Minotour Service Manual

The following areas are covered in this manual:

- **Interlock Feature**
- **Vandalock Feature**
- **AC System**
- **Heaters**
- **Passenger Advisory System**

MINOTOUR SERVICE MANUAL

ELECTRICAL TROUBLESHOOTING
MINOTOUR (2009 -)

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SECTION

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General

There are several ways a system could fail to perform, as expected, resulting in a malfunction that either limits or denies operation. This could be caused by either a mechanical, electrical, or an interlock conditional response the system requires.

If the problem is not due to a safety feature of a system waiting to be satisfied, it could be caused by the failure of one of the following:

- Mechanical Malfunction
- Electrical Malfunction
- Conditional Requirements

Mechanical Malfunction

A mechanical malfunction could be related to a device or component requiring some form of physical movement and did not perform as expected. Such as those involving HMI (Human Machine Interface):

- Lever – set, unset or defective
- Door – not opened properly, not closed properly or defective
- Latch – secured, unsecured, unadjusted or defective

Electrical Malfunction

An electrical malfunction of associated wiring and components such as fuses, bus wiring, loose connections, switches, relays or circuit boards could cause the lift to become inoperable.

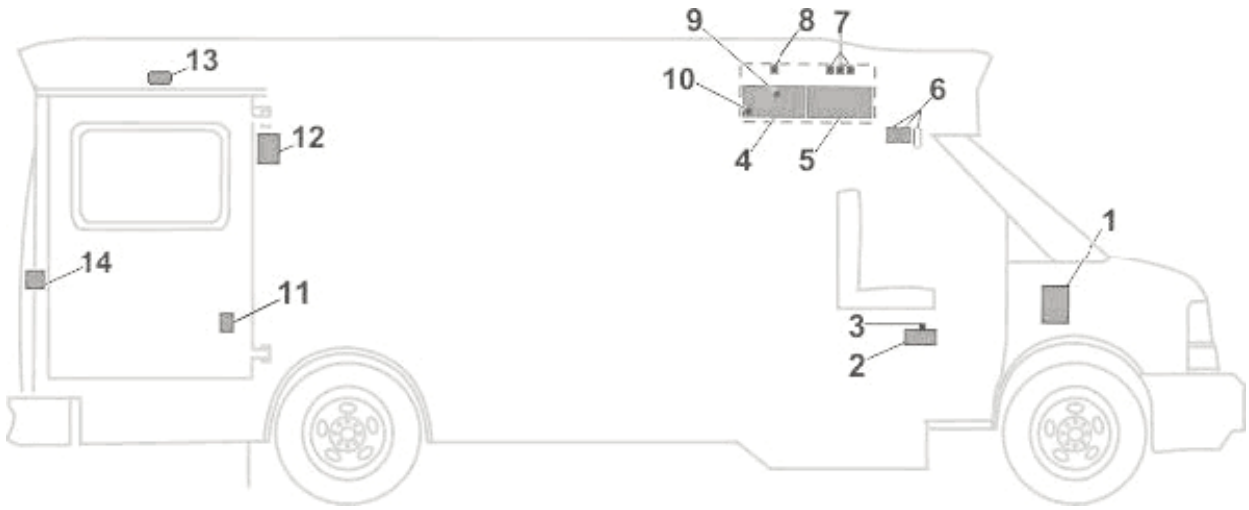
Conditional Requirements

The requirements of the Interlock feature must be met before certain operations can proceed. The parking brake must be set. The gear selector must be set in the park position. The ignition switch must be turned to the on or run position. The lift door must be opened all the way.

a. Park Brake – Set
b. Gear Selector – Park position
c. Ignition Switch – On or Run position
d. Lift Door – Opened and secured (to prevent accidental closing)

There are certain conditions that must be met before the buses electrical system will allow certain features to operate.

Design and Function - Block Diagram



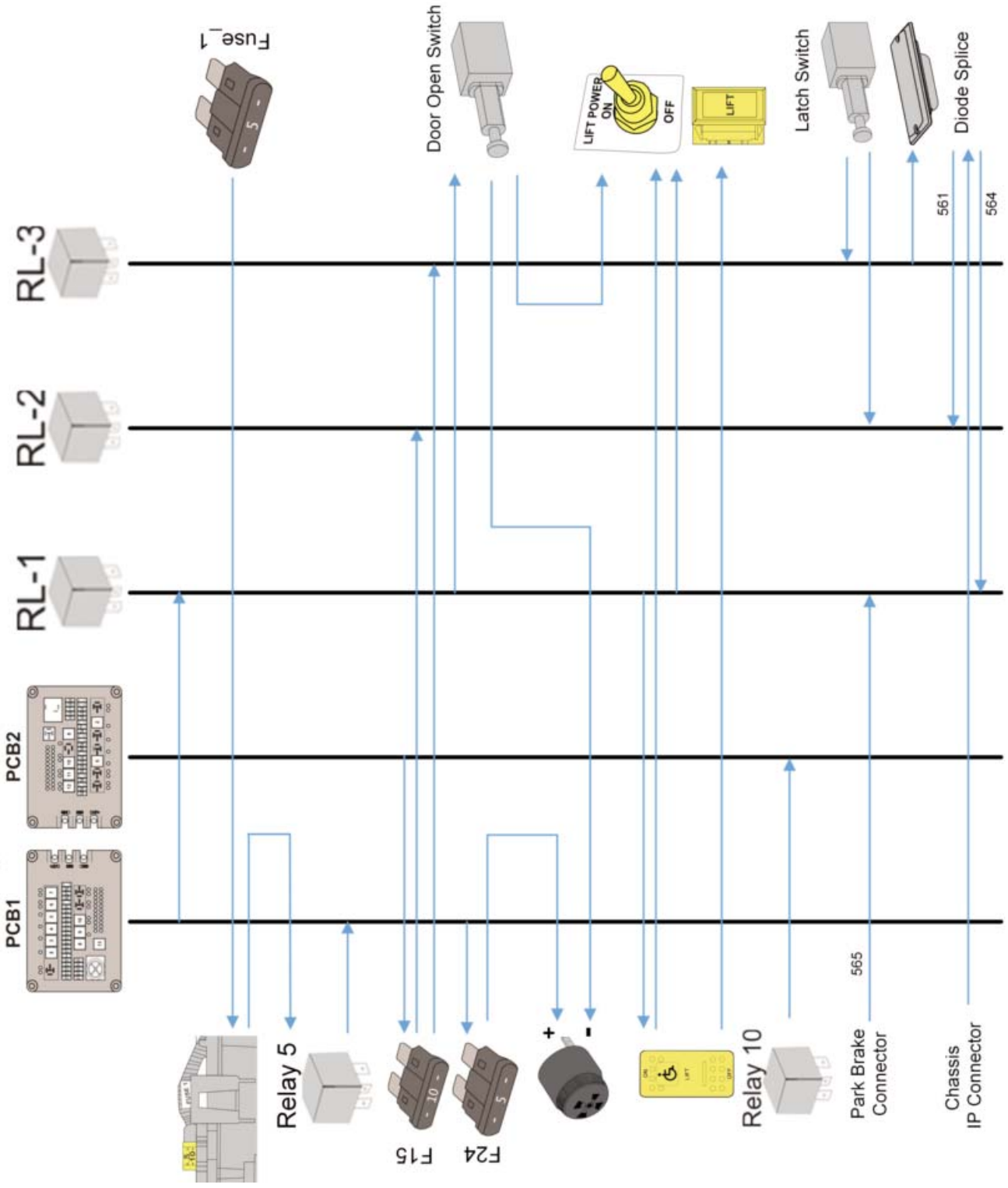
Block Diagram

1 – GM interface
2 – GM electrical center
3 – Fuse_1
4 – PCB1 (Printed Circuit Board 1)
5 – PCB2 (Printed Circuit Board 2)
6 – Lift switch and pilot light
7 – Relays 1, 2, 3
8 – RLY-1
9 – Ignition relay 5 (PCB-1)
10 – Buzzer
11 – Lift power, switch
12 – Lift door open, switch
13 – Lift door light
14 – Lift door latch, switch

The Interlock feature is built into the bus drivetrain, chassis, and body systems for operator and passenger safety. They limit or prevent bus operation of larger system components such as transmission engagement, engine starting, and park brake release until a safety Interlock has been satisfied to design standards. There is also a visual alert and a buzzer to remind the driver that an Interlock condition is present.

This document will troubleshoot the several different Interlock conditions preventing the wheel chair lift operation and the “bus drive away” condition. Individual component checks can also be made to assist in solving difficult troubleshooting problems. However, this document does not provide information on the lift operation or any troubleshooting of the lift itself. See your lift service information or dealer for any information pertaining to troubleshooting the lift itself.

Design and Function - Functional Flow Diagram



Specifications

Lift Door Switch Adjustments

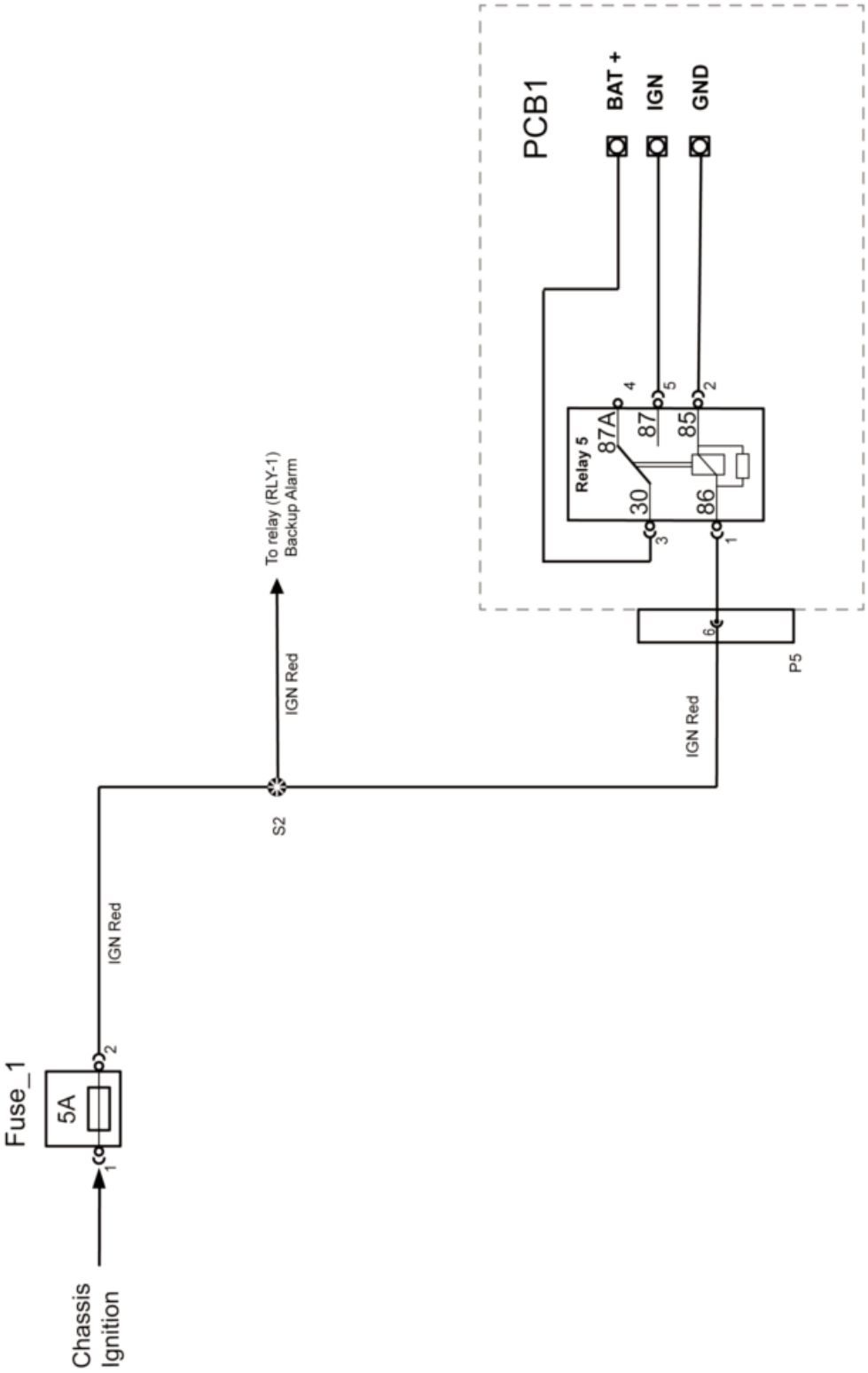
Door Open Switch

- No specifications found

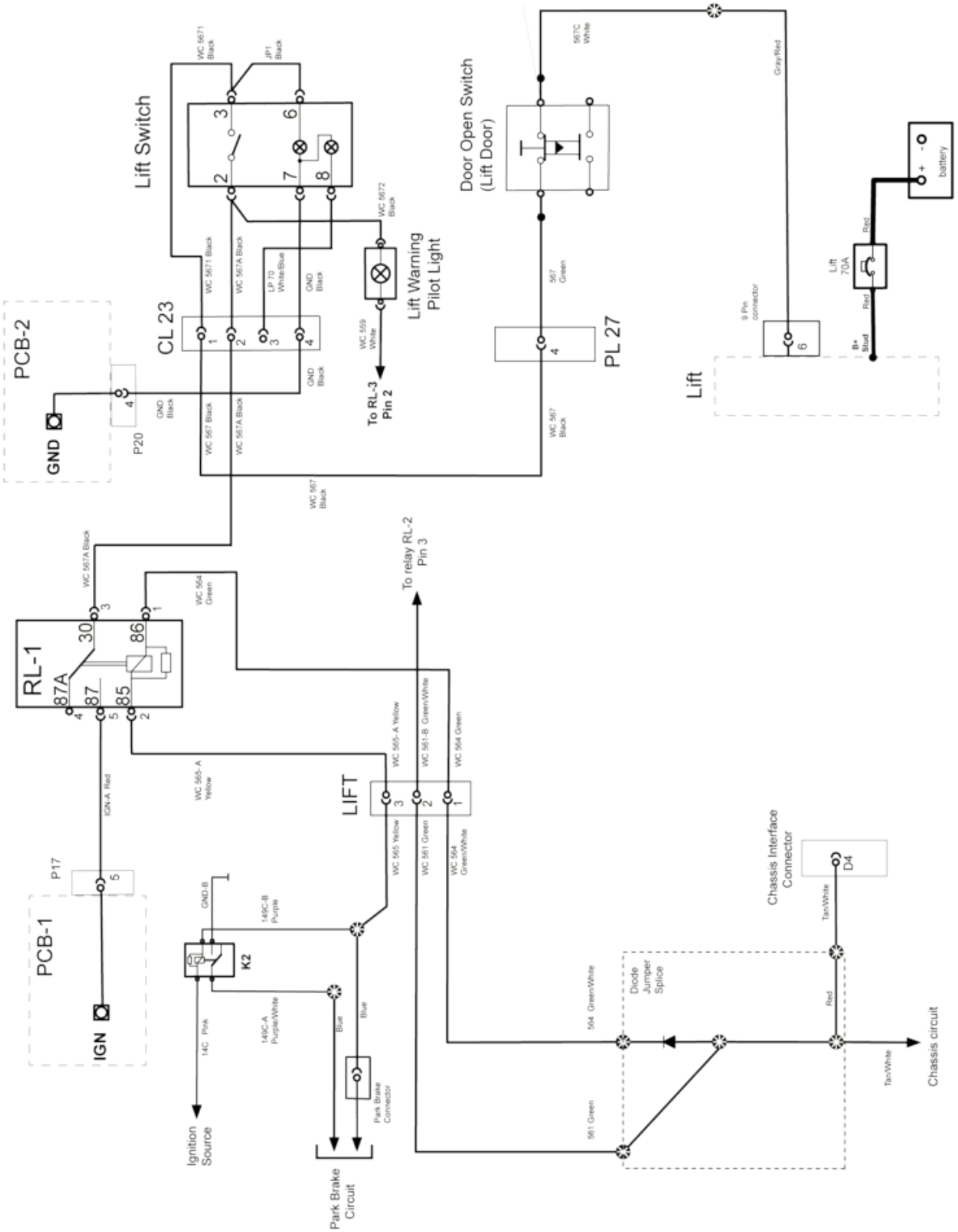
Door Latch Switch

- Bracket edge to edge of switch body = 3/8”
- Bracket edge to end of bolt latch = 1/2"

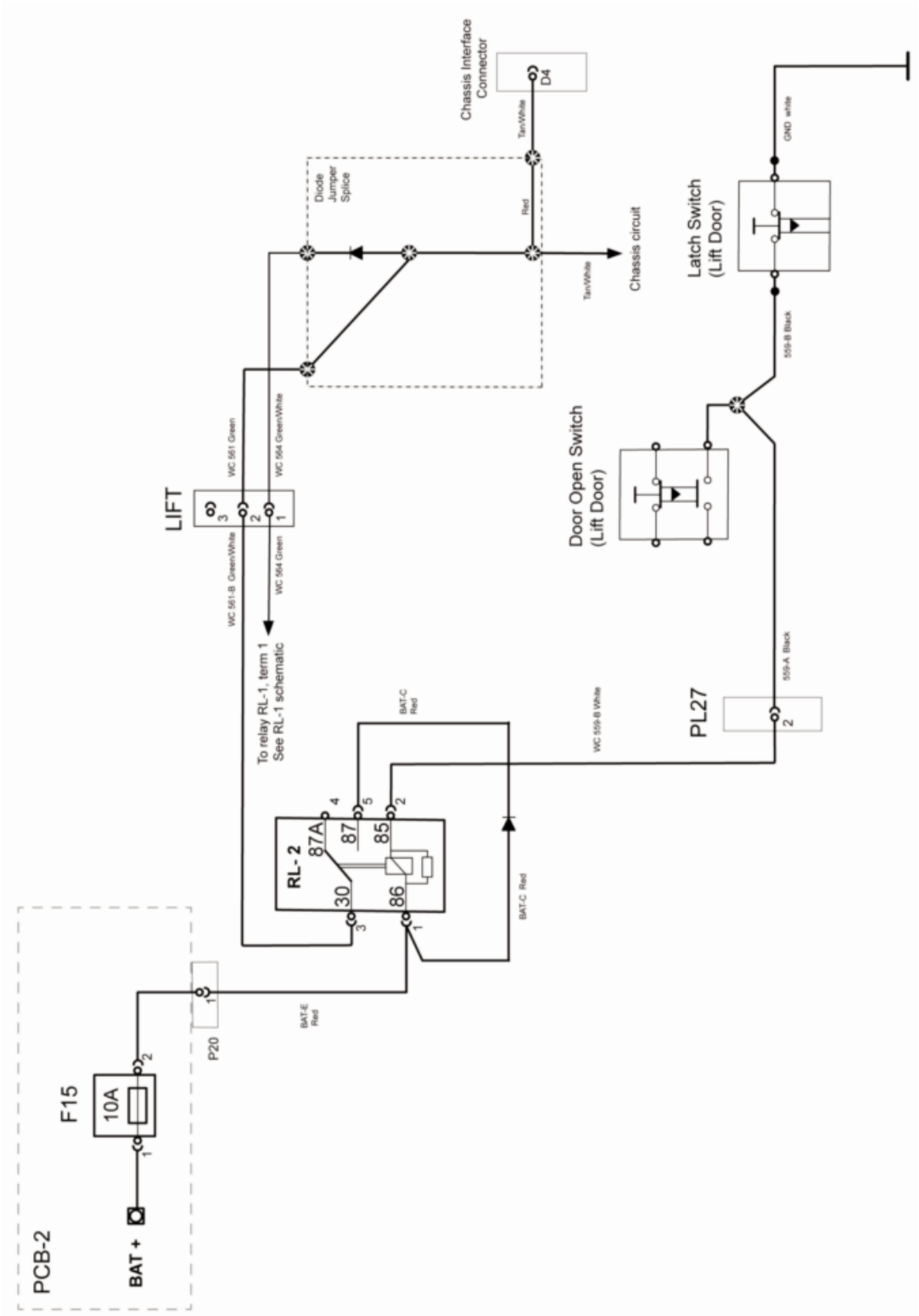
Electrical Schematic - Ignition Power



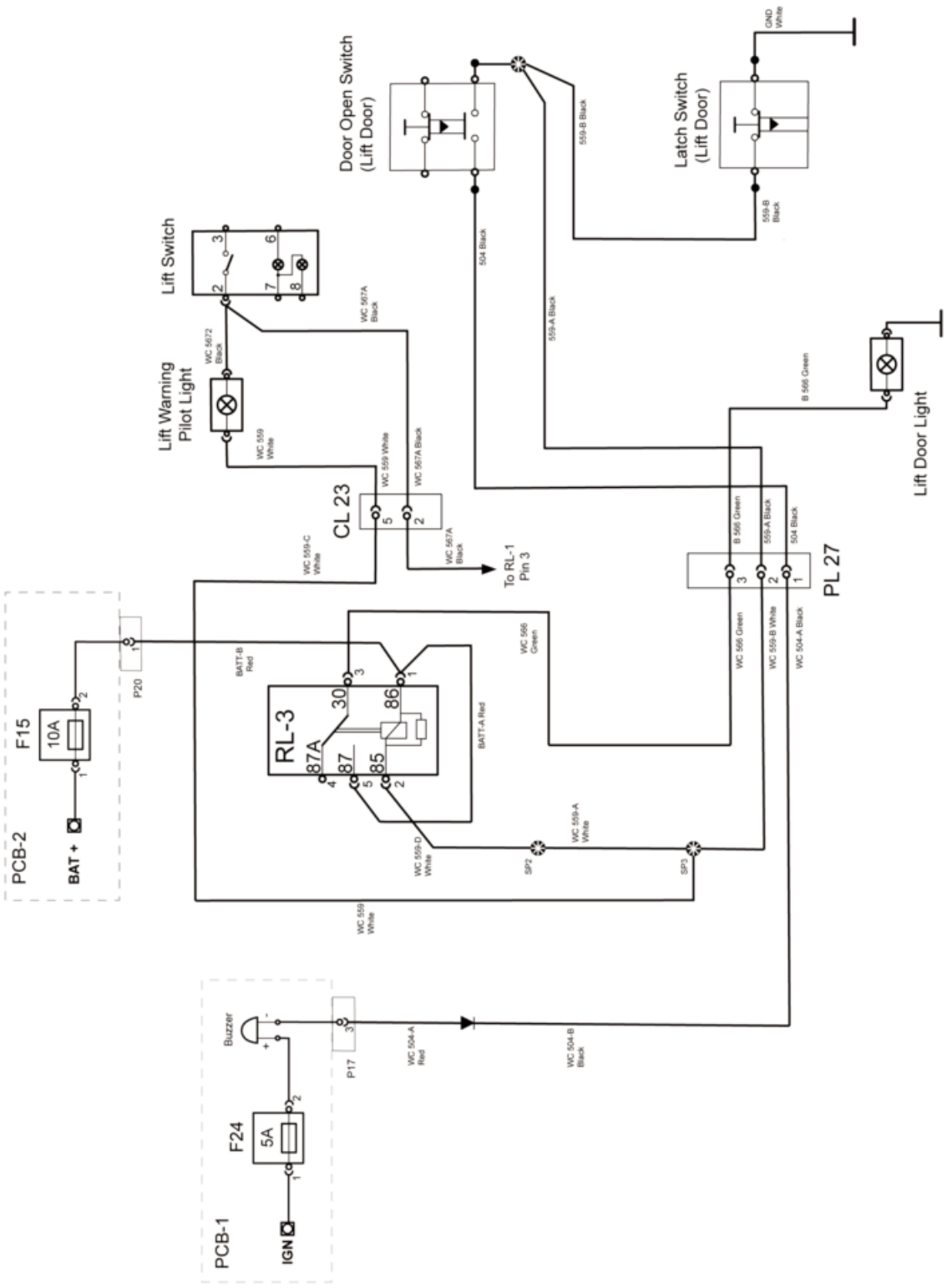
Electrical Schematic - Lift Power and Interlock



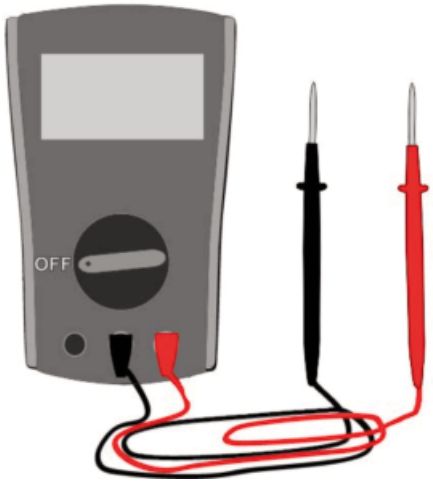
Electrical Schematic - Service Brake Applied (when lift door is open)



Electrical Schematic - Lift Door Light and Buzzer



Special Tools



Digital Multimeter (DMM)

Symptoms

- **Lift Inoperable (pg. 1.22)**
- **Gear Shift Interlock (pg. 1.15)**

Interlock:

The Interlock feature can be checked at several different locations. There are three associated wires to the Interlock feature that determine when the lift will work. They also prevent the bus from being driven away with the lift extended. If any measured values are questionable or the lift still does not work, each connection check should be made to determine where the fault may be located.

Checks:

1. **Relay RL-1 and RL-2** – located on the upper right portion of the Electrical Center Panel
2. **LIFT Connector** – located behind the Electrical Center Panel
3. **GM Interface** – located under dash behind the foot pedals in floor board area

The following circuits are to be checked at each of the **three** locations: **RL-1 relay, RL-2 relay, LIFT Connector, and Chassis Interface.**

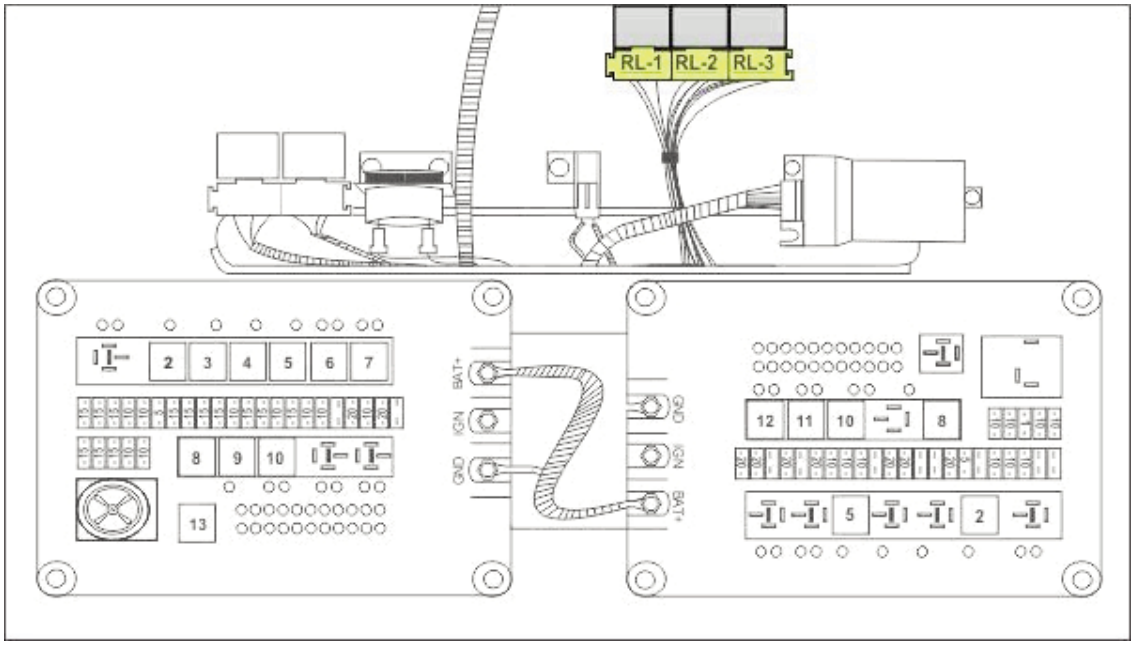
- **Circuit 565 (yellow)** – Park brake, ground supply to B- coil of RL-1 relay (controls power supply to switches for Lift operation)

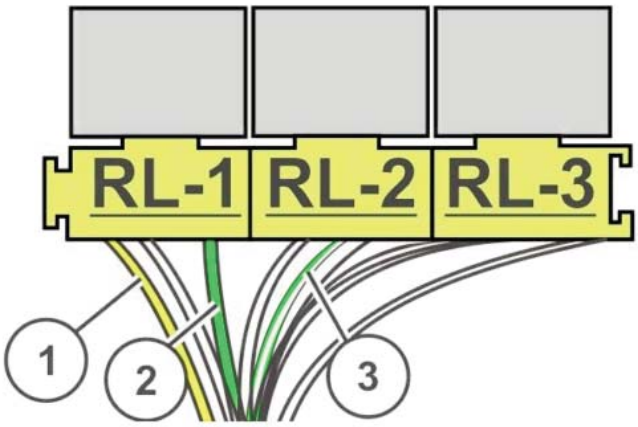
- **Circuit 564 (green)** – Shift interlock, power supply to B+ coil of RL-1 relay (controls power supply to switches for Lift operation)

- **Circuit WC 561 (green/white)** – Service brake applied, the chassis service brakes are applied by RL-2 relay when lift door is unlatched (sends 12v to chassis brake solenoid)

Note: Check and correct all related mechanical malfunctions and Interlock conditions first before troubleshooting any perceived wiring or component related problems.

Locate the **upper electrical center** located above the drivers seating area. Open access door and perform the following checks using a digital multimeter (DMM).





1 – WC 565 (yellow)
2 – WC 564 (green)
3 – WC 561-B (green/white)

Note: These relays may not be locked together in any specific order or marked. Check wire numbers to ensure correct relay is being tested.

Note: You may have to remove the cable tie to access the wires located under the relays.

1. Relays

Relay 1 Checks
Measuring Voltage: DC (volts)

Conditions:
- Key **"ON**

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 565 (yellow)	Park Brake (**ON**)	WC 565 to GND on printed circuit board	Approx. = 0 v	
WC 565 (yellow)	Park Brake (**OFF**)	WC 565 to GND on printed circuit board	Approx. = 12 v	

Conditions:
- Key **"ON**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Gear shift interlock	WC 564 to GND on printed circuit board	Approx. = 0 v	

Conditions:
- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Gear shift interlock	WC 564 to GND on printed circuit board	Approx. = 12 v	

Relay 2 Checks
Measuring Voltage: DC (volts)

Conditions:
- Key **"NO"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

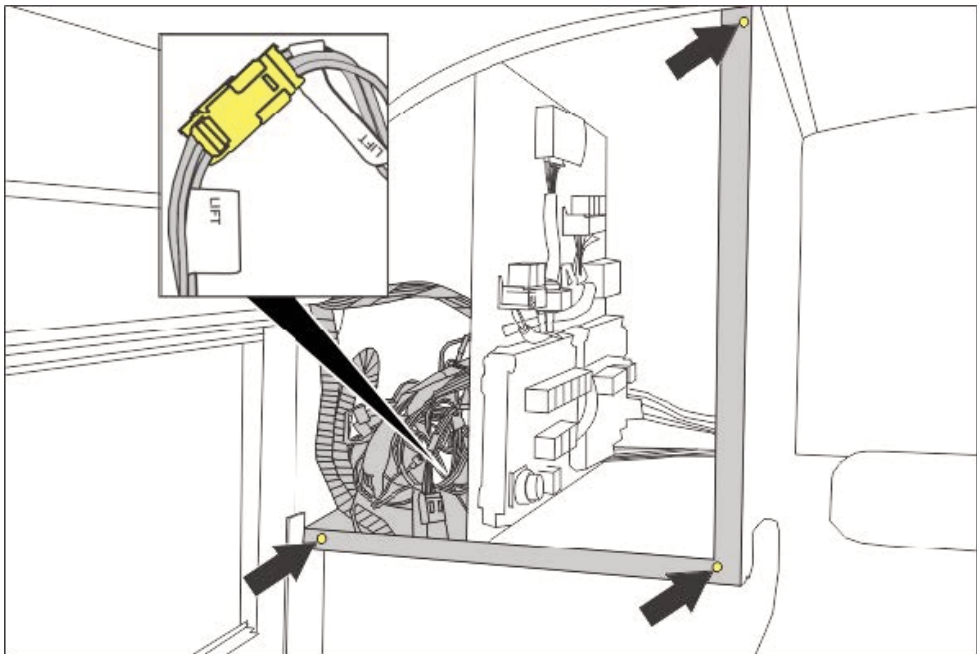
Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 561-B (green/white)	Service brake applied	WC 561-B to GND on printed circuit board	Approx. = 0 v	

Conditions:
- Key "**ON"**
- Gear selector in "**PARK"**
- Lift door **open** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 561-B (green/white)	Service brake applied	WC 561-B to GND on printed circuit board	Approx. = 12 v	

Note: If measured values are correct at the relays, then proceed to the LIFT connector checks.

2. Lift Connector:



Remove the three screws securing the upholstered closing panel for the Electrical Center to access the connector marked "LIFT".

Note: The same measured values should be found at connector labeled "LIFT" located behind the Electrical center.

Park Brake Circuit Checks

Conditions:

- Key **"NO"**
- Gear selector in **"PARK"**

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 565 (yellow)	Park Brake **(ON)**	WC 565, pin 3 GND to known ground	Approx. = 0 v	
WC 565 (yellow)	Park Brake **(OFF)**	WC 565, pin 3 GND to known ground	Approx. = 12 v	

Shift Interlock Checks

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Shift Interlock	WC 564, pin 1, to known ground	Approx. = 0 v	

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **open** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Shift Interlock	WC 564, pin 1, to known ground	Approx. = 12 v	

Service Brake Applied

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

CIRCUIT	FUNCTION	MEASURE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
WC 561-B (green/white)	Service brake applied	WC 561-B, pin 2, to a known ground	Approx. = 0 v	

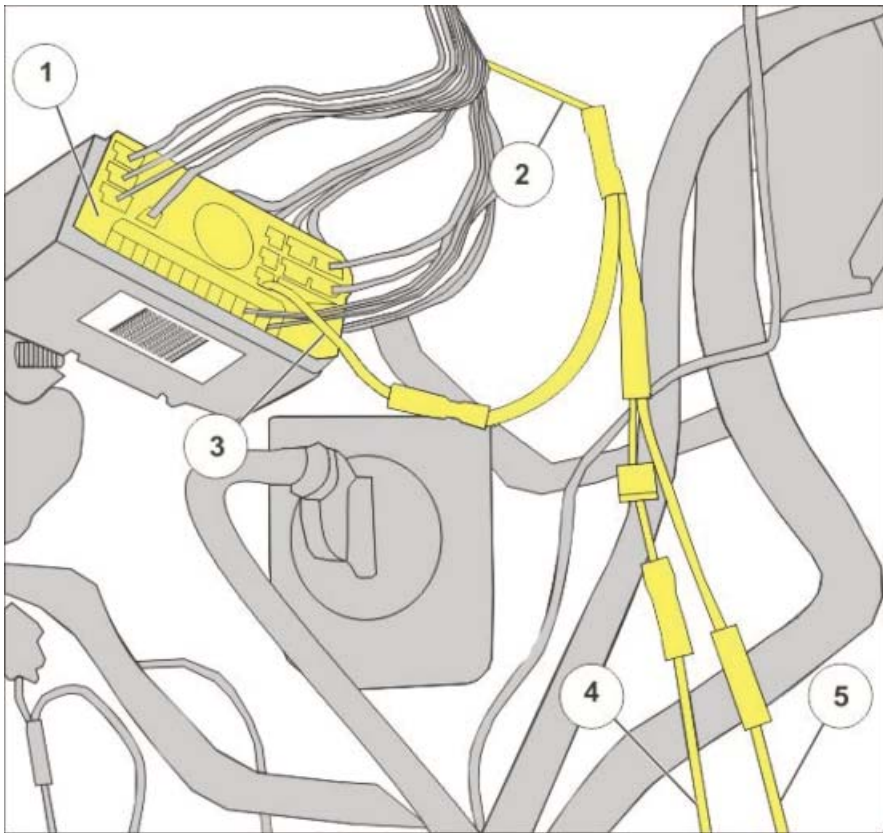
Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **open** (completely)

CIRCUIT	FUNCTION	MEASURE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
WC 561-B (green/white)	Service brake applied	WC 561-B, pin 2, to a known ground	Approx. = 12 v	

Note: If any of the above values are incorrect, a measurement of the same wires as they tie in to the chassis electrical system under the dash will need to be checked.

3. Chassis Interface:



1 – Chassis Interface Connector
2 – (tan/white)
3 – D4 (tan/white)
4 – WC 564 (green)
5 – WC 561-B (green/white)

1) WC 564 circuit check

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Gear Shift Interlock	WC 564 (green) to a known ground	Approx. = 0 v	OK = Proceed to next step NOK = Check splice connections NOK: see chassis Service Information

2) WC 564 circuit check

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door open (completely)

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
WC 564 (green)	Shift Interlock	WC 564 (green) to a known ground	Approx. = 12 v	OK = Proceed to next step NOK = Check splice connections NOK: see chassis Service Information

3) WC 561 circuit check

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **closed** (completely)

CIRCUIT	FUNCTION	MEASURE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
WC 561-B (green/white)	Service brake applied	WC 561-B (green/white) to a known ground	Approx. = 0 v	OK = Proceed to next step NOK = Check splice connections NOK: See chassis Service Information

4) WC 561 circuit check

Conditions:

- Key **"ON"**
- Gear selector in **"PARK"**
- Lift door **open** (completely)

CIRCUIT	FUNCTION	MEASURE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
WC 561-B (green/white)	Service brake applied	WC 561-B (green/white) to a known ground	Approx. = 12 v	OK = Proceed to next step NOK = Check splice connections NOK: See chassis Service Information

Components: Lift Functionality

Fuses:

- Fuse_1 (under driveer's seat)
- Fuse 15 (printed circuit board 2)
- Fuse24 (printed circuit board 1)

Relays:

- RL-1, RL-2, RL-3, Relay 5
- RL-2 (upper electrical center)
- RL-3 (upper electrical center)
- Relay 5 (upper electrical center, PCB1)

Chassis Interface:

- Under dash chassis wiring

Switches:

- Door Open (lift door, upper hinge)
- Door Latch (lift door, latch)
- Lift On/Off (upper console)
- Lift On/Off (wheelchair lift)
- Park Brake (left kick panel, driver's side)

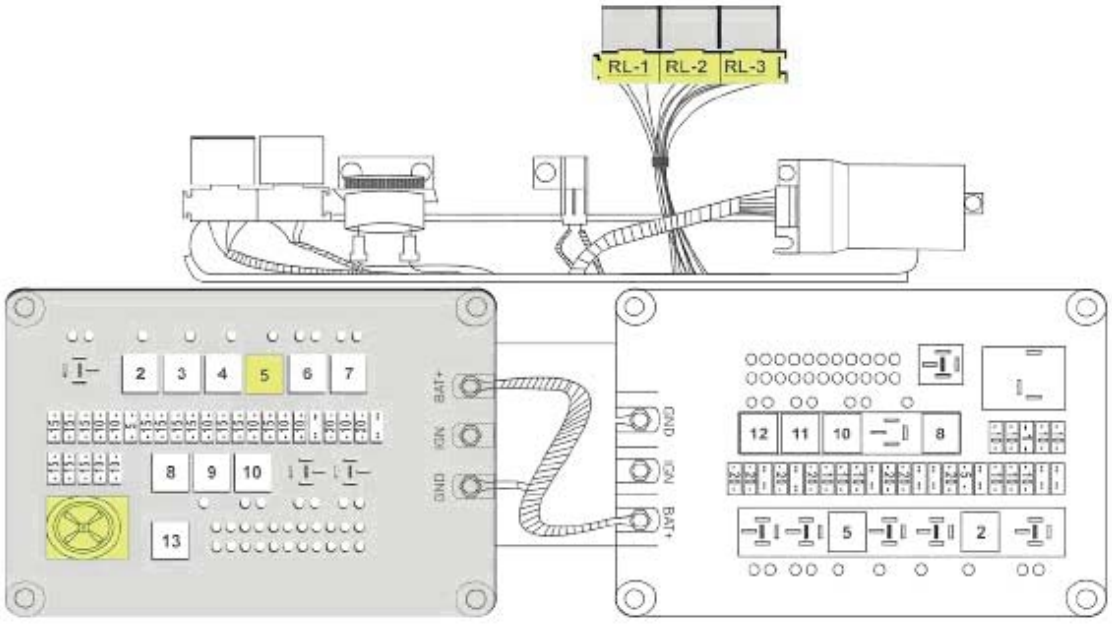
Lights:

- Lift Door, [wheelchair lift]
- Lift Warning Pilot (upper console)

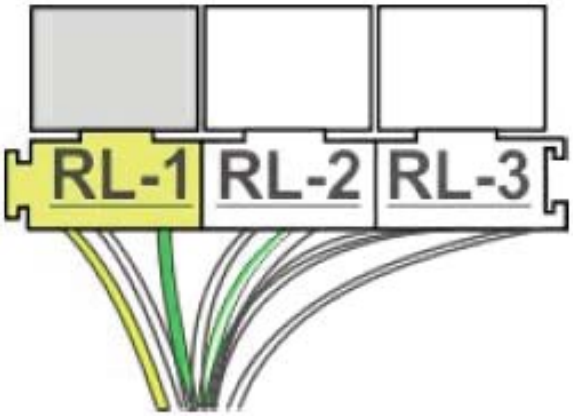
This section of troubleshooting represents a list of key electrical components associated with **lift functionality** and the conditional interlocks as they interact with normal bus operation.

Key components in any system will require replacement at some point during the life cycle of a vehicle. Although some may never need replacing, others may need to be replaced more often due to cycling and wear.

There is no defined order to performing these checks. These checks should be utilized per the technician's suspected thoughts and in agreement with the electrical system behavior at the time of testing. The technician should proceed to test the components he feels necessary to check.



Note: These relays may not be locked together in any specific order or marked. Check wire numbers to ensure correct relay is being tested.



RL-1 (Relay 1), Lift Power

Action: Measuring voltage (Volts DC)

Conditions:

- Ignition **"ON"**
- Engine **Not** running
- Gear Selector in **"PARK"**

CIRCUIT	FUNCTION	MEASURE POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
IGN-A (Red)	12 v Supply	IGN-A (Terminal 5) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = Check power on IGN stud on PCB1 *If no power on PCB1 then see Component Checks for PCB1
WC 564 (Green)	Coil B + (Neutral Safety, 12v Supply)	WC 564 (Terminal 1) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = See Component Checks, Chassis Interface
WC 565 (Yellow)	Coil B - (Ground coming from Park Brake circuit)	WC 564 (Terminal 2) IGN-A (Terminal 5)	Approx. = 12 v	OK = Proceed to next step NOK = See Component Checks, Park Brake
WC 567A (Black)	12 v Supply to Lift	WC 567A (Terminal 3) GND (on printed circuit board)	Approx. = 12 v	OK = Lift should operate NOK = *See steps below

(Continued on next page)

1) Check voltage on gray/red wire, pin 6 at the 9-pin connector at Lift.

    - If voltage is present, call your Lift service center.
    - If voltage is not present, check voltage on wire 567C (white) at Door Open switch.

2) Check voltage at door open switch, wire 567C (white).

    - If voltage is present, check for open circuit on wire 567C (white) going to the gray/red wire at the 9-pin connector at Lift.
    - If voltage is not present, check voltage on wire 567 (green) at switch.

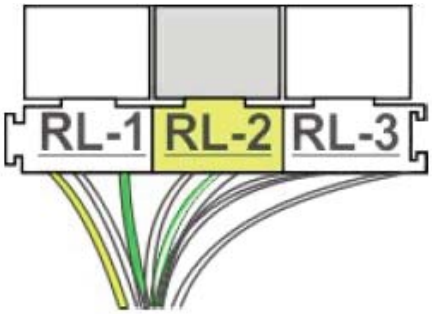
3) Check voltage at Door Open switch, wire 567 (green).

    - If voltage is present, check Door Open switch for proper function.

*See component checks for Door Open switch and replace as necessary.

    - If voltage is not present, check for open circuit in bus wiring coming from relay RL-1 to Door Open switch.

RL-2 (Relay 2), Service Brake Applied



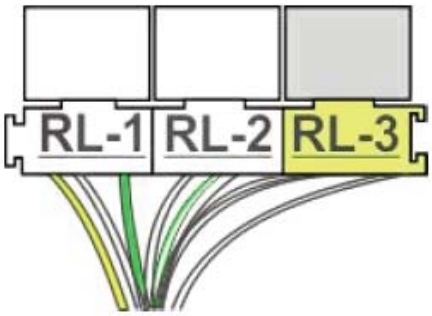
Action: Measuring voltage (Volts DC)

Conditions:

- Ignition **"ON"**
- Engine **No**t running
- Lift Door **Open** (Completely)

Circuit	Function	Measure Points	Expected Results	Corrective Action
BATT-E (Red)	Coil B+	BATT-E (Terminal 1) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = Check Fuse F15 on PCB2 condition and size 10A (Replace as required)
BATT-C (Red)	B+ Source power to Lift Door Light	BATT-C (Terminal 5) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = Check Wire connections on terminals of relay socket (Replace as required)
WC 559-B (White)	Coil B- (Ground coming from Latch Switch)	WC 559-B (Terminal 2) BATT-C (Terminal 5)	Approx. = 12 v	OK = Proceed to next step NOK = See Component Checks for Lift Door, Latch Switch *If Latch Switch is OK, check for open circuit on bus wiring between the latch switch and relay RL-2
WC 561-B (White)	12 v supply to Service Brake (chassis)	WC 561-B (Terminal 3) GND (on printed circuit board)	Approx. = 12 v	OK = Service Brakes should be applied *If Service Brakes are not applied See Component Checks Diode Splice NOK = Check and/or replace relay

RL-3 (Relay 3)



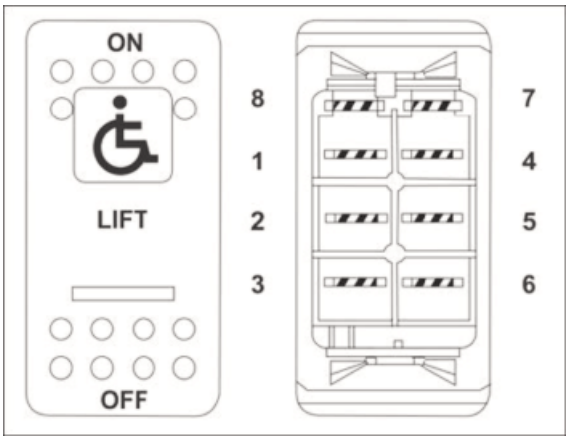
Action: Measuring voltage (Volts DC)

Conditions:

- Ignition **"ON"**
- Engine **Not** running
- Lift Door **Open** (Completely)

Circuit	Function	Measure Points	Expected Results	Corrective Action
BATT-B (Red)	Coil B+	BATT-B (Terminal 1) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = Check Fuse F15 on PCB2 condition and size 10A (Replace as required)
BATT-A (Red)	B+ Source power to Lift Door Light	BATT-A (Terminal 5) GND (on printed circuit board)	Approx. = 12 v	OK = Proceed to next step NOK = Check Wire connections on terminals of relay socket (Replace as required)
WC 559-D (White)	Coil B - (Ground source coming from Latch Switch)	WC 559-D (Terminal 2) BATT-A (Terminal 5)	Approx. = 12 v	OK = Proceed to next step NOK = See Component Checks for Lift Door, Latch Switch *If Latch Switch is OK, check for open circuit on bus wiring between the latch switch and relay RL-3
WC 566-B (Green)	12 v supply to Lift Door Light	WC 566-B (Terminal 3) GND (on printed circuit board)	Approx. = 12 v	OK = Lift Door Light should illuminate *If Lift Door Light does not illuminate See Component Checks Lift Door Light NOK = Check and/or replace relay

Lift Switch



Location: Overhead Switch Panel

Action: Measuring voltage (Volts DC) (rear of lift switch and harness, partially removed from panel)

Conditions:

- Ignition **"ON"**
- Engine **Not** running
- Lift Door **Closed**
- Lift Switch **"ON"**

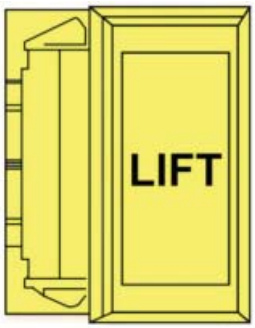
Circuit	Pin	Function	Measure Points	Expected Results	Corrective Action
NA	1	NA	NA	NA	NA
WC 567 A	2	Ignition Power (to switch from RL-1)	Pin 2 to pin 7	Approx. = 12v	OK = Proceed to next step NOK = Check the following: 12v Circuit 567A
WC 5672 (Black)		Lift (warning) Pilot Light			
WC 5671	3	Power Supply to Lift)	Pin 3 to 7	Approx. = 12v	OK = Proceed to next step NOK = Ensure ground on pin 7 is OK. If Ok, replace switch
JP1 (Black)		Power Supply (to lift **"ON"** light)	Pine 6 to 7		
NA	4	NA	NA	NA	NA
NA	5	NA	NA	NA	NA
JP1 (Black)	6	Lift Switch (**"ON"** Illumination)	Pin 6 to Pin 7	Approx. = 12v	OK = “On” light in switch should be illuminated. Proceed to next step NOK = Check jumper wire/terminal If jumper wire is OK, ensure ground on pin 7 is OK. If ground is OK, replace switch.
LP 70 (Blue/White)	8	Panel Lights (Check w/panel light ON)	Pine 8 to Pin 7	Approx. = 12v	OK = Panel light in switch should be illuminated. Proceed to next step NOK = Ensure ground on pin 7 is OK. If ground is OK, replace switch.

Action: Measuring Resistance (Ohms Ω) (rear of lift switch and harness)

Conditions:
- Ignition **"OFF"**
- Engine **Not** running
- Lift Door **Opened**
- Lift Switch **"ON"**

Circuit	Pin	Function	Measure Points	Expected Results	Corrective Action
GND (Green)	7	Ground	Pin 7 to body ground	Approx. = 0 Ω	Check circuit GND continuity back to PCB-2 and repair as necessary.

Lift (warning) Pilot Light



Action: Measuring Resistance (Ohms Ω) (rear of pilot light and harness)

Conditions:
- Ignition **"OFF"**
- Lift Door **Closed**
- Lift Switch **"OFF"**

Circuit	Function	Measure Points	Expected Results	Corrective Action
WC 559 (White)	Lift Door (open)	WC 559 to Body ground	Approx. = 0 Ω	OK = Proceed to next step NOK = Check circuit 559 for continuity from lift pilot light to lift door latch where it finally grounds.

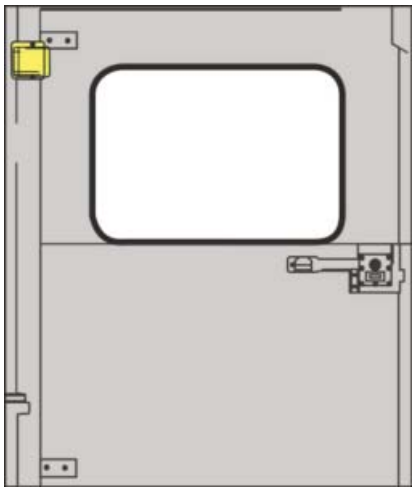
Action: Measuring voltage (Volts DC) (rear of pilot light and harness)

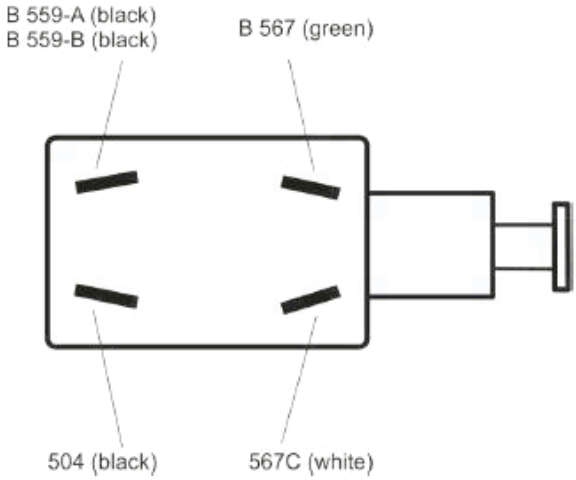
Conditions:

- Ignition **"ON"**
* Engine **Not** running
- Lift Door **Closed**
- Lift Switch **"ON"**

Circuit	Function	Measure Points	Expected Results	Corrective Action
WC 5672 (Black)	Lift (warning) Pilot Light (power feed)	WC 5672 to WC 559	Approx. = 12 v	OK = Lift Pilot Light should illuminate NOK = Check circuit 5572 for continuity between lift pilot light and lift door switch (console). If Ok, check power coming from RL-1 and IGN stud on PCB1. Repair as necessary.

Switch, Door Open





Action: Measuring Resistance (Ohms Ω)
(switch door open, lift door)

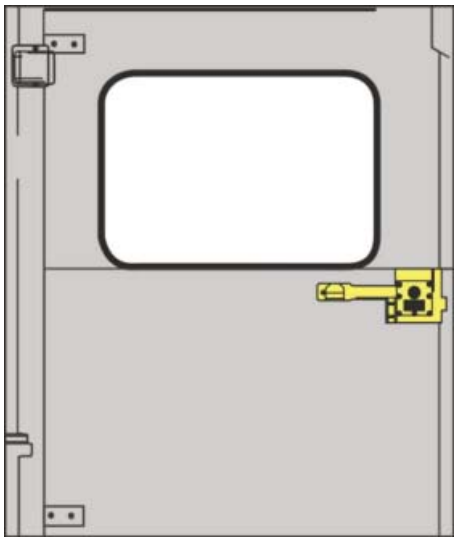
Conditions:

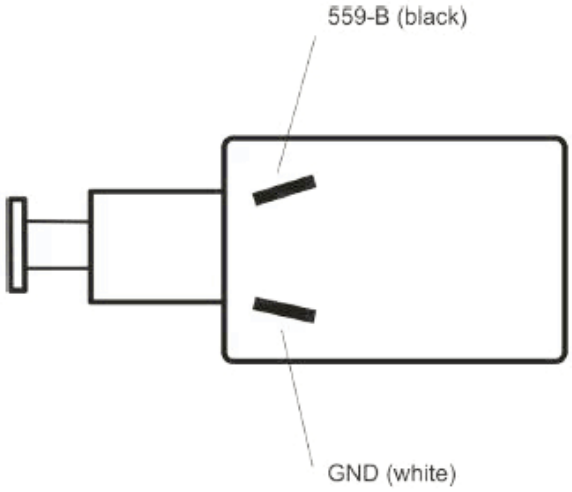
- Ignition **"OFF"**
- Lift Door **Closed** – Lift Door **Opened**
- Lift Switch **"OFF"**

  Note: Remove cover assembly to access switch

CIRCUIT	FUNCTION	MEASURE POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
B559-A/B	Lift Door switch (closed door = closed switch)	B559-A/B to B504	Approx. = 0 Ω	OK = Proceed to next step NOK = Check switch for proper operation, if switch does not function correctly replace switch
B567 (green)	Lift Door switch (closed door = closed switch)	B567 to 567C	Approx. = 80 Ω (± 20 Ω) **Note:** The resistance across these terminals reflect the coil resistance of relay RL-3 due to a splice connection of another circuit.	OK = Proceed to next step NOK = Check switch for proper operation, if switch does not function correctly replace switch
B559-A/B	Lift Door switch (open door = open switch)	B559-A/B to B504	Approx. = Open circuit	OK = Proceed to next step NOK = Check switch for proper operation, if switch does not function correctly replace switch
B567 (green)	Lift Door switch (open door = open switch)	B567 to 567C	Approx. = Open circuit	OK = Proceed to next step NOK = Check switch for proper operation, if switch does not function correctly replace switch

Switch, Latch (Buzzer Activation)





Note: The buzzer located on PCB-1 is activated (grounded) when both switches (lift door open switch) and (lift door latch switch) work together and have continuity through each to a ground located after the latch switch. The lift door must be unlatched but "not open" to get the ground circuit to pass on to the latch switch. The latch switch is grounded when it is in the unlatched position.

Note: The buzzer will not be grounded and will not sound if the door is opened more than simply being unlatched.

Action: Measuring Resistance (Ohms Ω) (latch switch at lift door)

Conditions:

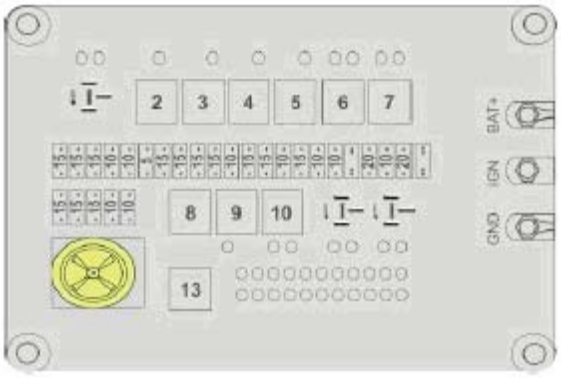
- Ignition **"OFF"**
- Lift Door, **(Closed and Opened)**
- Lift Switch **"OFF"**

Circuit	Function	Measure Points	Expected Results	Corrective Action
GND (white)	Lift Door Latch switch (closed door/open switch)	GND to known chassis ground	Approx. = 0 Ω	OK = Proceed to next step NOK = Check and repair ground circuit from lift door latch switch to ground
B559-B (Black)	Lift Door Latch switch (open door/closed switch)	B559-B to GND (across switch terminals)	Approx. = Open circuit (no connection)	OK = Proceed to next step NOK = Ensure switch moves properly and is adjusted properly. If OK, replace switch
B559-B (Black)	Lift Door Latch switch (open door/closed switch)	B559-B to GND (across switch terminals)	Approx. = 0 Ω	OK = Buzzer should activate when key is on and door is unlatched, but not opened. Note: Check 559 circuit back to the lower terminal of buzzer on PCB1 NOK = Ensure switch moves properly and is adjusted properly. If OK, replace switch

Buzzer for Lift Door

Concern – Buzzer not working

Note: it will not work or sound if buzzer is in backwards



Action:

- Measuring voltage (Volts DC)
- Measuring Resistance (Ohms Ω)
  (PCB1, Buzzer, rear - upper terminal)

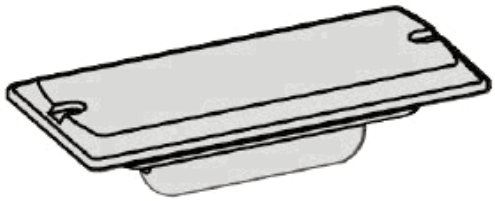
Conditions:

- Ignition **"ON"**
- Engine **Not** running
- Lift Door **Unlatched** (not open)
- Lift Switch **"ON"**

CIRCUIT	FUNCTION	MEASURE POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Buzzer (B+)	Buzzer Supply (B+ terminal at Buzzer rear)	Buzzer (upper pin) to Ground stud	Approx. = 12v	OK = Buzzer not working, Proceed to next step NOK = Check Fuse F24 condition and size 5A (Replace if required)
PCB1_P17 pin 3	Buzzer Ground (from door switches)	Buzzer (upper pin) to J17 pin 3	Approx. = 12v	OK = Buzzer not working, Replace Buzzer NOK = Proceed to next step
J17 pin3	Buzzer ground (from door switches)	J17_pin3 to ground stud	Approx. = 0 Ω	OK = Replace Printed Circuit Board (PCB1) NOK = See below *

*Check the following components: **Door Open switch, Door Latch switch, wiring, and ground connection to chassis.**

Lift Door Light



Concern: Light not working

Note: Check bulb and filament, replace as required

Action:

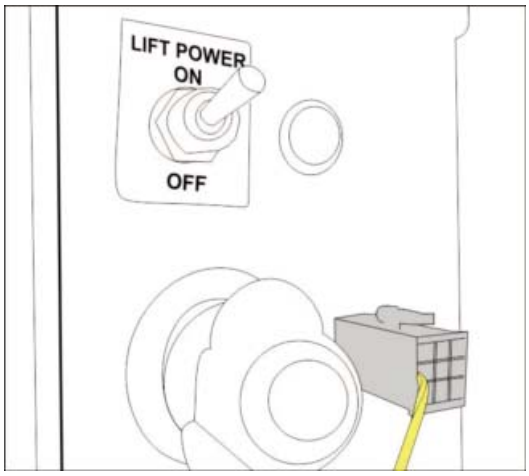
- Measuring voltage (Volts DC) (at Lift Door Light)
- Measuring Resistance (Ohms Ω) (at Lift Door Light)

Conditions:

- Ignition **"ON"**
- Engine **Not** running
- Lift Door **Open**

Circuit	Function	Measure Points	Expected Results	Corrective Action
B 566 (green)	Lift Door Light Supply	B 566 to Ground	Approx. = 12v	OK = Proceed to next step NOK = Check relay RL-3 for proper operation, replace if necessary Check Fuse F15 (PCB2) condition and size 5A (Replace if required
Light housing	Ground	Housing or mounting to body ground	Approx. = 0 Ω	OK = Light should illuminate NOK = Repair ground as necessary

Switch, Lift On/Off



Action: Measuring voltage (Volts DC)
(Lift On/Off switch, Lift connector)

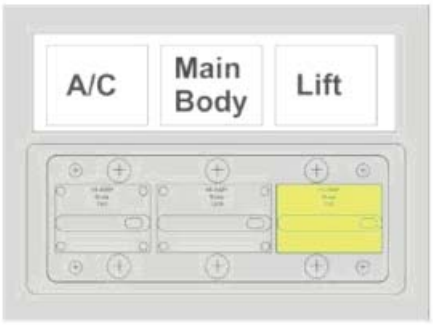
Conditions:

- Ignition - **"On"**
- Engine **Not** running
- Lift Door - **Open**
- Lift Switch - **"On"** (Console)
- Lift Switch – **"On"** (at Lift)

Note: If green light is ON when the lift switch is on, more than likely the switch has power and the problem is on the Lift side.

Circuit	Function	Measure Points	Expected Results	Corrective Action
567C (white) splices: • white/purple • gray/red	Lift switch (12v supply)	Gray/red wire at 9 pin connector to ground	Approx. = 12v	OK = Lift should operate NOK – Check lift circuit 567 coming from lift switch (console) to door open switch and to gray/red wire for continuity. Repair as necessary.

Lift Power (Battery Power to Lift)



Action: Measuring voltage (Volts DC)

Conditions:

- Park Brake **set**
- Gear Shifter in **"PARK"**
- Lift Door **Opened**

Lift Power Check

Circuit	Function	Measure Points	Expected Results	Corrective Action
B+ (Red) cable	Lift Battery Supply	Lift power stud to chassis ground	Approx. = 12v	OK = Lift should operate See Lift On/Off switch checks NOK = Check 70A Lift Circuit Breaker for being tripped
70A circuit breaker	Lift Battery Supply	Physical Check		Ok = Check cable connections at battery NOK = Reset breaker and recheck poweron cable at lift

Lift Ground Check

Action: Measuring Resistance (Ohms Ω)

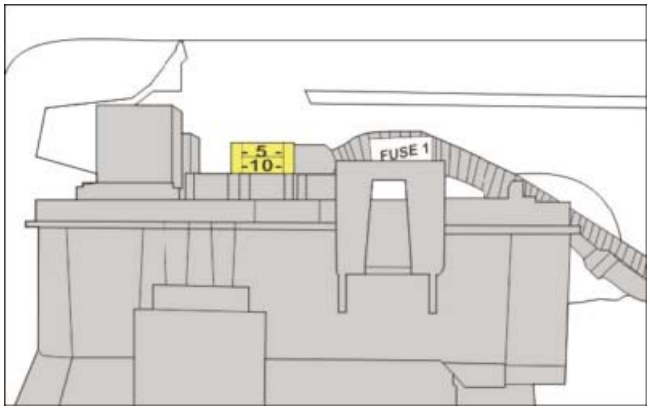
Conditions:

- Park Brake **set**
- Gear Shifter in "**PARK"**
- Lift Door **Opened**

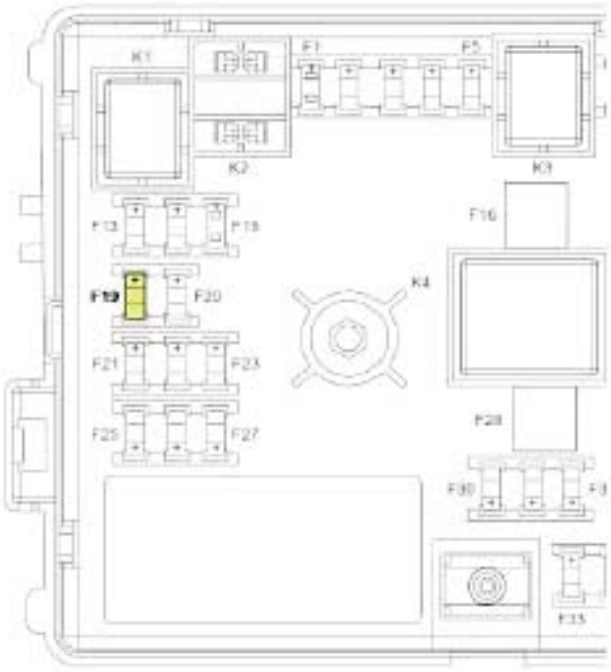
CIRCUIT	FUNCTION	MEASURE POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Lift ground	Lift frame ground (B- battery return)	Lift frame to chassis ground	Approx. = 10 Ω or less	OK = Lift has good ground and should work. NOK = Check, clean and or repair ground connections from battery, frame and body to lift until sufficient for lift to operate

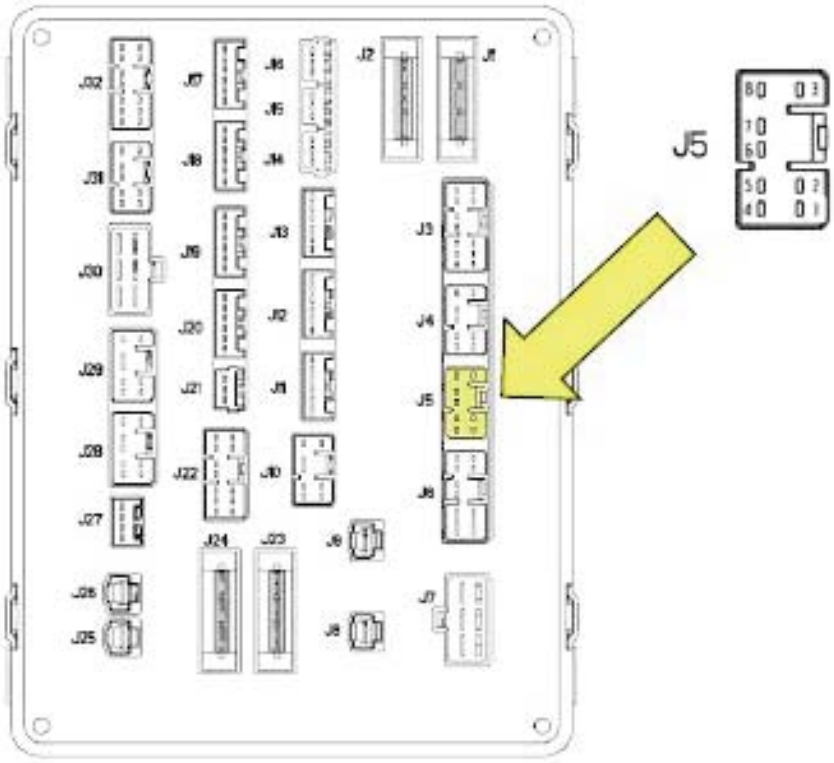
PCB1 (Printed Circuit Board 1), Ignition Power

(Power source from chassis and related components)

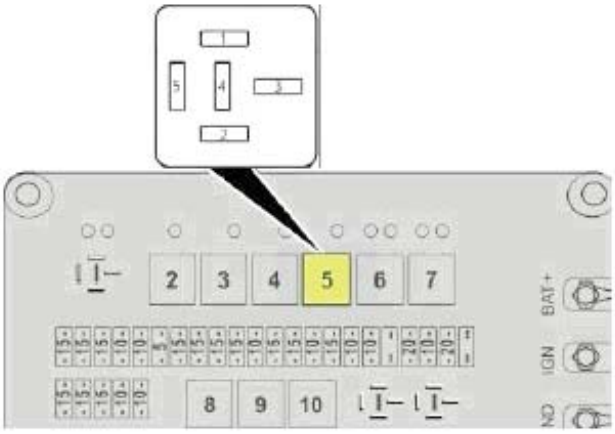


Power supply from Fuse_1
(electrical center located under driver's seat)





PCB1_P5 connector (located on rear of PCB1 & supplied from Fuse_1)



Relay 5 (Ignition Source Relay for both PCB1 and PCB2 boards)

1) Terminal 1 – Coil power, from FUSE_1
2) Terminal 2 – Coil ground, from GND stud
3) Terminal 3 – Battery source, from B+ stud
4) Terminal 4 – NA
5) Terminal 5 – Ignition source, to IGN stud

Concern – No 12v Ignition power on IGN stud of PCB1

Action: Measuring voltage (Volts DC)

- Fuse_1
- Connector PCB1_P5 pin 6
- PCB1 Relay 5
- IGN stud
- BAT+ stud

Conditions:

- Ignition **"ON"**
- Engine **Not** running

Circuit	Function	Measure Points	Expected Results	Corrective Action
FUSE_1 (5A)	Fuse, 5 A (position F19 of chassis Electrical Center, under driver's seat)	Fuse – check voltage on both outer contacts to a known ground	Approx. = 12v (top of fuse, both contact points)	IOK – proceed to next check NOK – Replace Fuse or check chassis electrical system
IGN (red)	12v supply (From chassis Electrical Center, under driver's seat to PCB1)	PCB1_P5 pin 6 to ground	Approx. = 12v	IOK – proceed to next check NOK – Check and or repair wiring from FUSE_1 to connector P5 at PCB1
Relay 5 (Socket terminal 1)	Ignition Supply (12v) to Relay 5	Terminal 1 to terminal 2	Approx. = 12v	OK – Proceed to next check NOK – Ensure GND stud circuit to body/chassis ground is good
Relay 5 (Socket terminal 3)	Battery Source voltage (12v) to Relay 5	Terminal 3 to terminal 2	Approx. = 12v	OK – Proceed to next check NOK – 1) Ensure GND stud circuit to body/chassis ground is good 2) Check voltage at BAT+ stud
IGN stud	Ignition Supply (12v) from Relay 5 to IGN stud	IGN stud to the GND stub	Approx. = 12v	OK – Proceed to next check NOK – Ensure GND stud circuit to body/chassis ground is good
BAT+	Battery Source voltage to PCB1 and PCB2	BAT+ stud to GND stud	Approx. = 12v	OK – No further action required NOK – Check: 1) Circuit Breaker - Main 2) Battery cables 3) Battery connections 4) Battery Fuse – correct size and condition 5) Battery condition

PCB2, Printed Circuit Board

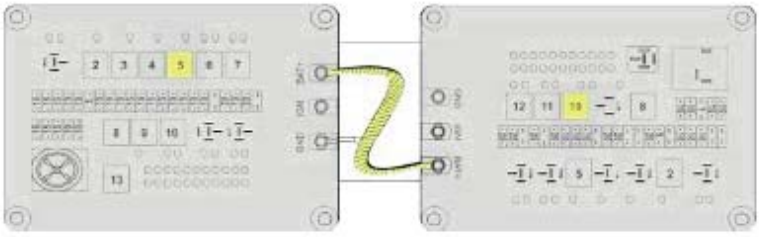
(Power, Ignition, and Ground)

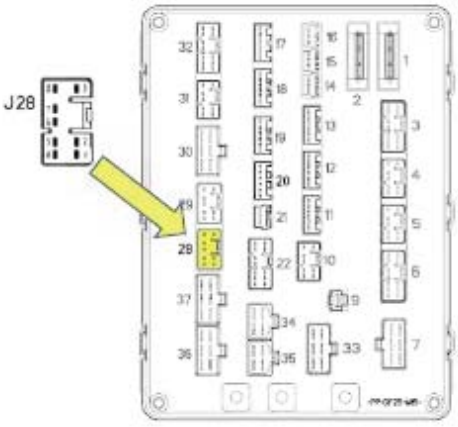
The following checks are used to determine power and ground supply circuits to PCB2 and the Interlock relays, RL-1 and RL-2.

Note: The battery voltage supply for PCB2 comes directly from PCB1 by a cable coming from BAT+.

However, the ground supply and ignition signal voltage are sourced via **jumper harness.**

- The jumper harness connects PCB1 to PCB2 by way of connector P28.
- Ignition voltage on PCB1 is controlled by relay 5, located on PCB1.
- Ignition voltage on PCB2 is controlled by relay 10, located on PCB2.





J28 Connector, PCB2

Check PCB2 Ground Circuit

Action:

- Measuring Resistance (Ohms Ω)

Conditions:

- Key **"OFF"**
- Gear selector in **"PARK"**
- Park Brake **"ON"**

CIRCUIT	FUNCTION	MEASURE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
Jumper Harness	PCB2 Ground	P28_pin 1 to GND stud	Approx. = 0 Ω	OK = Proceed to next step NOK = Check jumper harness between boards PCB1 and PCB2 (P28_pin 1 to P28_pin 1) Repair or replace as needed

Check PCB2 - Ignition Supply

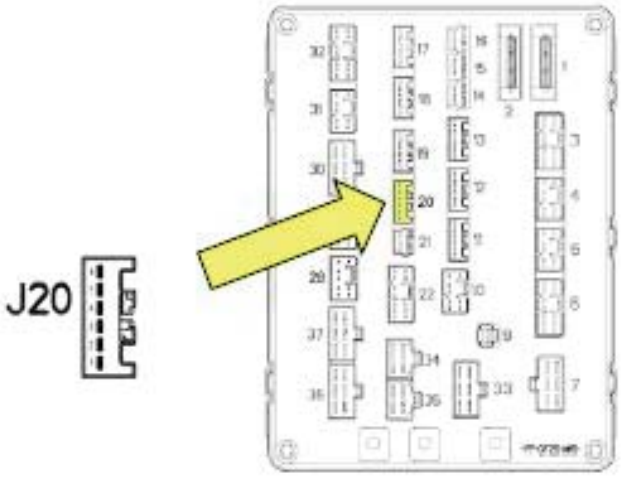
Action:

- Measuring Voltage (Volts)

Conditions:

- Key "**ON**"
- Gear selector in **"PARK"**
- Park Brake "**ON"**

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
Jumper Harness	Ignition Signal from PCB1 to PCB2	P28_pin 6 to GND stud	Approx. = 12v	OK = Proceed to net step NOK = Check the following: • Check jumper harness boards PCB1 and PCB2 (P28_pin 6 to P28_pin 6) Replace as needed • Check power on Ignition stud. Repair battery connection to PCB1 • Check **Relay 5** for proper function on PCB1 Replace as needed
PCB2 fuse/s	PCB2 Ignition Supply	Any Fuse on PCB2 to GND stud	Approx. = 12v	Ok = PCB2 should have ignition power NOK = Check **Relay 10** on PCB2 for proper function. Replace as needed.



J28 Connector, PCB2

Check PCB2 - Battery Supply Voltage (Output to relays RL-2 and RL-3)

Action:

- Measuring Voltage (Volts)

Conditions:

- Key **"On"**
- Gear selector in **"PARK"**
- Park Brake **"ON"**

Circuit	Function	Measure Voltage	Expected Results	Corrective Action
BATT- B (Red)	Battery Power supply to relays RL-2 and RL-3	J20_pin 1 to GND stud	Approx. = 12v	OK = Relays RL-1 and RL-2 should have battery power NOK = Check fuse F15 (10A) for proper size and condition. Replace as needed

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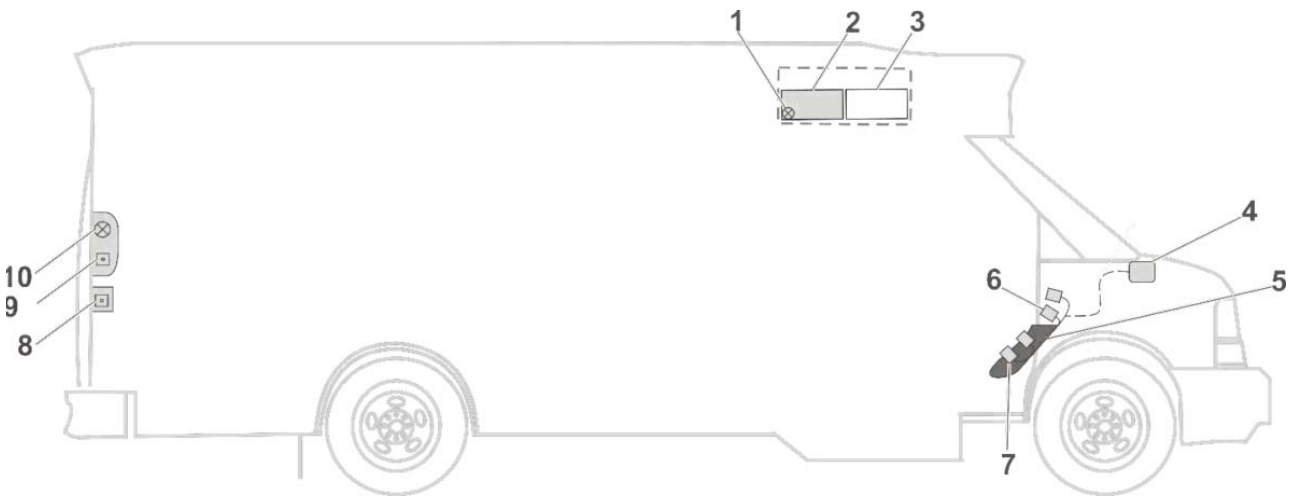


Vandalock Diagram

1 – Buzzer (front)
2 – PCB1
3 – PCB2
4 – Splice Connections (GM)
5 – Vandalock Harness (under dash/floor mat)
6 – Splice Connections (Ford)
7 – Vandalock Relay
8 – Vandalock Switch
9 – Latch Switch
10 – Buzzer

General

The troubleshooting within this document will cover the Vandalock feature. Vandalock consists of several devices: a fused relay, two buzzers, and a switch.

Mechanically, the system has only one device which is a **barrel lock (latch)** that must be manually manipulated to engage or disengage the Vandalock feature. When both the relay and the switch are working in combination, they can open or close the starter circuit to the engine.

Provided below are certain conditions where the Vandalock feature would be enforced:

- **While parked:** The Vandalock feature helps to prevent vandalism, theft, or unauthorized use of the bus in the event forced entry occurs while the bus is in the **parked** position by preventing the engine from starting.

- **While starting:** For the starter to operate correctly and engage the engine for cranking, the emergency exit door (**barrel lock (latch)**) must be in the **unlocked** position. If it is in the locked position, a “no start” condition exists.

- **While driving:** The Vandalock feature alerts the driver that the emergency exit door has become locked. Buzzers (front and rear) will sound to alert the driver to take corrective action to remedy the alert situation.

Note: The rear emergency exit door is required to remain unlocked during normal bus operation in the event of an accident so that passengers may exit the door without delay.

Design and Function

The Vandalock feature is part of a complex system of bus interlock conditions, which when activated, will limit or prevent operation of larger system components for operator and passenger safety. Normal bus operations will be halted until certain safety interlock conditions have been satisfied per design manufacturing standards.

The main conditional response of the Vandalock feature comes from a plunger-style contact switch located on the rear emergency exit door of the bus. This switch is directly acted upon by a manually operated barrel-locking latch. When the latch is in the **locked** position, the Vandalock feature is active and the bus will **not** crank. When the barrel lock is in the **unlocked** position, the bus will crank and the engine **will** resume normal operation.

There are **two** buzzers utilized to remind the driver that a Vandalock condition is present: one buzzer is situated on **PCB1 (Printed Circuit Board 1)** and is located above the driver in the **upper electrical center** while a second buzzer is mounted next to the **door latch switch** located directly on the rear emergency exit door. The Interlock switch when active provides a ground to a relay which in turn interrupts power to the start circuit on the vehicle chassis.

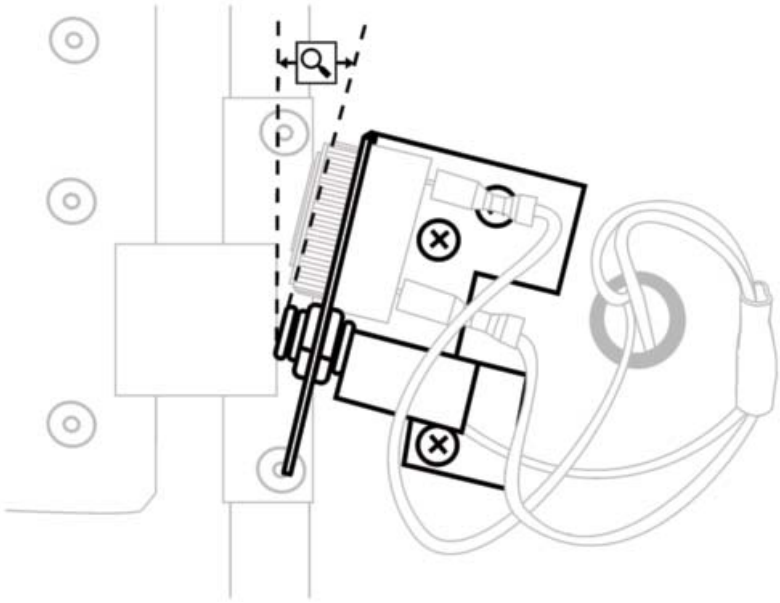
The information within this document is identical for both the Ford and GM chassis **except for the interface connections and their locations**. The **Ford relay harness and connection tie-in** are located under the dash near the steering column. The **GM relay harness** is located is **under the dash** while the **tie-in** is situated on the **harness bundle** traversing the bulkhead located **underneath the hood**.

This document will assist in troubleshooting the several circuit components that make up the Vandalock feature.

Note: For specific details concerning the Ford or GM chassis models, consult the vehicle manufacturer for more technical information.

Specifications

Emergency Exit Door, Switch Adjustments



Latch Switch, switch adjustment

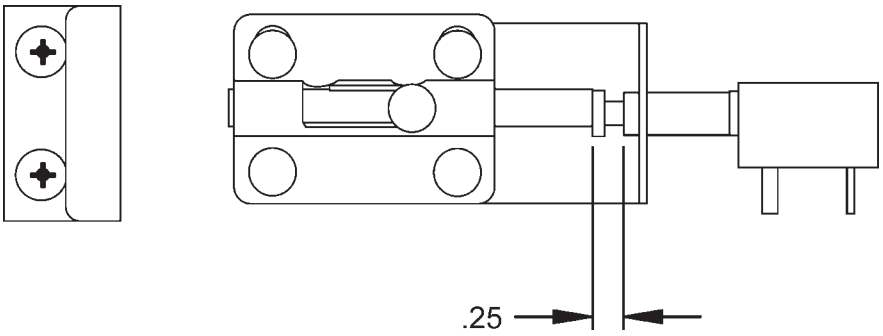
Latch Switch

(from image above) = Justify the switch plunger length to latch bolt face when the door is shut. Make certain the plunger does not bottom out the switch, but allow enough relief to make and break the electrical connection when door is opened and shut.

Note: Adjustment of the bracket may be necessary to further assist in getting the proper detent and relief on the switch plunger.

Note: Ensure the buzzer does not touch the latch bolt after adjustment to switch is complete.

Note: Check buzzer operation after switch adjustment.

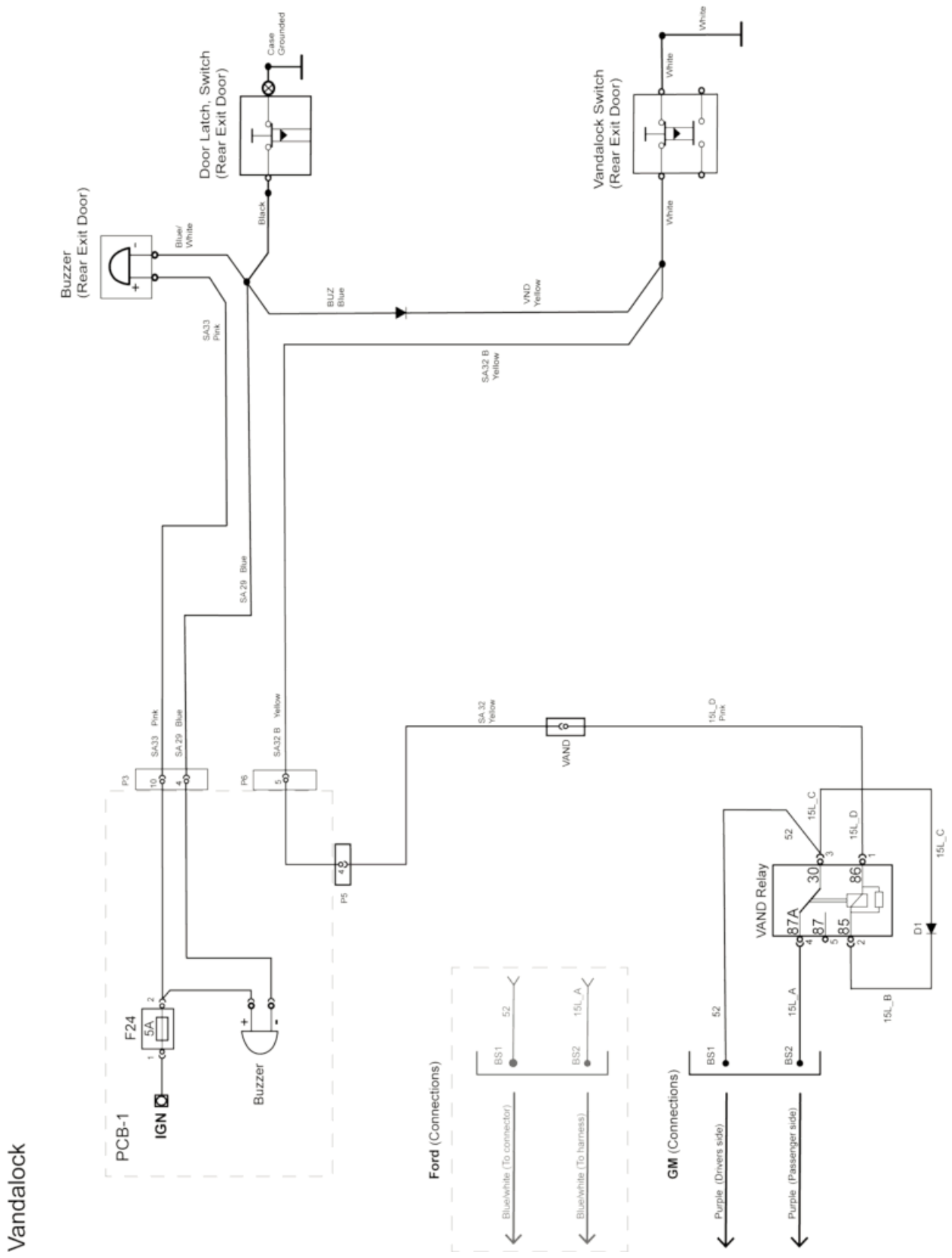


Vandalock Switch

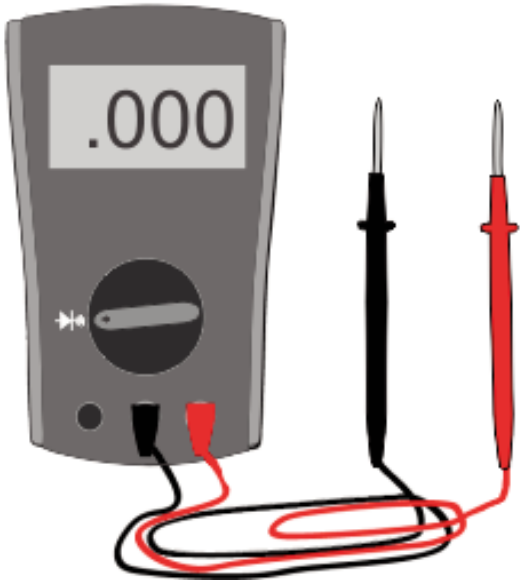
Vandalock Switch

1. Adjust switch with barrel bolt in the unlocked position.
2. Adjust the switch plunger to within 1/4” (.25 in) from bottoming out.

Electrical Schematic - Vandalock



Special Tools



Digital Multimeter (DMM)

Symptoms

- **Engine will not start, page 2.9**
- **Engine starts but the Vandalock will not set, page 2.12**
- **Buzzer(s) Inoperative, page 2.13**

The Vandalock feature can be checked at several locations depending on vehicle type. The standalone relay harness interrupts the engine starting condition by receiving a ground input from the emergency exit door switch (Vandalock).

Ford – This model can be checked by removing the closing panel underneath and beside the steering column. The relay harness marked Vandalock should be present and can be accessed directly.

GM – This model can be checked in two separate locations:

1. Open the hood and check the Vandalock specific wiring labeled **BS1** and **BS2** located within the harness crossing from left to right of the vehicle's bulkhead.
2. The Vandalock relay harness that is located underneath the dash and driver's side floor mat.

The relay when grounded via the Vandalock switch will disconnect the vehicle start circuit. A front and rear buzzer will sound to alert the driver that Vandalock is active during key switch activation.

- The relay disconnects the circuit when activated.
- The relay connects the circuit when deactivated (at rest).

Note: Keep this reverse usage of the relay in mind when troubleshooting this feature.

If any measured values are questionable or seem unreasonable check each connection to and from the relay to determine where the fault may be located.

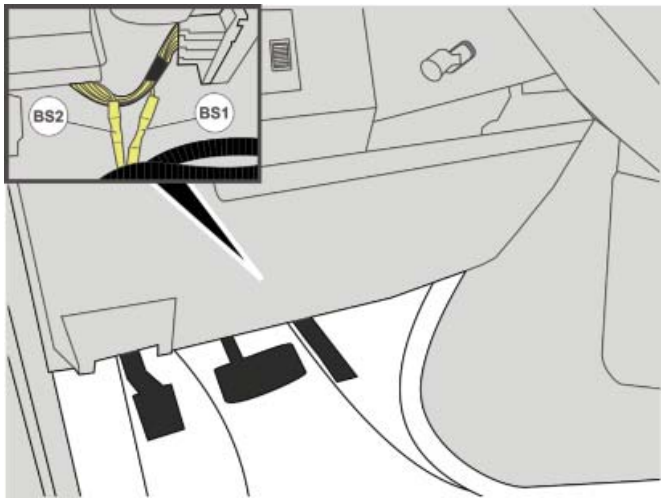
Engine will not start

Vandalock Relay

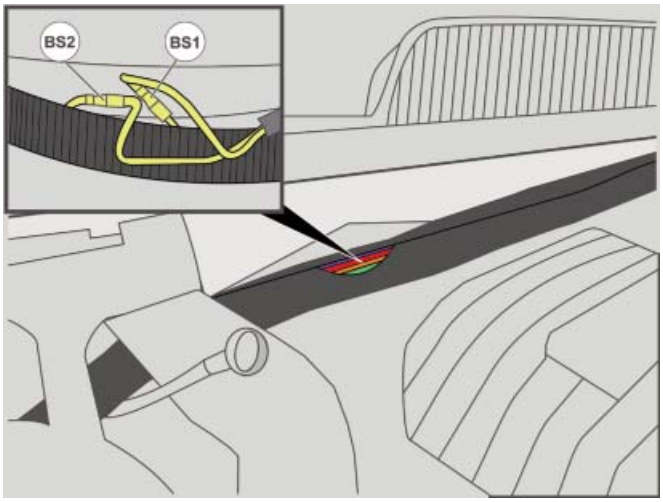
The Vandalock relay circuitry is tied into the vehicle starter circuit via splices BS1 and BS2.

When the relay is **inactive (barrel latch – unlocked position)**, the current flows directly through the relay and the starter cranks the engine as normal.

When the relay is **active (barrel latch – locked position)**, the Vandalock relay is grounded and opens the starter circuit connection and the bus starter will not function.



Splice Connections (Ford)



Splice Connections (GM)

BS1 and BS2 Butt Splices

Measuring Voltage (Volts) at BS1 and BS2 butt splices:

Conditions:

- Key switch **"ON"** and turned to **"Start"** position at the moment of testing
- Park Brake **set**
- Gear selector in **park**
- Barrel latch – **unlocked** position

Note: The barrel latch on the emergency exit door should be in the unlocked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
BS1 (pink)	12v Supply Splice (Starter supply from vehicle crank circuit)	BS1 to a known ground	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check vehicle start circuit. Contact the local certified chassis dealer.
BS2 (pink)	Vandalock Relay Output (to starter)	BS2 to a known ground	Approx. = 12 v	**OK** = Vehicle starter should engage. If voltage **OK** and starter will not engage, contact the local certified chassis dealer. **NOK** = See Vandalock Relay check below.

Vandalock Relay

1. **Measuring Voltage (Volts) at Vandalock Relay**

   Conditions:
   - Key switch **"ON"** and turned to **"Start"** position at the moment of testing
   - Park Brake **set**
   - Gear selector in **park**
   - Barrel latch – **unlocked** position

Note: The barrel latch on the emergency exit door should be in the unlocked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
52, pin 3, (30)	Relay Input Supply (Starter 12v supply from vehicle via BS1)	52, pin 3, (30) to a known ground	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check for open circuit in wiring coming from BS1 splice and repair.
15L_A, pin 4, (87A)	Relay Output Supply	15L_A, pin 4, (87A) to a known ground	Approx. = 12 v	**OK** = Relay is good. Check for open circuit on 15L_A (pin 4) wiring going from relay to BS2 splice and repair. NOK = Check for active ground on circuit 15L_D (pin 1). If open circuit, Replace Relay. Proceed to next step.

2. Measuring Resistance (Ohms Ω) at Vandalock Relay

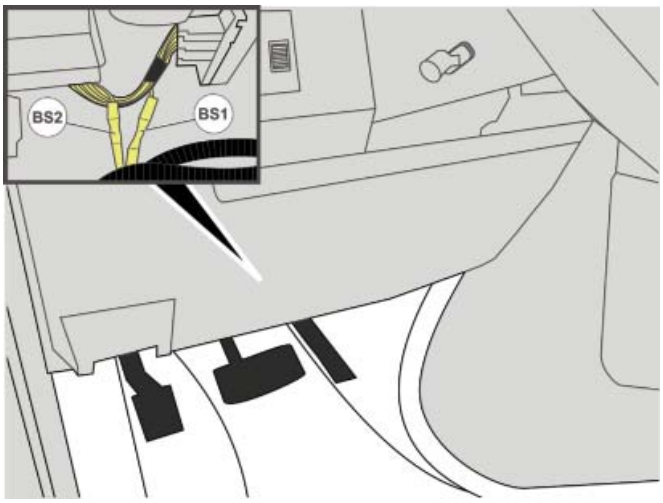
Conditions:

- Key switch **"OFF"**
- Park Brake **set**
- Gear selector in **park**
- Barrel latch – **unlocked** position

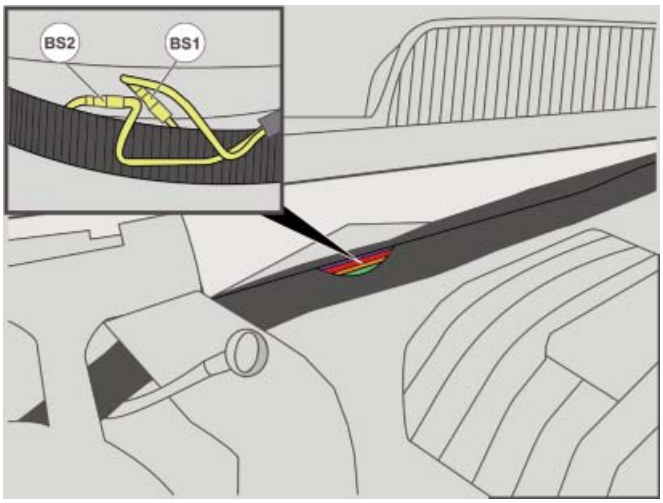
Note: The barrel latch on the emergency exit door should be in the unlocked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
15L-D, pin 1, (86)	Coil B -	15L-D, pin 1, (86) to a known ground	Approx. = Open circuit	**OK** = Vehicle starter should function. If it does not function, replace relay. **NOK** = If circuit 15L_D is grounded or closed circuit (approx. 10 Ω) See Vandalock switch check.

Engine starts, but Vandalock will not set



Splice Connections (Ford)



Splice Connections (GM)

BS2 Butt Splice

1. **Measuring Voltage (Volts) at BS2 butt splice:**

   Conditions:
   - Key switch **"ON"** and turned to **"Start"** position at the moment of testing
   - Park Brake **set**
   - Gear selector in **par**k
   - Barrel latch – **locked** position

Note: The barrel latch on the emergency exit door should be in the locked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
BS2 (pink)	Vandalock Relay Output (to starter)	BS2 to a known ground	Approx. = 0 v	**OK** = Engine should not start. Relay is good. Engine should not start. Relay is good. **NOK** = Engine should not start. Relay is good.

Vandalock Relay

1. **Measuring Voltage (Volts) at Vandalock Relay:**

   Conditions:
   - Key switch **"ON"** and turned to **"Start"** position at the moment of testing
   - Park Brake **set**
   - Gear selector in **park**

Circuit	Function	Measuring Points	Expected Results	Corrective Action
15L_B pin 2 (85)	Coil B+	15L_B to a known ground	Approx. = 12 v	**OK** = Proceed to step two below. **NOK** = Check voltage on circuit 52.
52 / 15L_C pin 3 (30)	Relay Input Supply (Starter 12v supply from vehicle via BS1 splice)	52 / 15L_C pin 3 (30) to a known ground	Approx. = 12 v	**OK =** Proceed to next step. **NOK** = Repair circuit coming from BS1 splice**.**

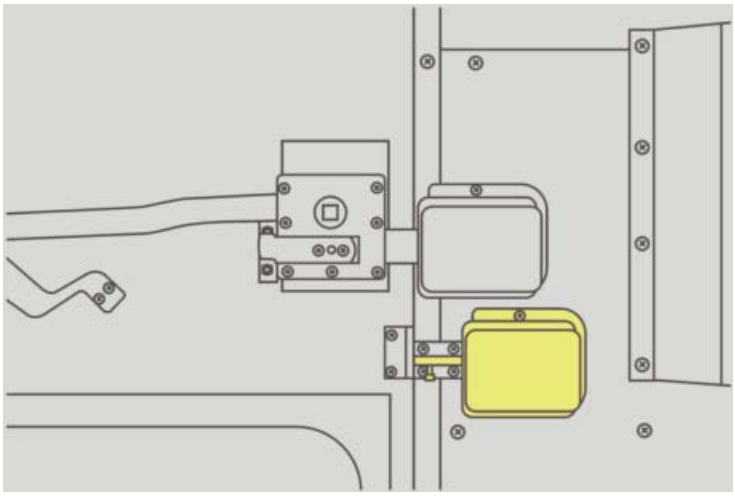
2. **Measuring Resistance (Ohms Ω) at Vandalock Relay:**

   Conditions:
   - Key switch **"OFF"**
   - Park Brake **set**
   - Gear selector in **park**
   - Barrel latch – **locked** position

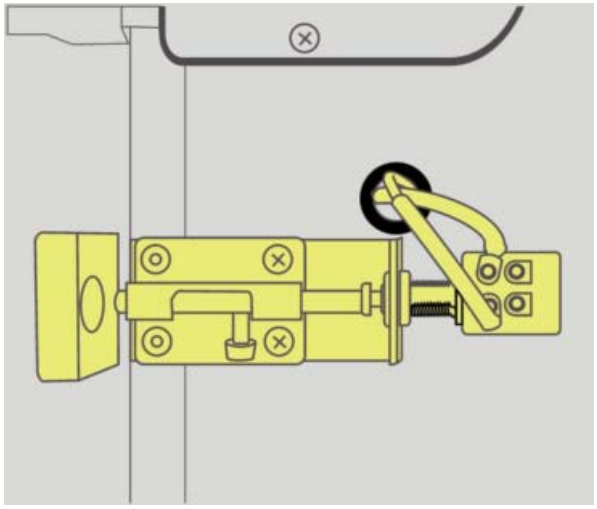
Note: The barrel latch on the emergency exit door should be in the locked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
15L-D, pin 1 (86)	Coil B -	15L-D, pin 1, (86) to a known ground	Approx. = 10 Ω or less	**OK** = Ground circuit is good coming from Vandalock switch. Relay is defective. Replace relay. **NOK** = Open circuit. Check for ground at each of the following connections: • VAND connector to ground • PCB1_J5 pin 4 to ground * • PCB1_P6 pin 5 to ground * If the above connections are found to be open circuit at any junction, repair each section as required. See Vandalock Switch checks.

Note: The connections going to P5 and P6 on PCB1 are a throughput connection only. See schematic for more information.



Vandalock Switch Location



Vandalock Switch, Uncovered

Vandalock Switch

1. **Measuring Resistance (Ohms Ω) at Vandalock Switch:**

   Conditions:
   - **Key switch "OFF"**
   - Park Brake **set**
   - Gear selector in **park**
   - Barrel latch – **unlocked** position
   - Door latch – **latched** position

Note: The barrel latch on the emergency exit door should be in the unlocked position.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Vandalock switch contacts (white)	Switch for Vandalock relay activation	Across switch terminals (White) to (White)	Approx. = Open circuit	**OK** = Proceed to next step. **NOK** = Approx. 10 Ω or less. Switch is short circuit. Check and/or replace switch.
Alternate Check: SA 32 B (Yellow)	Ground return for Vandalock relay activation	SA 32 B (Yellow) to a known ground	Approx. = Open circuit	**OK** = Proceed to next step. **NOK** = Approx. 10 Ω or less. Check SA 32 B separately from butt splice and repair if required.

Note: While checking the Vandalock switch, it may become necessary to temporarily remove the butt splice connection to get a better reading for both the switch and SA 32 B circuit.

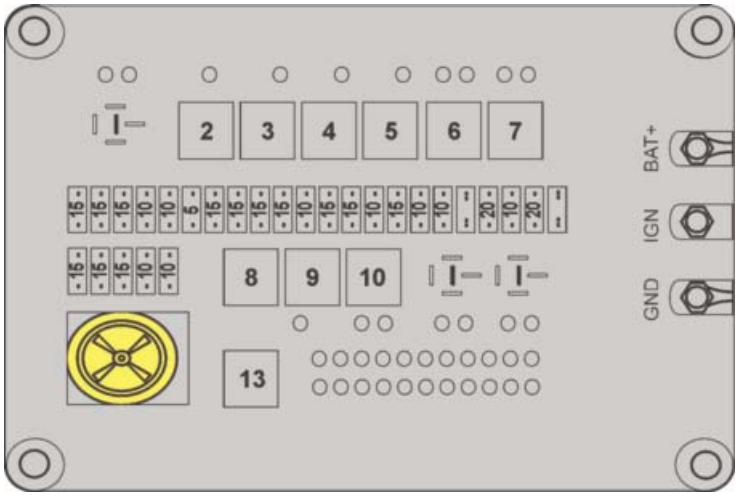
2. Measuring Resistance (Ohms Ω) at Vandalock Switch:

Conditions:

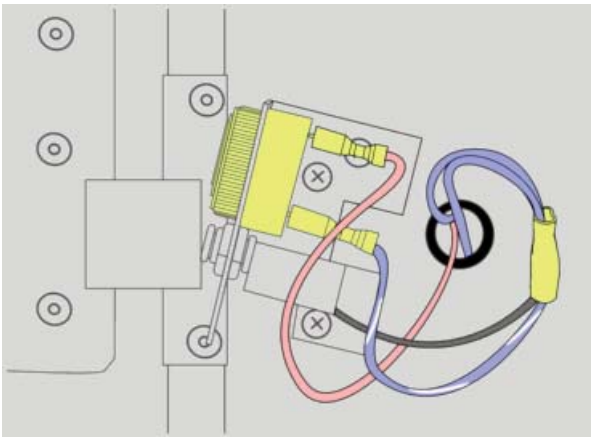
- Key switch **"OFF"**
- Park Brake **set**
- Gear selector in **park**
- Barrel latch – **locked** position
- Door latch – **latched** position

Note: The barrel latch on the emergency exit door should be in the locked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
Vandalock switch contacts (white)	Switch for Vandalock relay activation	Across switch terminals (White) to (White)	Approx. = 10 Ω or less	**OK** = Proceed to next step. **NOK** = Open circuit exists for either switch or ground. Check the ground circuit from switch to body ground.
Vandalock switch contact (white - ground)	Switch for Vandalock relay activation	White (ground) wire on switch terminal to a known ground	Approx. = 10 Ω or less	**OK** = Vandalock switch is good. **NOK** = Open circuit. Repair ground wire from body ground to switch.



Front Buzzer



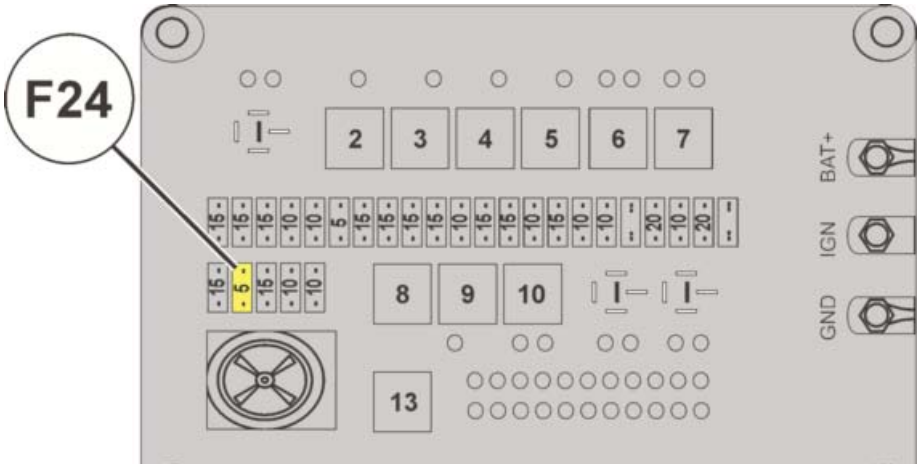
Rear Buzzer

Buzzer(s) Inoperative

The buzzers (front and rear) function when either the rear emergency exit door is opened (unlatched) or when the barrel latch is locked (Vandalock is **set**) and key switch is in the **"ON"** position.

The front buzzer is located on PCB1 at the lower left corner of the upper electrical center of the bus body. The rear buzzer is located on the emergency exit door at rear of the bus just above the door latch switch.

Note: The buzzers are polarity sensitive and should be installed correctly or they will not sound.



Fuse F24 located on PCB1

Ignition Voltage (buzzer supply)

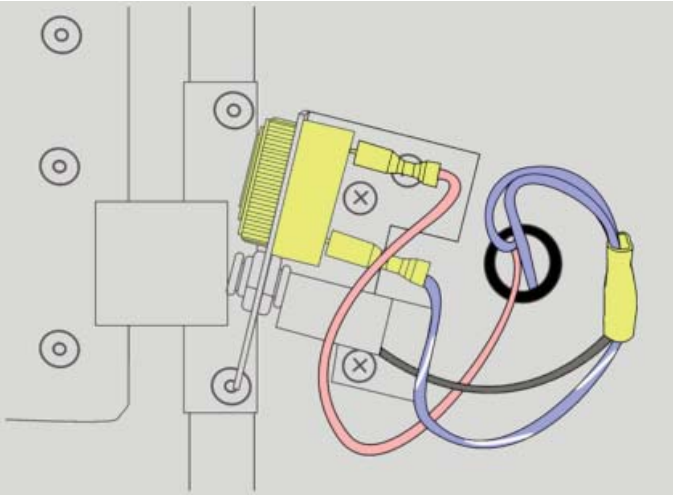
Measuring Voltage (Volts) at fuse F24 on PCB1:

Conditions:

- Key switch **"ON"**
- Park Brake **set**
- Gear selector in **park**
- Barrel latch – **locked** position
- Door latch – **unlatched** position

Note: The door latch on the rear emergency exit door should be in the unlocked position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
Fuse F24	Supply Voltage to both Buzzers	Across fuse F24 contacts to ground stud (GND) of PCB1	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Open fuse. Check Fuse F24 condition and size 5A (replace if required).
SA 29 (blue) (PCB1_P3 pin 4)	Buzzer ground from rear door latch switch	SA 29 to IGN stud on PCB1	Approx. = 12v	**OK** = Ground circuit to rear door latch should be good. **NOK** = Check for oopen ground circuit back to rear emergency door switches If circuit OK, check and/or replace switch as required



Rear Buzzer

Buzzer, Rear

1. **Measuring Voltage (Volts) at buzzer, rear door:**

   Conditions:
   - Key switch **"ON"**
   - Park Brake **set**
   - Gear selector in **park**

Note: The buzzers are polarity sensitive and should be installed correctly or they will not sound.

`CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
SA 33 (pink)	Supply Voltage to rear buzzer	SA 33 circuit at buzzer to a known ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = 0 volts. Check circuit SA 33 from PCB1_P3 pin 10 to rear buzzer and repair as required.

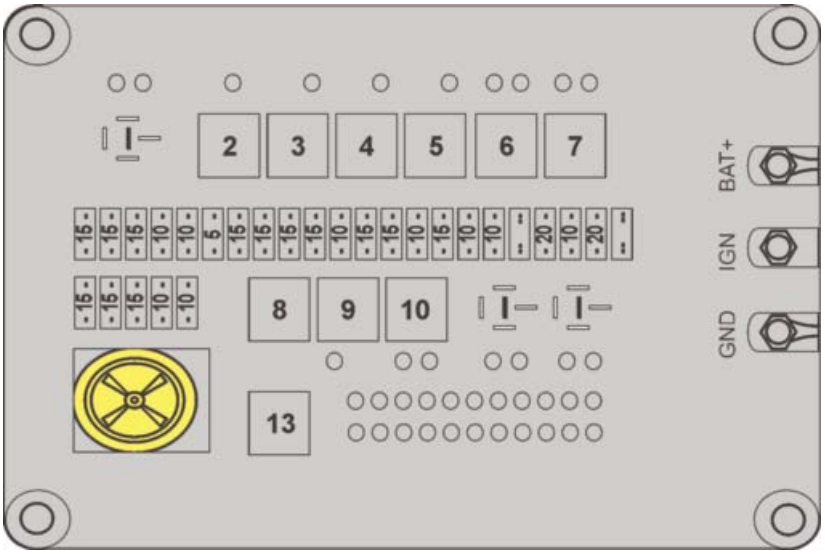
2. **Measuring Resistance (Ohms Ω) at buzzer, rear door:**

   Conditions:
   - Key switch **"OFF"**
   - Park Brake **set**
   - Gear selector in **park**
   - Door latch – **unlatched** position

Note: The door latch on the emergency exit door should be in the unlatched or open position.

Note: The buzzers are polarity sensitive and should be installed correctly or they will not sound.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Blue/white (butt spliced to black)	Ground return to rear buzzer	Blue/white circuit to a known ground	Approx. 10 Ω or less	**OK** = Buzzer should sound. If buzzer does not sound, replace buzzer **NOK** = Open circuit or defective latch switch. Repair ground as required. Also, see Door Latch switch checks.



Front Buzzer

Buzzer, Front

1. **Measuring Voltage (Volts) at buzzer, (PCB1, upper electrical center):**

   Conditions:
   - Key switch **"ON"**
   - Park Brake **set**
   - Gear selector in **park**

Note: The buzzers are polarity sensitive and should be installed correctly or they will not sound.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
Buzzer B+	Supply Voltage to front buzzer	Buzzer B+ (upper pin) to ground stud	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Open fuse. Re-check fuse F24 condition and size 5A (replace if required). If fuse is good and no voltage exists on upper pin for buzzer, contact the local Thomas dealer for more information.

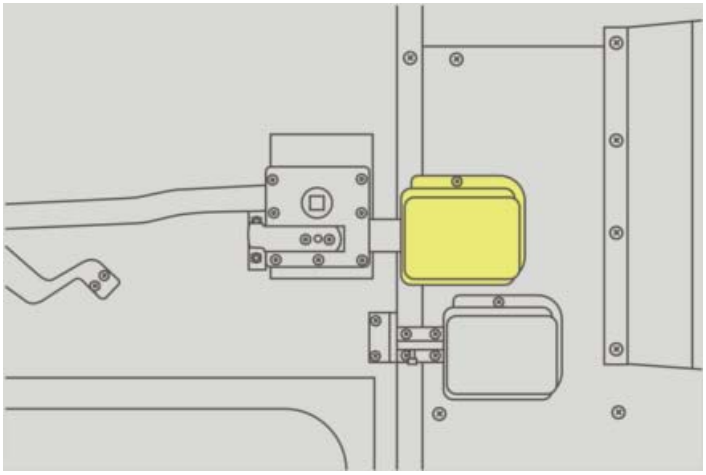
2. **Measuring Resistance (Ohms Ω) at front buzzer, (PCB1, upper electrical center):**

   Conditions:
   - Key switch **"OFF"**
   - Park Brake **set**
   - Gear selector in **park**
   - Door latch – **unlatched** position

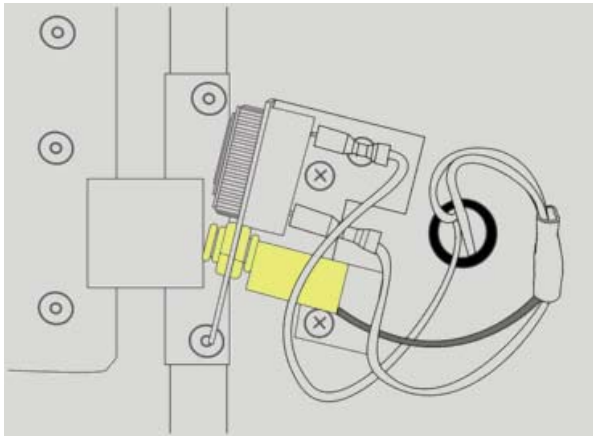
Note: The door latch on the emergency exit door should be in the unlatched or open position.

Note: The buzzers are polarity sensitive and should be installed correctly or they will not sound.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
SA 29 (blue) (PCB1_P3 pin 4)	Buzzer ground (from emergency exit door latch switch)	SA 29 to ground stud	Approx. 10 Ω or less	**OK** = Proceed to next step. **NOK** = Open circuit. Repair ground as required. Also, see Door Latch switch checks.
Buzzer B -	Buzzer internal grounding through PCB1	Buzzer B - (lower pin) to PCB1_P3 pin 4	Approx. 10 Ω or less	**OK** = Buzzer should sound. If buzzer does not sound, replace buzzer. **NOK** = Contact the local Thomas dealer for more information.



Door Latch Switch, Location



Door Latch Switch Uncovered

Door Latch Switch

1. **Measuring Resistance (Ohms Ω) at Door Latch Switch**

   Conditions:
   - Key switch **"OFF"**
   - Park Brake **set**
   - Gear selector in **park**
   - Barrel latch – **unlocked** position
   - Door latch – **unlatched** position

Note: The door latch on the emergency exit door should be in the unlatched or open position.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
Door Latch switch (Black wire)	Buzzer activation (front and rear)	Black wire at butt splice to a known ground	Approx. = 10 Ω or less	**OK** = Proceed to next step. **NOK** = Open circuit. (latch switch defective or ground connection is open). Check and repair ground connection. If the ground connection from switch to body ground is **OK**, replace switch.

2. Measuring Resistance (Ohms Ω) at Door Latch Switch

Conditions:

- Key switch **"OFF"**
- Park Brake **set**
- Gear selector in **park**
- Barrel latch – **unlocked** position
- Door latch – **latched** position

Note: The door latch on the emergency exit door should be in the latched position.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Door latch switch (Black wire)	Buzzer activation (front and rear)	Black wire at butt splice to a known ground	Approx. = Open circuit	**OK** = Latch switch is functioning properly. **NOK** = Approx. 10 Ω or less. Switch is short circuit. Check and/or replace switch.

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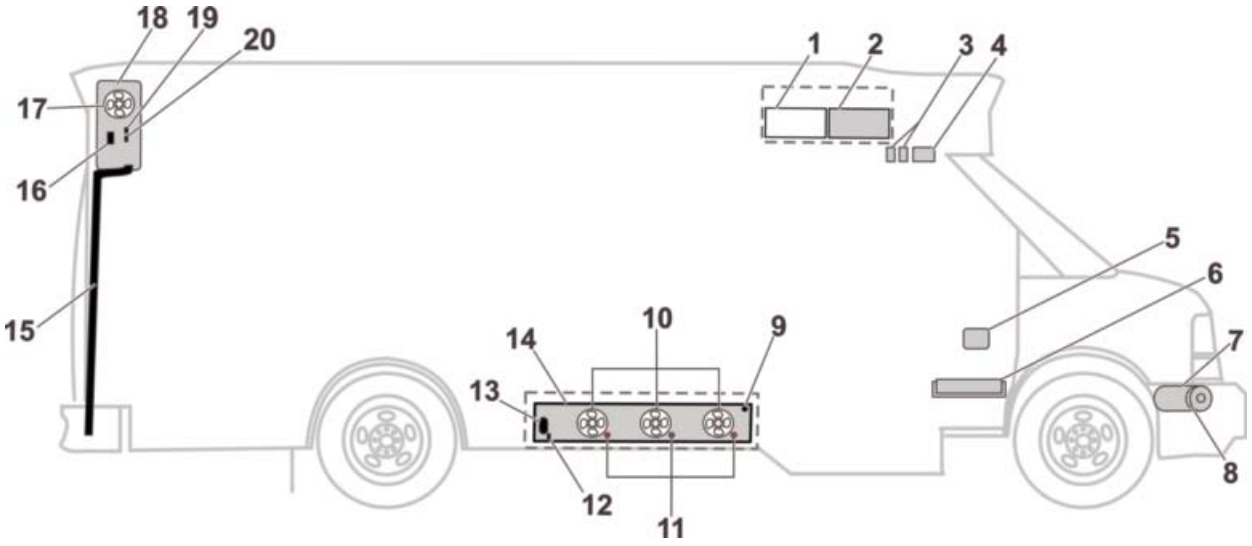


Air Conditioning Diagram

1 – PCB1
2 – PCB2
3 – Manual Control (AC ON/OFF, AC Fan Speed)
4 – Thermostatic Control (optional)
5 – AC Circuit Breaker (70A)
6 – AC Relay Control Panel
7 – AC Compressor
8 – AC Clutch
9 – Harness Connections
10 – Fans
11 – Fan Fuses (20A)
12 – High Pressure Switch
13 – Receiver/Drier
14 – Condenser (Located on Driver's Side
15 – Condensate Drain (2x)
16 – Expansion Valve
17 – Blower Fans
18 – Evaporator
19 – Thermostat (Freeze-Up Switch
20 – Low Pressure Switch

General

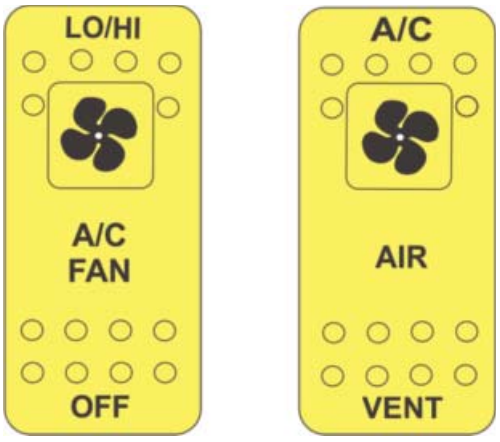
The troubleshooting within this document will cover primarily the electrical side of the AC (air conditioning) system. However, some mechanical and pressure issues will be mentioned to allow for checks that are independent of the electrical system even though they will not be covered. Since the system we are concerned with is a standalone unit as having AC only, the heating portion of the combination HVAC system attributing to poor AC cooling system failures is not covered within this document.

Note: It is recommended that all independent heating units be turned off during air conditioning testing. It should be verified that no heat is radiating through the heater core of either the body or chassis heaters.

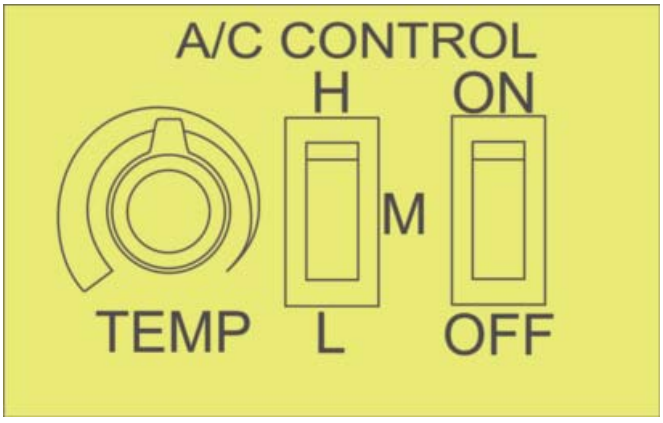
Due to the complex arrangement and location of the components in an AC system, a problem could be caused by any of the parts listed here or by other unknown causes. See below a list of AC components to check and/or observe while determining and locating the fault:

- AC compressor belt is tensioned properly and in good working order
- AC compressor and clutch is operational
- AC system is properly charged and not overcharged
- AC system is apparently leak free
- AC hoses are properly routed and secured
- Electrical harnesses are properly routed and secured
- Switches and controls are functional
- Evaporator fans are operational
- Condenser fans are operational

The main power for the AC system is supplied directly from the batteries to a 70 amp resettable circuit breaker. It is located on the lower portion of the outside wall beside the entrance door and is labeled as AC along with two other circuit breakers: 1) main body and 2) lift. The 70A AC circuit breaker supplies power to a copper buss bar which attaches to a group of five automatic 4 resettable circuit breakers varying in amperage ranging from 10 to 50 amps.



AC Switches, Manual Control



Thermostatic Control Unit

Temperature control

In general, a properly maintained and operating AC system will normally lower the air temperature 25˚F to 30˚F (14˚C to 17˚C) below the outside ambient temperature. Regions of the country having different climate extremes can cause the cooling effect to feel as if the AC is not working properly even though the system is performing correctly. Gradual or slight fluctuations in a properly operating AC system is normal. However, extreme fluctuations or poor system control could be due to a defective switch, sensor, temperature control unit, or unusual compressor cycling due to electrical switching conditions caused by either low or too high refrigerant capacity.

The Minotour bus is available with two possible variants for AC control: 1) Switch Control (two switches) and 2) Thermostatic Control (unit).

- The Switch Control version utilizes individual switches that manually control the system as necessary to keep cooling until they are turned off.

- The Thermostatic Control version will try to maintain the inside temperature of the bus to the specified temperature setting on the control dial.

If the sensor within the unit measures an ambient temperature warmer than the set position on the dial, the AC on run time interval will be longer. If the sensor measures an ambient temperature colder than the dial setting, the AC on run time will be a shorter interval. The AC compressor ON/OFF clutch circuit is then interrupted by the control unit and allows the air inside the bus to warm slightly before returning to the cooling cycle. The thermostatic control will continue to maintain the inside temperature of the bus to the desired dial setting until switched off or a desired comfort level has been achieved.

Note: Passenger comfort ultimately depends on climate conditions, humidity, and temperature.

Design and Function

Air conditioning systems by design perform better in humid, warm, or hot climates. They do not perform well in cooler or moderate climates due to the necessary exchange of heat transferred between the system and the outside ambient air. The heat transfer is greater and therefore more efficient in hotter climates and is less efficient in cooler more moderate ones.

An AC system consists mainly of the following components: compressor, condenser, evaporator, switches, expansion valve, filter/drier, fans, hoses, and refrigerant. AC systems are made up of three basic systems: 1) mechanical, 2) electrical, and 3) refrigerant (a compressible and condensable gas).

The Mobile Climate Control (MCC) is a wall (bulkhead) mounted, free blowing system with a maximum output total of 53,000 BTU/hr., which includes the vehicles output of approximately 15,000 BTU/hr.

Refrigerant – Refrigerant is considered a working fluid or a substance that transitions easily from a liquid to a gaseous state and back again. During the transition cycle, heat rejection is the primary function. This rejection of heat can occur within the refrigerant component (evaporator) or outside of the refrigerant component (condenser). The ability of a refrigerant to reject heat is utilized for maximum cooling effect and the dehumidifying of the air for human comfort.

Refrigerant Oil – Refrigeration oil is necessary for proper compressor lubrication and to prevent compressor seizure. Since there are several different oil types and weights used, consult the OEM service information for correct usage.

Compressor – The compressor is located on the engine and is belt driven. The compressor can be shared by the chassis and bus or up-fitted as a standalone component used entirely by the bus body. Some buses may have either one or two compressors depending on order options. The primary function of the compressor is to compress the low-pressure refrigerant gas into a high-pressure refrigerant gas which in turn flows to the condenser for the first cycle of heat rejection.

Condenser – The condenser is a side-mounted unit located along the skirting on the exterior of the bus. The primary function of the condenser is to lose or reject some of the heat gained from the refrigerant being compressed into a high-pressure gas. This is accomplished by outside air passing over the condenser fins which cools the hot gas and condenses to a lower pressure gas.

Filter/Drier – It is located after and near the condenser. The canister receives refrigerant after being compressed and passing through the condenser. The drier filters moisture and some component debris/matter that occurs within the system.

Expansion Valve – The expansion valve is located before and close to the evaporator coils. Its primary function is to further reduce the low-pressure refrigerant (gas) into a low-pressure refrigerant (liquid). This liquid refrigerant is then metered and passed to the evaporator coils.

Evaporator – The evaporator unit is located on the inside of the bus. The primary function of the evaporator is to allow a second heat exchange from the refrigerant – now in a liquid state – pass through the coils and be transmitted in the form of cooled air to the interior of the bus. The evaporator performs this function through fans that pull warm air through the cooling coil fins. The warm air passing over the fins causes the liquid refrigerant to vaporize and turn back into a low-pressure gas and return to the compressor. As warm air is circulated though the evaporator and becomes cooled, the cycle continues until the temperature has reached a level determined comfortable by the manufacturer.

The evaporator has a built-in tray that catches any moisture build up from the heat transfer process. Two drain tubes are attached to the lower portion of the evaporator and route any excess moisture buildup away and down each rear corner of the bus body to the outside.

Pressure Switches – There are two pressure (High and Low) switches used to control the compressor's magnetic clutch operation. Each switch is acted upon by the refrigerant pressure to cut out the clutch operation. The high-pressure switch is located near the condenser and prevents overpressurization of the system which could lead to compressor failure or bursting of a line leading to refrigerant loss. The low-pressure switch is located near the evaporator and prevents clutch activation in the event of either too low or no refrigerant in the system. Either switch can interrupt the compressor operation by deactivating the magnetic clutch.

Thermostat Switch – The thermostat switch is located near the evaporator coil and has a capillary bulb which senses evaporator temperature. This switch can interrupt the compressor operation to prevent the evaporator from freezing up and causing the AC system to stop functioning. The switch has built-in temperature limits or set points to allow proper cut in/out of the compressor clutch. A freeze up condition or loss of cooling effect is only temporary and will return to normal operation after the evaporator has warmed to an acceptable temperature range.

Controls, Manual Switch (ON/OFF/Fan Speed) – A three position (Hi/OFF/Lo) switch is located above the driver in the overhead console. Its primary purpose is to control the rear evaporator fan speeds to move and return the cooled air for passenger comfort. A two position switch turns on the AC compressor. This begins the cycle of refrigerant flow and cooling effect which reduces the ambient air temperature. This switch controls either cooled air (AC) when switched on or temperate air (vent) when switched off.

Controls, Thermostatic – A unit comprised of several sub-components consisting of several switches and a thermistor. The unit controls the AC ON/OFF compressor cycle, evaporator fan speeds, and allows more/less cooling due to the use of a variable temperature resistor called a thermistor. The thermistor interrupts power to the compressor when the temperature has reached the desired setting on the control panel.

Specifications

Mobile Climate Control (MCC):

- **Model** – AC-5W13 T (Bulkhead mounted AC system – with OEM tie in)
- **BTU/HR** – Maximum 53k, which includes OEM capacity of 15k
- **Compressor** – Shared with OEM vehicle system
- **Evaporator models:**

  IW- 1 – Free Blow Unit, Rear wall mounted, 1400 CFM, 24 amps @ 12.5v, weight 50lbs, approx. – 50,000 BTU cooling

  IW-2 - Free Blow Unit, Front wall mounted, 800 CFM, 21 amps @ 12.5v, weight lbs, approx. – 40,000 BTU cooling
- **Condenser models:**

  CM-2 – Skirt mounted, 1600 CFM, 14 amps @ 12.5v, 66 lbs., 57,000 BTU Heat Rejection

  CM-3 - Skirt mounted, 2400 CFM, 21 amps @ 12.5v, 76 lbs., 76,000 BTU Heat Rejection
- **Amperage** – Maximum 52 Amps

Requirements (vehicle):

- OEM vehicle AC system
- Tinted glass and windshield
- Alternator – 145 Amp
- Plywood flooring
- Specify chassis option(s) - 200, 300, 400 along with AC-5W13 T AC system

Restrictions (vehicle):

- **Variant/body models** – DRW and either 041M or 051M
- **Wheel chair restraint** – located beside rear mounted Wheel Chair Lift

Refrigerant Type:

- R134a

Refrigerant and Oil Capacities:

Split AC System

Minotour (Wheel Type)	Condenser Type	Evaporator Type (With In-Dash Tie In)	R-134a Charge (Lbs.)	Oil Charge (Oz.)
DRW	CM-3	IW-1	4	**8**
SWR	CM-4	IW-3	5	**10**

Abbreviations:

DRW - Dual rear wheels
SRW - Single rear wheels
CM - Condenser module
IW - In wall unit

Note: Evaporator tie-in: When an additional evaporator or in-dash evaporator is added to a standard system, the refrigerant charge will increase by 1 lb. For CM-2 tie-in, consult factory for application review.

Note: The above chart is based on 20 ft. of liquid line. Increase charge by 0.5 lb. for each additional 10 feet of line

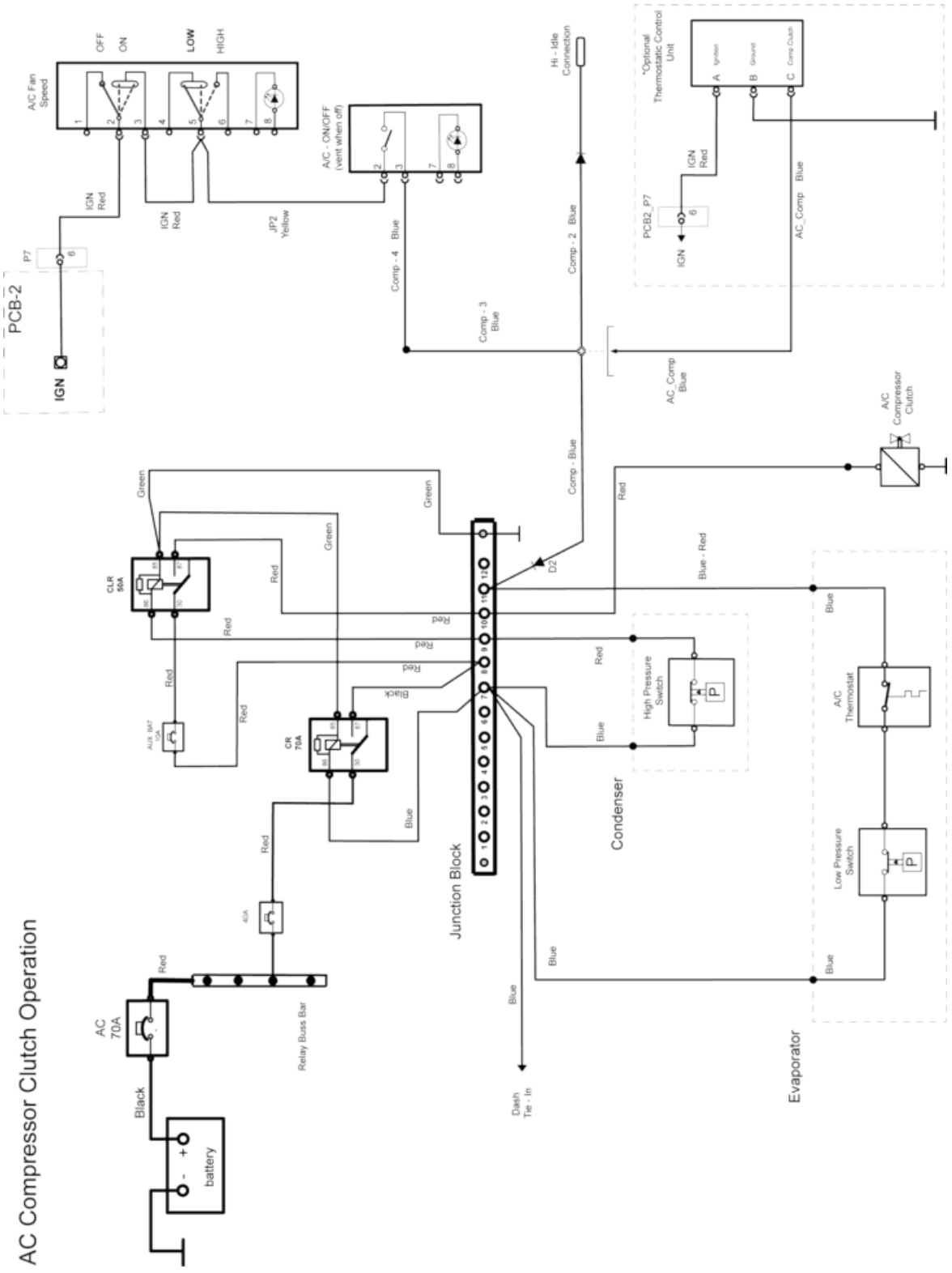
Refrigerant Oil Type (Factory recommended) – SELTEC 100 PAG OIL

Note: Pag (polyalkylene glycol) oil (ISO) 100, is a medium weight synthetic air conditioning compressor oil that is fully compatible with R134A.

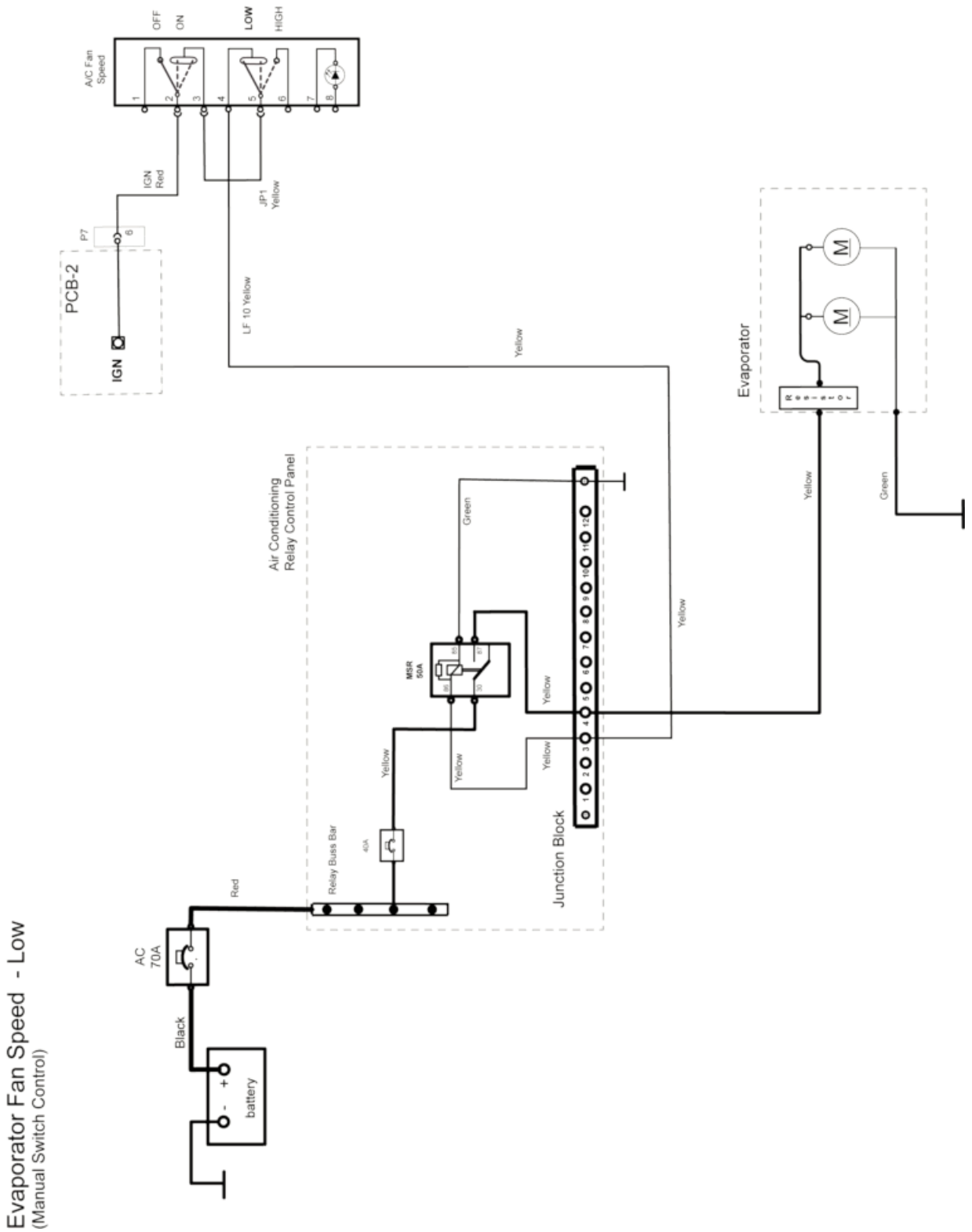
! CAUTION

Use only the exact oil specified by compressor manufacturer. Use of a different oil other than specified will void compressor warranty.

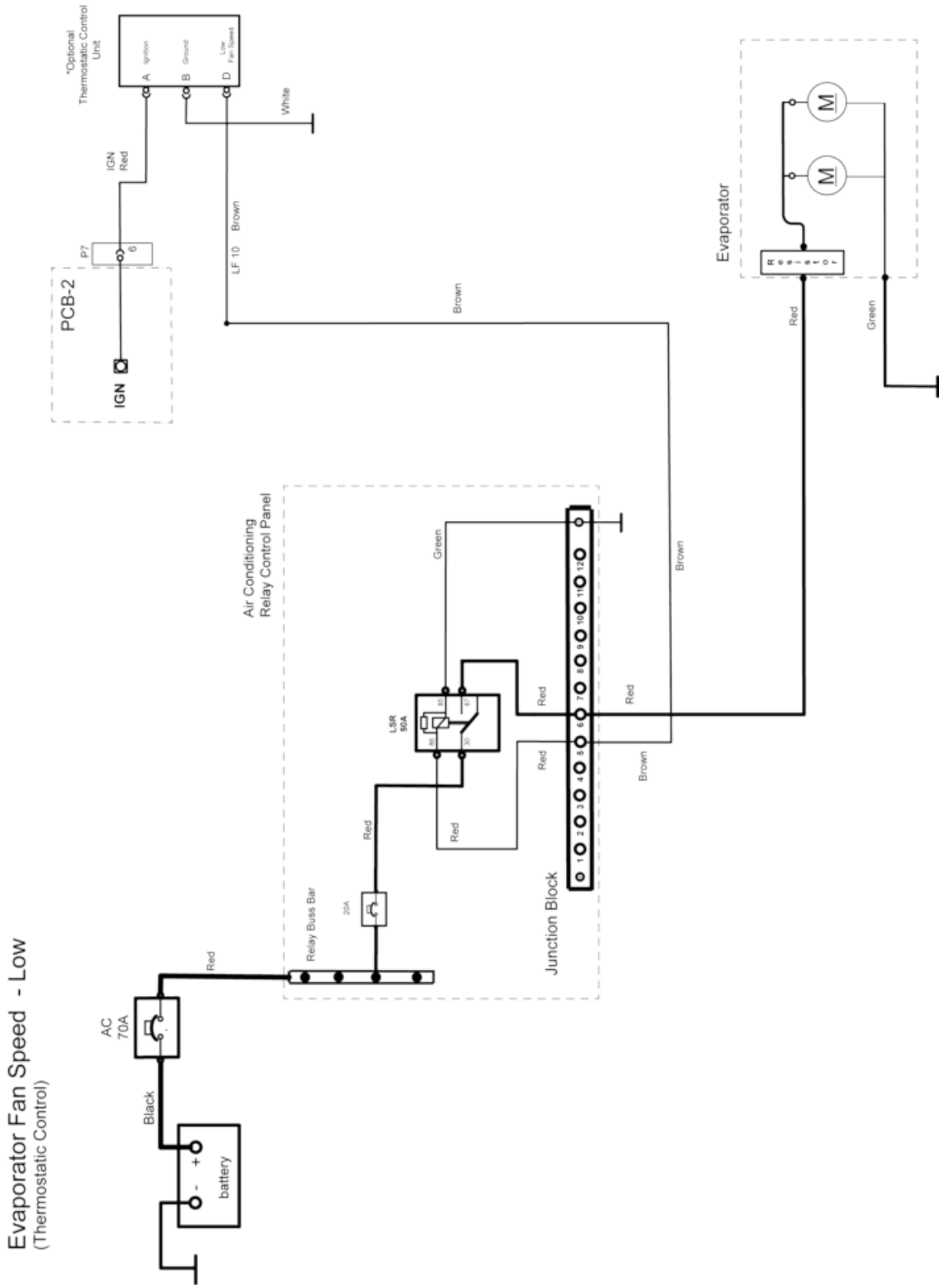
Electrical Schematics - AC Compressor Clutch Operation



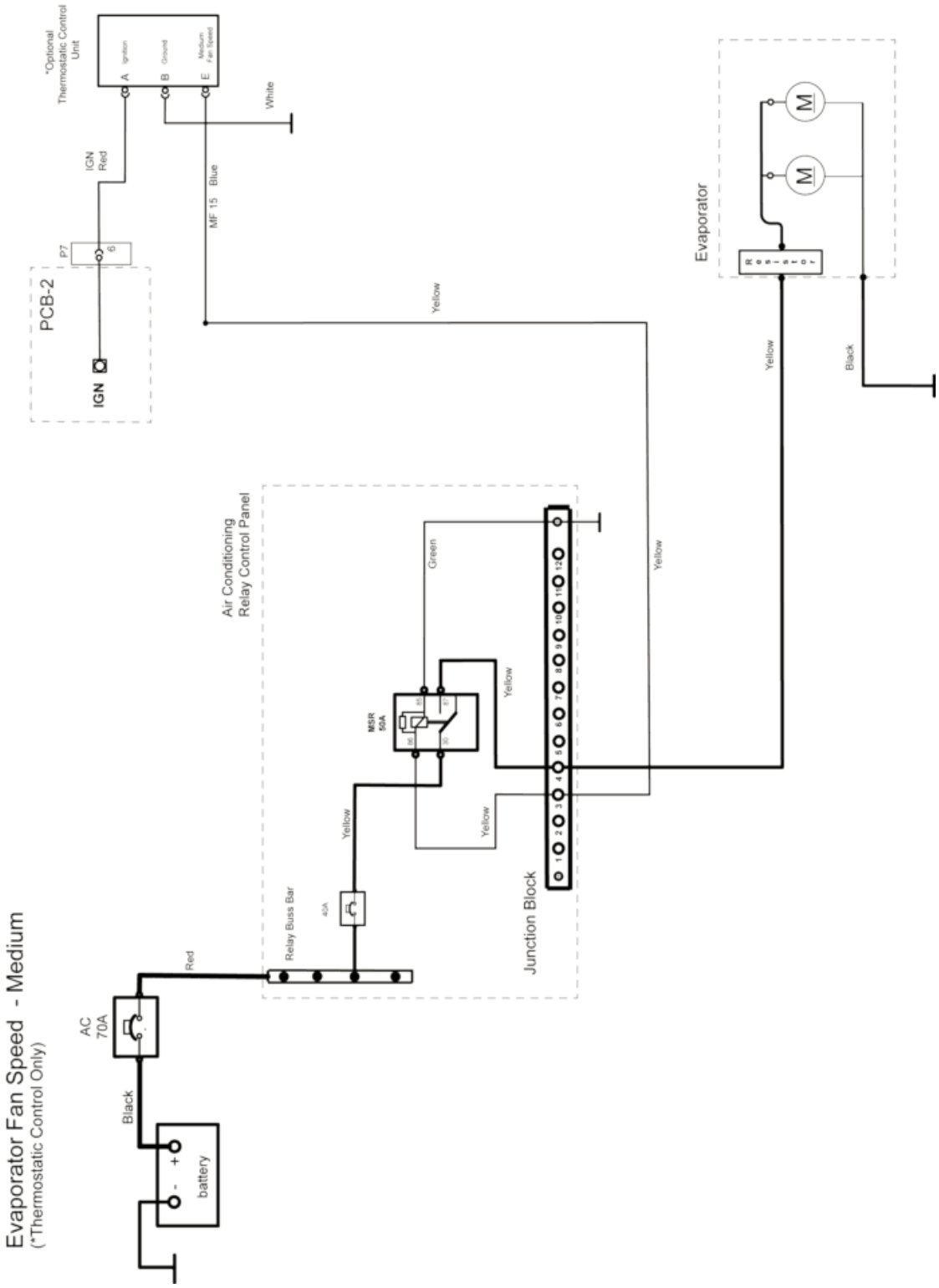
Electrical Schematics - Evaporator Fan Speed, Low (Manual Switch Control)



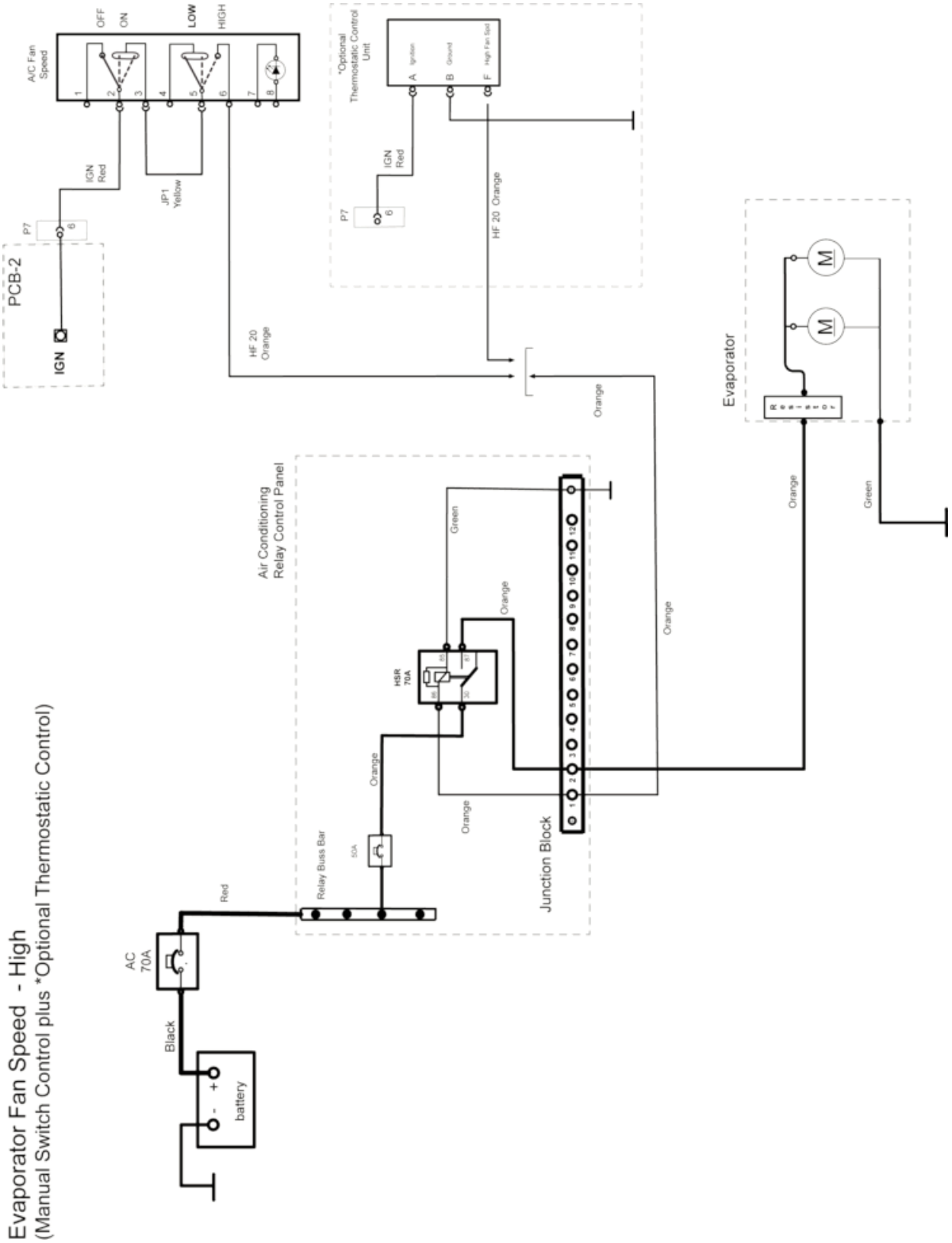
Electrical Schematics - Evaporator Fan Speed, Low (Thermostatic Control)



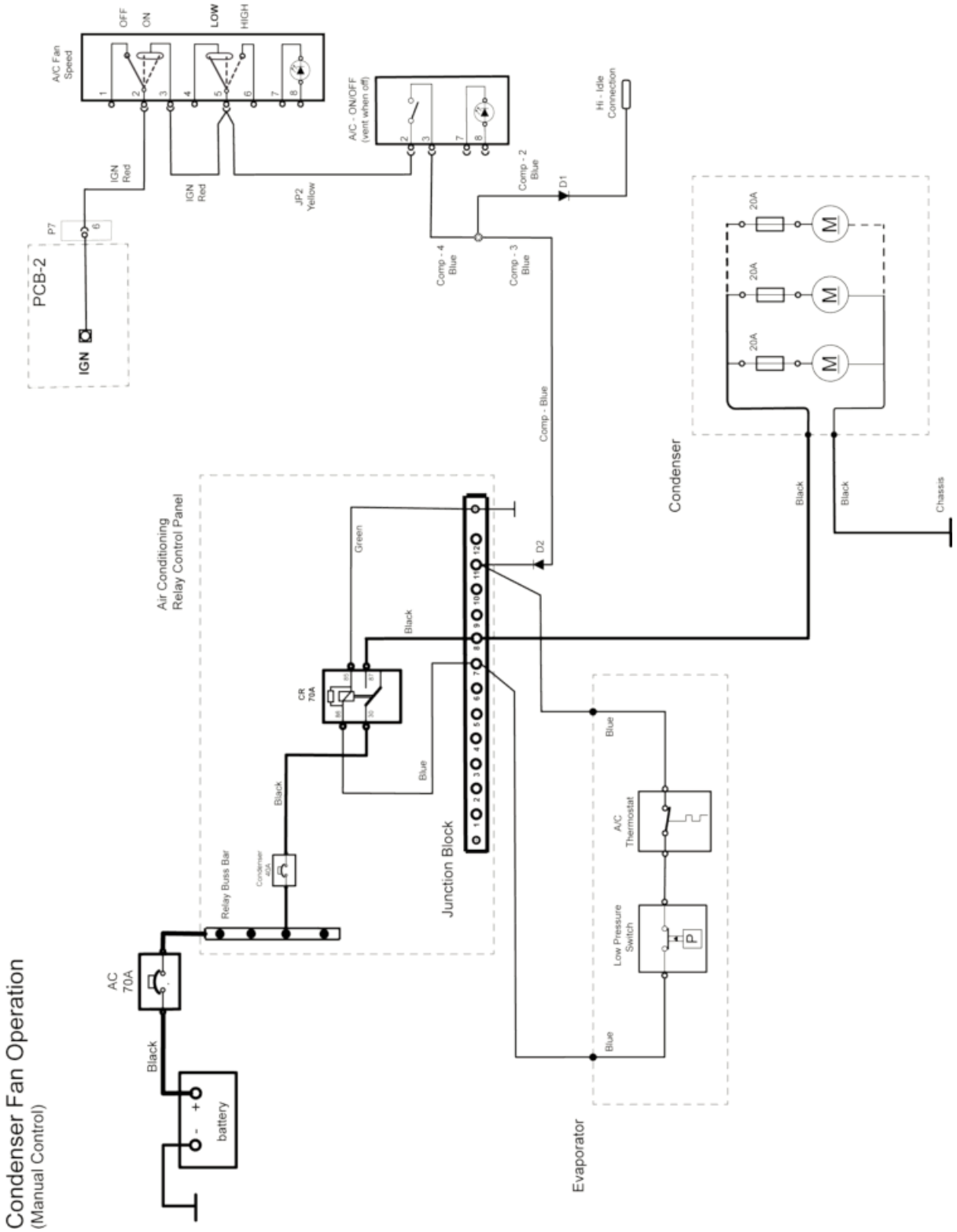
Electrical Schematics - Evaporator Fan Speed, Medium (*Thermostatic Control Only)



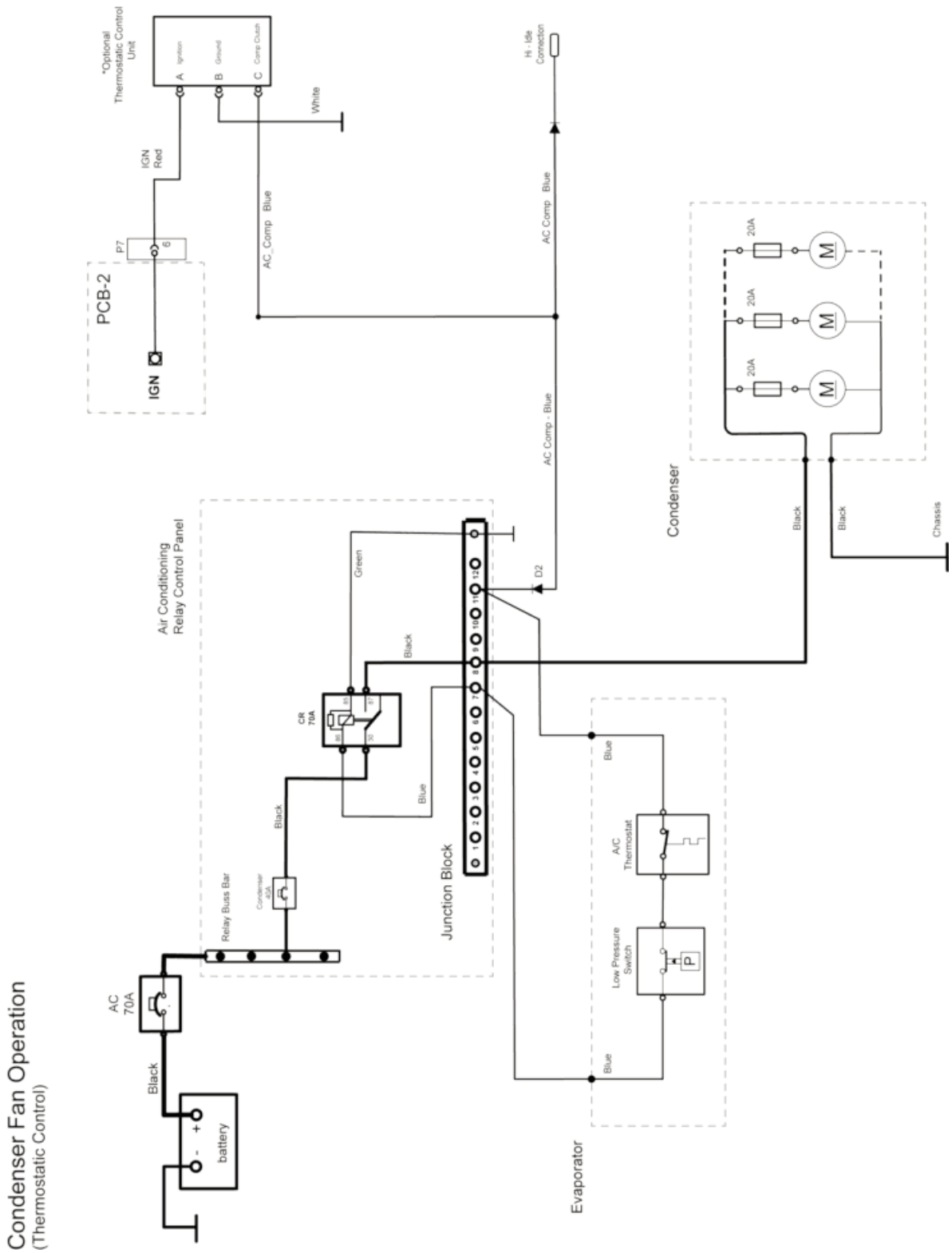
Electrical Schematics - Evaporator Fan Speed, High (Manual Switch Control plus *Optional Thermostatic Control)



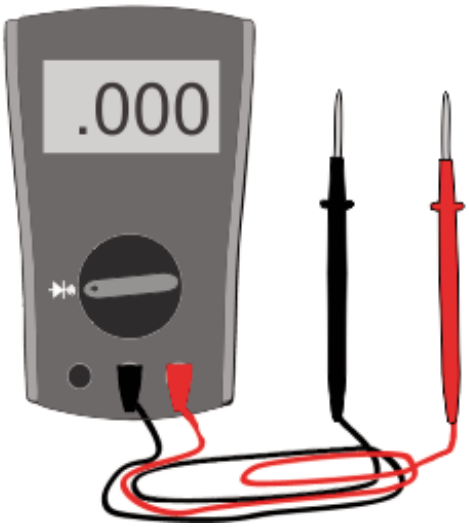
Electrical Schematics - Condenser Fan Operation (Manual Control)



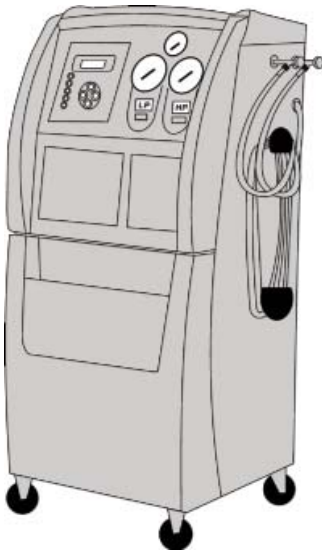
Electrical Schematics - Condenser Fan Operation (Thermostatic Control)



Special Tools



Digital Multimeter (DMM)



AC Charging & Recovery Station

Discovery Process

Determining whether the bus AC system is standalone or tie-in is an important factor to know so that a decision can be made as to which side, body, or vehicle to begin the troubleshooting.

Check and answer the following questions to gain an understanding of what the problem is and where it may be located. The questions are not definitive in scope, but will assist in the discovery process.

1. Is the AC system (body) a stand-alone or tie-in version? _____

- Stand-alone – The stand-alone body AC system operates independently of the vehicle. The problem most likely lies within the body. Continue to follow the troubleshooting below.
- Tie-in – The tie-in body AC system is dependent on the vehicle compressor functioning properly to compress and recirculate refrigerant.

2. Does the vehicle AC system operate and cool properly? Yes or No? _____

- If Yes, and is a stand-alone AC system: no further troubleshooting on the vehicle side is necessary.
- If No, and is a tie-in AC system: check the entire AC system for refrigerant leaks, air-in system, or contamination. If found, repair as needed before repairing the body AC system. A leak-free system is required for both systems to perform as designed.

(Continued on next page)

3. Will the compressor clutch engage? Yes? No? Sometimes? _____

- If Yes, continue to follow the troubleshooting below.
- If No, follow the troubleshooting for **"Compressor clutch will not engage"**.
- If Sometimes, check for system leaks and repair.

Note: If no leaks are found and system is fully charged, check for a worn or faulty clutch. Follow troubleshooting for "Compressor clutch will not engage".

4. Is the compressor clutch noisy? Yes or No? _____

- If Yes, check the physical condition, proper clutch adjustment/clearance, or replace compressor clutch if required.
- If No, continue troubleshooting.

5. Does the AC system cool any at all? Yes or No? _____ at what level? None, Some, Mostly?

- If Yes, (Some/Mostly) continue to troubleshoot the AC system for being low on refrigerant and the reason why. The system may need servicing and the receiver/drier replaced to maintain maximum efficiency.
- If No, (None) then determine if the problem is due to a major system leak first, and continue to check for other problems if cooling has not yet returned to normal.

6. Will the evaporator blower fans turn on and blow air? Yes or No? _____

- If Yes, continue troubleshooting.
- If No, follow the troubleshooting for **"Evaporator blower fans will not function"**.

7. Do the evaporator blower fans function on all speeds? Yes or No? _____

- If Yes, continue troubleshooting.
- If No, follow the troubleshooting for **"Evaporator blower fans will not function"**.

8. Will the condenser fans turn on or function? Yes or No? _____

- If Yes, continue troubleshooting. • If No, follow the troubleshooting for **"Condenser fans will not function"**.

Symptoms

- AC will not cool
- Compressor clutch will not engage
- Evaporator blower fans will not function
- Condenser fans will not function

AC will not cool

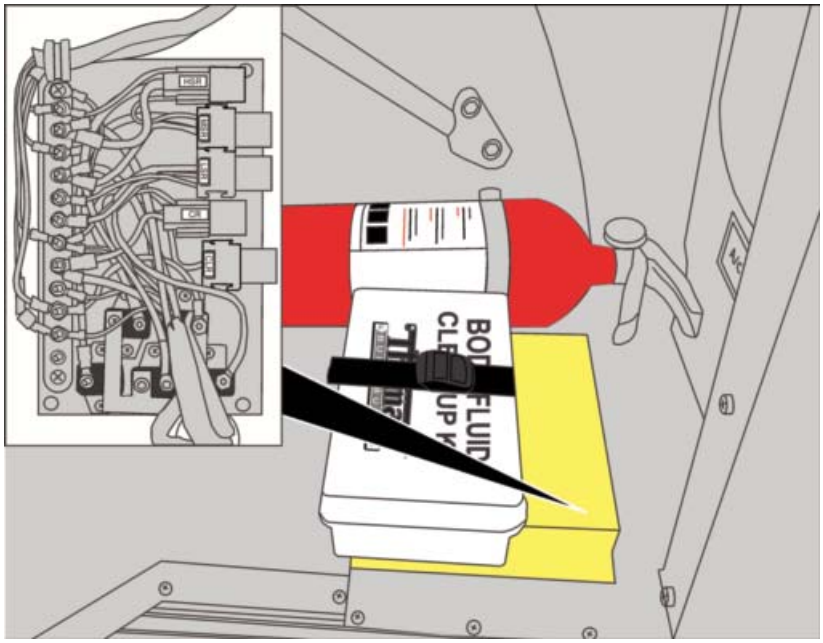
The AC system operates, but not cooling properly.

System Component	Checks	Corrective Action
Compressor belt(s) Compressor clutch Compressor	Visual Inspection: • Drive belt loose or defective • Compressor clutch slipping/coil defective • Compressor defective or worn	Adjust and/or replace belts Check compressor clutch and if found defective replace as needed. If compressor will not raise pressure high enough and everything else is in order, replace compressor as needed.
Refrigerant	Check AC system with gauges: • Low charge • Over charged system • Air in system • Moisture in system • Contamination (from compressor failure)	Check and repair per AC system manufacturer's Service Repair manual.
Expansion valve	Check AC system with gauges: • If valve is stuck open – Both High and low side readings will have similar pressures • If valve is stuck closed or clogged – High pressure may stay high and low side will go into a vacuum	Check and repair per AC system manufacturer's Service Repair manual.
Condenser fans	Condenser Fans inoperative	See **"Condenser fans will not function"**
Evaporator fan	Evaporator fan inoperative	See **"Evaporator fans will not function"**
Evaporator condensate drain	Check for a clogged condensate drain (If a condensate drain is clogged it can affect cooling by causing poor evaporator performance)	Check and clean the drains at the rear of the bus if clogger. They are located underneath the bus at the rear corners and are about an inch in diameter.

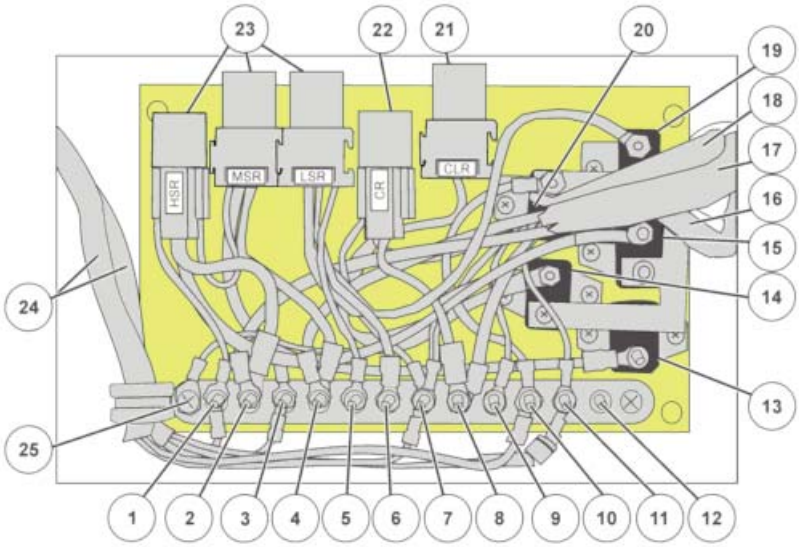
AC system is not operational

System Component	Checks	Corrective Action
Compressor	Check pressures with gauges to determine if charged A visual inspection is also necessary to determine: • Drive belt defective, too loose or missing • Compressor clutch failure • Compressor defective	Check and repair per AC system manufacturer's Service Repair manual.
Electrical circuit malfunction	AC system switches (AC Fan, AC Power ON/OFF) Circuit breaker open Relay defective Defective pressure switch (high or low) Defective thermostat freeze-up switch Electrical circuit interruption (short or open)	Check system power Check AC relay control panel for component measuring and troubleshooting

Compressor will not engage

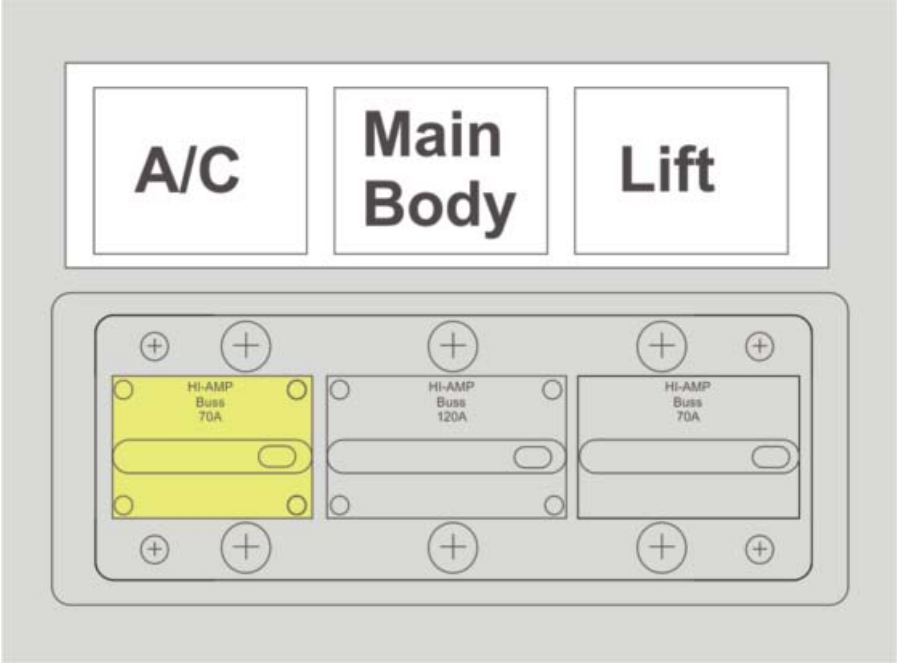


AC Relay Control Panel Location



AC Relay Control Panel

1 – Terminal 1 –HSR (Coil B+)
2 – Terminal 2 – HSR (Load)
3 – Terminal 3 – MSR (Coil B+)
4 – Terminal 4 – MSR (Load)
5 – Terminal 5 – LSR (Coil B+)
6 – Terminal 6 – LSR (Load)
7 – Terminal 7 – CR (Coil B+)
8 – Terminal 8 – CR (Load)
9 – Terminal 9 – CLR (Coil B+)
10 – Terminal 10 – CLR (Load)
11 – Terminal 11 – Circuit Junction
12 – Terminal 12 – N/A
13 – Circuit Breaker (MSR)
14 – Circuit Breaker (CR)
15 – Circuit Breaker (HSR)
16 – Battery 12v (from 70A Breaker)
17 – Evaporator Harness
18 – Condenser Harness
19 – Circuit Breaker (LSR)
20 – Circuit Breaker (Aux)
21 – Compressor Clutch Relay
22 – Condenser Relay
23 – Evaporator Fan Speed Relays
24 – Harnesses to Vehicle Interface/Body
25 – AC Panel Ground



AC 70A Circuit Breaker

Note: The junction block terminal studs are a good place to take measurements from and the table below can be referenced at any point to begin troubleshooting.

Abbreviations:

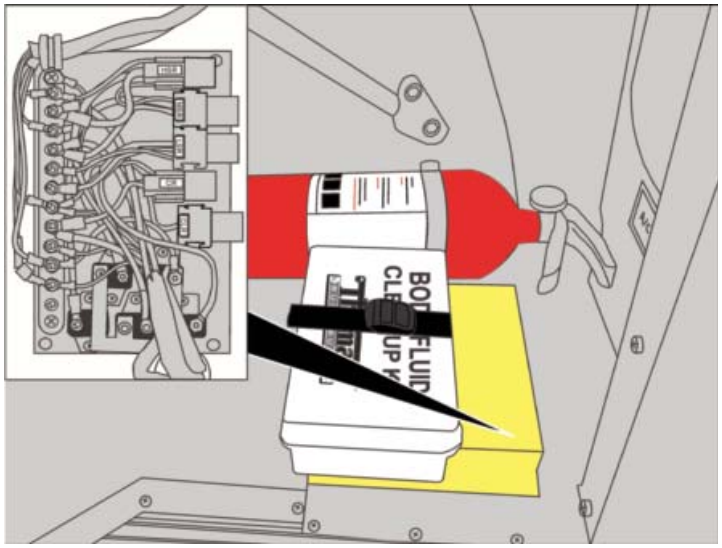
JB – Junction Block
HP – High Pressure
LP – Low Pressure
CB – Circuit Breaker
TF – Thermostatic Freeze-up
NC – Normally Closed
NO – Normally Open
CR – Condenser Relay
CLR – Compressor Clutch Relay
LSR – Low Speed Relay
MSR – Medium Speed Relay
HSR – High Speed Relay

System Component	Measuring Points	Expected Results	Corrective Action
Console Switches (AC-ON/OFF, FAN)	JB 11 to ground	Approx. = 12v	**OK = Proceed to next step**
			NOK = Check Ignition power coming from console manual control switches (ON/OFF/FAN) (Circuit LF 10 (yellow), pin 4 on AC FAN switch) **NOK** = Check Ignition power coming from Thermostatic Control unit (console) if equipped. (Circuit LF 10 (brown), pin D on Thermostatic Control)
CLR relay (86, coil B+)	JB 9 to ground	Approx. = 12v	**OK** = CLR relay should activate. Proceed to next step **NOK** = Check for an open circuit on any of the following: • HP switch (NC) • LP switch (NC) • TF switch (NC) Check and repair per a/c system manufacturer's Service Repair manual for more instructions. Repair or replace as necessary
CLR relay (87, output B+)	JB 10 to ground	Approx. = 12v	**OK** = Compressor clutch should engage If voltage on JB 10 is OK but clutch is not engaged, inspect circuit to clutch connector for open circuit. If voltage at clutch is OK but clutch does not engage, repair or replace clutch. **NOK** = Check the following:

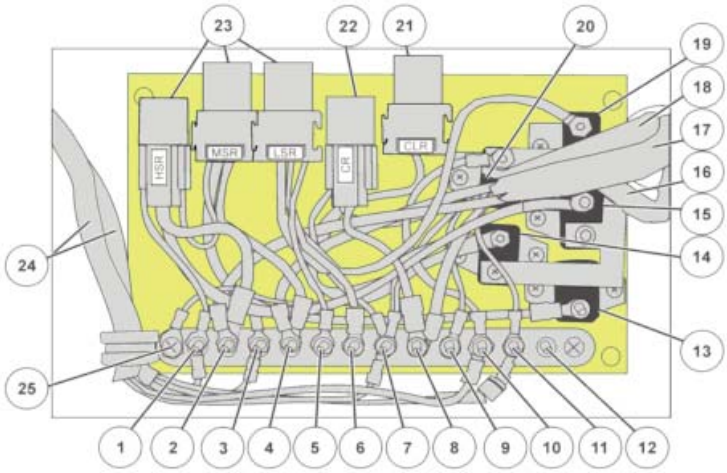
(Continued on next page)

			• Aux circuit breaker, see below • CR relay, see below
CR Relay (86, coil B+)	JB 7 to ground	Approx. = 12v	**OK** = CR relay should activate If not, replace relay **NOK** = Check for an open circuit on the following: • LP switch (NC) • TF switch (NC)
CR Relay (87, output B+)	JB 8 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check circuit breaker supplying power to CR relay. See Condenser Circuit breaker (40A) below. **Note: If circuit breaker is found to be OK, then replace relay.**
AUX circuit breaker (10A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Check circuit breaker and replace if required.
Condenser Circuit breaker (40A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Check circuit breaker and replace if required.

Evaporator blower fan(s) will not function

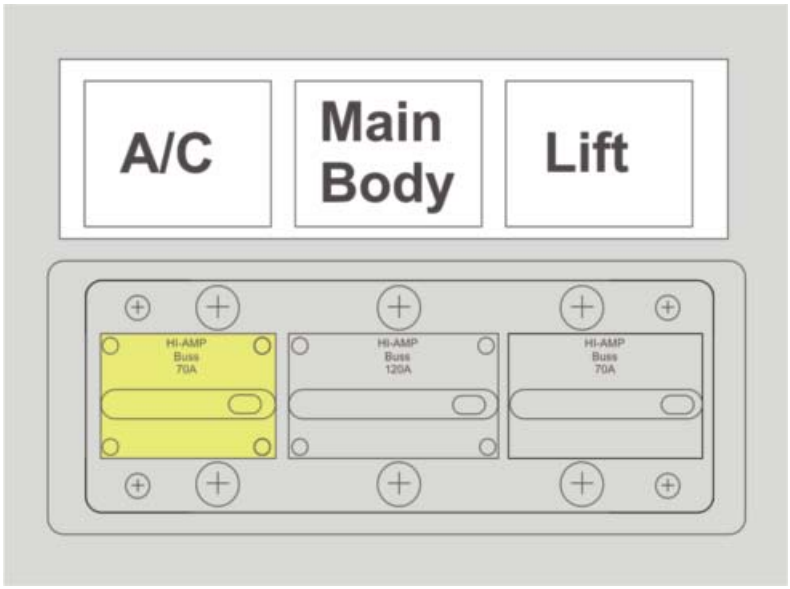


AC Relay Control Panel Location

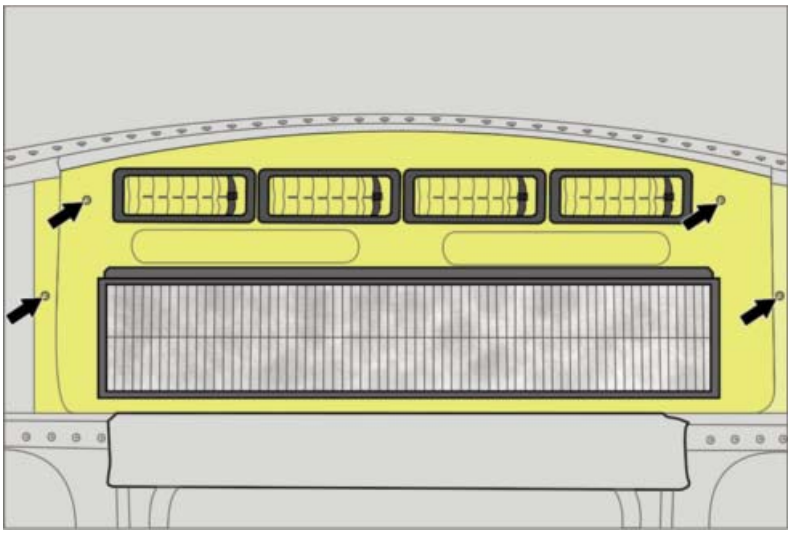


AC Relay Control Panel

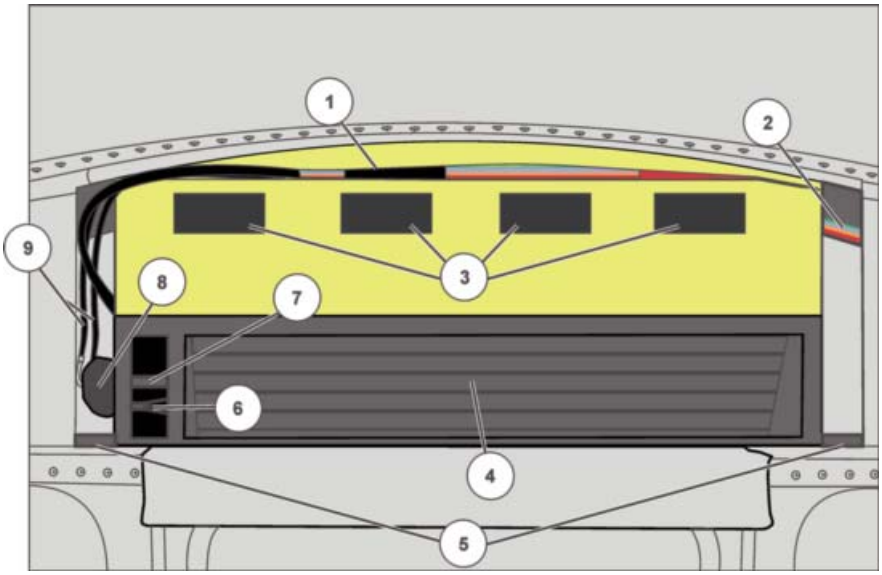
1 – Terminal 1 –HSR (Coil B+)
2 – Terminal 2 – HSR (Load)
3 – Terminal 3 – MSR (Coil B+)
4 – Terminal 4 – MSR (Load)
5 – Terminal 5 – LSR (Coil B+)
6 – Terminal 6 – LSR (Load)
7 – Terminal 7 – CR (Coil B+)
8 – Terminal 8 – CR (Load)
9 – Terminal 9 – CLR (Coil B+)
10 – Terminal 10 – CLR (Load)
11 – Terminal 11 – Circuit Junction
12 – Terminal 12 – N/A
13 – Circuit Breaker (MSR)
14 – Circuit Breaker (CR)
15 – Circuit Breaker (HSR)
16 – Battery 12v (from 70A Breaker)
17 – Evaporator Harness
18 – Condenser Harness
19 – Circuit Breaker (LSR)
20 – Circuit Breaker (Aux)
21 – Compressor Clutch Relay
22 – Condenser Relay
23 – Evaporator Fan Speed Relays
24 – Harnesses to Vehicle Interface/Body
25 – AC Panel Ground



AC 70A Circuit Breaker



Evaporator Unit, Cover Installed



Evaporator Unit, Cover Removed

1 – Evaporator Harness Connections
2 – Evaporator Ground Routing
3 – Blower Fans
4 – Evaporator Core
5 – Condensation Tube
6 – Low Pressure Switch
7 – Thermostat Freeze-Up Switch
8 – Expansion Valve
9 – Refrigerant Connections

a) Low speed, Manual Switch Control

System Component	Measurement (Volts)	Expected Results	Corrective Action
MSR Relay (86, coil B+)	JB 3 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power going to and coming from console manual control switches (ON/OFF/FAN) (Circuit LF 10 (yellow), pin 4 on AC FAN switch.

(Continued on next page)

MSR Relay (87, output B+)	JB 4 to ground	Approx. = 12v	**OK** = Proceed to Evaporator Harness step below **NOK** = Check circuit breaker supplying power to MSR relay. **Note: if circuit breaker is found to be OK, then replace relay.**
Low speed fan circuit breaker (40A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed next step **NOK** = Check circuit breaker and replace if required.
Evaporator Harness (Orange jacketed cable)	Yellow wire to ground	Approx. = 12v	**OK** = Check and repair per a/c system manufacturer's Service Repair Manual. **NOK** = Locate open circuit on yellow wire between evaporator and AC relay control panel and repair as necessary.

b) Low speed, Thermostatic Control Only

System Component	Measurement (Volts)	Expected Results	Corrective Action
LSR Relay (86, coil B+)	JB 5 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power coming from Thermostatic Control unit (console) if equipped. (Circuit LF 10 (brown), pin D on Thermostatic Control)
LSR Relay (87, output B+)	JB 6 to ground	Approx. = 12v	**OK** = Proceed to Evaporator Harness step below **NOK** = Check circuit breaker supplying power to LSR relay. **Note: If circuit breaker is found to be OK, then replace relay.**

(Continued on next page)

Low speed fan circuit breaker (20A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check circuit breaker and replace if required.
Evaporator Harness (Orange jacketed cable)	Red wire to ground	Approx. = 12v	**OK** = Check and repair per a/c system manufacturer's Service Repair Manual. **NOK** = Locate open circuit on red wire between evaporator and AC relay control panel and repair as necessary.

Evaporator blower fan(s) will not function

Medium speed, Thermostatic Control Unit Only

System Component	Measurement (Volts)	Expected Results	Corrective Action
MSR Relay (86, coil B+)	JB 3 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power from Thermostatic Control unit (console) (Circuit MF 15 (Blue), pin E on Thermostatic Control) if equipped
MSR Relay (87, coil B+)	JB 4 to ground	Approx. = 12v	**OK** = Proceed to Evaporator Harness step below **NOK** = Check circuit breaker supplying power to MSR relay. **Note: If circuit breaker is found to be OK, then replace relay.**

(Continued on next page)

Medium speed fan circuit breaker (40A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Check circuit breaker and replace if required.
Evaporator Harness (Orange jacketed cable)	Yellow wire to ground	Approx. = 12v	**OK** = Check and repair per a/c system manufacturer's Service Repair Manual. **NOK** = Locate open circuit on yellow wire between evaporator and AC relay control panel and repair as necessary.

Evaporator blower fan(s) will not function

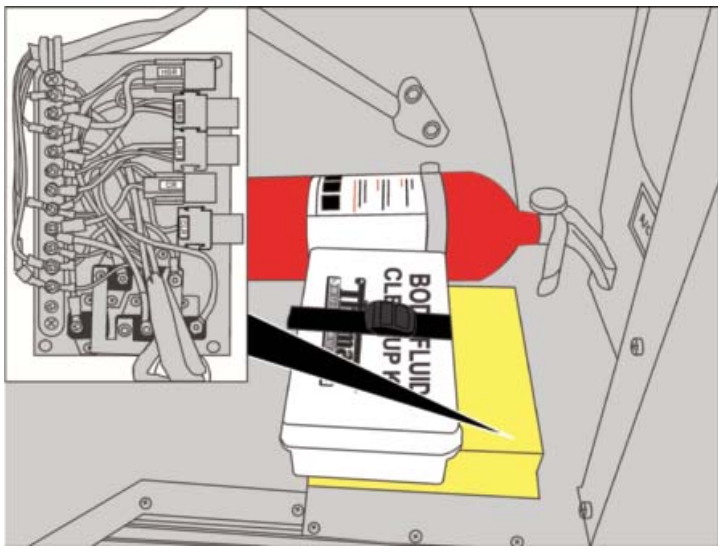
High speed

System Component	Measurement (Volts)	Expected Results	Corrective Action
HSR Relay (86, coil B+)	JB 1 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power from console manual control switches (ON/OFF/FAN) (Circuit HF 20 (orange), pin 6 on AC FAN switch)
			NOK = Check Ignition power from Thermostatic Control unit (console) if equipped (Circuit HF 20 (orange), pin F on Thermostatic Control)

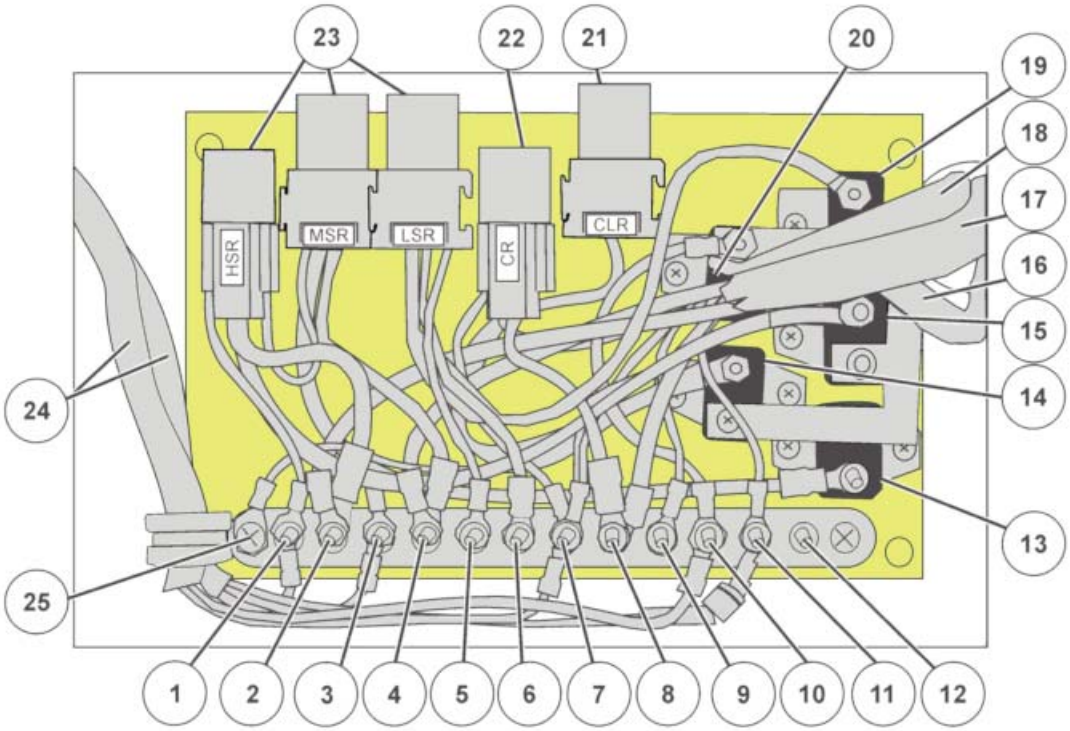
(Continued on next page)

HSR Relay (87, output B+)	JB 2 to ground	Approx. = 12v	**OK** = Proceed to Evaporator Harness step below **NOK** = Check circuit breaker supplying power to HSR relay. **Note: If circuit breaker is found to be OK, then replace relay.**
High speed fan circuit breaker (50A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Check circuit breaker and replace if required.
Evaporator Harness (Orange jacketed cable)	Orange wire to ground	Approx. = 12v	**OK** = See Service Repair Manual for more instructions **NOK** = Locate open circuit on Orange wire between evaporator and AC relay control panel and repair as necessary

Condenser fan(s) will not function

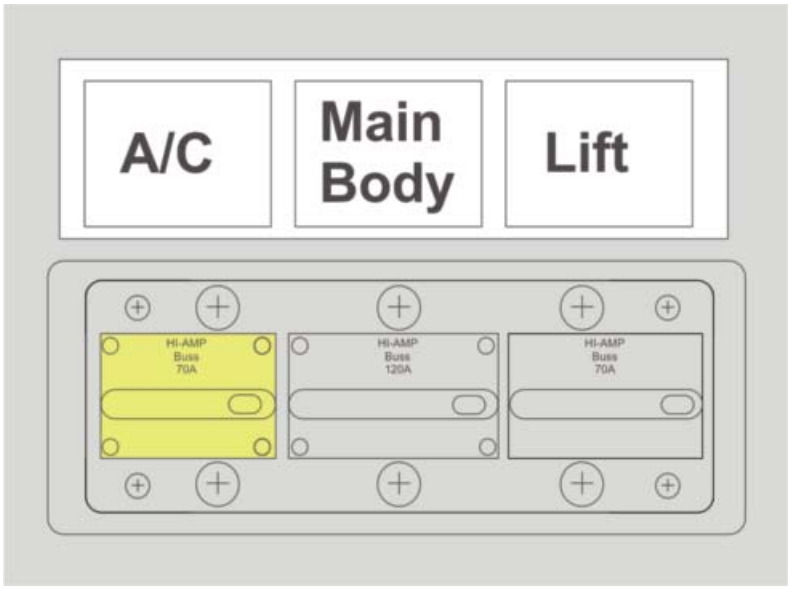


AC Relay Control Panel Location

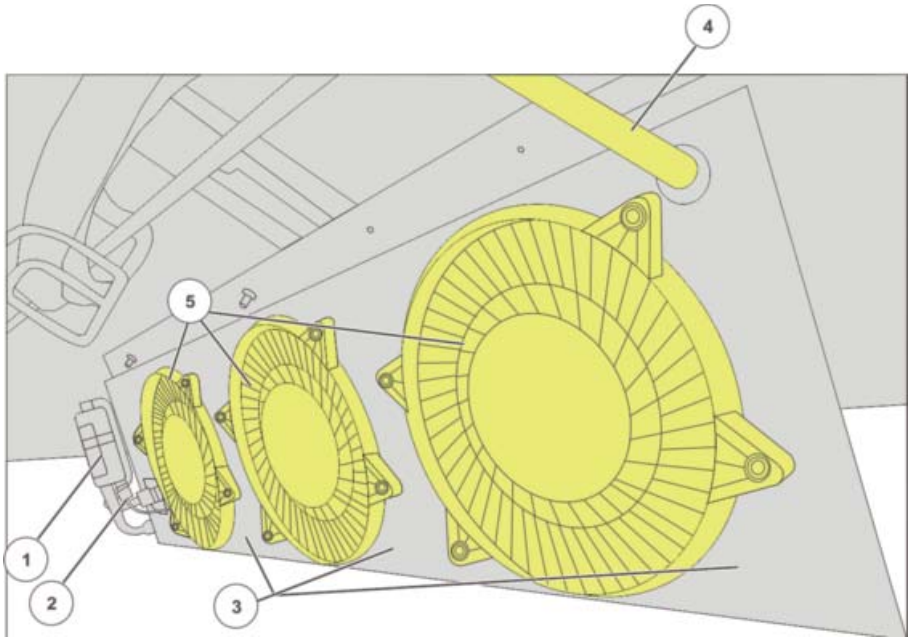


AC Relay Control Panel

1 – Terminal 1 –HSR (Coil B+)
2 – Terminal 2 – HSR (Load)
3 – Terminal 3 – MSR (Coil B+)
4 – Terminal 4 – MSR (Load)
5 – Terminal 5 – LSR (Coil B+)
6 – Terminal 6 – LSR (Load)
7 – Terminal 7 – CR (Coil B+)
8 – Terminal 8 – CR (Load)
9 – Terminal 9 – CLR (Coil B+)
10 – Terminal 10 – CLR (Load)
11 – Terminal 11 – Circuit Junction
12 – Terminal 12 – N/A
13 – Circuit Breaker (MSR)
14 – Circuit Breaker (CR)
15 – Circuit Breaker (HSR)
16 – Battery 12v (from 70A Breaker)
17 – Evaporator Harness
18 – Condenser Harness
19 – Circuit Breaker (LSR)
20 – Circuit Breaker (Aux)
21 – Compressor Clutch Relay
22 – Condenser Relay
23 – Evaporator Fan Speed Relays
24 – Harnesses to Vehicle Interface/Body
25 – AC Panel Ground



AC 70A Circuit Breaker



Condenser

1 – Receiver Drier
2 – High Pressure Switch
3 – Fuse Locations
4 – Condenser Harness
5 – Condenser Fan(s)

System Component	Measurement (Volts)	Expected Results	Corrective Action
CR Relay (86, coil B+)	JB 7 to ground	Approx. = 12v	**NOK** = Check for an open circuit on the following: • LP switch (NC) • TF switch (NC)
	JB 11 to ground	Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power from console switches (ON/OFF/FAN) (Circuit AC-Comp (blue), pin 3 on AC FAN switch)
		Approx. = 12v	**OK** = Proceed to next step **NOK** = Check Ignition power from Thermostatic Control unit (console) if equipped (Circuit AC-Comp (blue), pin C on Thermostatic Control)
CR Relay (87, output B+)	JB 8 to ground	Approx. = 12v	**OK** = Proceed to Condenser Harness step below **NOK** = Check circuit breaker supplying power to CR relay. **Note: If circuit breaker is found to be OK, then replace relay.**
Condenser fan(s) circuit breaker (40A)	Circuit breaker output pin to ground	Approx. = 12v	**OK** = Proceed to next step. **NOK** = Check circuit breaker and replace if required.

(Continued on next page)

Condenser Harness (Red jacketed cable)	Black wire to ground	Approx. = 12v	**OK** = See Service Repair Manual for more instructions **NOK** = Locate open circuit on black wire between condenser and AC relay control panel and repair as necessary **Note: Each fan is fused individually inside the condenser.** **Alternate check** = If power to condenser for fan operation is OK, remove the fan in question and check the fuse

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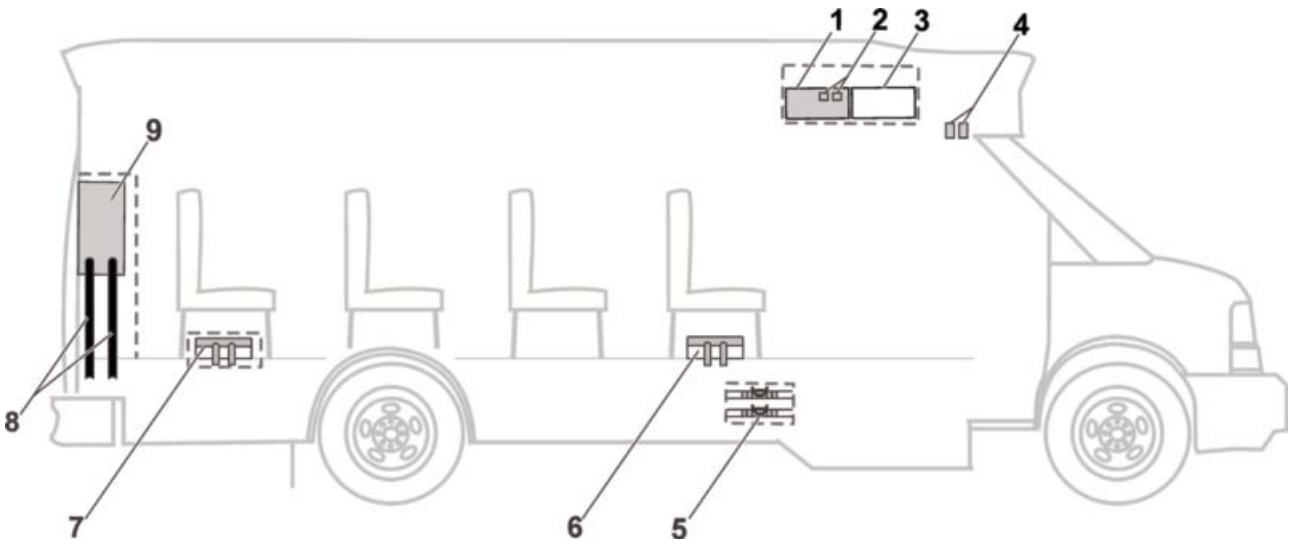


Heater Diagram

1 – PCB1
2 – Relay 6, Front Heater
Relay 7, Rear Heater
3 – PCB2
4 – Heater Switches, Front & Rear
5 – Heater Shut-Off Valves (location varies)
6 – Front Underseat Heater
7 – Rear Underseat Heater (optional)
8 – Coolant Hoses
9 – Wall-Mounted Heater

General

The heater units installed are available with several build options in relation to location, optional equipment, and passenger comfort.

These options may include, but are not limited to:

- **Heater-style:** Low profile underseat mounting, standard underseat mounting, or a wall-mounted unit.

- **BTU rating:**

  - 26,000 BTU heating capacity
  - 50,000 BTU heating capacity

- **Mounting locations:** The passenger heater location is dependent on customer requirements, seating option arrangements, and seat types. A wall-mounted version for wheelchair lift options can also be specified. The underseat locations can be chosen for front and rear mounting.

- **Manual control valves:** A pair of in-line coolant shut-off valves can be specified and located accord ing to customer needs. These valves control the flow of coolant to the heaters.

- **Coolant pump:** An optional booster pump is available for colder climate conditions requiring addition al coolant flow to multiple heater units. The coolant pump is necessary to overcome more extreme weather conditions and meet higher heating capacity needs with the increased flow.

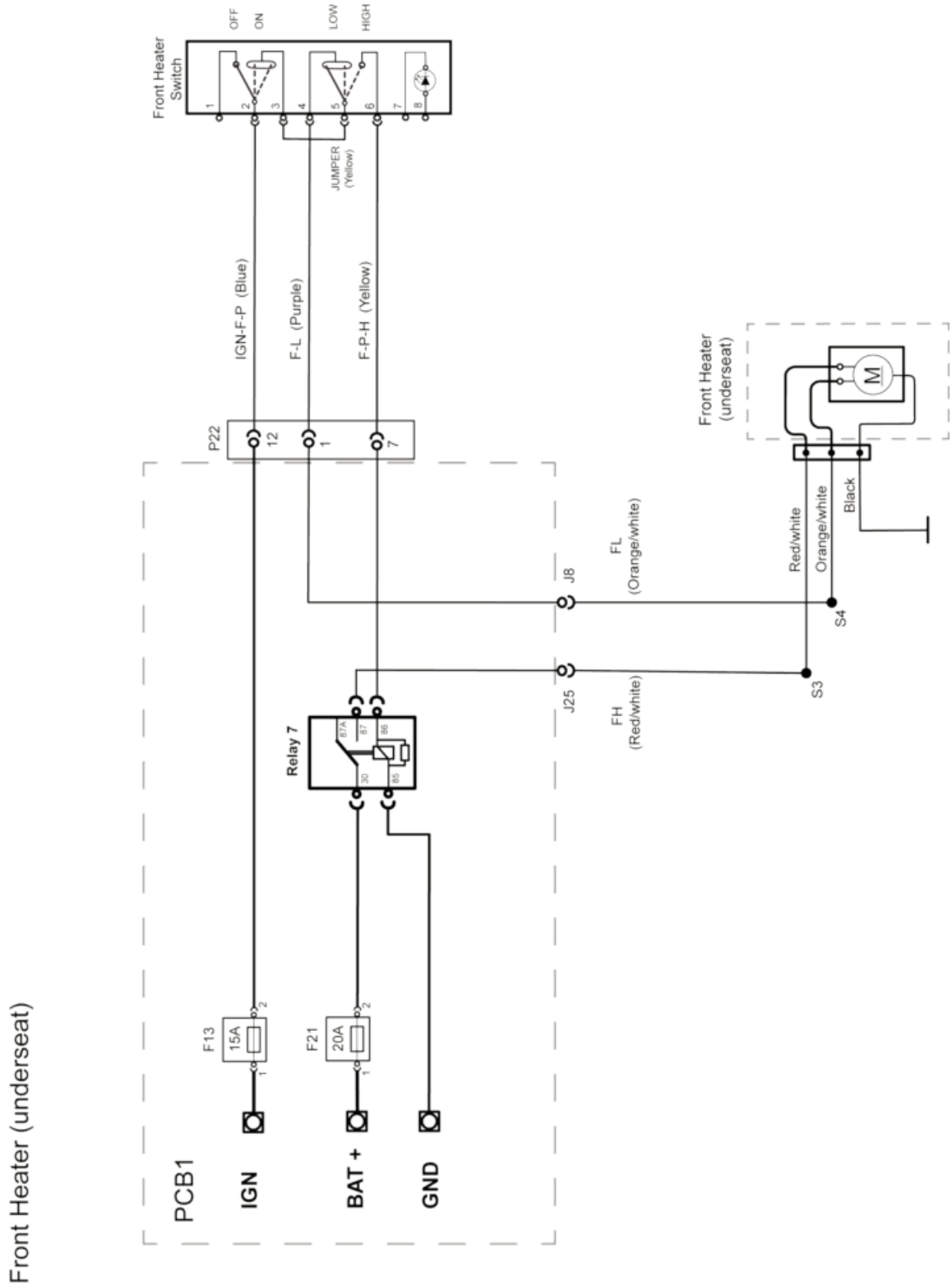
Design and Function

The front and rear passenger heaters are supplied directly with coolant from the engine via two pipes, which are routed under the floor along the outer frame rails of the bus. The upper mounted pipe is for coolant supply and the lower is for coolant return. Depending on heater mounting locations, a pair of manually operated inline shut off valves are installed to allow for heater maintenance repairs and to shut off the coolant flow during warmer seasons.

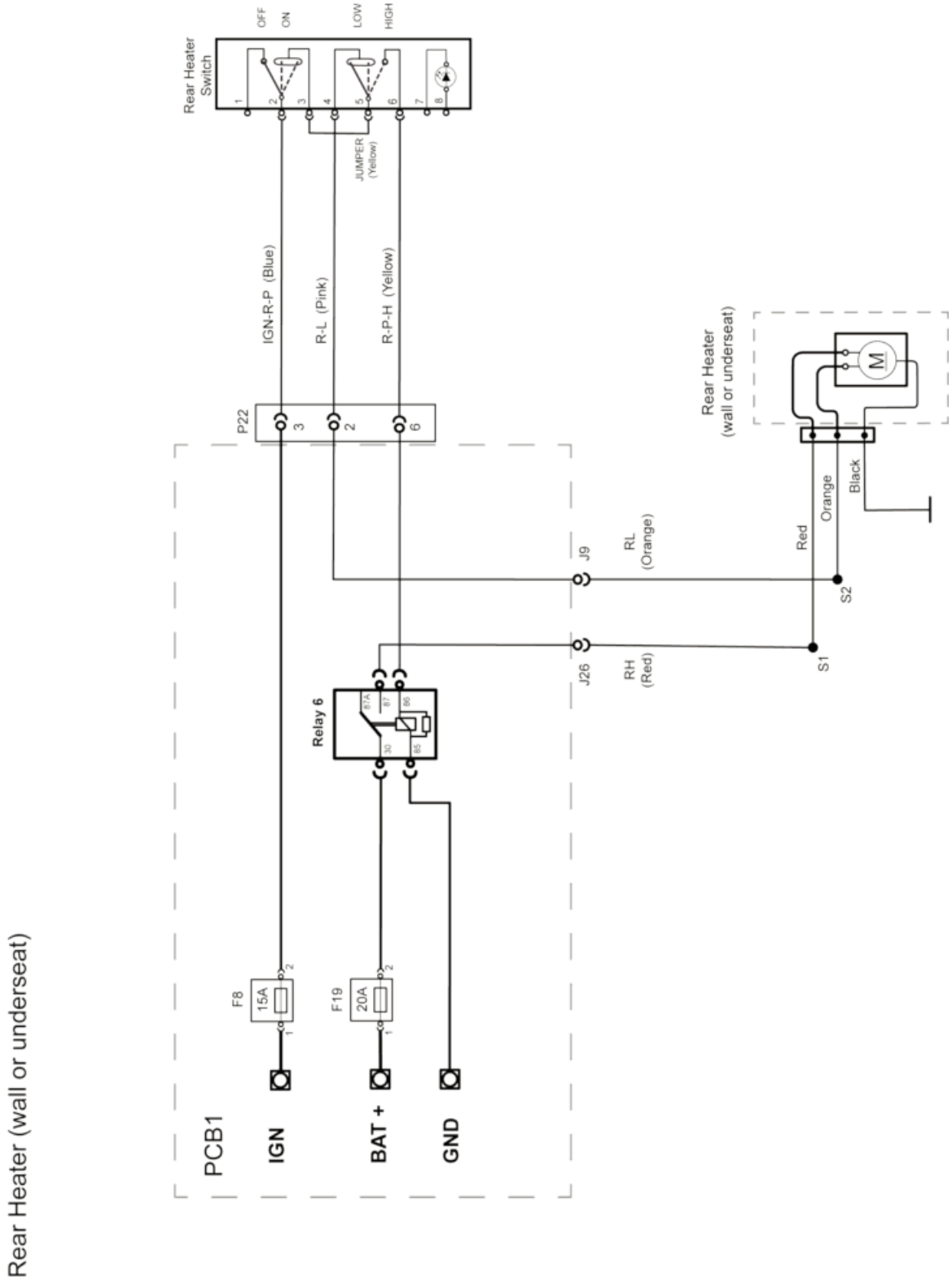
The passenger heaters deliver a constant flow of heat via self-contained blower fans. The fan motors are of a two-speed (low, high) type and are located adjacent to the heater core from which the heat is exchanged and distributed within the bus for passenger comfort.

The fan speeds are controlled by separate console mounted switches: front and rear. These switches are supplied by ignition power from printed circuit board (PCB1) by a pair of 15-amp fuses (F8 and F13) which control the lower speed setting. The high-speed setting is controlled by a pair of relays (R6 and R7) located on PCB1, which are ignition supplied by a pair of 20-amp fuses (F19 and F21).

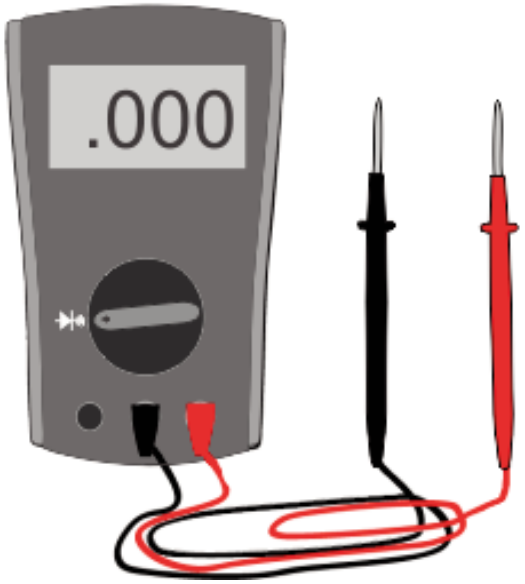
Electrical Schematic - Front Heater, Underseat



Electrical Schematic - Rear Heater, Wall or Underseat



Special Tools



Digital Multimeter (DMM)

Symptoms

Heater(s) not functioning properly

Heater efficiency depends on several factors:

1. **coolant temperature**
2. **coolant flow**
3. **proper fan operation**

A constant supply of temperature regulated coolant coming from the engine is needed so that the heater can perform to its maximum capacity. An internally located thermostat regulates the temperature of the engine and therefore maintains a constant temperature of the heated coolant by which the operation of the heaters function.

An unrestricted flow of coolant is required to maintain the proper heat exchange that is necessary for passenger comfort during cold weather conditions. Coolant flow could be impeded by either a restriction, a blockage, or air in the system. Coolant flow is largely dependent on the water pump's ability to pressurize and push the coolant through the engine onto various locations requiring heaters for comfort.

The last concern is proper fan operation. A properly operating fan is key in recirculating the heated air being exchanged from the heater core to the intended heated space.

When these three factors (coolant temperature, coolant flow, and proper fan operation) work as designed, they create a heated environment suitable for continuous passenger comfort during winter operation.

Insufficient or no heat output

A basic inspection of the suspect heater and the engine coolant system in general is necessary to understand if it is receiving and returning heated coolant back to the engine and that the fans are functioning correctly.

Front or rear heater

System Component	Checks	Corrective Action
Coolant level (vehicle)	Visual Inspection: • Check the coolant level • Check for leaks • Check the vehicle's heater performance and evaluate if heater performance is same as the body	If the coolant level is low, adjust as required. Look for and repair any known leaks and repair as required. Pressurize the coolant system to locate any unknown leaks. (Use the proper coolant type as recommended in the chassis manufacturer's manual)
Air-in coolant system	Check for air in the cooling system **Note: Air in the cooling system will prevent a constant flow of heated coolant to the heater core.** **Air in the system causes poor heater performance as no exchange of heat takes place within or outside of the core.**	If air is found in the cooling system, purge the air by venting. Bleed valves are used to remove air out of the cooling system. Some instances require purging the air at the highest point in the coolant system via loosening a hose, if possible. If loosening a hose is not possible, vent the air at a convenient location until coolant flow is steady and continuous.
Coolant temperature (vehicle)	Check the vehicle temperature gauge. Determine if vehicle is reaching operating temperature.	If the engine coolant temperature is found to be low or not reaching operating temperature, check and repair per Vehicle Service Repair manual recommendations
Coolant pump (engine)	Check operation of the engine coolant pump.	If the vehicle has concerns of low coolant or higher than normal operating temperatures, a suspected faulty coolant pump may be the cause. See Vehicle Service Repair manual for procedures on how to check coolant pump operation.

(Continued on next page)

*Optional Coolant pump (auxiliary) **Note: Electric coolant pump is optional, may be installed only on certain models in various locations.**	Check operation of the auxiliary coolant pump.	If the body heaters have concerns of poor performance, a check should be made to determine if the electrically operated body-mounted coolant pump is functioning correctly. See electrical section.
Coolant thermostat (engine)	Check operation of the engine coolant thermostat.	If the vehicle has concerns of low coolant, higher than normal operating temperatures, a suspected faulty coolant thermostat may be the cause. Contact the local certified dealer.
Coolant pipes/hoses	Visual Inspection: Check the coolant pipes and hoses for kinks or bends that may impede coolant flow from the engine to each suspect heater.	If kinks or bends in the coolant pipes or hoses are found, repair as required. **Note: This problem could be due to a prior faulty repair, subjected vehicle conditions, an accident, or other unknown causes.**
Coolant shut off valves **Note: These valves are in various positions around the bus. Locate and inspect as required.**	Visual Inspection of both valves: • Check the coolant shut-off valves are in the proper position (“ON” or handle is inline with piping). • Check the temperature on either side of valve.	<u>If the valves are turned OFF</u>: Turn the valves ON. (Heater operation should return to normal.) <u>If the valves are turned ON:</u> Check each side of the valve for equal temperature being felt. (If noticeably different, replace valve(s) as required.) If the valve will not turn ON or if handle spins on center, replace valve as required.

(Continued on next page)

Heater core	Visual Inspection of piping and core: Check the temperature of the inlet and outlet pipes at the core of the suspect heater. Check for debris, dirt, or other contaminants that can collect over time on he outside of the cooling fins of the core. **Note: A blockage could exist, which prevents the proper exchange of heat.**	If both inlet and outlet pipes are of same heated temperature, heater core should be flowing. If they are not of the same heated temperature, check core for some type of internal blockage.

Heater fan(s) inoperable

Front Heater, Underseat

Front Heater

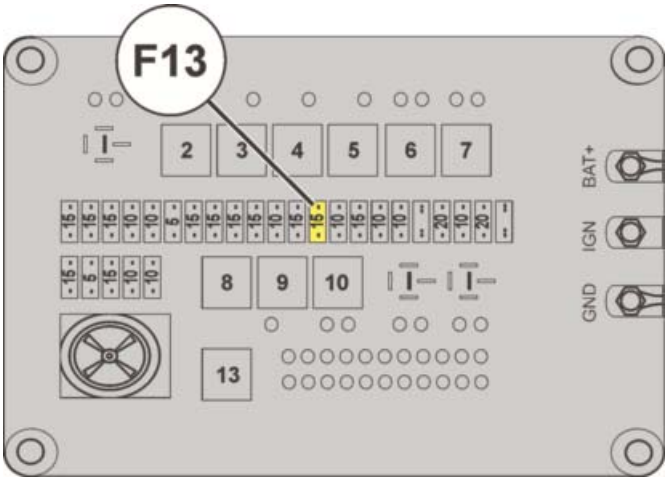
a) Low speed check

Measuring Voltage (Volts):

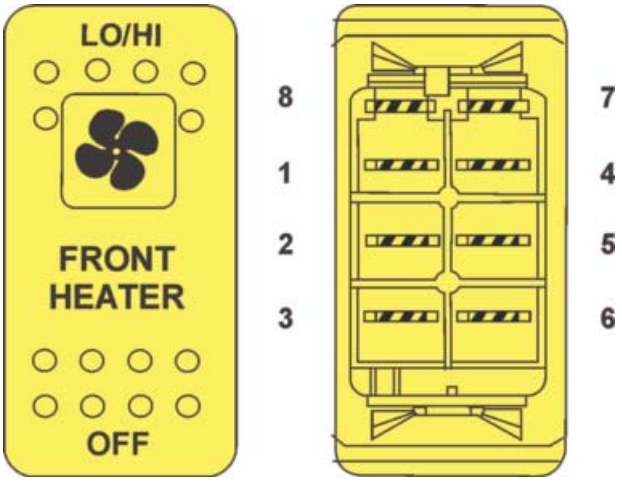
Conditions:

- Key switch **"ON"**
- Front Heater Switch **"On-Low"**
- Park Brake **set**
- Gear selector in **park**

Note: Ensure that the bus is in PARK and the Park Brake is SET before measuring voltage.

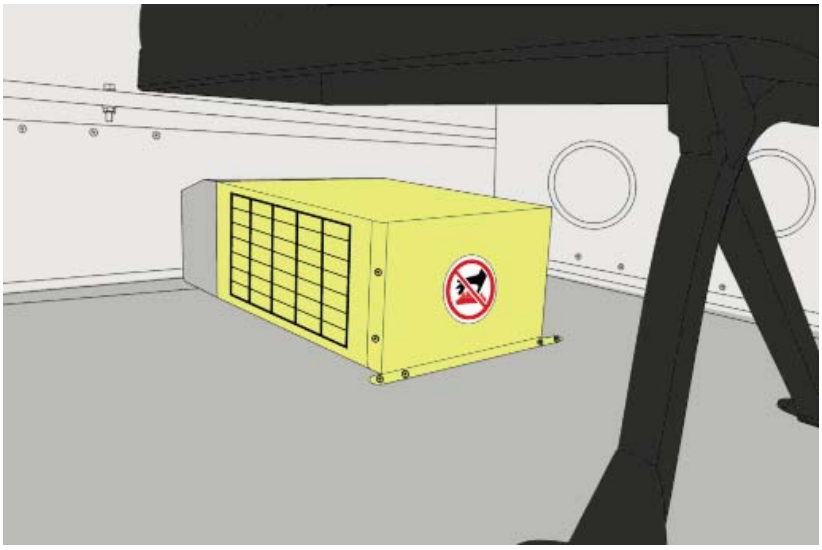


PCB1, Fuse 13



Heater Switch, Front

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Fuse F13 (15A)	Low speed fan supply	Across fuse F13 contacts to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Open fuse. Check Fuse F13 condition and size 15A (replace if required).
IGN-F-P PCB1_P22_pin 12 (blue)	12v output to front heater switch	IGN-F-P to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contact the local Thomas dealer.
F-L PCB1_P22_pin 1 (purple)	12v input from front heater switch	F-L to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check for open circuit on wire F-L from front heater switch, pin 4 to PCB1. If OK, replace switch.
F-L PCB1_J8 (Orange/white)	12v output to front heater motor (low speed)	F-L to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contat the local Thomas dealer.
F-L (Orange/white)	12v input to front heater motor (low speed)	F-L - Orange/White to a known ground	Approx. = 12 v	**OK** = Front heater fan-motor should work, if not replace fan motor. **NOK** = Check for an open circuit between front heater and J8 connection at PCB1.



Front Heater, Underseat

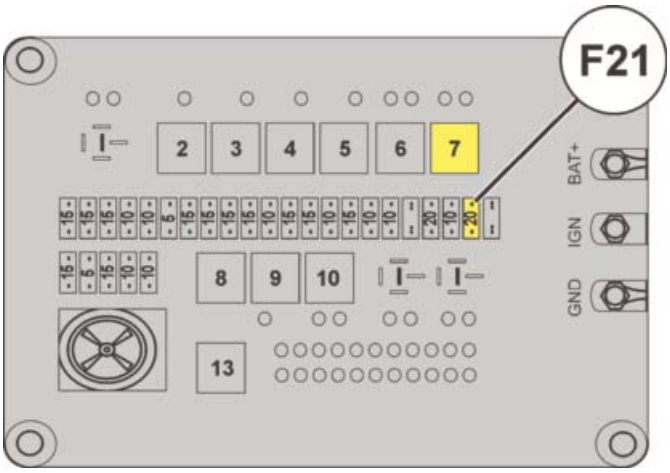
b) High speed check

Measuring Voltage (Volts):

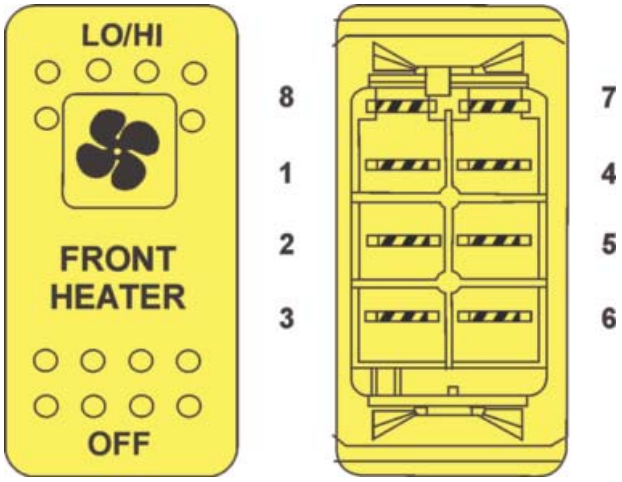
Conditions:

- Key switch **"ON"**
- Front Heater Switch **"On-High"**
- Park Brake **set**
- Gear selector in **park**

Note: Ensure that the bus is in PARK and the Park Brake is SET before measuring voltage.



PCB1, Fuse 21, Relay 7



Heater Switch, Front

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Fuse F21 (15A)	High speed fan supply	Across fuse F21 contacts to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Open fuse. Check Fuse F21 condition and size 20A (replace if required).
IGN-F-P PCB1_P22_pin 12 (blue)	12v output to front heater switch	IGN-F-P to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contact the local Thomas dealer.
F-P-H PCB1_P22_pin 7 (yellow)	12v input from front heater switch (coil B+, relay 7)	F-P-H to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check for open circuit on wire F-P-H from front heater switch, pin 6 to PCB1. If OK, replace switch
FH PCB1_J25 (Red/white)	12v output to front heater motor (high speed)	FH to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check relay 7 for proper function. If found defective, replace relay.
FH (Red/white)	12v input to front heater motor (high speed)	FH – Red/white to a known ground	Approx. = 12 v	**OK** = Front heater fan motor should work. If not, replace fan motor. **NOK** = Check for an open circuit between front heater and J25 connection at PCB1.

Heater fan(s) inoperable

Rear Heater

Rear Heater

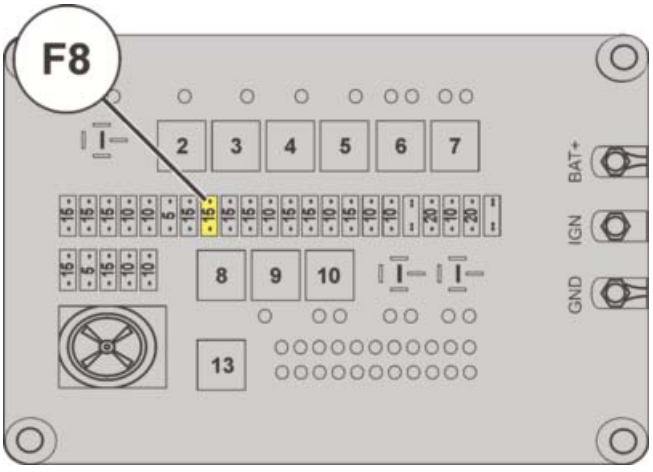
a) Low speed check

Measuring Voltage (Volts):

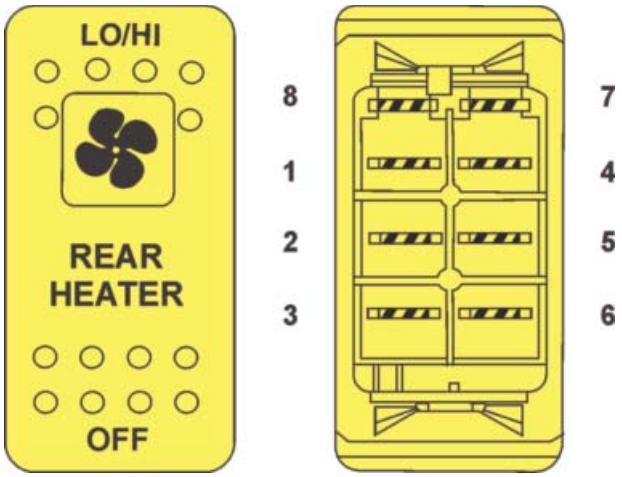
Conditions:

- Key switch **"ON"**
- Front Heater Switch **"On-Low"**
- Park Brake **set**
- Gear selector in **park**

Note: Ensure that the bus is in PARK and the Park Brake is SET before measuring voltage.



PCB1, Fuse 8



Heater Switch, Rear

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Fuse F8 (15A)	Low speed fan supply	Across fuse F8 contacts to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Open fuse. Check Fuse F8 condition and size 15A (replace if required).
IGN-R-P PCB1_P22_pin 3 (blue)	12v output to rear heater switch	IGN-R-P to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contact the local Thomas dealer.
RL PCB1_P22_pin 2 (pink)	12v input from rear heater switch	RL to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check for open circuit on wire R-L from rear heater switch, pin 4 to PCB1. If OK, replace switch.
RL PCB1_J9 (orange)	12v output to rear heater motor (low speed)	RL to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contact the local Thomas dealer.
RL (orange)	12v input to rear heater motor (low speed)	FL - Orange to a known ground	Approx. = 12 v	**OK** = Rear heater fan motor should work. If not, replace fan motor. **NOK** = Check for an open circuit between rear heater and J9 connection at PCB1.

Rear Heater

Rear Heater

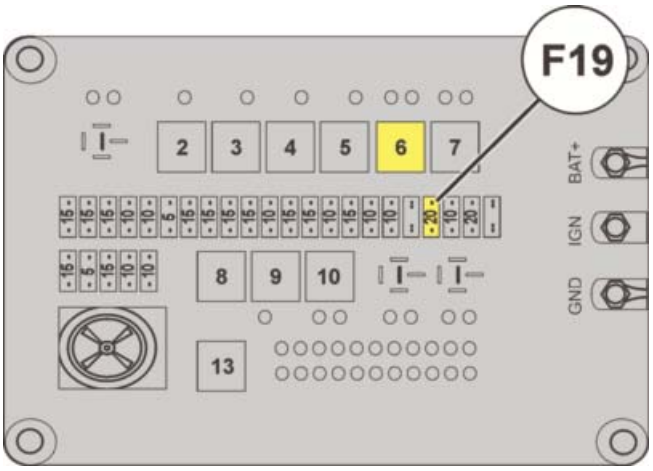
b) High speed check

Measuring Voltage (Volts):

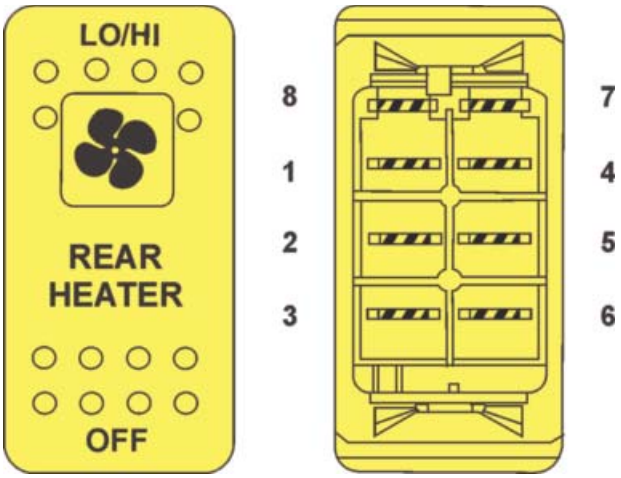
Conditions:

- Key switch **"ON"**
- Front Heater Switch **"On-High"**
- Park Brake **set**
- Gear selector in **park**

Note: Ensure that the bus is in PARK and the Park Brake is SET before measuring voltage.



PCB1, Fuse 19, Relay 6



Heater Switch, Rear

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
Fuse F19 (15A)	High speed fan supply	Across fuse F19 contacts to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Open fuse. Check Fuse F19 condition and size 20A (replace if required).
IGN-R-P PCB1_P22_pin 3 (blue)	12v output to rear heater switch	IGN-R-P to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Contact the local Thomas dealer.
R-P-H PCB1_P22_pin 6 (yellow)	12v input from rear heater switch (coil B+, relay 6)	R-P-H to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check for open circuit on wire F-P-H from rear heater switch, pin 6 to PCB1. If OK, replace switch.
RH PCB1_J26 (Red)	12v output to rear heater motor (high speed)	RH to ground stud (GND) of PCB1	Approx. = 12 v	**OK** = Proceed to next step. **NOK** = Check relay 6 for proper function. If found defective, replace relay.
RH (Red)	12v input to rear heater motor (high speed)	RH – Red to a known ground	Approx. = 12 v	**OK** = Rear heater fan motor should work. If not, replace fan motor. **NOK** = Check for an open circuit between rear heater and J26 connection at PCB1.

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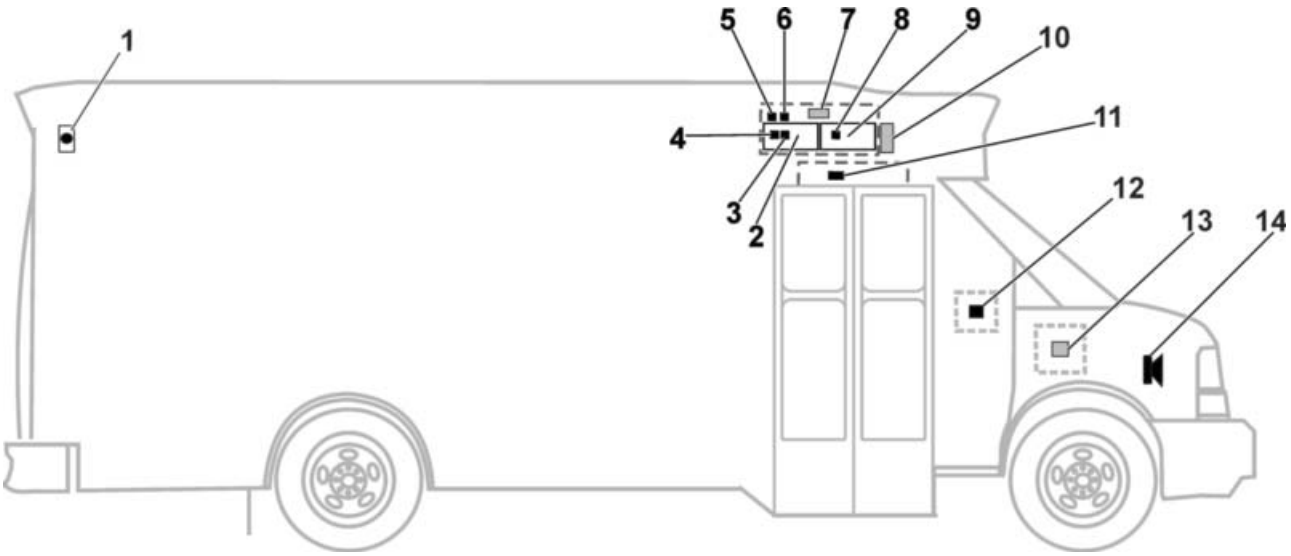


Passenger Advisory System

1 – Remote Vehicle Transmitter Button
2 – PCB1
3 – Relay 4 (Rear Lighting)
4 – Relay 3 (Front Lighting)
5 – Relay 1
6 – Headlight Warning Light Relay
7 – Check Mate module
8 – Relay 11
9 – PCB2
10 – Safety Flasher
11 – Entrance Door Switch (Electric)
12 – Entrance Door Switch (Manual)
13 – Driver's Door Switch
14 – Horn

General

The Passenger Advisory System is an interactive alarm system that aides the driver in recognizing any remaining passengers who have not disembarked from the bus.

The alarm serves two purposes: 1) alert the driver that the disarm procedure was not properly followed 2) awaken any remaining passengers. This feature is accomplished by sounding an alarm (horn) and flashing either the headlights or the warning lights.

The Passenger Advisory System is currently available in several order options and configurations. The option described in this document will pertain mainly to horn and warning light activation only. While several features and components are similar, some features and components are unique to your particular option build. Contact the locat Thomas dealer for more information.

The options include but are not limited to the following items, conditions, and responses:

Procedure to disarm/disable system – Varies with option, but basically follows this procedure and in this order: 1) Doors closed 2) Key OFF 3) RVT button (rear of bus) pressed for one second
Time to alarm – The time interval a driver must perform passenger search. The time varies from 60 seconds for most applications up to four minutes on one specific variant.
Type of alarm – The alarm can be the horn and the headlights or just the horn.
System activation/enable – There are three possible ways the system can become enabled for alarm mode to function: 1) Ignition On (first time switch is turned on) 2) Red warning Lights (first time warning lights are used) 3) 10-minute run time (bus cranked and running for a minimum of ten minutes)
Alarm activation – Ignition is turned OFF
Alarm indication – Pilot light turned ON and Interior lights are turned ON
Deactivation switch location – Rear of bus or rear bulkhead
Deactivation confirmation – Pilot light turned OFF and interior lights flash from either 2x to 3x according to option order
Dome lights – Dome lights turned on for approximately 60 seconds after deactivation
Pilot light operation – Turned on with activation
Operation without deactivation – 1) Dome lights turned ON. 2) If not disarmed within one minute, the horn will sound and warning lights will flash. The headlights will flash on some models.

Note: If the alarm sounds and the lights flash-

1) **The driver must re-enter the bus,**
2) **Close the doors,**
3) **Restart the vehicle,**
4) **Go through deactivation process.**

Design and Function

The Passenger Advisory System is designed to remind the driver to perform a thorough check for any passengers remaining on the bus after the journey or route is complete. This system alerts the driver by sounding the vehicles horn in case the process is not followed through completely as instructed. The process of making sure no passengers are unintentionally left on the bus is the drivers responsibility, but the Passenger Advisory System will serve as an aide to preventing any occurrences.

Before troubleshooting can begin, a thorough understanding of how the basic system functions and theory of operation is required.

The system consists of the following main components:

- **Check Mate Module** - Located in the upper electrical center. The module is a basic I/O (input/output) logic control device that is programmed to monitor key inputs and based on those received it will react according to the software instructions to control various outputs.

- **RVT (Remote Vehicle Transmitter)** - Located in rear of bus. It is used to disarm/disable the system. By pressing the button, the switch momentarily grounds to the bus body and a signal is transmitted to the module to disarm. After the button is pressed the switch remains illuminated for a period before turning off.

- **Switch, Drivers Door** – Located on driver's door and is tied into the bus body for convenience.

- **Switch, Entrance Door (electric)** – Located above the entrance door and works in conjunction with the opening and closing of the electric door motor.

- **Switch, Entrance Door (manual)** – Located under the top plate of the pivot arm bracket for opening and closing of the manual door. This switch is a plunger type, off-on switch.

- **Horn** – Located on chassis, to alert driver the system has not been properly disarmed or to awaken a sleeping passenger.

- **Dome/Interior Lights** - Located overhead in the bus body. They are turned on for visual inspection of bus and to serve as a visual alert to the driver.

- **PCB1** – Supplies ignition power and ground to the Passenger Advisory module. Controls the dome and interior lights via relays 3 and 4 to illuminate when prompted by the module.

- **PCB2** – Supplies battery power and ground to: Relay R1 (externally mounted), Relay R11 (located on PCB2), and the Safety Flasher for external body caution and warning signal lighting.

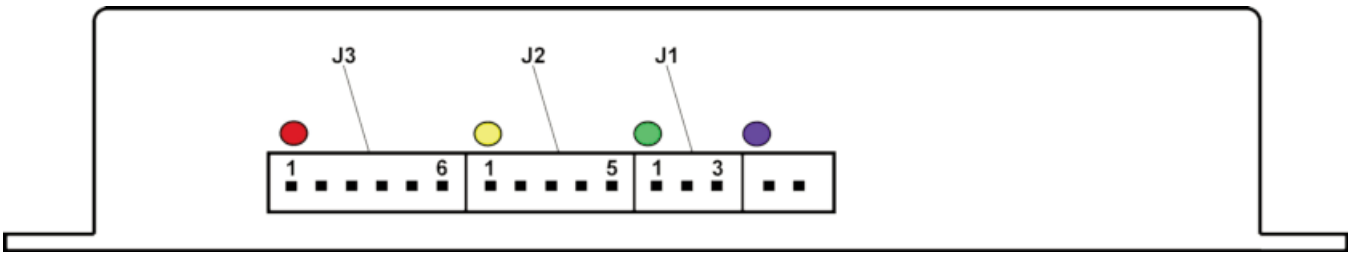
Description of operation:

Power and ground - The module receives ignition power from PCB1, fuse F4 (10A) and Ground. The battery voltage input is received from PCB2, fuse F17 (20A).
System Enable - After the system is powered up, it becomes initially enabled by a ground input circuit LW59 coming from the entrance door switch the first time it is opened and operated.
System Arm – At the same time the entrance door is opened, the system becomes armed by one of two input sources. It can be armed by either a voltage signal coming from the body Warning Lights activation circuit LW82 pink (TERM WL) or to a direct key on ignition signal circuit IGN-1 yellow (TERM-IGN) connected directly to the CRS-SEL terminal circuit ARM gray wire. Once a voltage signal is received from either source, the system has been armed. **Note: Consult your manufacturer to determine how the circuit should be connected according to your specific build option.**
System Disarm/Disable – Once the bus is parked, (1) both entrance door and driver's door must be shut and the (2) Ignition switch is turned to the off position (Interior lights will turn on). The driver must go to the rear of the bus and (3) press the RVT button for approximately one second to disarm or disable the system. The interior lights will flash to signify the system has been properly disarmed. The driver may now (4) exit the bus.
System Alarm – The system will alarm anytime the ignition is turned off and any of the following conditions are not met or performed correctly. • If either the driver's door or entrance door is open or opened before the RVT button is pressed, the alarm (horn) will sound. • If the RVT button is not properly pressed before exiting the bus, the alarm (horn) will sound.

Note: To turn off or stop the alarm (horn), you must turn the ignition switch back on and restart the engine. Follow the steps under System Disarm/Disable to prevent alarm from sounding.

Note: The Main Body Power Relay (120A), located by the entrance door, will deactivate and reset the system.

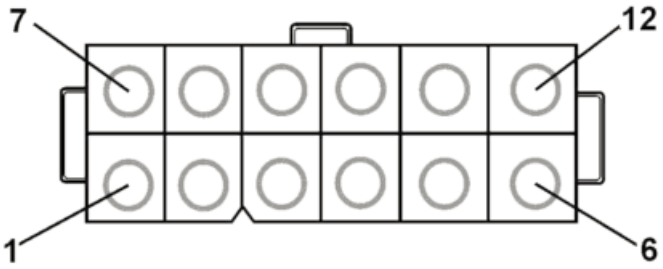
Specifications



Check Mate Module, end view

Check Mate Module (Input/Output Description):

Connector Pin	Circuit	Input/Output	Function	Signal Type	Signal Source
J1 - 1	NA	NA	NA		NA
J1 - 2	White/Blue	Input	• Signal to “Enable” the Passenger Advisory System • Signal to activate the alarm	B- ground	Entrance door switch
J1 - 3	NA	NA	NA	NA	NA
J2 - 1	NA	NA	NA		NA
J2 - 2	NA	NA	NA	NA	NA
J2 - 3	NA	NA	NA	NA	NA
J2 - 4	NA	NA	NA	NA	NA
J2 - 5	Purple	Output	Signal to activate lighting relays 3 and 4 on PCB1	B+ voltage	Module
J3 - 1	Red	Input	Battery voltage supply	B+ voltage	PCB2 - fuse F17 (20A)
J3 - 2	Black	Input	Signal to activate the Alarm	B- ground	Driver door switch
J3 - 3	Yellow	Input	Ignition voltage supply	B+ voltage	PCB1 - fuse F4 (10A)
J3 - 4	Blue	Input	Signal to **"Disarm"** and **"Disable"** System	NA	RVT - Remote Vehicle Transmitter
J3 - 5	Brown	Input	Signal to **"ARM"** system	B+ voltage	Warning Lights (WL) or Ignition (IGN-1)
J3 - 6	Green	Output	Signal to active Horn	B- ground	Module



Child_Alarm 12-pin view

Child Alarm Connector (Circuit Identification):

Connector Pin	Circuit	Wire Color	Function
1	GND	White	Driver door switch
2	NA	NA	NA
3	NA	NA	NA
4	POS - SW	Purple	RVT (Disable/Disarm)
5	NA	NA	NA
6	LW59	Pink	Entrance Door Switch (Enable)
7	BAT	Green	Battery B+
8	HORN	Blue	Horn
9	NA	NA	NA
10	LD19	Black	Interior Lights
11	IGN	Yellow	Ignition
12	ARM	Gray	Arm the system

Electric Door

Entrance Door Micro-Switch Adjustment (Lower switch):

1) Check that the micro-switch tabs are being properly detented (activated) prior to door closing.
2) If not, adjust the micro-switch by loosening and repositioning switch to allow for detent on tabs.

Note: If the micro-switch cannot be adjusted, make certain the doors are completely closed and properly adjusted.

Electric Door Adjustment:

1) Close entrance doors.
2) Adjust Hex Rod:
   a) Lengthen hex rod to tighten doors against seals
   b) Shorten hex rod if doors are too tight against seals
3) Adjust Micro-Switch
   a) Check that the micro-switch tabs are being detented (activated) just prior to the door closing.
   b) If not, adjust lower micro-switch by loosening and repositioning the switch to allow for the proper detent on the tabs.

Note: If the micro-switch cannot be adjusted, make certain the doors are completely closed.

4) Adjust Secondary Rod (if required):
   If AFT leaf is trailing the forward leaf, lengthen the secondary rod.
   If AFT leaf is leading the forward leaf, shorten the secondary rod.
5) Open the entrance doors.
6) Adjust the upper micro-switch in same manner as above in step three.

Note: If the doors auto-reverse prior to full closure, readjust the lower switch.

Manual Door

Manual Door Adjustment:

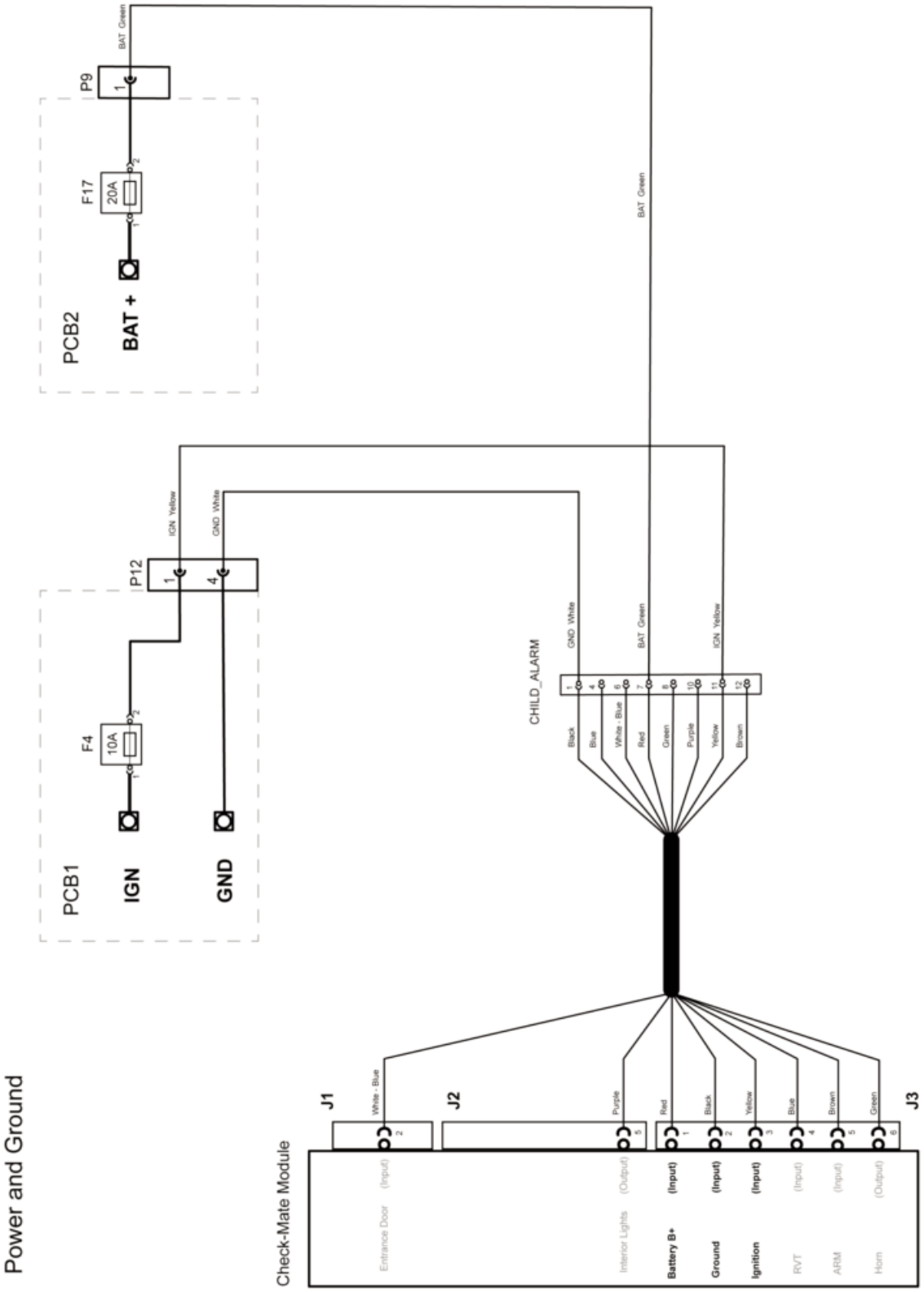
1) Close entrance doors
2) Adjust Hex Rod:
   a) Lengthen hex rod to tighten doors against seals
   b) Shorten hex rod if doors are too tight against seals
3) Adjust Plunger-Style Switch
   a) Check that the switch is being detented (activated) just prior to the door closing.
   b) If not, adjust the switch by loosening and repositioning to allow for the proper detent.

Note: Make certain the plunger does not bottom out the switch, but allows enough relief to make and break the electrical connection when door is opened and shut.

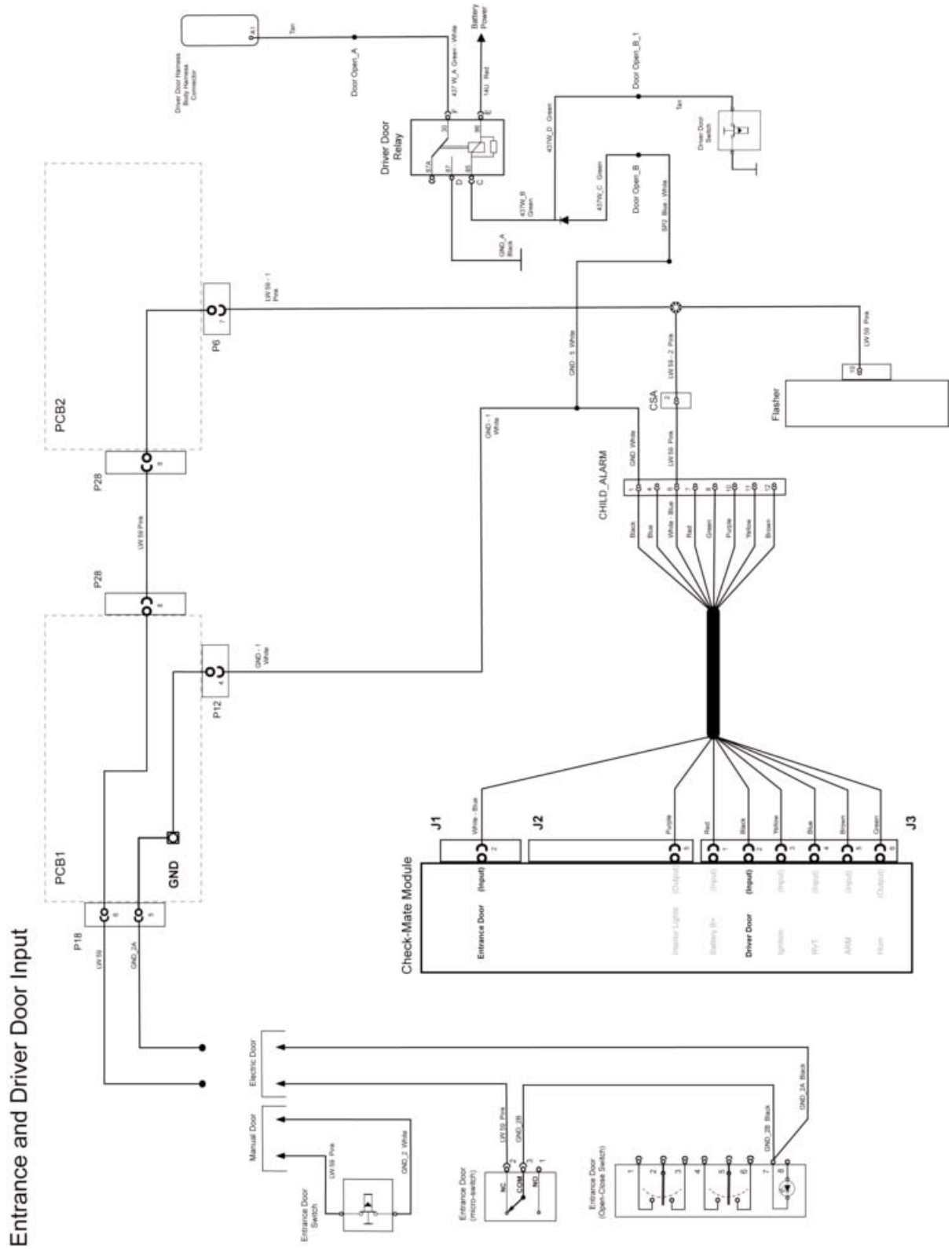
Note: If the switch cannot be adjusted, make certain the doors are completely closed.

4) Adjust Secondary Rod (if required):
   If AFT leaf is trailing the forward leaf, lengthen the secondary rod.
   If AFT leaf is leading the forward leaf, shorten the secondary rod.
5) Open the entrance doors.

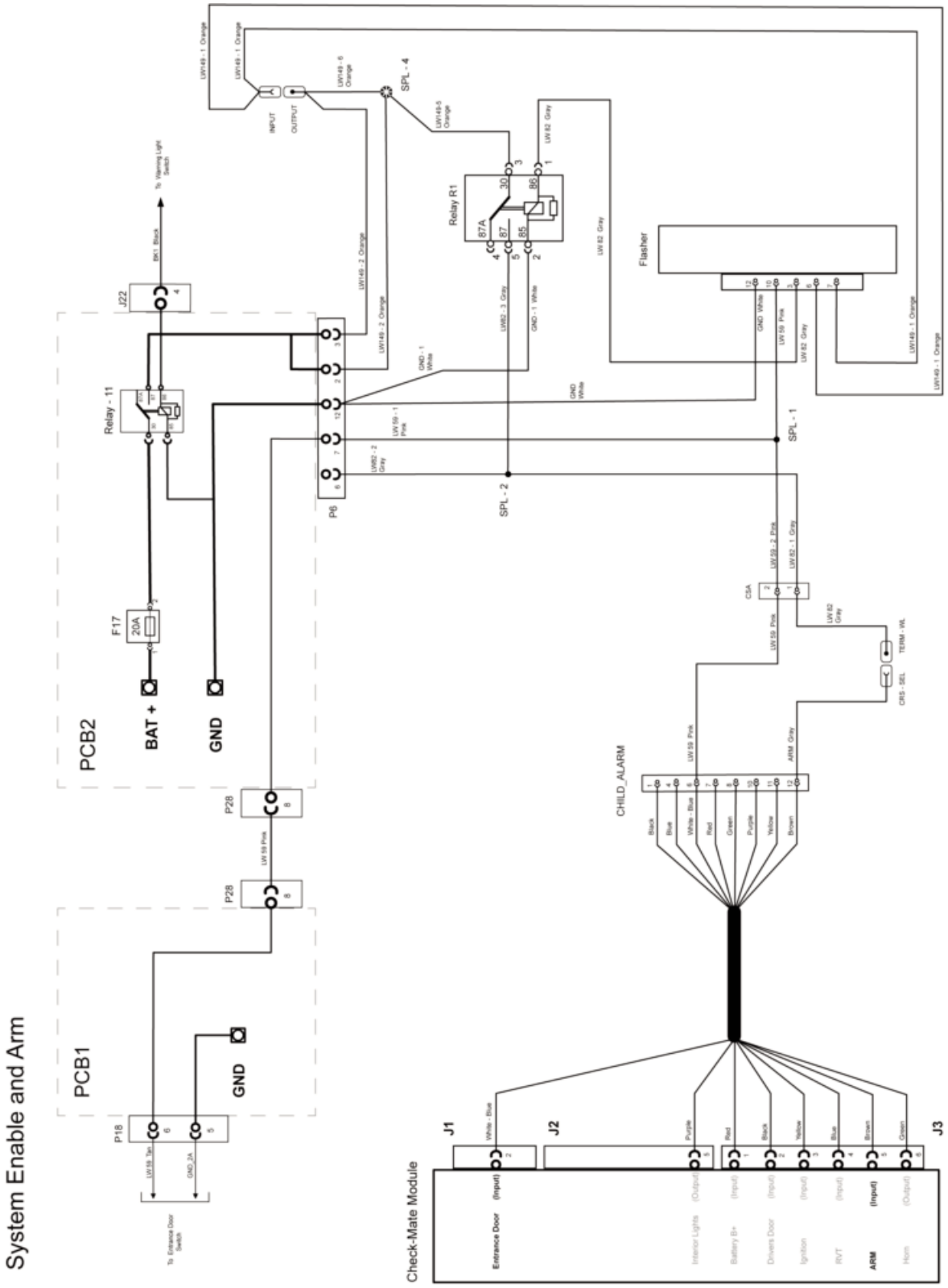
Electrical Schematics - Power and Ground



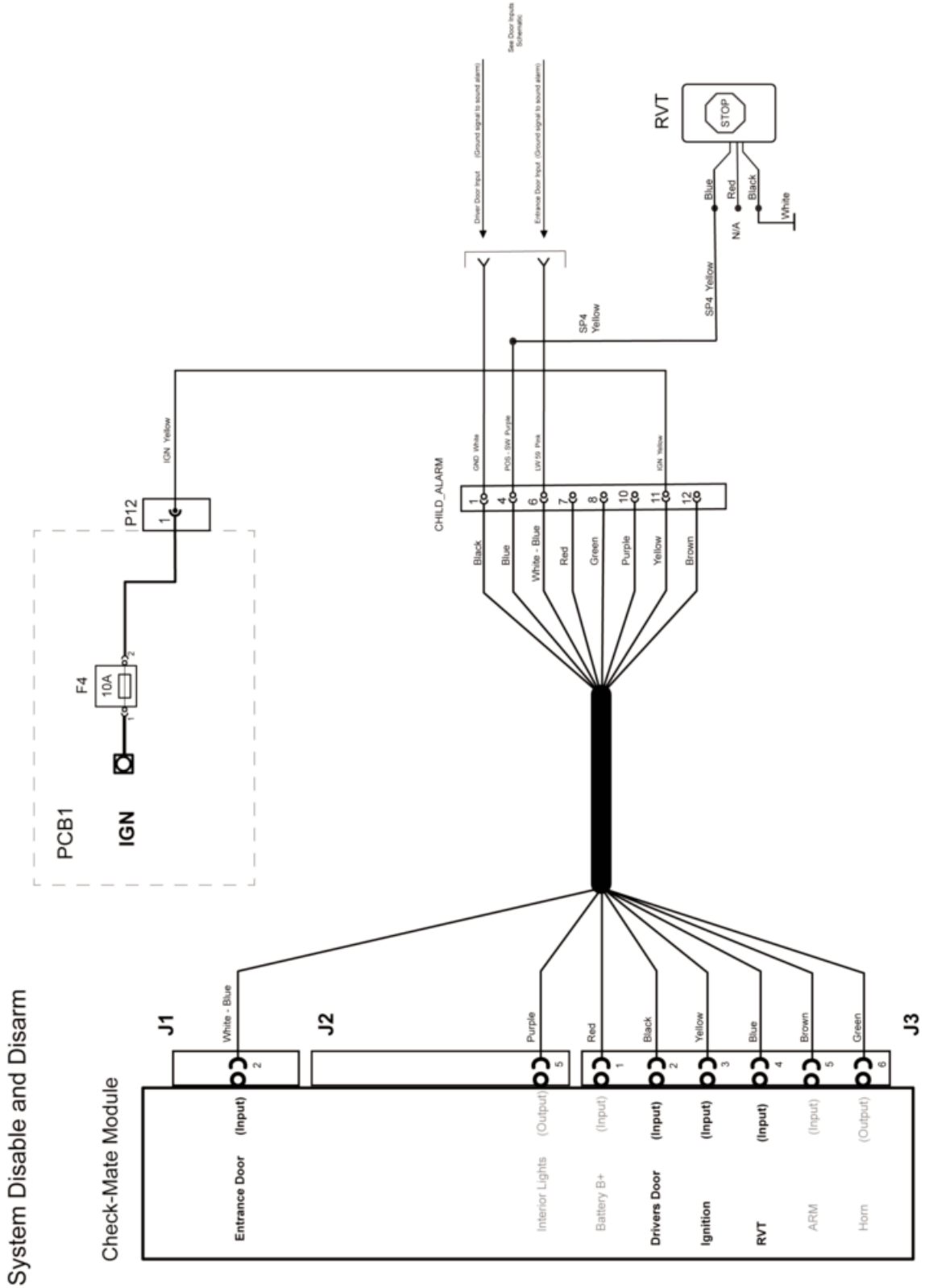
Electrical Schematics - Entrance and Driver Door Input



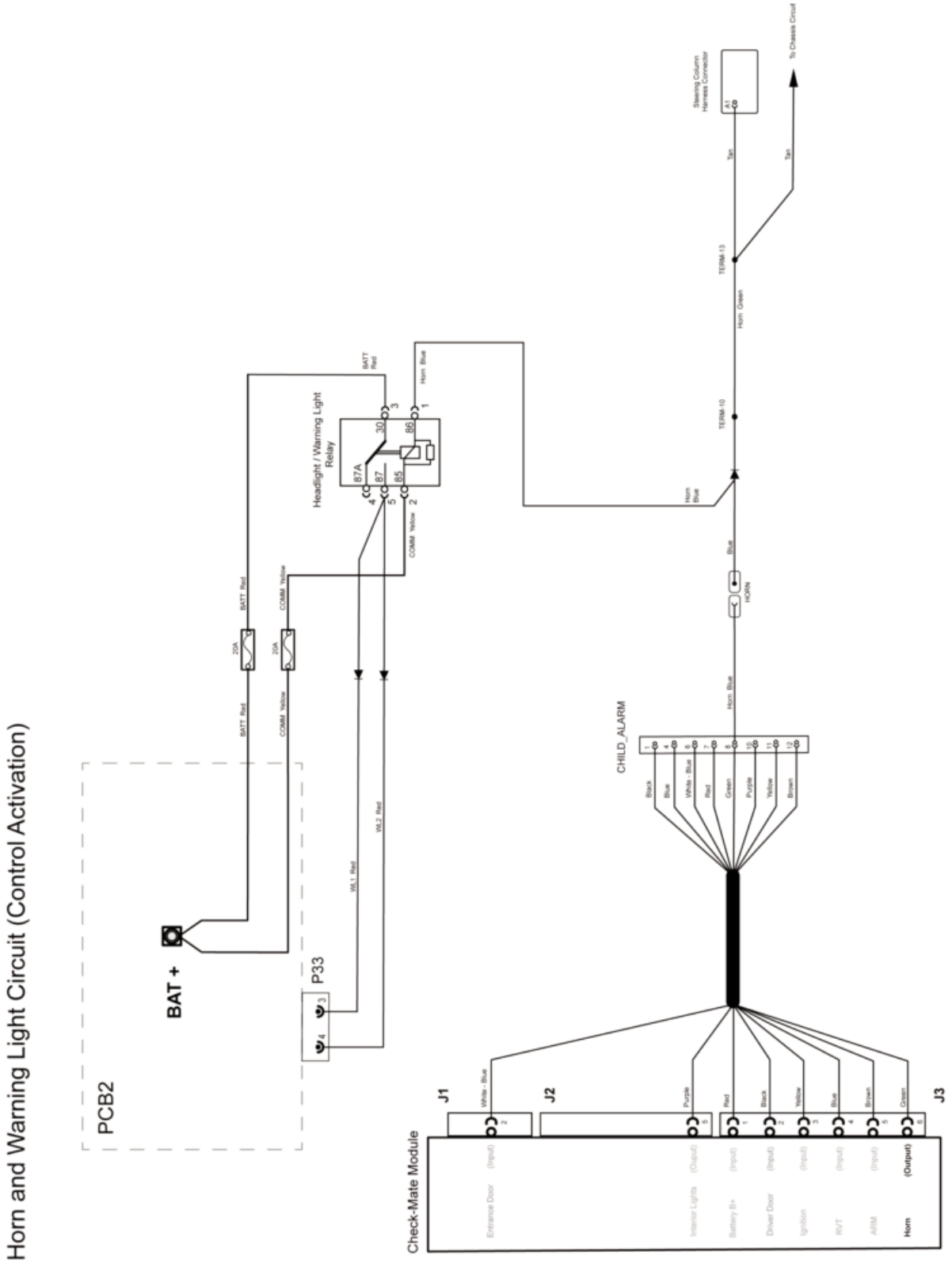
Electrical Schematics - System Enable and Arm



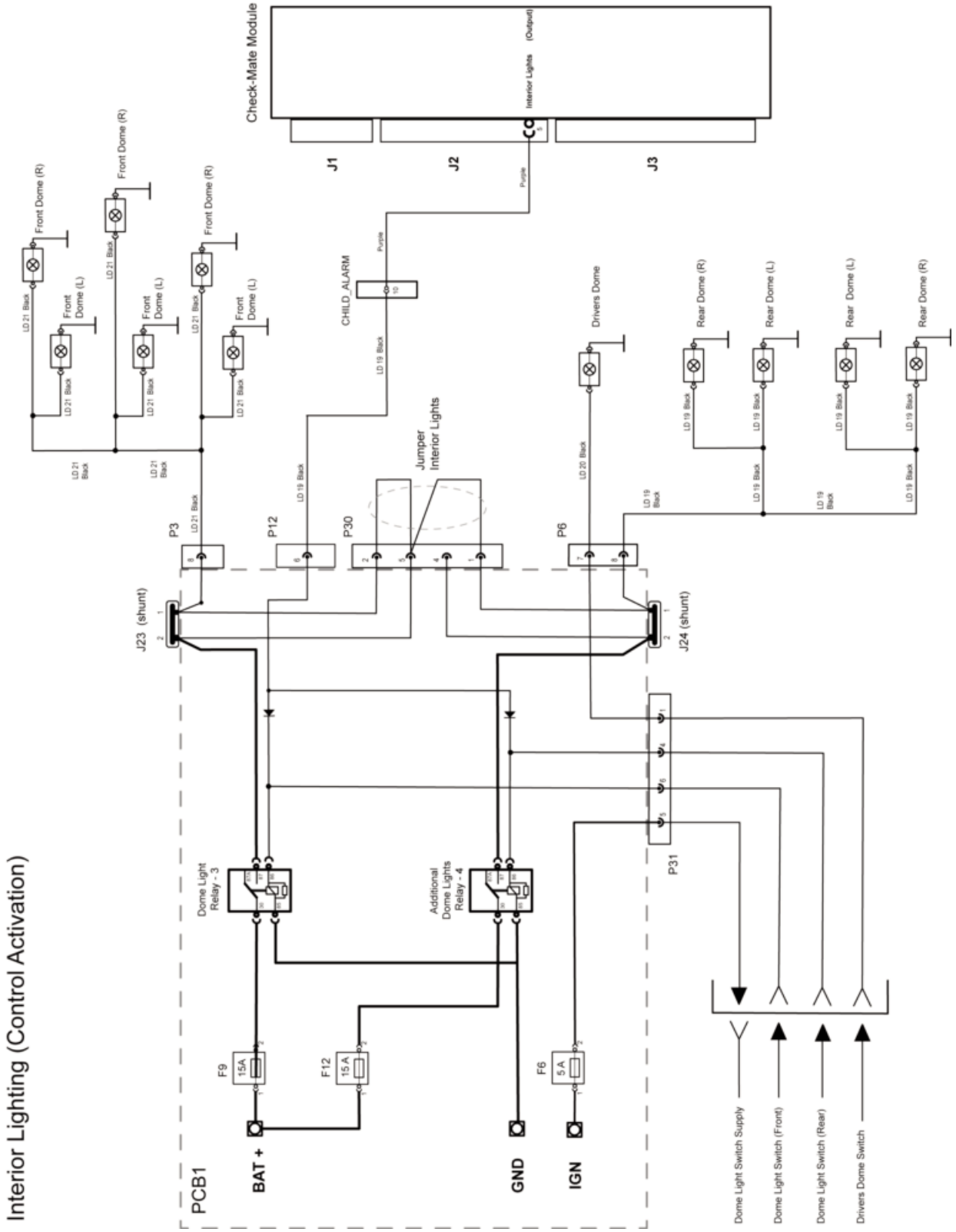
Electrical Schematics - System Disable and Disarm



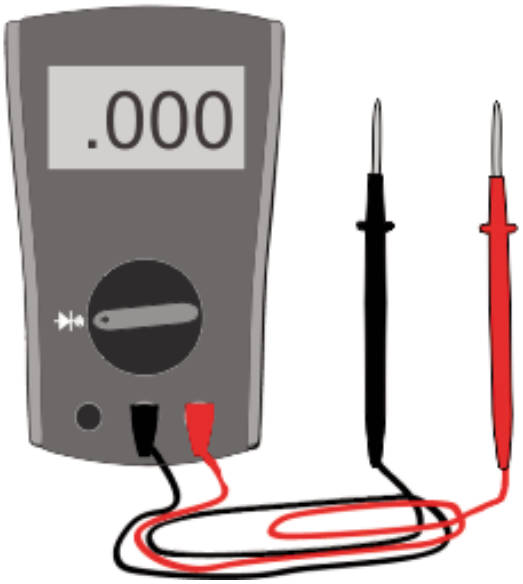
Electrical Schematics - Horn and Warning Light Circuit (Control Activation)



Electrical Schematics - Interior Lighting (Control Activation))



Special Tools



Digital Multimeter (DMM)

Symptoms

- System will not Disable or Disarm (page 5.15)
- System will not Enable or Arm (page 5.19)

The Passenger Advisory System can be checked directly via the 12pin connector (CHILD_ALARM) that joins the bus body harnessing to the module. The module is dependent on certain conditional input responses received from bus components to control the output alarm (horn) and lighting functions.

System Arming is enabled directly and indirectly from the following key components:

- Warning Light switch or Ignition signal
- Relay 11 (PCB2, fuse F17 (20A)
- Relay R1
- Safety Flasher
- Entrance door switch (door opened – switch closed)

System Disarming is accomplished by the following key components:

- Entrance door switch (door closed – switch open, no input to module)
- Driver's door switch (door closed – switch open, no input to module)
- RVT switch (button pressed – switch closed)

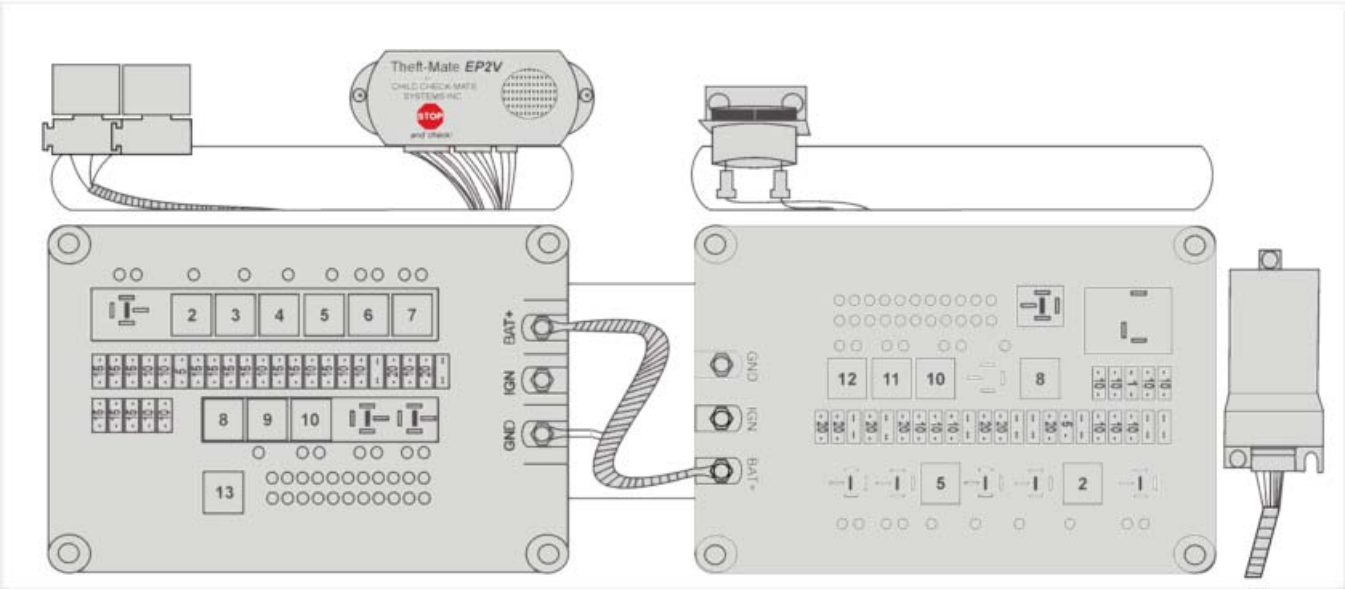
System Alarm is activated by either or both of the following key components:

- Entrance door switch (door opened – switch closed, ground input sent to module)
- Driver's door switch (door opened – switch closed, ground input sent to module)
- RVT switch (button not pressed – switch opened or button pressed out of sequence)

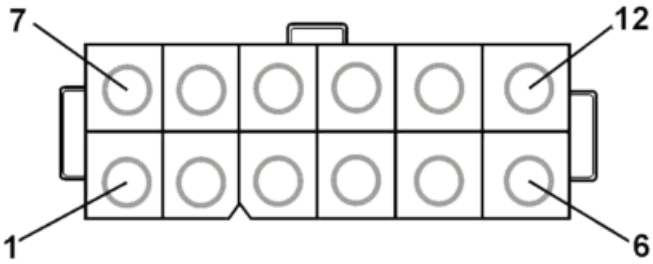
Note: Consult the manufacturer for more information.

System will not Disable or Disarm

Locate the **upper electrical center** located above the driver's seating area. Open access door and perform the following checks at the 12-pin connector (CHILD_ALARM) using a digital multimeter (DMM).



Upper Electrical Center

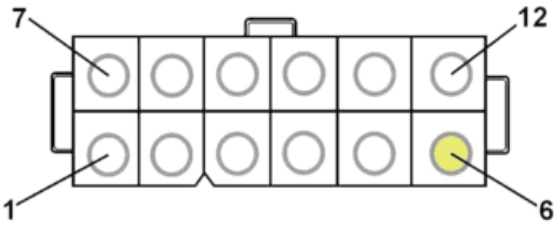


CHILD_ALARM 12-pin view

CHILD_ALARM Connector

The 12 pin CHILD_ALARM connector is a good reference point to begin troubleshooting the system. Once the harness connector is disconnected, you can begin measuring directly on the connector pin sockets. By disconnecting the harness, any additional internal values of the module are avoided during testing.

Basically, there are two input values to be measured: the entrance door and the driver's door. The door inputs should not be connected to ground after the ignition switch is turned off. If either door input is grounded, the alarm will sound until the ignition power is restored to the module or the battery runs down.



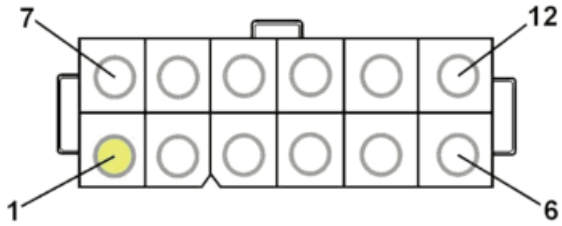
CHILD_ALARM 12-pin view, pin 6

1) Measuring Resistance Ohms (Ω) on entrance door switch circuit (electric or manual door)

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (open/closed)

CIRCUIT	FUNCTION	MEASURIE VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
LW 59 (pink) (CHILD_ALARM connector, pin 6)	Entrance door switch circuit (Door open)	LW59 pin 6 to a known ground	Approx. = 0 Ω	**OK** = Proceed to next step **NOK** = Open circuit on LW59 Check the following components: • Entrance door switch adjustment • Entrance door micro-switch See schematics for circuit information
LW 59 (pink) (CHILD_ALARM connector, pin 6)	Entrance door switch circuit (Door closed)	LW59 pin 6 to a known ground	Approx. = Open circuit	**OK** = Switch circuit is good, proceed to other input checks **NOK** = Approx. = 10 Ω or less. Circuit is shorted to ground. Check the following components: • Entrance door switch adjustment • Entrance door micro-switch See schematics for circuit information



CHILD_ALARM 12-pin view, pin 1

2) Measuring Resistance Ohms (Ω) on Driver's Door switch circuit

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Temporarily unplug connector P12 on PCB1 (a false reading will occur if connected during testing)
- Driver's door (open/closed)

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
GND (white) (CHILD_ALARM connector, pin 1)	Driver's door switch circuit (Door open)	GND pin 1 to a known ground	Approx. = 0 Ω	**OK** = Proceed to next step **NOK** = Open circuit on GND Check the following components: • Driver's door switch • Driver's door switch relay • Butt splice under dash connections See schematics for circuit information
GND (white) (CHILD_ALARM connector, pin 1)	Driver's door switch circuit (Door closed)	GND pin 1 to a known ground	Approx. = Open circuit	**OK** = Proceed to next step **NOK** = Approx. = 10 Ω or less Circuit is shorted to ground. Check the following components: • Driver's door switch • Driver's door switch relay • Butt splice under dash connections See schematics for circuit information

Note: Reconnect the P12 connector onto PCB1 after these checks have been made.

Note: If both door circuit measurements and switches check OK and the system will not disarm, contact the local Thomas dealer for more information.

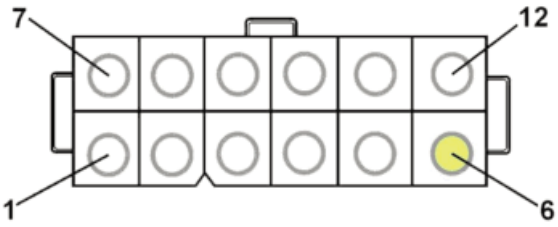
System will not Enable or Arm

The passenger advisory system requires input from two sources to enable and arm itself for an alarm event to occur. If the system will not arm itself or if no alarm occurs at any time regardless of bus operation or driver's actions, follow the troubleshooting guide as outlined below.

To Enable - A ground input signal must be received by the module coming from **pin 6** (LW59 pink) of the CHILD_ALARM connector to enable or activate the system. This signal originates from the entrance door switch.

To Arm - A voltage input signal must be received by the module coming from **pin 12** (ARM gray) of the CHILD_ALARM connector to arm the system. This voltage can come from two sources: Warning Lights activation or from Ignition and is optional depending on your build option.

When the voltage signal is received on pin 12 (of CHILD_ALARM connector) going to the module, the system is considered armed and will alarm if either door is opened after ignition is turned off or RVT button not pressed.



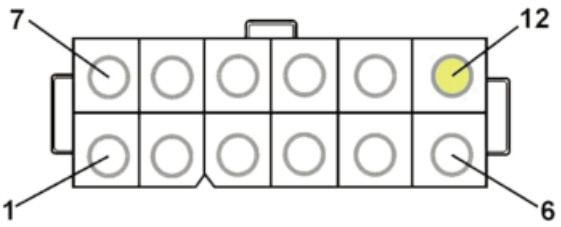
CHILD_ALARM 12-pin view, pin 6

1) Measuring Resistance Ohms (Ω) on entrance door switch circuit (electric or manual door)

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**open**)

CIRCUIT	FUNCTION	MEASURED VOLTAGE	EXPECTED RESULTS	CORRECTIVE ACTION
LW 59 (pink) (CHILD_ALARM connector, pin 6)	Entrance door switch circuit (Door open)	LW59 pin 6 to a known ground	Approx. = 0 Ω	**OK =** System should enable. Proceed to next check **NOK =** Open circuit on LW59 Check the following components and repair as required: • Circuit LW59 • Entrance door switch adjustment • Entrance door micro-switch See schematics for circuit information



CHILD_ALARM 12-pin view, pin 12

2) Measuring Voltage (Volts DC) on pin 12 of CHILD_ALARM connector:

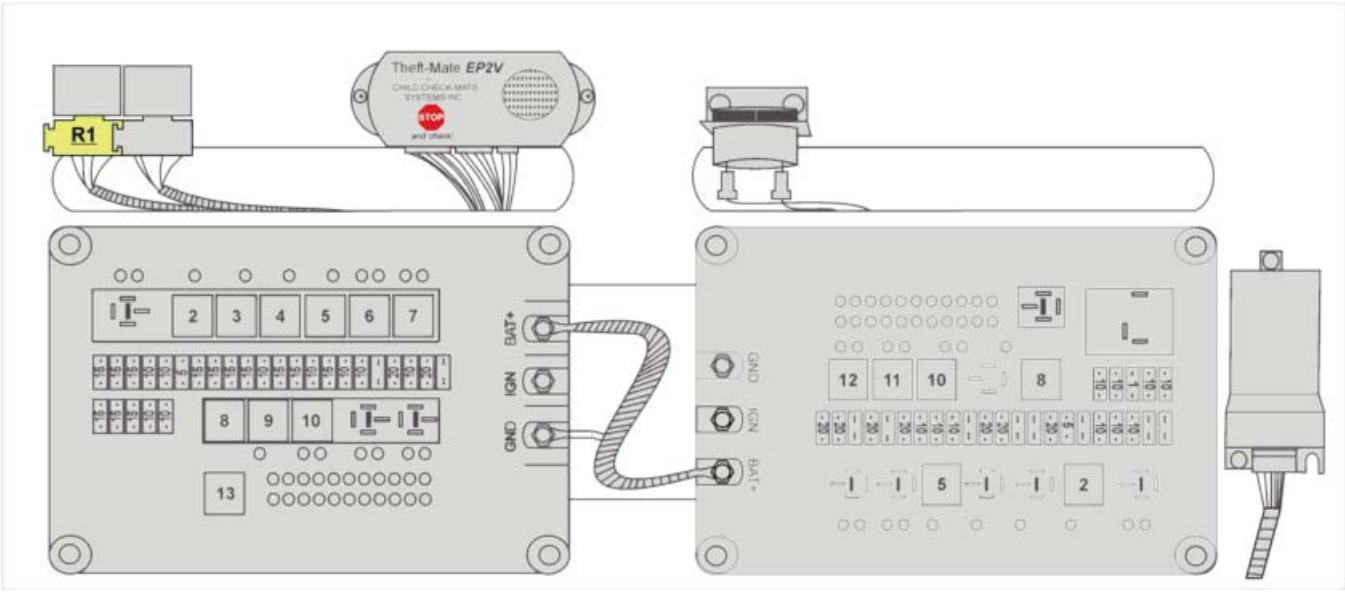
Conditions:

- Key **"ON"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**open**)
- Warning Lights "**ON"**

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
ARM (gray) (CHILD_ALARM connector, pin 12)	Supply voltage to arm system	Pin 12 to a known ground	Approx. = 12v	**OK =** System should arm itself. If system does not arm at this point, contact the local Thomas dealer for more instruction. **NOK =** Proceed to R1 relay checks

Component Checks

- **R1 Relay**
- **R11 Relay (PCB2)**
- **Safety Flasher**
- **Switch, Entrance Door (electric)**
- **Switch, Entrance Door (manual)**
- **Switch, Driver's Door**



Upper Electrical Center, R1 Relay

R1 Relay

1) Measuring Voltage (Volts DC) at R1 relay:

Conditions:

- Key **"ON"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**open**)
- Warning Lights **ON**

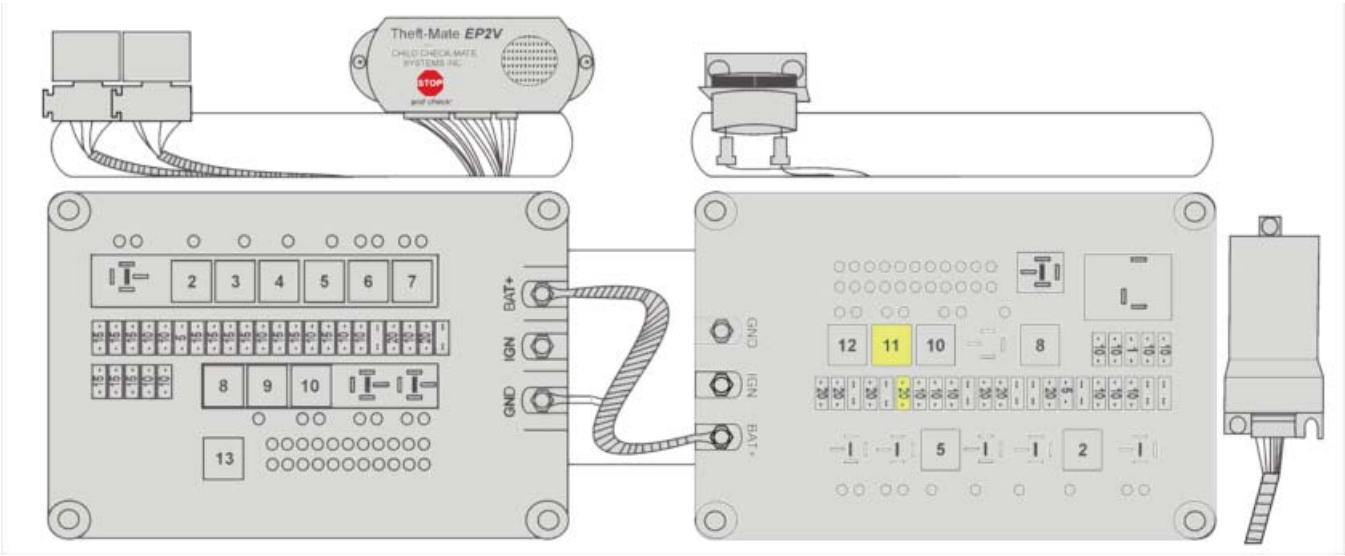
CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW149-5 (orange) R1 relay, pin 3 (30)	Relay Input Supply	LW149-5 (orange) to a known ground	Approx. = 12 v	**OK =** Proceed to next step **NOK** = Check voltage at PCB2_P6, pins 2 and 3 If voltage at PCB2 is OK repair circuit LW149-2 and/or LW149-5 as required
LW82 (gray) R1 relay, pin 1 (86)	Coil B+	LW82 (gray) to a known ground	Approx. = 12 v	**OK** = Proceed to next step **NOK** = Check voltage at Safety Flasher, pin 3 circuit LW 82 (gray). If voltage is present, locate open circuit on LW82 (gray) wire and repair as required. If no voltage present,proceed to Safety Flasher checks (possible faulty flasher)
LW82-3 (gray) R1 relay, pin 5 (87)	Relay Output Supply	LW82-1 (gray) to a known ground	Approx. = 12 v	**OK** = Proceed to step 2 below **NOK** = Check for ground on pin 2 (85) (See step 2 below) If ground circuit is OK, replace relay as required.

2) Measuring Resistance Ohms (Ω) at R1 relay:

Conditions:

- Key **"ON"**
- Park Brake **ON**
- Gear shift in **Park**
- Entrance door (**open**)

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
GND-1 (white) R1 relay, pin 2, (85)	Coil B-	GND-1 (white) to a known ground	Approx. = 10 Ω or less	**OK =** R1 relay should work. **NOK** = Check ground circuit coming from PCB2, P6_pin 12 to R1 relay. If circuit is OK and relay does not function, replace relay as required.



Upper Electrical Center, R11 Relay, Fuse 17

R11 Relay (PCB2)

1) Measuring Voltage (Volts DC) at R11 relay:

Conditions:

- Key **"ON"**
- Park Brake "**ON"**
- Gear shift in **Park**
- Entrance door (**open**)
- Warning Lights "**ON"**

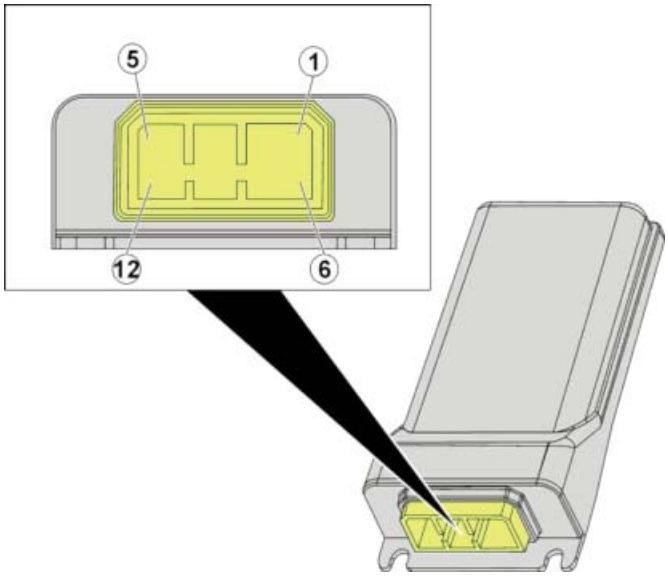
CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
R11 relay, pin 3 (30)	Relay Input Supply	Pin 3 to a known ground	Approx. = 12 v	**OK =** Proceed to next step **NOK** = Open fuse. Check Fuse F17 condition and size 20A (replace if required)
R11 relay, pin 1 (86)	Coil B+	Pin 1 to a known ground	Approx. = 12 v	**OK** = Proceed to next step **NOK** = Check voltage at Warning Light Switch on circuit BK1 If voltage present, repair circuit BK1 from switch to PCB2_J22, pin 4 circuit BK1 (black) as required. If no voltage present, check for faulty Warning Light switch. Replace as required.
R11 relay, pin 5 (87)	Relay Output Supply	Pin 5 to a known ground	Approx. = 12 v	**OK** = Proceed to next step **NOK** = Check for ground on pin 2 (85) (See step 2 below) If ground circuit is OK, replace relay

2) Measuring Resistance Ohms (Ω) at R11 relay:

Conditions:

- Key **"ON"**
- Park Brake "**ON"**
- Gear shift in **Park**
- Entrance door (**open**)

Circuit	Function	Measuring Points	Expected Results	Corrective Action
R11 relay, pin 2, (85)	Coil B-	Pin 2 to a known ground	Approx. = 10 Ω or less	**OK =** R11 relay should work **NOK** = Check ground circuit coming to PCB2. If ground circuit is good, contact the local Thomas dealer for more information. If circuit is OK and relay does not function, replace relay as required.



Safety Flasher

Safety Flasher

1) Measuring Voltage (Volts DC) at Safety Flasher:

Conditions:

- Key **"ON"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (open)

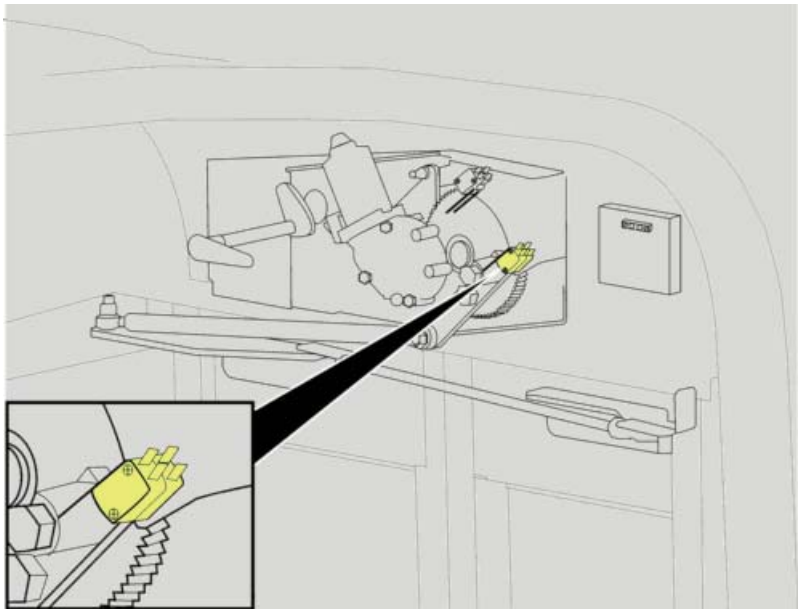
CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW149-1 (orange), pin 6	Flasher Input Supply	Pin 6 to a known ground	Approx. = 12 v	**OK =** Proceed to next step **NOK** = Check for battery voltage at PCB2_P6, pins 2 and 3 If voltage OK, check both circuits - LW149-2 from PCB2 to flasher and repair as required.
LW82 (gray), pin 3	Output Signal Supply to R1 relay	Pin 3 to a known ground	Approx. = 12 v	**OK** = Proceed to next step **NOK** = Ensure ground checks below are OK. If ground checks are OK, replace flasher.

2) Measuring Resistance Ohms (Ω) at Safety Flasher:

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**open**)

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
GND (white) pin 12	Flasher Ground	Pin 12 to a known ground	Approx. = 10 Ω or less	**OK =** Ground circuit is good. **NOK** = Safety Flasher should output on pin 3, LW82 circuit. If not replace flasher.
LW59 (pink) Pin 10	Ground input from entrance door	Pin 10 to a known ground	Approx. = 10 Ω or less	**OK** = Circuit to entrance door is good. **NOK** = Check circuit LW59 from Entrance Door to Flasher and repair as required If OK, flasher should output on pin 3, LW82 circuit, if not replace flasher.



Entrance Door Switch, Electric Door

Switch, Entrance Door (electric)

The micro-switch is located just above the entrance doors. A closing panel will need to be removed to access the switch for testing purposes.

1) Measuring Resistance Ohms (Ω) on Entrance Door micro-switch circuit:

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**closed**)

Note: It is recommended that the entrance doors be checked for proper closure and adjusted if necessary prior to testing. See Specifications page 5.5 for more information.

Note: Entrance door should be Closed completely.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW59 (tan) GND_2B (black)	Entrance door switch (signal to flasher and module)	Across contacts: Terminal to Terminal	Approx. = Open Circuit	**OK =** Proceed to step 2 below **NOK** = Check switch adjustment, see Specifications page 5.5 for more information If switch adjustment is OK and step 2 check.

2) Measuring Resistance Ohms (Ω) on Entrance Door micro-switch circuit

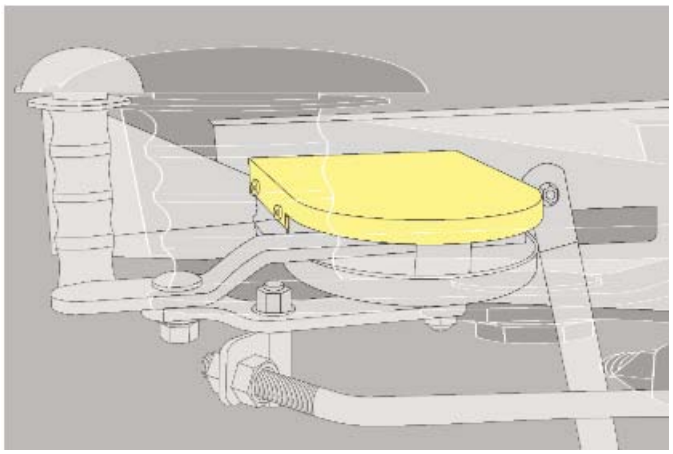
Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**opened**)

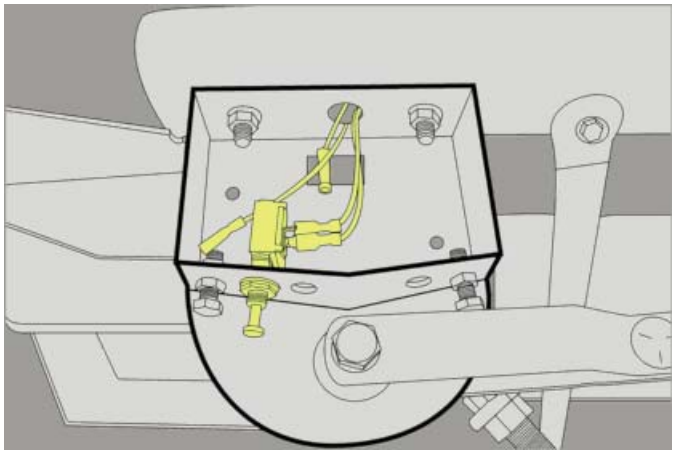
Note: It is recommended that the entrance door be checked for proper closure and adjusted if necessary prior to testing. See Specifications page 5.5 for more information.

Note: Entrance door should be Opened all the way.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW59 (Tan) GND_2B (black)	Entrance door switch (signal to flasher and module)	Across contacts: Terminal to Terminal	Approx. = 10 Ω or less	**OK =** Micro-switch is functioning **NOK** = If step 1 check is OK and switch adjustment is OK, then switch is faulty, replace switch.



Entrance Door Switch, Electric Door



Entrance Door Switch

Switch, Entrance Door (manual)

The plunger-style switch is located under the top cover plate within the pivot bracket mount. The top cover plate will need to be removed to access the switch for testing purposes.

1) Measuring Resistance Ohms (Ω) on Switch, Entrance Door

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**closed**)

Note: It is recommended that the entrance doors be checked for proper closure and adjusted if necessary prior to testing. See Specifications page 5.5 for more information.

Note: Entrance door should be Closed completely.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW59 (pink) – GND_2 (white)	Entrance door switch (signal to flasher and module)	Across contacts: Terminal to Terminal	Approx. = Open Circuit	**OK =** Proceed to step 2 below **NOK** = Check switch adjustment, see Specifications page for more information. If switch adjustment is OK and step 2 check seems OK, then switch is faulty, replace switch.

2) Measuring Resistance Ohms (Ω) on Switch, Entrance Door

Conditions:

- Key **"OFF"**
- Park Brake **"ON"**
- Gear shift in **Park**
- Entrance door (**opened**)

Note: It is recommended that the entrance door be checked for proper closure and adjusted if necessary prior to testing. See Specifications page 5.5 for more information.

Note: Entrance door should be Opened all the way.

CIRCUIT	FUNCTION	MEASURING POINTS	EXPECTED RESULTS	CORRECTIVE ACTION
LW59 (tan) GND_2B (black)	Entrance door switch (signal to flasher and module)	Across contacts: Terminal to Terminal	Approx. = 10 Ω or less	**OK =** switch is functioning OK **NOK** = If step 1 check is OK and switch adjustment is OK, then switch is faulty, replace switch.

The driver's door switch is an integrated switch located on the inside of the door. The switch can be accessed indirectly for the purposes of testing at the butt splice noted in the troubleshooting table below.

1) Measuring Resistance Ohms (Ω) on Switch, Driver's Door

Conditions:

- Key **"OFF"**
- Park Brake **ON**
- Gear shift in **Park**
- Driver's door (**closed**)

Note: Driver's door should be Closed completely.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
437W_D (green) Butt splice – (Door Open_B_1)	Door switch (ground signal to door relay and module)	Butt splice - (Door Open_B_1) to a known ground	Approx. = Open Circuit	**OK =** Proceed to step 2 below **NOK** = Check for faulty switch, replace if required. Contact the local Thomas dealer for more information.

2) Measuring Resistance Ohms (Ω) on Switch, Driver's Door

Conditions:

- Key **"OFF"**
- Park Brake **ON**
- Gear shift in **Park**
- Driver's door (**opened**)

Note: Driver's door should be Opened all the way.

Circuit	Function	Measuring Points	Expected Results	Corrective Action
437W_D (green) Butt splice – (Door Open_B_1)	Door switch (ground signal to door relay and module)	Butt splice - (Door Open_B_1) to a known ground	Approx. = 10 Ω or less	**OK =** Door switch is functioning OK **NOK** = Check for faulty switch, replace if required. Contact the local Thomas dealer for more information.

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