

BATTERY CONTROL CENTER - MINI GAS/DIESEL

SERVICE MANUAL



Part Number 00-00886-000/-100

Product Description

The Battery Control Center is a centralized power switching, fusing and distribution center. Power from the Main and the Auxiliary batteries is fed into the Battery Control Center. The full power of both batteries is available within the box. The system consists of two (2) Battery Disconnect Relays, a bi-directional battery charging circuit, an auxiliary start function to provide a "jump start" from the Auxiliary battery, ignition power switching, and an Accessory relay circuit.

CAUTION:

All servicing of the Battery Control Center should be done only by a qualified Service Technician. Inadvertent shorts inside the Battery Control Center could result in severe damage and/or injury.

TOOLS REQUIRED: Low current Test Light, Accurate Voltmeter, (digital read-out preferred).

TO REMOVE COVER: Gently lift the cover catches, located on each side of the box, and pull them outward and towards yourself. The cover may then be lowered to allow easy access to the fuses and circuitry.

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How The Battery Control Center Works

Battery Disconnect -

The Battery Disconnect relays are used to disconnect the batteries during periods of storage, or during service. The disconnect relays operate by momentarily applying 12 volts to the solenoid coil in either of two directions; +12 volts on the "S" terminal and ground on the "I" terminal for opening and (+12 volts on the "I" terminal and ground on the "S" terminal for engaging). The actuation voltage is supplied from the highest voltage of either the Auxiliary battery or Main battery. The voltage is supplied to the momentary switches mounted in the coach via fuse F28 for the chassis battery disconnect relay and fuse F29 for the coach battery disconnect relay and then fed back to the relays in the box. (See Battery Disconnect schematic, Figure 2). A unique feature of this version of the Battery Control Center is that the application of ignition voltage to J12, pin 11 causes both the chassis battery disconnect relay and coach battery disconnect relay to automatically latch "on". While ignition voltage is present at J12, pin 11, an "ignition lockout" circuit prevents the chassis battery from being disconnected.

Charging Circuit -

The charging circuit, (which utilizes an isolator solenoid to connect the two batteries together for charging) will charge both batteries if either battery is being charged. It operates by sensing the voltage on the Main and Auxiliary batteries. If either voltage goes above 13.3 volts (the minimum necessary to fully charge a battery) for more than 14 seconds, the isolator solenoid will pull in, charging both batteries. If, while the ignition is on, the voltage falls below 12 volts for more than 4 seconds, the isolator relay will open, keeping all of the alternator's output available for the chassis functions. If the ignition is off and the Auxiliary battery voltage should drop below 12.8 volts (voltage of a fully charged battery) for 4 seconds, the isolator relay will open, preventing the coach loads from discharging the main battery. (See Charging Circuit/Aux Start schematic, Figure 3).

Auxiliary Start -

The Auxiliary Start function is used to provide a "jump start" from the auxiliary battery in the event that the Main battery does not have sufficient charge to start the engine. It operates by momentarily connecting the Main and the Auxiliary batteries together through the isolator relay. This function is accomplished by pressing the dash mounted switch, connected between J12, pin 2 and J12, pin 10, which applies 12 volts to the isolator relay coil. The switch power is supplied by fuse F26. (See Charging Circuit/Aux Start schematic, Figure 3).

Ignition Switched Power -

The ignition circuits are switched by three relays, K1A, K1B, and K2B. The power for these relay coils comes from the ignition switch through J12, pin 11. (See Charging Circuit/Aux Start schematic, Figure 3). Each of the ignition relays is rated at 30 Amps, therefore the sum of the total continuous currents through relay K2B, which includes fuse F9 (J5, pin 5)+F10 (J5, pin 6), must not exceed 30 Amps. In like manner, the sum of the total continuous currents through relay K1A which includes fuse F11 (J5, pin 7)+F12 (J5, pin 8)+F13 (J6) must not exceed 30 Amps, and the sum of the total continuous currents through relay K1B which includes fuse F14 (J7)+F15 (J8)+F16 (J9) must not exceed 30 Amps.

Accessory Relay -

The accessory relay supplies 12 volt chassis battery power to accessory items. To operate the accessory relay, 12 volts from the chassis battery is fed to the accessory ignition switch on the column and is applied to the relay's coil, through J12, pin 12. The accessory power is switched by the relay and is routed through F17 to J12, pin 8 and through F18 to J12, pin 6 on the printed circuit board.

Circuit Breakers -

There are two 50 Amp circuit breakers, located near the front at the bottom of the box, that are used to protect the wiring between the Auxiliary battery and the converter. There is also a 30 Amp circuit breaker, located near the front at the bottom of the box, supplying chassis battery power. These breakers have manual reset buttons that pop out when they are tripped (See Figure 5)

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TROUBLE SHOOTING

The Battery Control Center is built in two layers, the printed circuit board and the relays. The box has been designed so that nearly ALL trouble shooting can be done without the removal of the printed circuit board. Read and understand the trouble shooting procedure first before EVER removing the printed board. The printed circuit board must be removed to repair the relays on the lower level.

Checking Fuses -

Once the outer box cover has been removed, ALL the fuses in the box are located on the printed circuit board and are easily visible for testing and replacement. The fuses can be checked either visually, or with a test light.

To check the fuses visually: Remove the suspected fuse using the fuse tool supplied in the box and examine for damage to the fusing element.

To check using a test light: Ground the test light to the test ground terminal, J17, provided on the board. (See printed circuit board illustration, Figure 1) **Note: This ground terminal should never be used for any other purpose.** Check for power on both sides of the fuse. If applicable, make sure Battery Disconnect Relays and accessory relays are on when checking fuses.

Checking the Battery Disconnects -

The Battery Disconnect relay terminals are available at test points on the printed circuit board, making it unnecessary to remove the board for testing. These test points are located near the left edge of the board and are labeled. Each "S" terminal is available through a 1/4" spade connector so that the test light can be clipped to it. There is a ground terminal at the bottom of the group that can be used for a test light ground.

To engage a relay, momentarily apply +12 volts to the "I" terminal, TP1 or TP2, and the "S" terminal, J19 or J21, is grounded. To open the relay, momentarily apply +12 volts to the "S" terminal and the "I" terminal is grounded.

Isolator Relay -

A push button to test the isolator relay is provided on the board to manually actuate the relay. It is located near the upper right corner of the board and labeled "AUX START". (See Figure 1) The coach must be unplugged and the engine and generator need to be off for at least ten minutes, to allow the isolator electronics to turn off the relay drive. Pressing this button should close the isolator relay, which can be detected by the clicking sound of the relay.

Circuit Breakers

The two 50 Amp converter circuit breakers, which are in parallel, carry the current between the Auxiliary battery and the converter. If the coach is not being supplied 120 volts AC, the current is flowing from the battery to the converter. If the coach is being supplied 120 volts AC, the converter is usually charging the batteries and the current will flow from the converter to the batteries. If there is a fault or overload between the converter and the batteries, the circuit breakers will open as indicated by the reset buttons being popped out. The 30 Amp chassis breaker carries the current between the chassis battery and associated loads. To reset the breakers push the buttons in until they latch.

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PRINTED CIRCUIT BOARD REMOVAL

In the event that the printed circuit board needs to be removed, the following procedure should be followed.

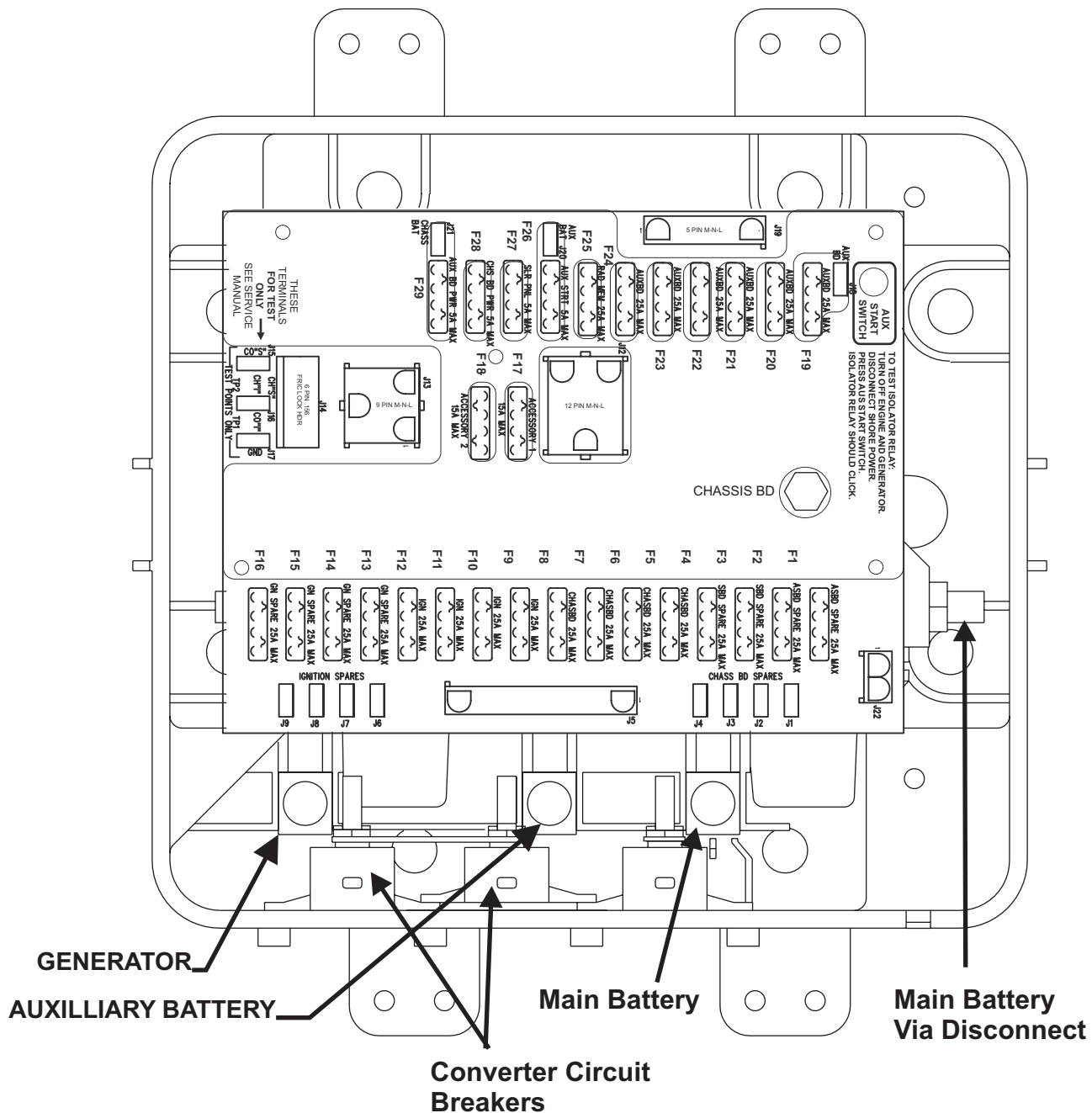
- 1) Remove the negative wires from both batteries to prevent injury to individuals and the equipment. Be sure that these wires stay clear of the battery posts. Remove power to the converter.
- 2) Remove the cover of the Battery Control Center to expose the board.
- 3) Pull chassis harness plugs from connectors, J12, J14, J19, and J5.
- 4) Note the locations of wires connected to quick-disconnect connectors, J1 through J4, and J6 through J9, located along the lower edge of the board next to J5. It is best to write down the wire positions and colors so that they can be re-connected correctly.
- 5) Pull relay harness plug from J13.
- 6) Note the locations of wires connected to output Faston connectors, J18, J20, and J21, located along the upper edge of the board. It is best to write down the wire positions and colors so that these wires can be re-connected correctly.
- 7) Remove the 1/4" hex head bolt located near the center-right side of the board.
- 8) Remove the four #8 hex head screws located in the four corners of the board.
- 9) Remove the board.

PRINTED CIRCUIT BOARD REPLACEMENT

Replace the board in the reverse order from the removal. Be sure to tighten the 1/4" hex head bolt going through the board, for it provides the power connection to the battery feed. Apply 30 in-lbs (+/- 5 in-lbs) of torque to this bolt to guarantee a tight connection. Failure to properly tighten this bolt will lead to failure.

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Pictorial View
Figure 1

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TROUBLE SHOOTING - Battery Disconnect

A. Both relays fail to operate.

1. Batteries may be dead. Check for voltage at the top end of F28 and F29 which are fed from the higher of either the auxiliary or main battery. (F28 and F29 are located at the top left center of the printed circuit board). The voltage on F28 and F29 should be at least 11 volts. If the voltage is less, charge either battery. If the voltage is more than 11 volts, continue.
2. F28 or F29 may be blown. Check for voltage at both tabs on F28 and F29 using a test light. The voltage should be the same on both ends. Replace the fuse, if the voltage is not the same.
3. Ground lead to switches may be open. Check for ground and 12 volts on the "I" and "S" test points on the printed circuit board of the Disconnect Relay, while an assistant presses the Battery Disconnect switch in the coach.

B. One relay fails to operate.

1. Wiring or switch may be faulty. To check the operation, have an assistant operate the Battery Disconnect switch inside the coach. Check for voltage on the "I" and ground on the "S" terminal at the test points on the printed circuit board.
2. Disconnect Relay may be faulty. If at least 11 volts is available on the "I" or "S" terminal and the relay fails to operate, replace the relay.

C. Main battery relay fails to operate.

1. Ignition may be on. Check to be certain that the switched-ignition is 0 volts.
2. Interlock relay may be faulty. Check for 12 volt power feeding switch at plug J13 pin 8.
3. There may not be 12 volt power to the switch. If there is not 12 volts check fuse F28.

D. Coach functions operate when coach is plugged in, but not from the battery.

1. Circuit breakers feeding converter may be open. Reset circuit breakers in box.

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TROUBLE SHOOTING - Charging Circuit

A. Auxiliary battery does not charge.

1. The isolator relay may not be closing. Operate the engine at a high idle for at least twenty (20) seconds and check the chassis battery voltage. The voltage must be at least 13.3 volts before the isolator activates. Check the alternator, if the voltage is less than 13.3 volts.

Check for voltage on the coil terminal of the isolator relay. This voltage is available on J14 pin 5. If there is **no** voltage on the coil, replace the printed board. If there is voltage on the coil, check for voltage between the main and auxiliary batteries. If the voltage is more than 0.1 volts replace the relay.

B. Main battery continues to drain.

1. Isolator relay may be bad. Check for voltage on the solenoid coil lead which is available on J14 pin 5, when the engine is off. If there is no voltage, replace the relay.

C. Main battery doesn't charge from converter.

1. The converter is not putting out at least 13.3 volts. Check the converter and turn off excess 12 volt loads if necessary.
2. Converter circuit breakers in Battery Control Center open. Manually reset the breakers located on lower edge of box.

Auxiliary Start

A. Auxiliary Start fails to operate.

1. Fuse 26 may be blown. Check F26.
2. The Auxiliary battery may be dead. Charge battery.
3. Isolator relay may be defective. To test the relay, press the "AUX START" switch on printed circuit board while measuring the voltage between the two batteries. (The isolator relay should "click" indicating that it is closing.) If the voltage is more than 0.1 volt, replace the relay.
4. Switch or wires may be faulty. Check for +12 volts or greater at J12 pin 10, while pushing switch. If voltage is not present, check wiring, if OK, replace the switch.

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TROUBLE SHOOTING

Ignition Relay

A. All of the spare ignition outputs fail to operate.

1. Check for 12 volt ignition power coming into printed circuit board on plug J12, pin 11.
2. Check respective fuse.
3. Check for faulty wiring from the ignition switch.
4. Replace the printed circuit board.

Accessory Relay

A. Accessory Loads fail to operate.

1. Ignition accessory switch is not on.
2. No 12 volt power on **Acc. 1** (J12, pin 9) or **Acc. 2** (J12, pin 6) outputs. Check fuses F17 (Acc. 1) or F18 (Acc. 2).
3. No power from the ignition accessory switch. Check for voltage at J12, pin 12.
4. Accessory relay has failed. Replace printed circuit board.

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FUSES

The fuses used on the Battery Control Center are standard, plastic "ATO", blade (automotive) type. There are 29 positions for fuses on the board. These are fed from five main sources, the Disconnect-Switched Main Battery, Disconnect Switched/Ignition-Switched Main Battery, Disconnect-Switched Auxiliary Battery and the Auxiliary Battery.

The 23 fuses and their size are as follows:

<u>Disconnect-Switched Main Battery</u>		<u>GAS</u> <u>-000</u>	<u>DIESEL</u> <u>-100</u>	<u>Connector</u> <u>Pin-Out</u>
Spare	F1	25 Amp	25 Amp	J1
Spare	F2	25 Amp	25 Amp	J2
Spare	F3	25 Amp	N/I	J3
Spare	F4	25 Amp	N/I	J4
Spare	F5	20 Amp	20 Amp	J5-1
Spare	F6	5 Amp	3 Amp	J5-2
Spare	F7	3 Amp	3 Amp	J5-3
Spare	F8	15 Amp	3 Amp	J5-4

Disconnect Switched / Ignition-Switched Main Battery

Spare	F9	15 Amp	15 Amp	J5-5
Spare	F10	20 Amp	3 Amp	J5-6
Spare	F11	15 Amp	20 Amp	J5-7
Spare	F12	20 Amp	15 Amp	J5-8
Spare	F13	20 Amp	10 Amp	J6
Spare	F14	20 Amp	15 Amp	J7
Spare	F15	20 Amp	N/I	J8
Spare	F16	20 Amp	N/I	J9

NOTE: Each of the ignition relays is rated at 30 Amps, therefore care must be exercised when substituting fuses or adding additional loads. The sum of the total continuous currents through relay K2, which includes fuse F6 (J5, pin 4)+F8 (J5, pin 6), must not exceed 30 Amps. In like manner, the sum of the total continuous currents through relay K1A which includes fuse F9 (J5, pin 7)+F10 (J5, pin 8)+F11 (J11) must not exceed 30 Amps, and the sum of the total continuous currents through relay K1B which includes fuse F12 (J12)+F22 (J17)+F23 (J18) must not exceed 30 Amps.

Disconnect Switched / Accessory-Switched Main Battery

Spare	F17	15 Amp	15 Amp	J12-9
Spare	F18	15 Amp	15 Amp	J12-6

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FUSES (CONT'D)

<u>Disconnect-Switched Auxiliary Battery</u>		<u>GAS</u> <u>-000</u>	<u>DIESEL</u> <u>-100</u>	<u>Connector</u> <u>Pin-Out</u>
Spare	F19	15 Amp	20 Amp	J19-5
Spare	F20	15 Amp	15 Amp	J19-4
Spare	F21	15 Amp	15 Amp	J19-3
Spare	F22	15 Amp	3 Amp	J19-2
LP Det	F23	5 Amp	3 Amp	J12-4
Spare	F24	20 Amp	10 Amp	J12-1
 <u>Auxiliary Battery</u>				
Radio Memory	F25	15 Amp	20 Amp	J19-1
Aux Start Switch	F26	5 Amp	3 Amp	J12-2
Solar Panel	F27	5 Amp	3 Amp	J12-3
 <u>Battery Disconnect</u>				
Chassis BD Relay Power	F28	5 Amp	5 Amp	J13-8
Auxiliary BD Relay Power	F29	5 Amp	5 Amp	J13-7

CIRCUIT BREAKERS

There are two 50 Amp, and one 30 Amp type III (manual reset) circuit breakers mounted in the box. The 50 Amp Circuit Breakers are connected in parallel to the Auxiliary battery through the Disconnect relay. The 30 Amp chassis breaker carries the current between the chassis battery and associated loads and is connected to the Main (Chassis) battery through the Disconnect relay. These circuit breakers are located at the bottom of the box, near the front edge. To reset the breakers, press the buttons on the ends.

PLUGS, PINS, & FUNCTIONS

<u>.250 Quick-Disconnects</u>	<u>Function</u>	<u>Fuse</u>
J1	Spare Chassis BD	F1
J2	Spare Chassis BD	F2
J3	Spare Chassis BD	F3
J4	Spare Chassis BD	F4
J6	Spare Ignition	F13
J7	Spare Ignition	F14
J8	Spare Ignition	F15
J9	Spare Ignition	F16
J15	Aux BD "S" Test	
J16	Main BD "S" Test	
J17	Ground Test	
J18	Aux BD IN	
J20	Aux Bat IN	
J21	Main Bat IN	

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PLUGS - PINS & FUNCTIONS (Cont'd)

J5 - 8 pin Mate-N-Lok Mating Housing AMP 640586-1

Pin	Function	Fuse
1	Spare Main BD	F5
2	Spare Main BD	F6
3	Spare Main BD	F7
4	Spare Main BD	F8
5	Spare Ignition	F9
6	Spare Ignition	F10
7	Spare Ignition	F11
8	Spare Ignition	F12

J12 - 12 pin Mate-N-Lok Mating Housing AMP 1-480708-0

Pin	Function	Fuse
1	Spare Aux. BD	F24
2	Aux Start Switch	F26
3	Solar Panel	F27
4	L. P. Det. (Aux.)	F23
5	NC	
6	Accessory 2	F18
7	Ground	
8	NC	
9	Accessory 1	F17
10	Aux Start Relay Coil	
11	Ignition Relay Coil	
12	Accessory Relay Coil	

J13 - 9 pin Mate-N-Lok Mating Housing Amp 1-480706-0

Pin	Function	Fuse
1	Main BD "I" terminal	
2	Main BD "S" terminal	
3	Auxiliary BD "S" terminal	
4	NC	
5	NC	
6	Auxiliary BD "I" terminal	
7	Auxiliary BD power, (Aux. Bat.)	F29
8	Main BD power, (Main Bat.)	F28
9	BD Relay ground	

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PLUGS - PINS & FUNCTIONS (Cont'd)

J14 - 8 pin in-line (KK-156)

Pin	Function
1	Main BD "I" terminal
2	Main BD "S" terminal
3	Auxiliary BD "S" terminal
4	Auxiliary BD "I" terminal
5	Isolator Relay "HOT" terminal
6	Isolator Relay GROUND terminal

J19 - 5 pin in-line Mate-N-Lok Mating Housing AMP 1-480763-0

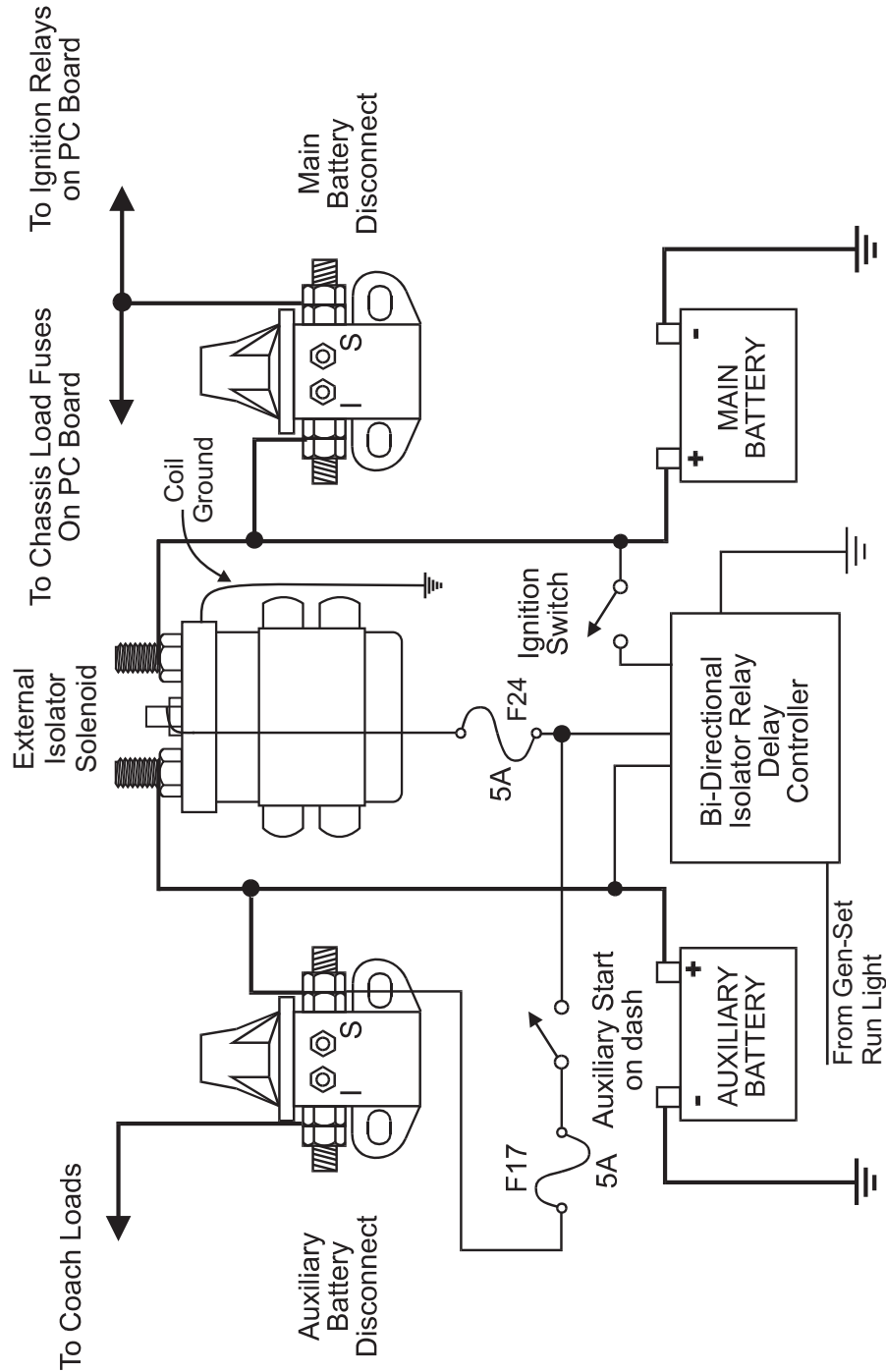
Pin	Function	Fuse
1	Radio Memory Feed	F25
2	Spare Aux. BD	F22
3	Spare Aux. BD	F21
4	Spare Aux. BD	F20
5	Spare Aux. BD	F19

J22 - 2 pin Mate-N-Lok Mating Housing AMP 1-480698-0

Pin	Function	Fuse
1	Isolator Relay Coil Power	
2	Isolator Relay Coil Ground	

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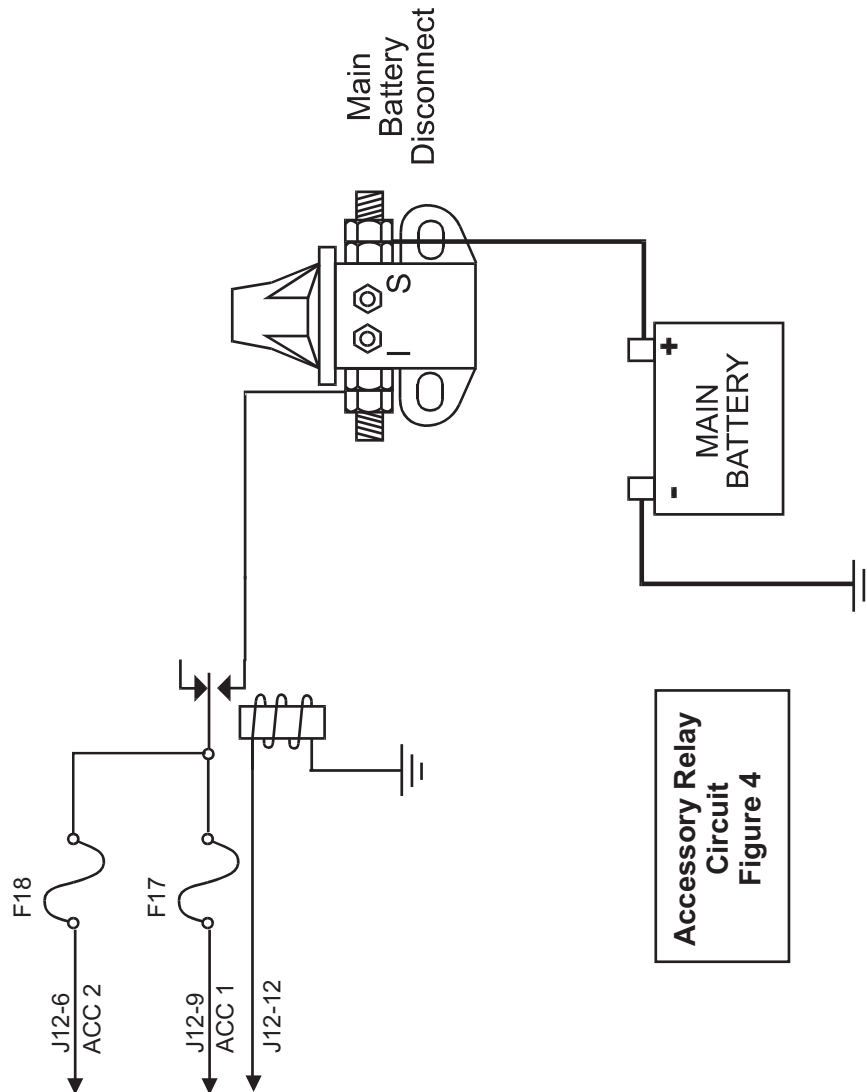
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Charging/Auxiliary
Start System
Figure 3

BATTERY CONTROL CENTER - MINI GAS/DIESEL

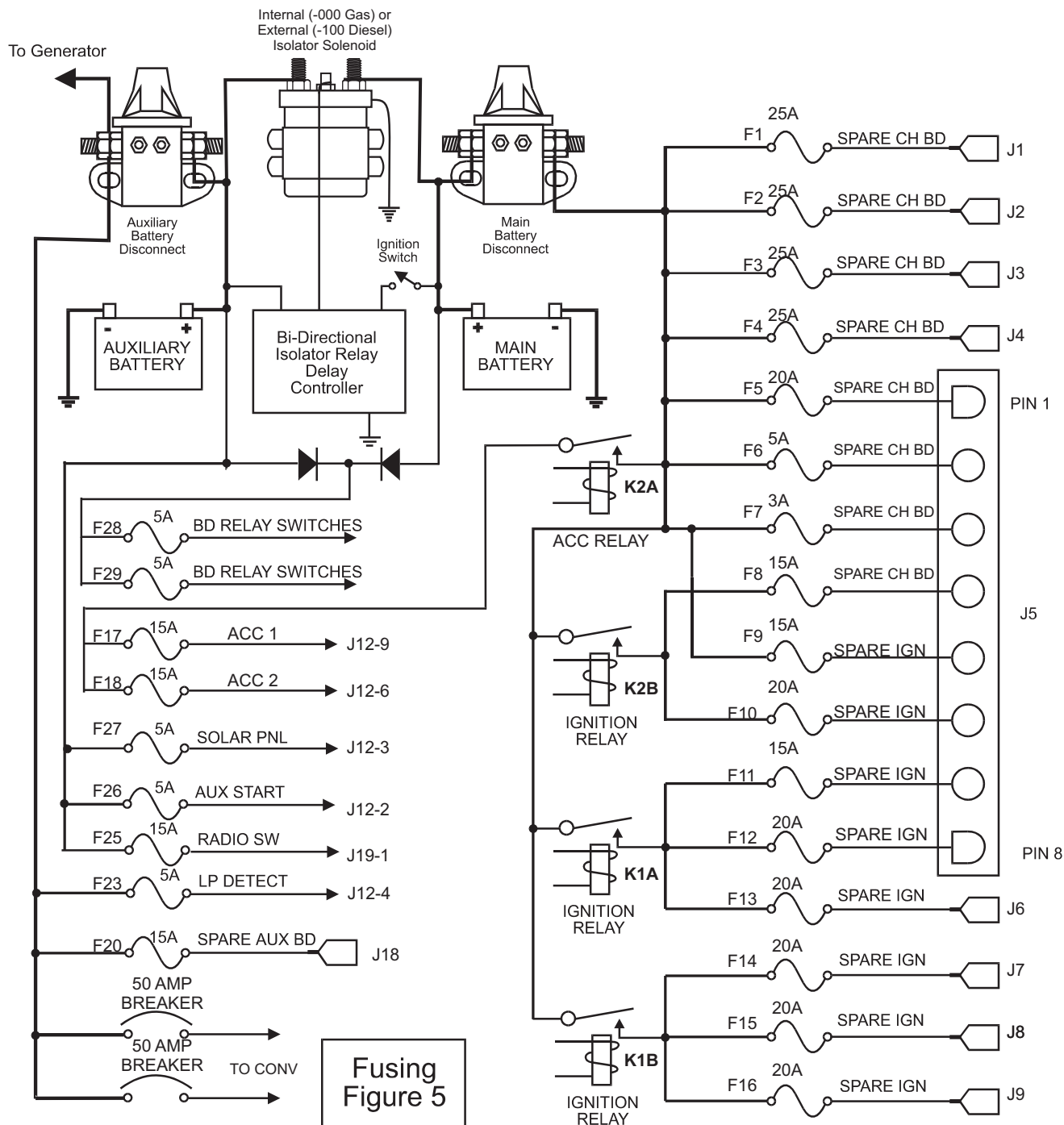
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