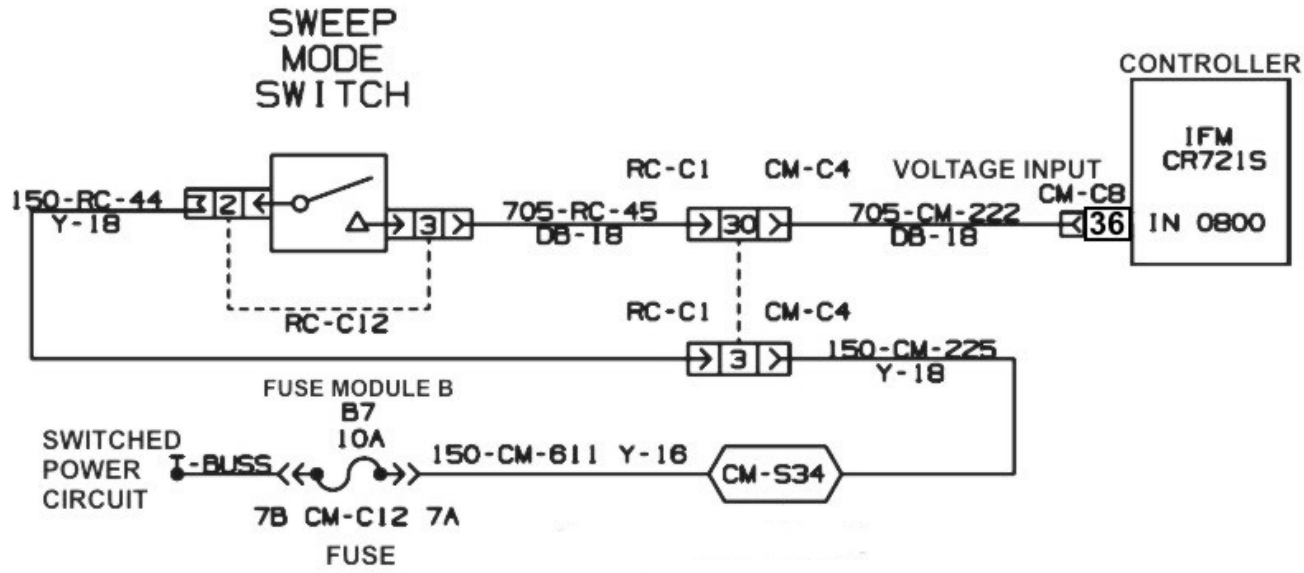

Fig. 239: Sweep Mode Circuit

The illumination of the sweep mode (Sweep Mode) indicator (Fig. 241: Sweep Transport Mode) indicates the sweep mode switch (Swp/Transp. Btn) has been toggled to the Sweep position. Voltage has been routed from the switch terminal 3 to controller CR721S CM-C8 pin 36 and voltage has been routed from controller CR721S CM-C8 pin 19 to the sweep power relay terminal 85, energizing the relay. The illumination of any of the device components requiring sweep power voltage (such as main broom, left broom, right broom or conveyor) indicates voltage has been routed from sweep mode switch to the controller and from the controller to the sweep power relay terminal 85. The operation of the component indicates the relay is energized and voltage has been routed from the relay terminal 87 to fuses D6 through D10 and the sweep components. A variation from this description may be displayed as a fault warning. See the fault code descriptions for additional information and fault warnings.

The illumination of the transport mode (Transport Mode) indicator indicates the sweep/transport mode switch was pressed again to toggle back to transport mode.

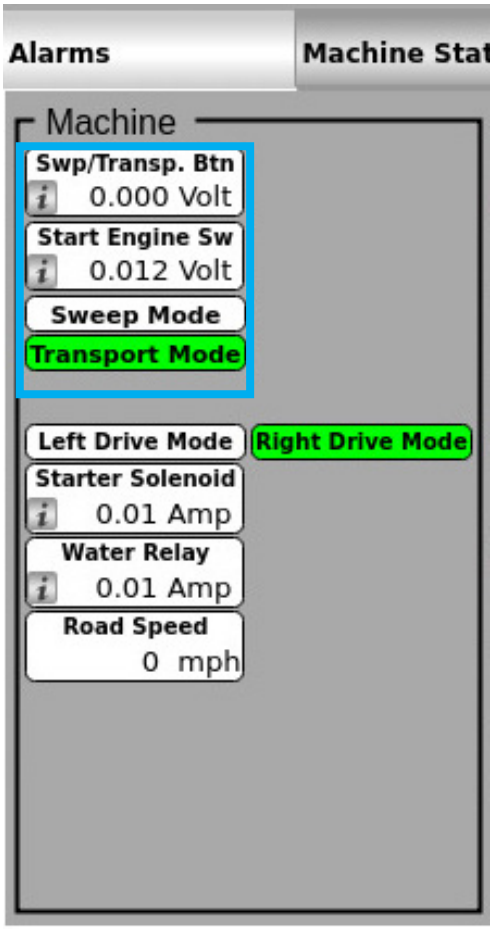

Fig. 241: Sweep Transport Mode

Transport Mode

When the momentary transport/sweep mode switch toggles to the transport position, the momentary battery voltage from the switch to controller CR721S CM-C8 pin 36 causes the control system to stop output for the sweep power circuit. See Sweep Power Circuit on page 209.

The illumination of the transport mode (Transport Mode) indicator (Fig. 242: Transport Mode) indicates the momentary sweep/transport mode switch was toggled to the transport/off position. Sweep power voltage is no longer available and the main broom and conveyor will raise and drive motors stop rotation. The transport (Transport) indicator on the main display screen, in transport mode, displays the sweeper trip mileage and engine hours. A variation from this description may be displayed as a fault warning. See Table 8: Fault Codes and Descriptions on page 35 for additional information and fault warnings.

Fault Codes: Sweep switch stuck – X0100-11.
Use a multimeter to check for input voltage at the sweep mode switch terminal 2. The presence of 12V on switch input CM-C8 pin 36 indicates a short to power or a stuck switch. See Testing for Opens, Shorts, and Short to Ground on page 50 to check for short to power.

See Table 8: Fault Codes and Descriptions on page 35 and descriptions and the cab display module alarms screen.

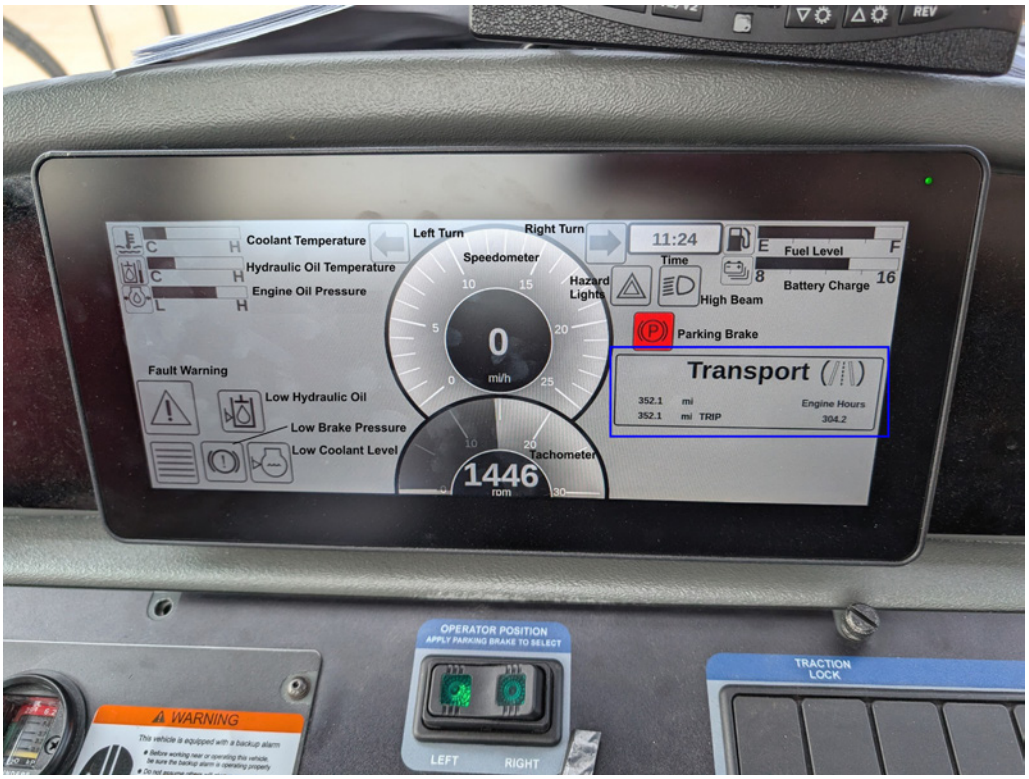

Fig. 242: Transport Mode

SWITCHED POWER CIRCUIT

The switched power circuit (Fig. 243: Switched Power Circuit on page 215) provides battery voltage power to components operational when the ignition switch is in the ON position. The switched power circuit is controlled by the switched power relay. The battery voltage for operation of the switched power relay is routed from module A CM-C14 fuse A1 (50A) to the switched power relay terminal 30. The battery voltage for operation of fuse module A CM-C14 is routed from the battery positive post and an 80A inline fuse. When the ignition switch is placed in the ON position battery voltage is routed from the switch terminal 1 to the switched power relay terminal 86. The switched power relay is grounded at terminal 85.

The battery voltage at terminal 86 and ground circuit at terminal 85 energize the switched power relay. When energized, the relay routes battery voltage from fuse A1 (50A) through the relay and terminals 30 and 87 to fuse module B providing battery voltage to the fuses mounted in fuse module B. All sweeper components using switched battery voltage are connected to a fuse in fuse module B.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

The switched power relay provides voltage to many sweep components. An indication of switched power relay failure would include no voltage input at fuses CM-C12 B1 through B20. Place the ignition switch in the on position. See the section entitled ignition switch circuit. Check for battery voltage at the relay terminal 30. If voltage is not present at the relay, use Testing for Opens, Shorts, and Short to Ground on page 50 to check for an open circuit between the ignition switch terminal 1 and the relay terminal 86. Also, check for a ground circuit at the relay terminal 85. If battery voltage is not available at the relay terminal 30, check the operation of fuse A1 and inline 80A fuse at the battery. If voltage is available at the relay terminal 30, check for battery voltage at the relay terminal 87. If voltage is not available at relay terminal 87, replace the relay. If voltage is available at the relay terminal 87, Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between the relay terminal 87 and fuse block CM-C12 module B.

Fig. 243: Switched Power Circuit shows the switched power circuit.

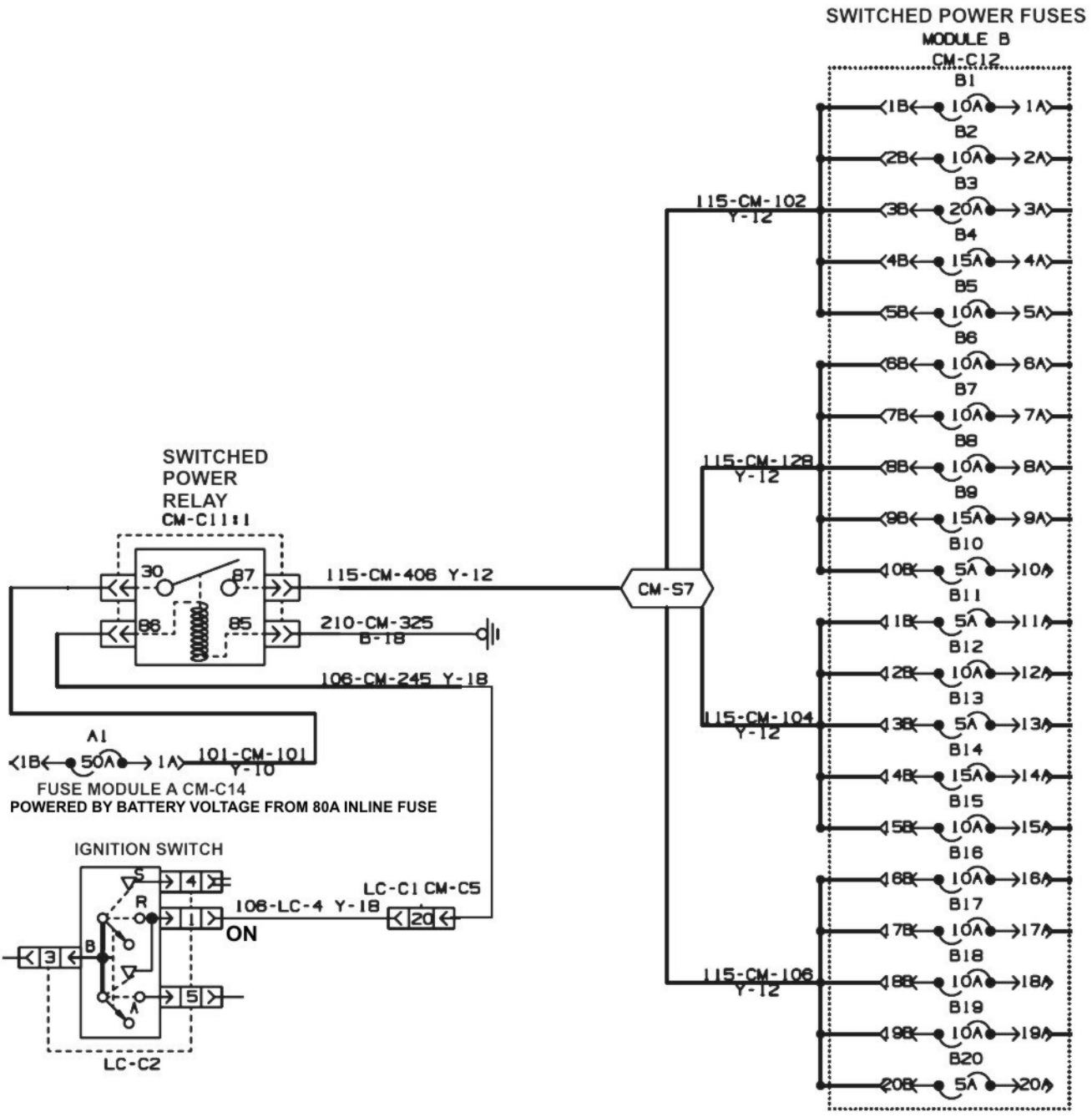

Fig. 243: Switched Power Circuit

WATER SYSTEM CIRCUIT
S0165

The water system is controlled by the water pump relay, controller CR721S, water low flow switch and the water pump. The battery voltage for operation of the water pump relay is routed from the sweep power circuit and fuse D9 (20A) to the relay terminal 3. The relay is grounded at terminal 2 by a ground circuit from ground splice CM-S40. The relay is energized at terminal 1 by battery voltage from controller CR721S CM-C8 pin 78. The battery voltage is routed from the controller CM-C8 pin 78 when a demand is input using the component (i.e. left broom water switch) water switches. The input to the controller causes the control system to route voltage from the controller to the water pump relay.

If necessary, see Fuses And Relays on page 19 to locate fuses and relays.

If necessary, see Controller Pin Locator And Usage on page 20 to locate CR721S controller pins.

When the relay is energized, battery voltage is routed from the relay terminal 5 to the water pump terminal A. The voltage is also routed from the relay terminal 5 to the water low flow water switch terminal 5. See the section below entitled water low flow switch. The control system also routes battery voltage from the controller CR721S to the appropriate water solenoid. See the individual component circuits for the component water solenoid controls.

The water pump is grounded at terminal B by a ground circuit from ground splice CH-S19. With the water pump low flow water switch in the HI position, the battery voltage at terminal A causes the water pump motor to rotate at full speed producing full water pressure. The water pressure is monitored by the 3 psi switch.

3 PSI Switch

The 3 psi switch is normally closed but water pressure hold it open. If the system water pressure drops below 3 psi, the switch closes, routing a ground circuit to controller CR721S CM-C18 pin 45. The voltage signal at CM-C18 pin 45 controls a low water level light in the display (Fig. 244: 3 PSI Switch Circuit).

Water Low Flow Switch

The battery voltage for operation of the water low flow switch is routed from the water pump relay terminal 5 to the switch terminal 5. The switch is grounded at terminal 2 by a ground circuit from ground splice CM-S39. In the LOW position, the switch routes an additional ground circuit terminal 1 to the water pump terminal C. The additional ground circuit causes the water pump motor to rotate at a slower speed producing less water. The switch is a two-position latching switch. When the switch is placed in the HI, position the additional ground circuit is no longer routed to the water pump and the water pump rotates at full speed producing full water pressure.

Water Enable Switch

The illumination of the water enable switch (Water Enable Sw), water solenoid (Water Sol) water relay (Water Relay) indicators (Fig. 245: Water Enable) indicates the side broom water enable switch has been placed in the on position and voltage has been routed from the side broom water switch terminal 3 to controller CR721S CM-C18 (pin 11 left broom, pin 30 right broom). The controller CR721S CM-C8 has routed voltage from pin 78 to the water pump relay terminal 1. A variation from this description may be displayed as a fault warning. See the following fault code descriptions for additional information and fault warnings.

Fault Codes

Fault Codes: Water pump relay – S0165-05, 06 & 12. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts and short to ground between controller CR721S CM-C8 pin 78 and the water pump relay terminal 1. Use a multimeter to check for a ground circuit at the water pump relay terminal 2.

See Table 8: Fault Codes and Descriptions on page 35 and the cab display module alarms screen.

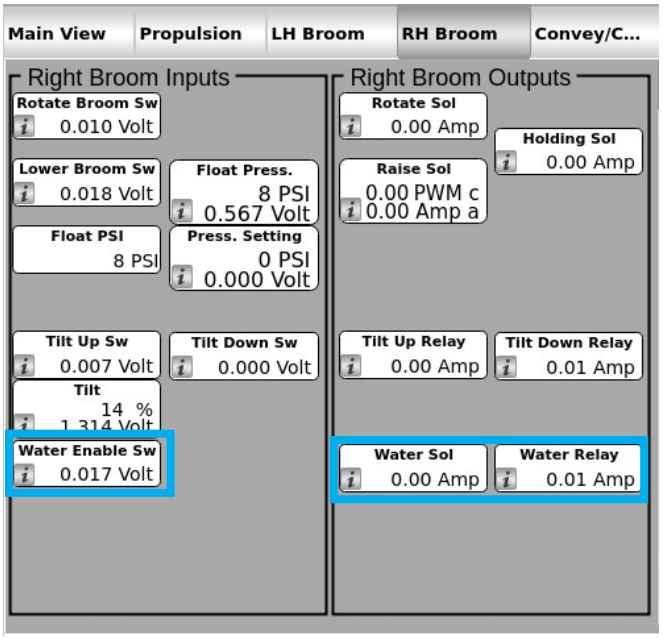

Fig. 245: Water Enable

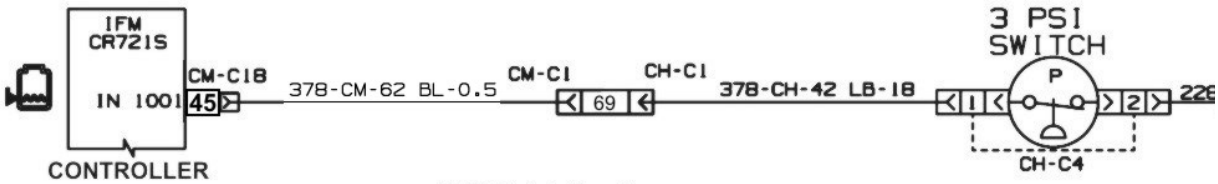

Fig. 244: 3 PSI Switch Circuit

Fig. 246: Water System Circuit Sheet 1 shows sheet 1 of the water system circuit.

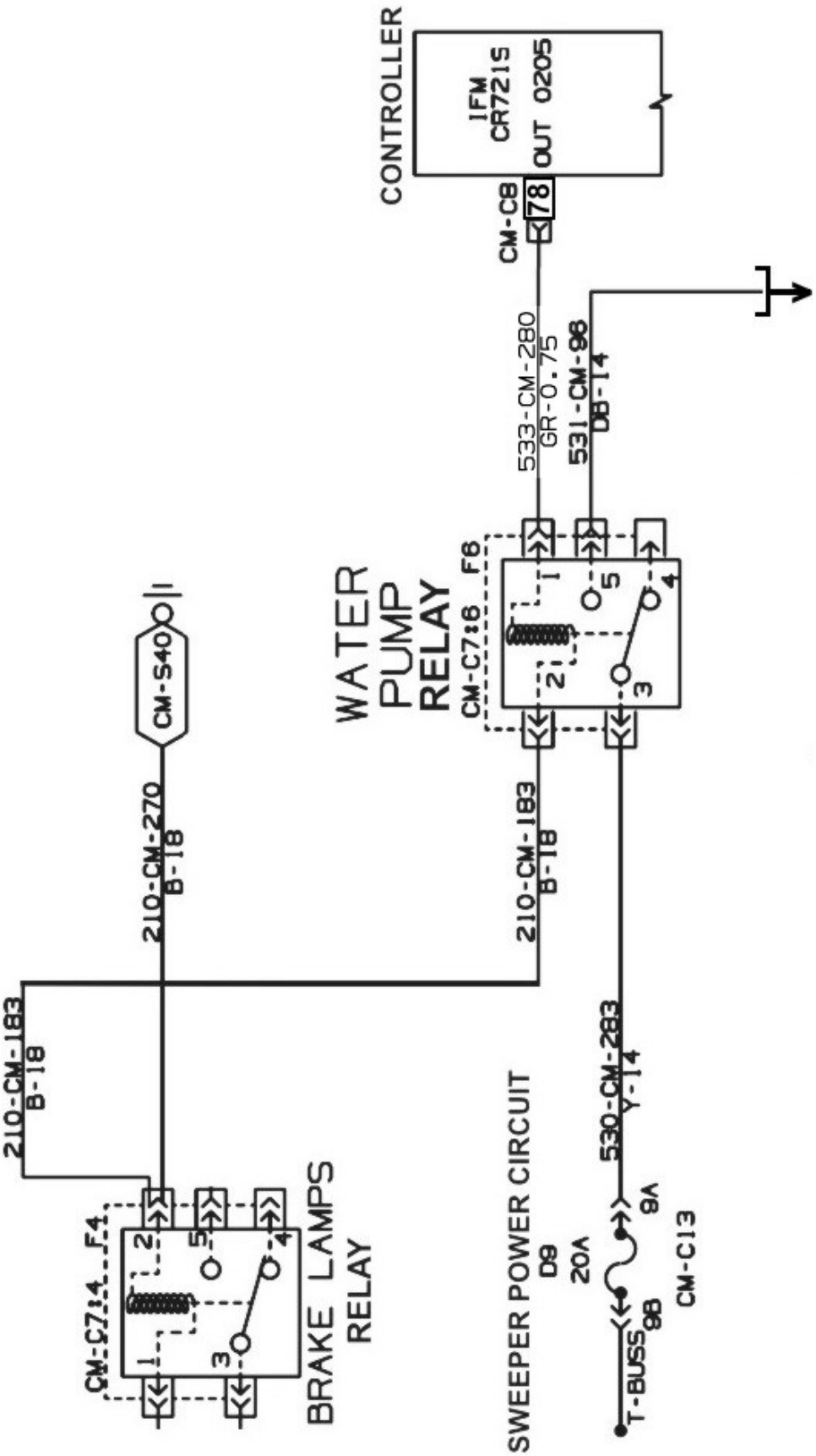

Fig. 246: Water System Circuit Sheet 1

Fig. 247: Water System Circuit Sheet 2 shows sheet 2 of the water system circuit.

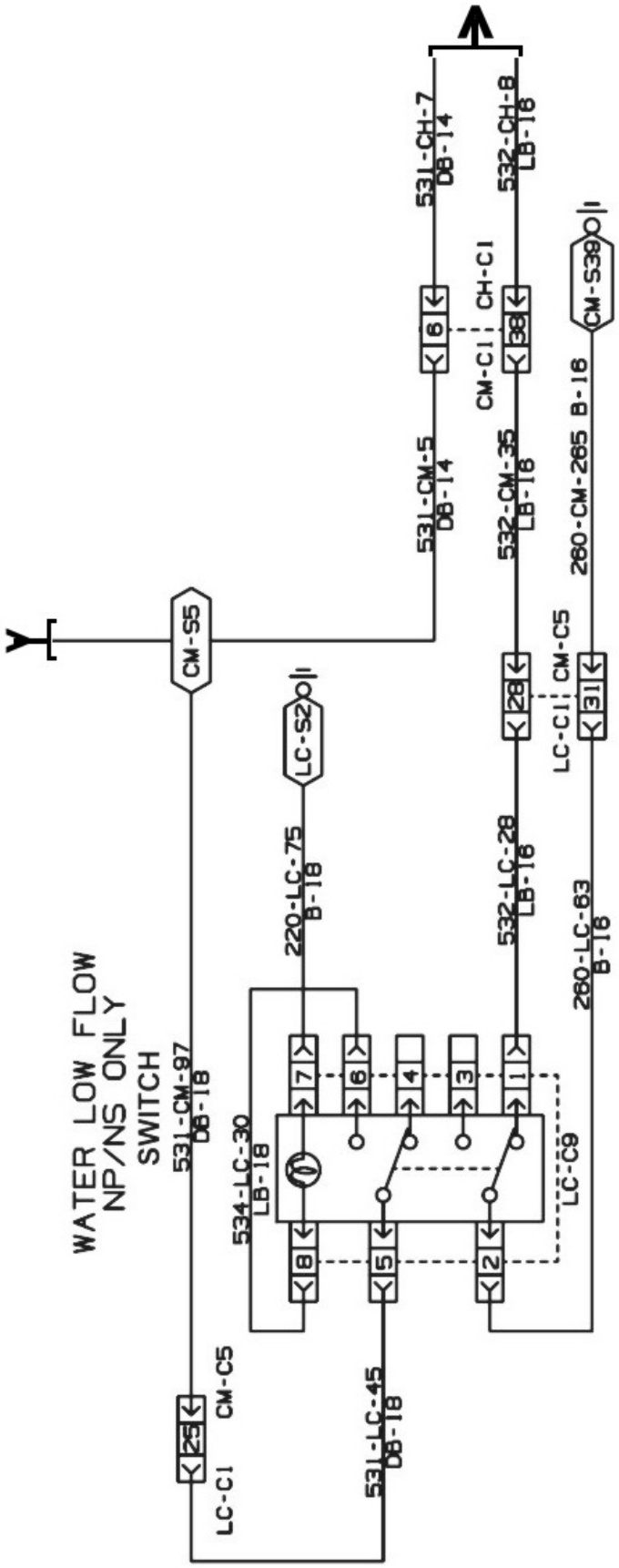

Fig. 247: Water System Circuit Sheet 2

PM-10 Water Circuit (Optional)

The PM-10 water system (Fig. 248: PM 10 Water Pump) is controlled by the water pump relay, controller CR721S, the water pump and pump hydraulic solenoids. The battery voltage for operation of the water pump relay is routed from the sweep power circuit and fuse D9 (20A) to the relay terminal 3. The relay is grounded at terminal 2 by a ground circuit from ground splice CM-S40. The relay is energized by battery voltage from controller CR721S CM-C8 pin 78. The battery voltage is routed from the controller CM-C8 pin 78 when a demand is input using the component (i.e. left broom water switch) water switches. The input to the controller causes the control system to route the voltage from the controller to the water pump relay 1 energizing the relay.

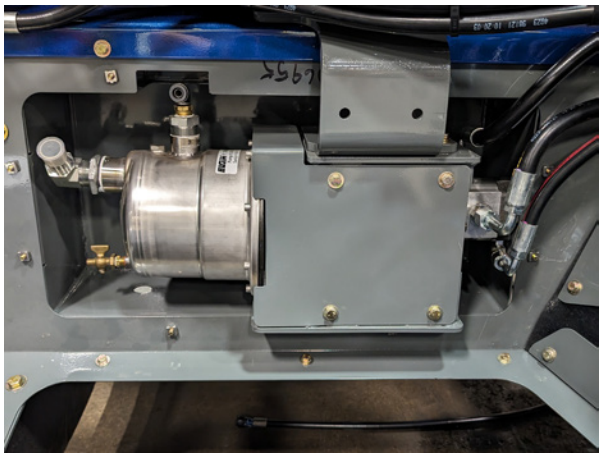

Fig. 248: PM 10 Water Pump

When the relay is energized, battery voltage is routed from the relay terminal 5 to the water low flow switch terminal 5. The voltage is also routed from the relay terminal 5 to the water pump drive motor hydraulic solenoids terminal 1. The water low flow switch circuit has no effect on the PM-10 water solenoid operation. The control system also routes battery voltage from the controller CR721S to the appropriate water solenoid. See the individual component circuits for the component water solenoid controls.

When the battery voltage from the water pump relay terminal 5 is routed to the hydraulic solenoid valves terminal 1, the solenoid valves are energized. When energized, the normally closed solenoid valve opens, allowing hydraulic to flow through the valve to one side of the water pump hydraulic motor. When energized, the normally open solenoid closes, blocking the hydraulic oil flow to the tank. The hydraulic oil flowing through the motor causes the motor to rotate causing the water pump to rotate and develop the necessary water system pressure (Fig. 249: Pump Motor Rotating).

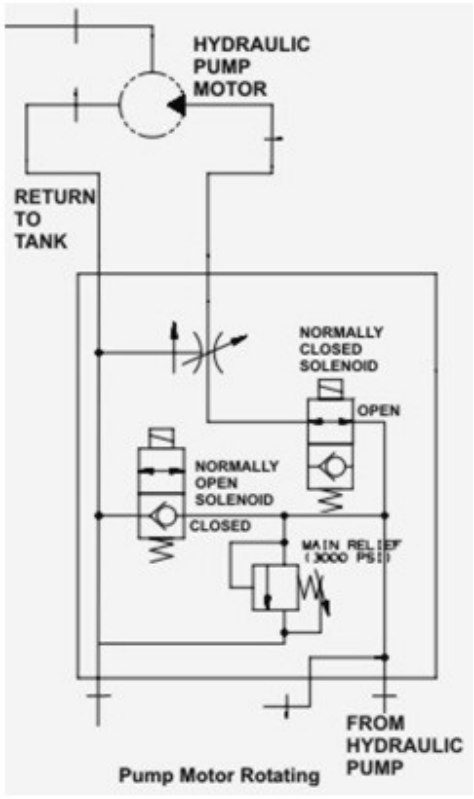

Fig. 249: Pump Motor Rotating

The water pump hydraulic solenoids are grounded at terminal 2 by a ground circuit from ground splice CH-S19. The solenoids of the water pump drive manifold (some of which are normally open and some of which are normally closed) control the flow of hydraulic oil to and from the water pump motor. In the off position, the normally closed solenoid valve blocks the flow of hydraulic oil to the water pump motor. Also, the normally open solenoid valve allows hydraulic oil to flow from to the hydraulic oil tank. See Fig. 250: Pump Motor Not Rotating.

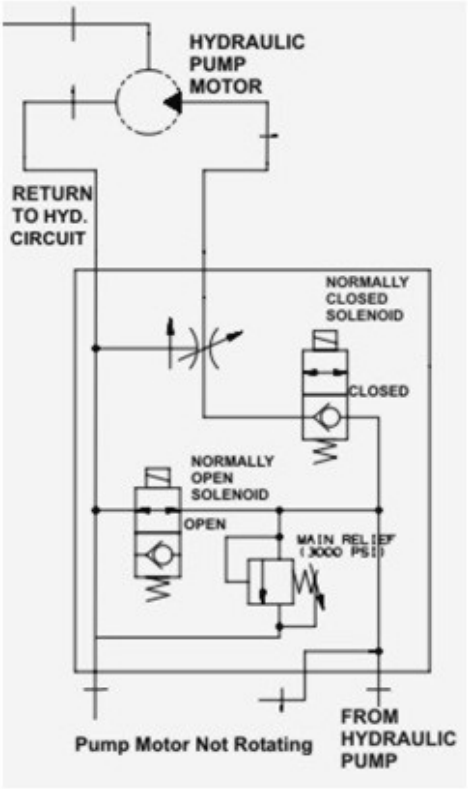

Fig. 250: Pump Motor Not Rotating

Fig. 251: Water PM-10 System Circuit Sheet 1 shows sheet 1 of the PM-10 water system circuit.

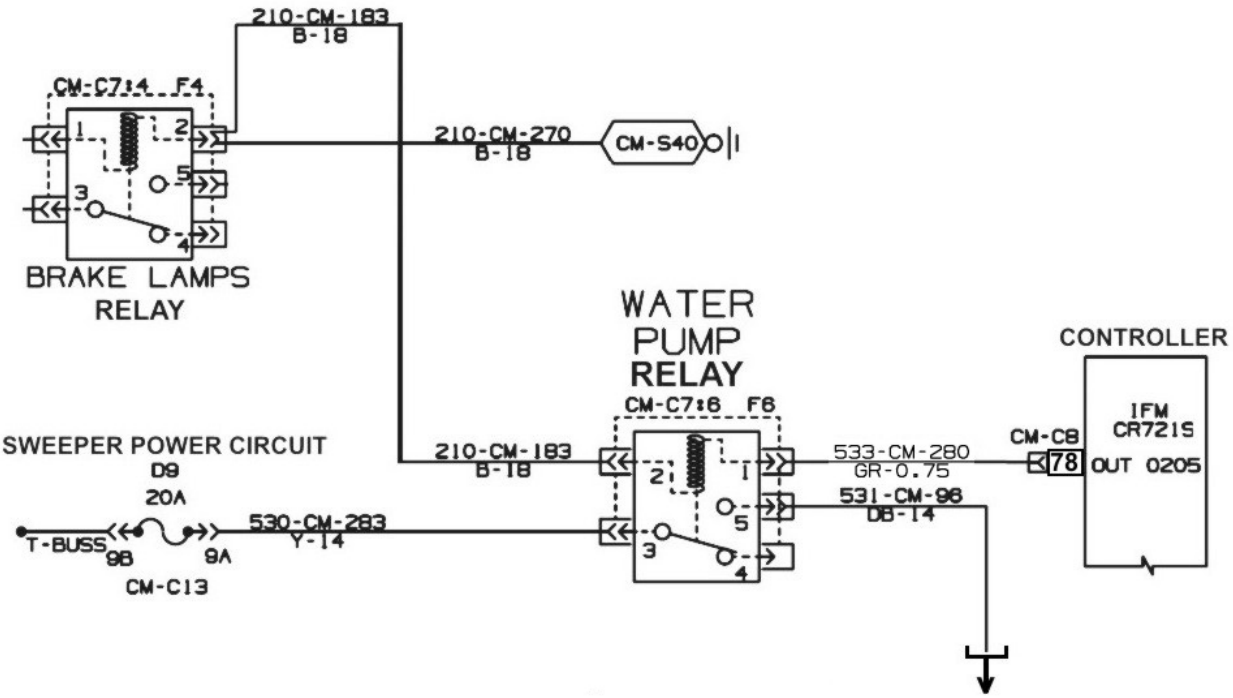

Fig. 251: Water PM-10 System Circuit Sheet 1

Fig. 252: Water PM-10 System Circuit Sheet 2 shows sheet 2 of the PM-10 water system circuit.

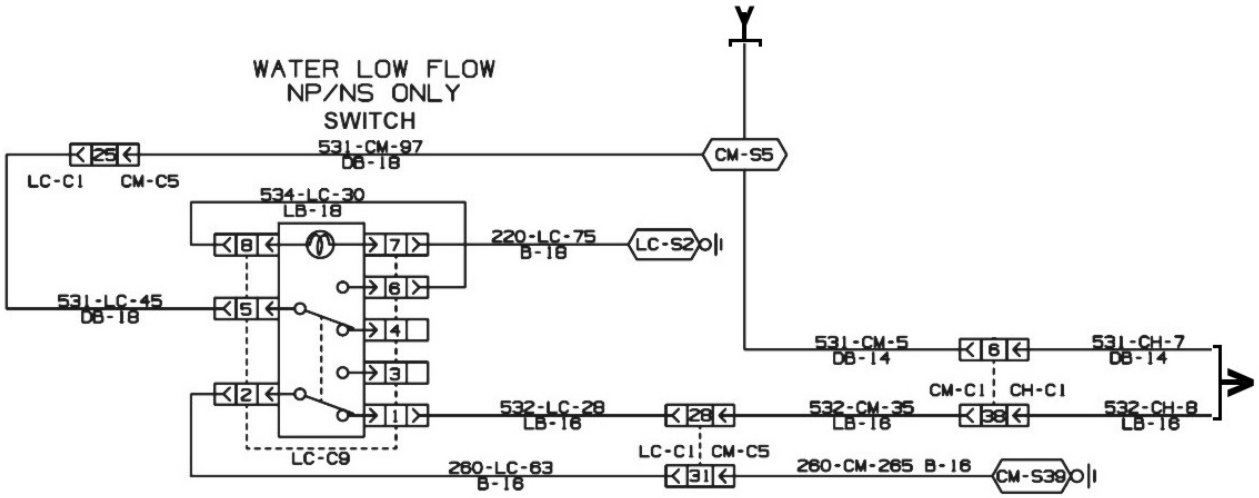

Fig. 252: Water PM-10 System Circuit Sheet 2

Fig. 253: Water PM-10 System Circuit Sheet 3 shows sheet 3 of the PM-10 water system circuit.

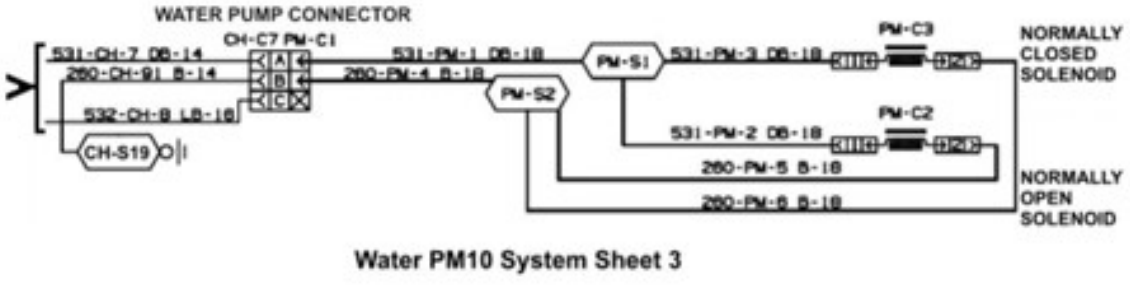

Fig. 253: Water PM-10 System Circuit Sheet 3

WASH DOWN (OPTIONAL)

The wash down circuit (Fig. 254: Wash Down Circuit) is controlled by the wash down switch. The battery voltage for operation of the wash down switch is routed from the switched power circuit and fuse B7 (10A) to the wash down switch terminal 2. When the momentary switch toggles to the ON position, battery voltage routed from the switch terminal 3 to controller CR721S CM-C18 pin 13.

The control system also routes battery voltage from controller CR721S CM-C8 pin 78 to the water pump relay. Because the water pump is grounded by a ground circuit from ground splice CH-S19, the water pump operates, allowing the wash down wand to have water flow.

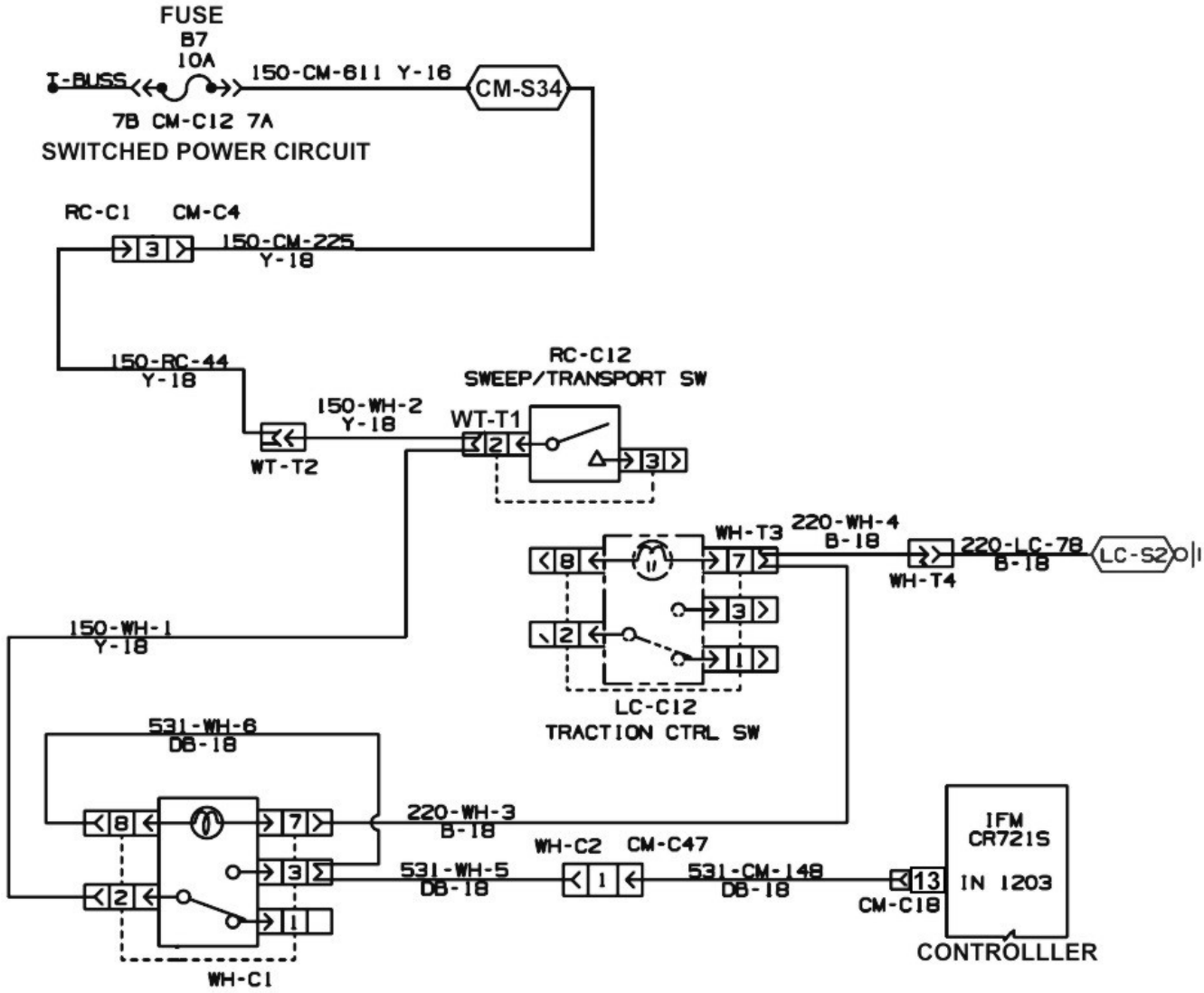

Fig. 254: Wash Down Circuit

WINDSHIELD WIPER AND WASHER

The windshield wiper and washer (Fig. 255: Windshield Wipers) are controlled by the wiper switch (Fig. 256: Windshield Wiper Switch). The battery voltage for operation of the switch is routed from the switched power circuit and fuse B14 (15A) to the switch terminal 1. The switch is grounded at terminal 2 by a ground circuit from ground splice CR-S2.

The wiper switch is a four position switch—high, low, delay, and off. The washer position (center button) routes battery voltage from the switch terminal 9 to the washer motor terminal CH-C70. The washer motor is grounded at terminal CH-C37 by a ground circuit from ground splice CH-S24. The battery voltage at terminal CH-C70 and ground at terminal CH-C37 cause the washer motor to rotate the washer pump and deliver washer fluid to the windshield.

The wiper switch high (HI) position routes the battery voltage from the wiper switch CR-C3 terminal 4 (left wiper) and terminal 7 (right wiper) to the wiper motor winding CR-C5 (left motor) and CR-C6 (right motor) terminals H. The wiper motors are grounded by a ground circuit from ground splice CR-S3 at motor terminal CR-C5 (left motor) and CR-C6 (right motor) terminal X. The battery voltage at terminal H and ground circuit at terminal X cause the wiper motors to rotate the windshield wipers at full speed.

The wiper switch low (LO) position routes battery voltage from the wiper switch CR-C3 terminal 3 (left wiper) and terminal 6 (right wiper) to the wiper motor secondary winding CR-C5 (left motor) and CR-C6 (right motor) terminals L. The battery voltage at terminal L and ground circuit at terminal X cause the wiper motors to rotate the windshield wipers at a reduced speed.

In the delay position, the wiper switch outputs an intermittent 12V on the L terminals. The P terminal is used for PARK. The wiper motors output a signal when the wiper is back in the parked position. The switch uses this for reference of when to remove power to the motor so the wiper always stops in the same place.

Wiper Switch – Check for battery voltage at the wiper switch terminal 1. If voltage is not available at the switch terminal 1, check the operation of fuse B14 (15A). Check for opens, shorts and short to ground between the switch and the fuse. Check for a ground circuit at the switch terminal 2. If a ground is not available at the switch terminal 2 check for opens and shorts between the switch terminal 2 and the ground splice. While checking for voltage, check the switch output voltage at each wiper switch position and washer output position output terminals 3, 4, 5, 6. 7, 8 and 9. If voltage is not available at any output terminal replace the switch.

Fig. 255: Windshield Wipers

Fig. 256: Windshield Wiper Switch

Wiper Motor– Check for a ground circuit at the wiper motors terminal X. If a ground circuit is not available check for open circuit between the motor terminal X and ground splice CR-S30. If the motor does not rotate at either switch position high, low, or delay, check for an open or short to ground between the switch output terminal and the motor terminal L or M. If a ground is available at the motor ground terminal and voltage is available at the motor terminal but the motor does not rotate replace the wiper motor.

Washer – Check for a ground circuit at the washer motor terminal CH-C37. If a ground is not available at the motor terminal CH-C37 check for an open circuit between the motor terminal CH-C37 and the ground splice CH-S24. Hold the washer button in the ON position and check for battery voltage at the motor terminal CH-C70. If voltage is not available at the motor terminal CH-C70 check for switch voltage output as described above and for opens, shorts and short to ground between the switch terminal 9 and the motor terminal CH-C70.

Fig. 257: Windshield Wiper Circuit shows the windshield wiper circuit.

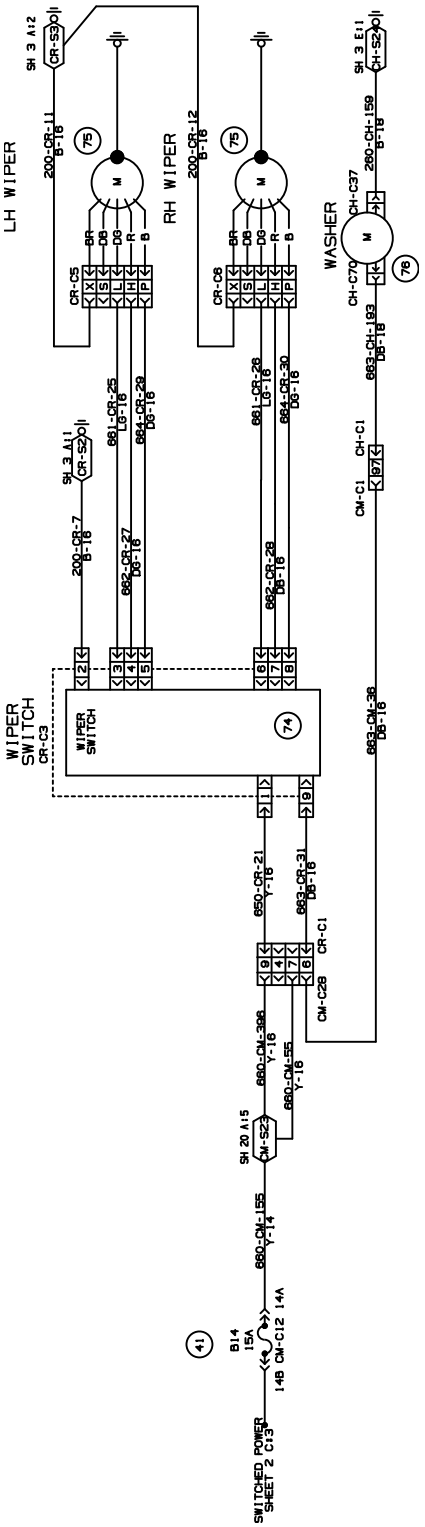

Fig. 257: Windshield Wiper Circuit

GROUNDS AND GROUND TREE CIRCUITS

Fig. 258: External Ground Studs shows the external ground studs.
Fig. 259: Ground Boss Locator shows the ground boss locator.

Fig. 258: External Ground Studs

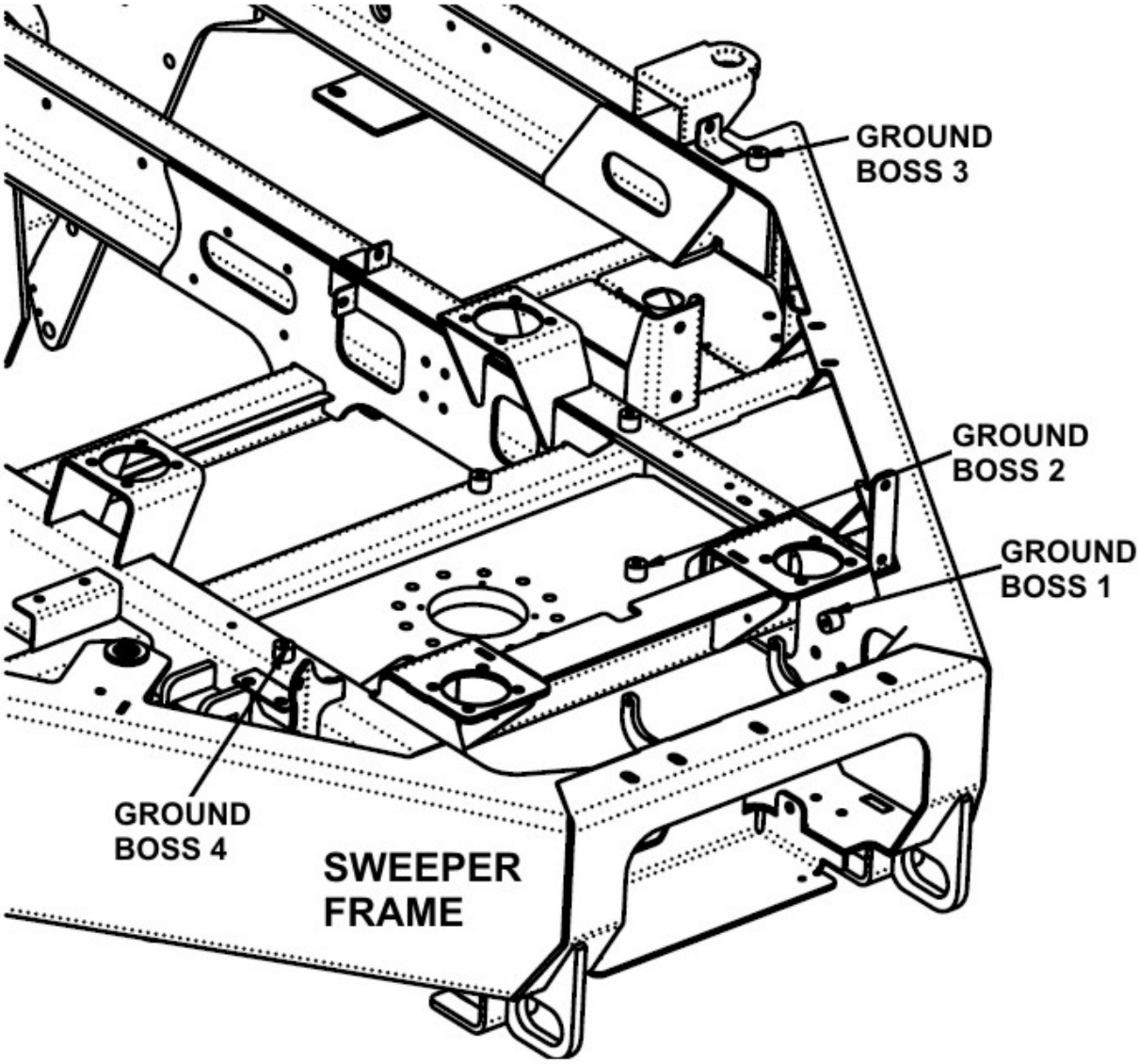

Fig. 259: Ground Boss Locator

Fig. 260: Ground Tree Circuit Sheet 1 shows ground tree circuit sheet 1.

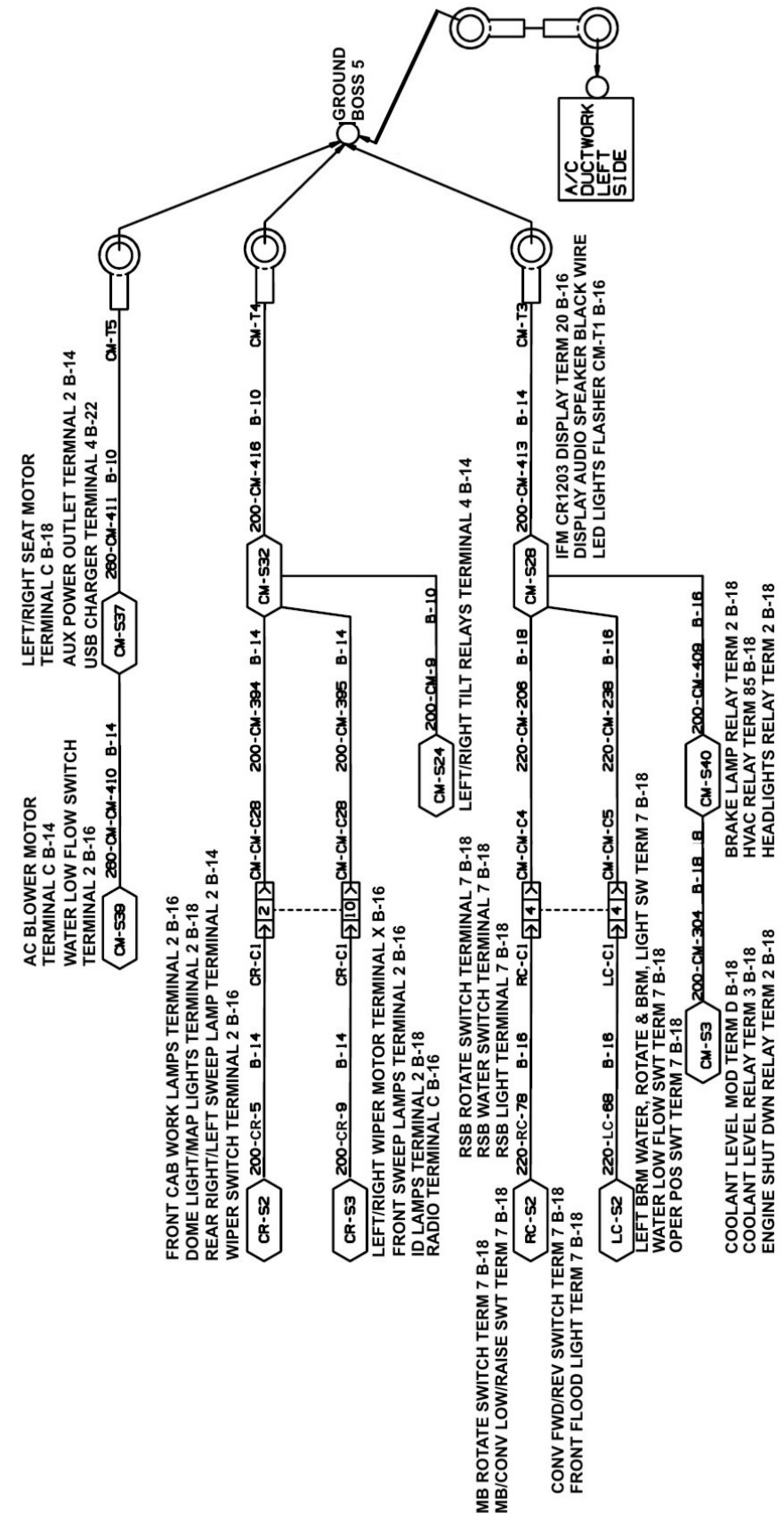

Fig. 260: Ground Tree Circuit Sheet 1

Fig. 261: Ground Tree Circuit Sheet 2 shows ground tree circuit sheet 2.

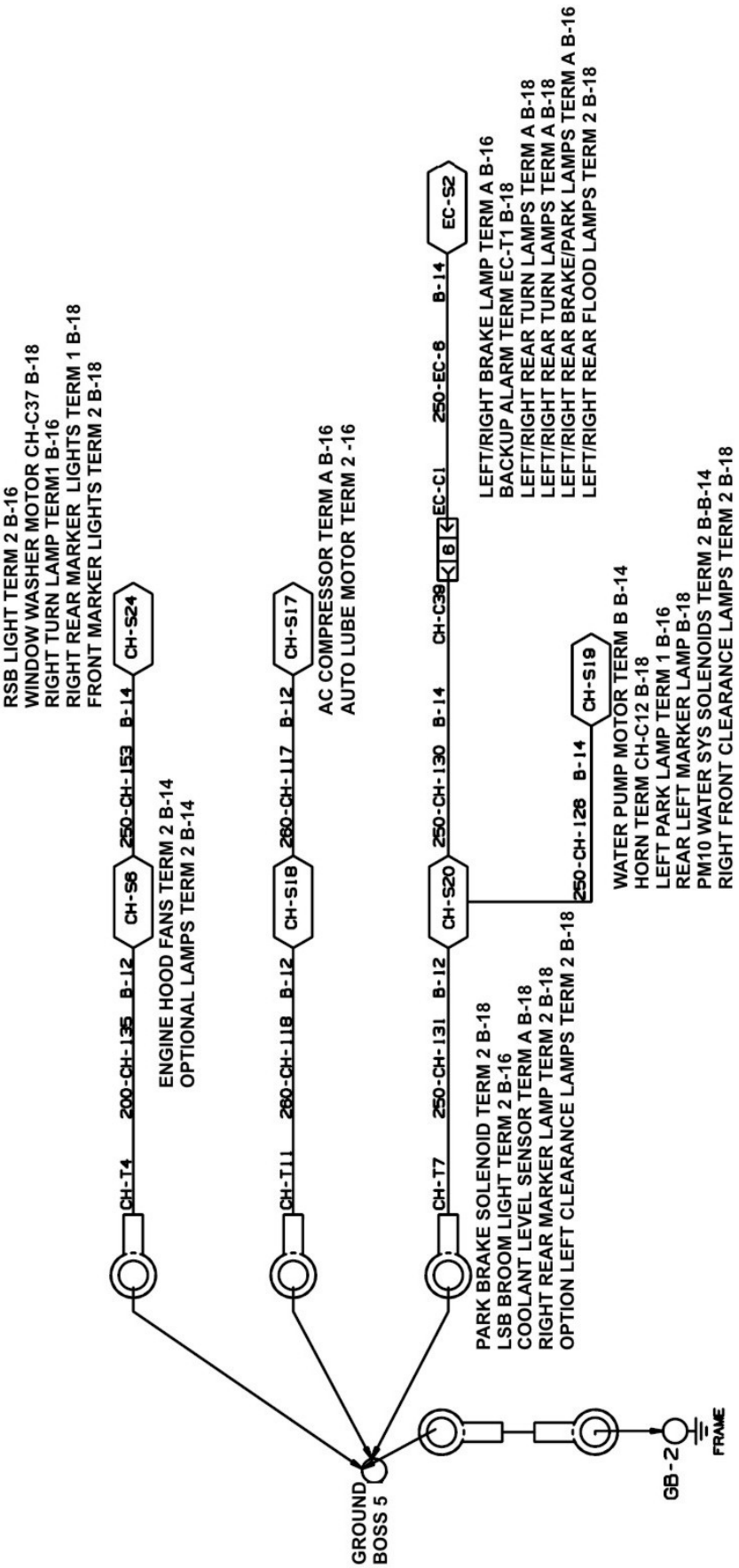

Fig. 261: Ground Tree Circuit Sheet 2

Fig. 262: Ground Tree Circuit Sheet 3 shows ground tree circuit sheet 3.

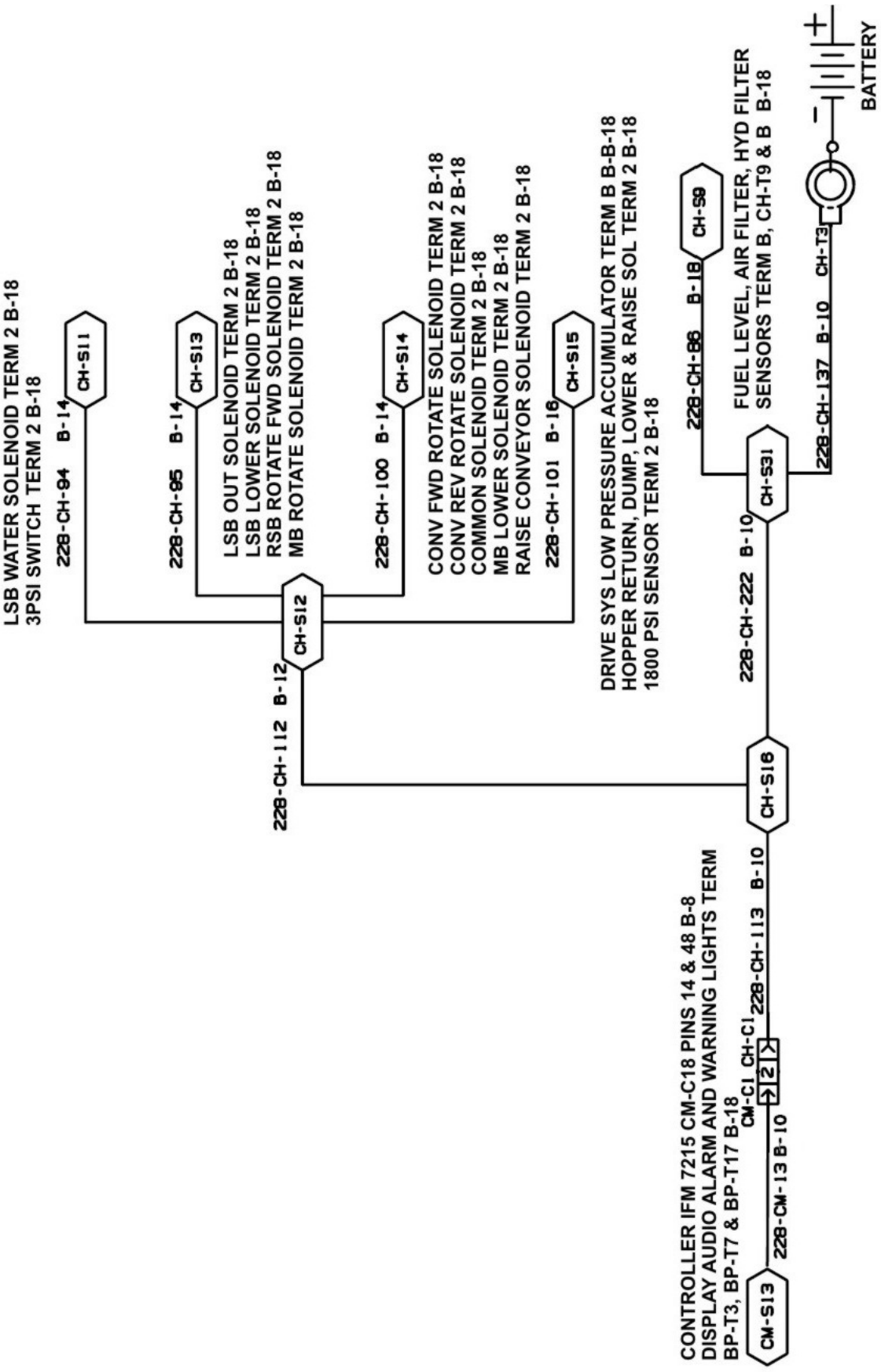

Fig. 262: Ground Tree Circuit Sheet 3

Fig. 263: Ground Tree Circuit Sheet 4 shows ground tree circuit sheet 4.

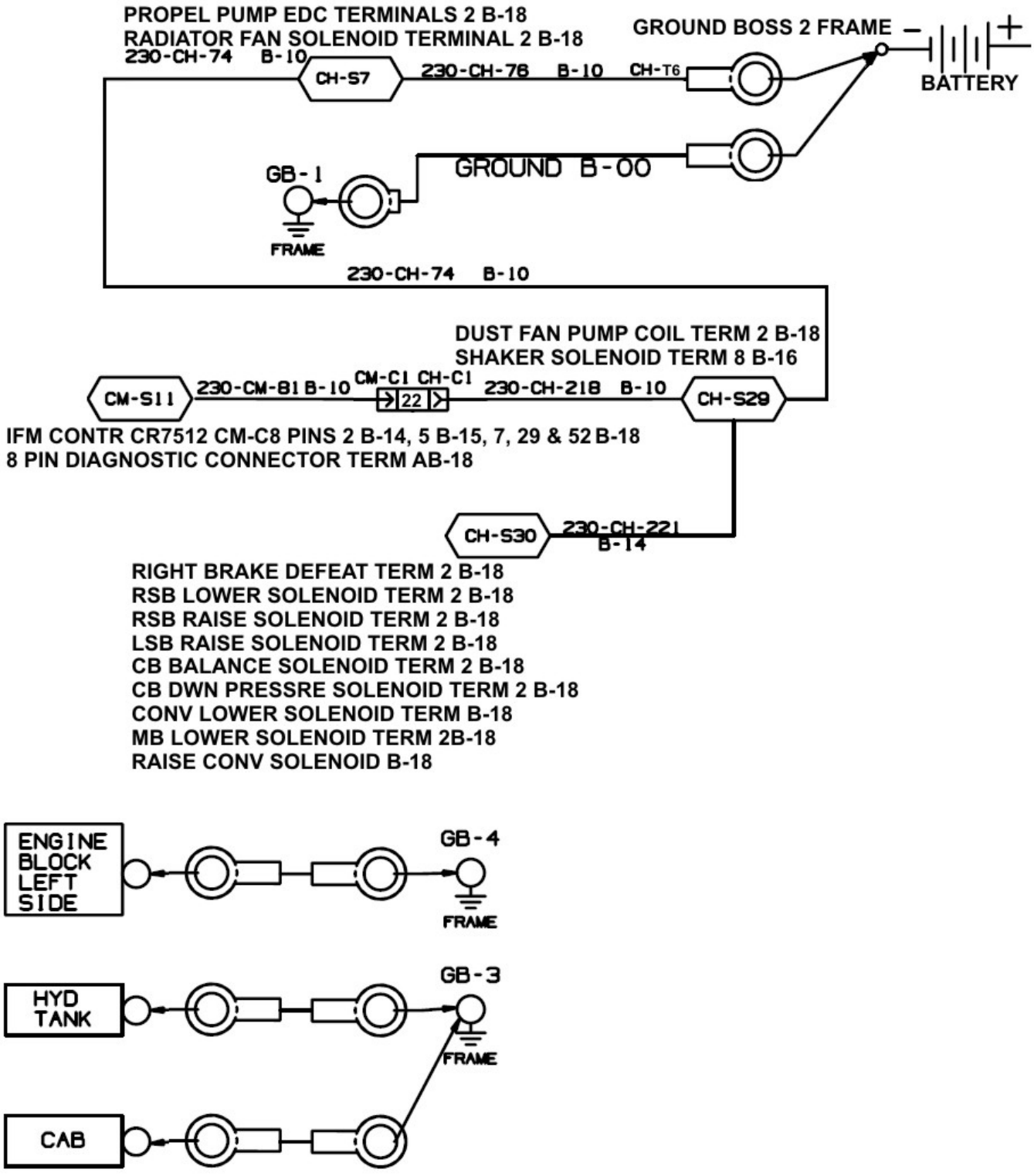

Fig. 263: Ground Tree Circuit Sheet 4

5 V SENSOR POWER
X0A50

The IFM controller CR721S provides a regulated and protected five volt power for various sensors on the machine from CM-C8 pin 31. This provides accurate power to sensors to improve the accuracy of the sensor signals.

The following sensors are powered by the 5 V sensor power:

- Engine Throttle Hall Effect control
- Right Foot Pedal
- Left Foot Pedal
- Right Tilt Actuator Sensor
- Left Tilt Actuator Sensor

In the event of failure of five volt sensor power, all of these sensor faults may be activated. Faults may include P0200 (Engine Throttle), P0210 (Right Foot Pedal), P0220 (Left Foot Pedal), S0230 (Right Tilt Sensor), S0330 (Left Tilt Sensor), S0500 (Vacuum Sensor – NR Only), and X0A50 (Module A 5V Sensor Power).

If many of these faults are active, start by testing the Five Volt Sensor Power for faults. Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CR721S CM-C8 pin 31 and the sensors.

Engine Throttle Circuit
5 V sensor feed faults – X0A50-03 and 06.
Use Testing for Opens, Shorts, and Short to Ground on page 50 to check for opens, shorts, and short to ground between controller CM-C8 pin 31 and the engine throttle potentiometer terminal A.

ENGINE ECU NOT COMMUNICATING
X0040-07

This code will be displayed any time there is a loss of communication with the engine ECU.

Check CAN wiring between engine ECU and cab modules.

If the display is not communicating with the engine ECU, code X0040-07 will be displayed.

If the CR721S controller is not communicating with the engine ECU, code X0040-07 displays and the APP0 LED on the controller lights RED.

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ELGIN
Built for clean. Backed for life.

Elgin Sweeper Company
Subsidiary of Federal Signal Corporation
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Elgin, IL 60120

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