SERVICE REPAIR

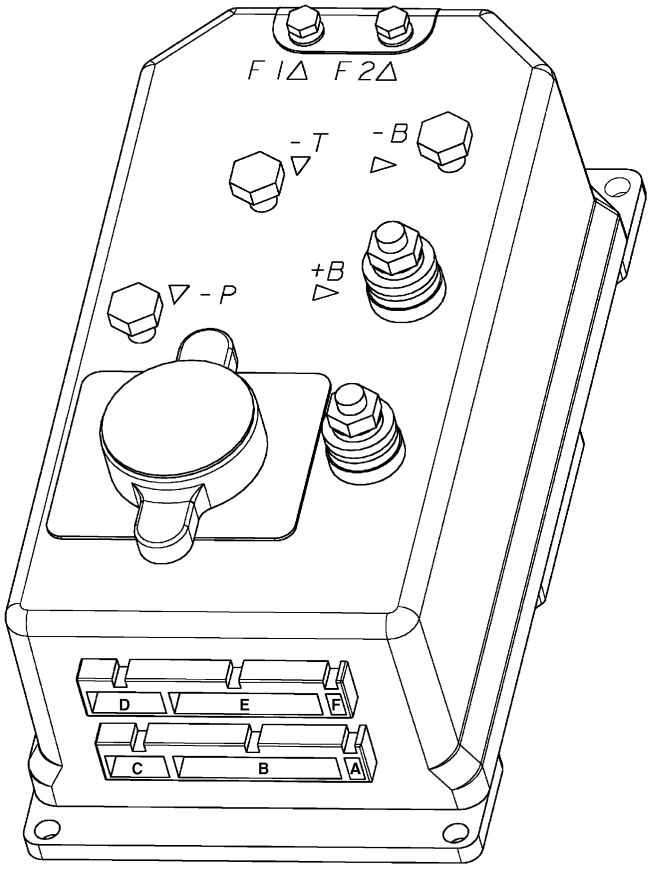
MANUAL

Hyster A495 (W20ZA W25ZA) Forklift

HYSTER

ZAPI™ CONTROLLERS

W20-25ZA [A495];
W25-30ZA$_2$ [B495];
W30-40ZA [B453];
W20-30ZR [B455];
W25-30-40ZC [B454]



HYSTER

PART NO. 1537482

2200 SRM 1064

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Hyster® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the WARNING symbol and word are on orange background. The CAUTION symbol and word are on yellow background.

TABLE OF CONTENTS

This section is for the following models:

(W20-25ZA) [A495];
(W25-30ZA2) [B495];
(W30-40ZA) [B453];
(W20-30ZR) [B455];
(W25-30-40ZC) [B454]

General

This section describes the ZAPI™ transistor motor controller. Procedures are outlined for controller safety, adjustments, troubleshooting, and repairs. See Figure 1.

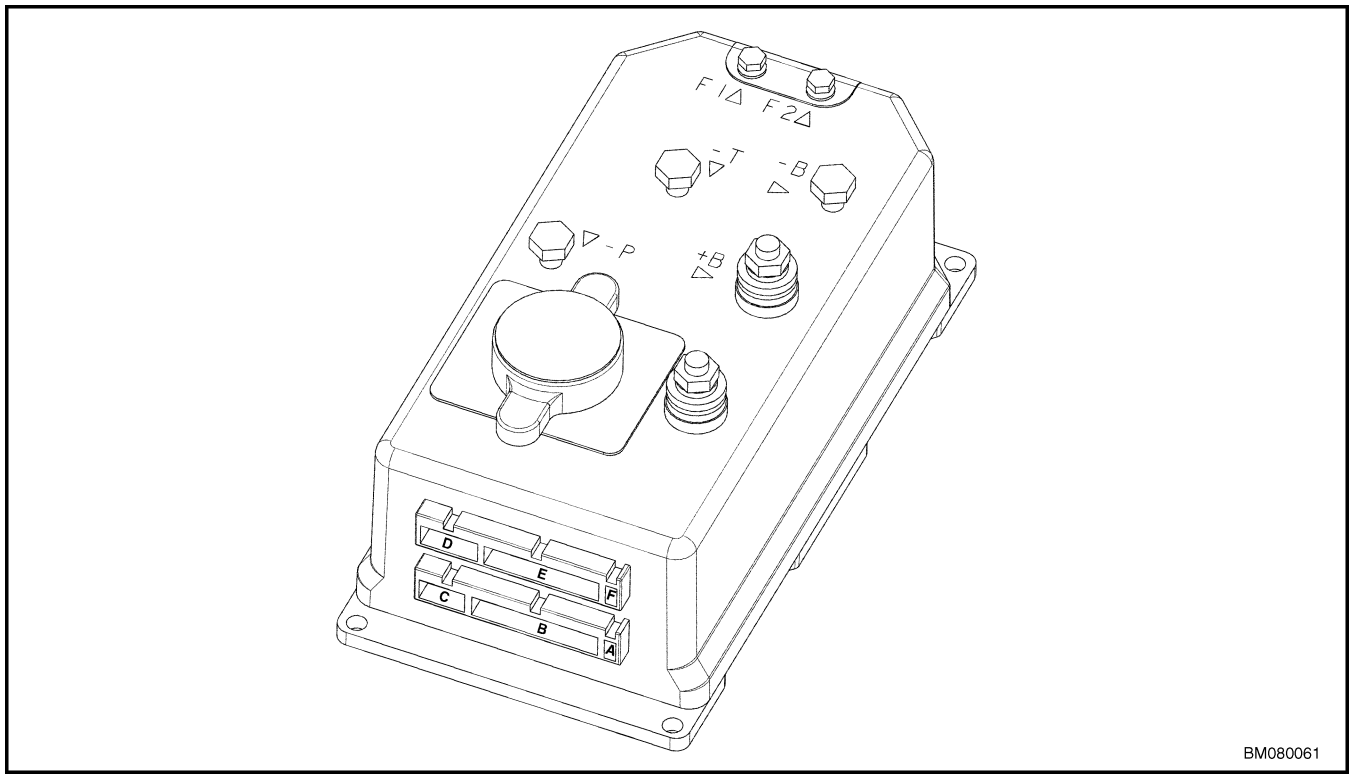


Figure 1. Controller

Description

ZAPI™ TRANSISTOR MOTOR CONTROLLER

The ZAPI™ controller is a solid-state DC motor controller utilizing SEM technology. It controls the traction motor, brake, and hydraulic system. The controller receives inputs from the control handle by serial communication, and direct inputs from the key switch and control handle arm position switch. The controller directly controls the traction motor, lift pump motor, lift valve, proportional lowering valve, brake, and main contactor. Additional hydraulic functions, such as reach, sideshift, and tilt are controlled through an auxiliary relay board mounted to the front of the controller. Jumpers are used to configure the basic controller and the controller with auxiliary relay board for different truck models.

The controller software provides self diagnostics which are accessed by means of a ZAPI™ handset or a PC with specialized ZAPI™ software. The controller software features a Test Menu for monitoring controller inputs and outputs, a Diagnostic Menu for viewing fault code information, and a Programming Menu for customizing the truck performance. The handset or PC connect to the controller through a cable with a six pin connector which attaches to the 10 pin "D" connector port on the bottom of the controller. The connector is installed centered in the "D" port leaving two pins on each end of the "D" port vacant. The connector retainer clip will align and secure the connector in position.

The self diagnostics monitor the traction motor, brake coil, lowering valve coil, contactor coil, control handle serial communications, controller temperature, and internal logic functions. The controllers on standard trucks come equipped with a red LED fault indicator located at the bottom of the controller. In the event of a fault, the LED flashes a numeric code.

NOTE: The dash indicator will display the code: EP 107 (or a higher number) for 1 to 2 seconds every time the key switch is turned to the ON position. The ZAPI handset similarly displays V1.07 (or higher). This code represents the EEPROM software version and DOES NOT INDICATE A FAULT CODE.

Troubleshoot the fault using a ZAPI™ handset or a properly configured IBM compatible PC. On trucks equipped with the optional dash display, the dash wiring harness plugs into the controller in place of the LED. The display also has a red LED, however, it does not flash codes. If a fault occurs, the red LED blinks, the wrench LCD is shown, and "AL" followed by the fault number is displayed.

PRINCIPLES OF OPERATION

The ZAPI™ transistor motor controller uses a sophisticated microprocessor to control the logic and operation of the controller, eliminating the need for forward and reverse contactors. The SEM motor controller operates on the principle of controlling the motor field circuit and the motor armature circuit independently. The controller has many programmable features, including maximum speed, acceleration rate, release braking, and braking current limit. The SEM controller includes a full range of features, as well as diagnostic and setup capability.

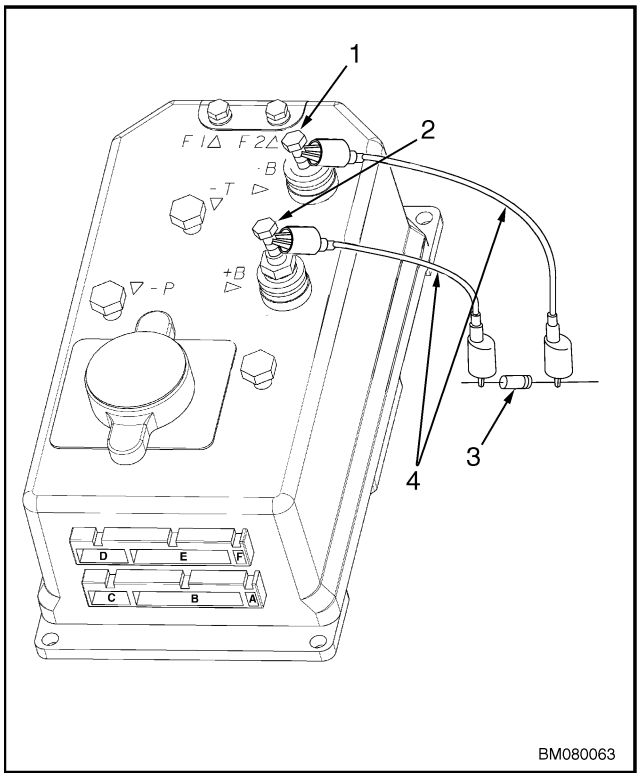
NOTE: There are no user-serviceable parts in the ZAPI™ controller. No attempt should be made to open, repair, or otherwise modify the controller. Doing so may damage the controller and will void the warranty.

Controller Safety

WARNING

The ZAPI™ controllers can hold an electrical charge for several minutes after the key switch has been turned OFF. To prevent injury, discharge the controllers by connecting a 200-ohm, 2-watt resistor between the battery positive connector and battery negative connector on the controller and hold there for 5 seconds.

See Figure 2.



1. NEGATIVE CONNECTION
2. POSITIVE CONNECTION
3. 200-OHM, 2-WATT RESISTOR
4. INSULATED JUMPER WIRES

Figure 2. Discharging Controller

Controller Adjustments

The ZAPI™ transistor motor controller can store and display Error Codes (Alarms). It is also possible to modify the controller Setup for individual preferences. Communication with the controller is possible by four methods:

1. **LED** - An LED (light emitting diode) can be installed in trucks that do not use a display. The LED flashes error codes to the technician for diagnosis. The LED would be installed on the bottom of the ZAPI™ controller at connector port D. See Figure 1.

2. **Dash Display** - Some trucks are equipped with an optional dash display or MDI. Error codes are shown on the LCD (liquid crystal display) when the wrench symbol and red light are lit. The format is AL XX where XX is the error code. The software version is displayed on startup.

3. **ZAPI™ Handset** - A diagnostic handset is available through your Hyster dealer. The handset makes it possible to diagnose faults and modify controller settings. See Programming, in this section.

4. **Personal Computer** - The controller can also be connected to a personal computer (PC) equipped with special software and cables. The PC can read, store, and change settings on the controller.

Proper use of these four methods and a list of diagnostic codes are explained in Troubleshooting, in this section.

Modes of Operation

It is possible to adjust the operating characteristics of the lift truck. There are two basic ways to do this: User-Selectable and Non-User-Selectable Operating Modes.

USER-SELECTABLE OPERATING MODES

The operator has a choice of three performance modes that are selectable through the control handle. The mode selection is made at startup or key **ON**. Performance parameters that vary are acceleration, deceleration, regenerative (neutral) braking, and top travel speed.

The three operator-selectable performance modes are factory programmed per the following:

- **Mode 1** - Economy mode (battery saver) - soft acceleration, reduced top speed with regenerative (neutral) braking.
- **Mode 2** - Performance with regenerative (neutral) braking - medium acceleration, reduced top travel speed with regenerative (neutral) braking.
- **Mode 3** - Performance without regenerative (neutral) braking - maximum acceleration, maximum top travel speed with coast at throttle release.

The following procedure is used to access the user-selectable operating modes:

1. The controller drive modes parameter must be **ON**. This is the factory setting.

NOTE: You must use the handset or PC interface to change this setting. Using the ZAPI™ handset or PC connection, it is possible to set the drive mode parameters to ON or OFF. In the ON mode, the user-selectable rules are enabled. In the OFF mode, the lift truck will only operate using the settings selected. The procedure to alter or modify these settings is given in Programming in this section.

2. Control handle must be in the full, upright position, brake **ON**.
3. Press and hold the horn button while turning the key switch to the **ON** position.
4. Release the horn button when the horn sounds.
5. Toggle through the modes by pressing the lift or lower buttons to the desired mode.
6. The horn provides an audible indication as to the mode selected. One beep indicates Mode 1, two beeps indicate Mode 2, and three beeps indicate Mode 3.
7. Lower the control handle to the operating position, brake **OFF**, and begin operation.
8. The selected mode is maintained until the procedure is repeated.
9. Turning the key **OFF** before lowering the control handle will cancel the mode change.

Programming

CUSTOM PERFORMANCE MODE

In some instances, it may be preferable to disable the Drive Modes and use a custom setting. This controller has adjustable parameters that may be modified to suit specific customer needs. There are two methods used to adjust these parameters: the ZAPI™ handset or the personal computer (PC) interface.

CONTROLLER PARAMETERS

Parameters are controller settings that can be adjusted to alter the performance characteristics of the truck.

To adjust parameters and install custom drive settings, Drive Modes must be **OFF**. To set Drive Modes to **OFF**, use the following procedure:

Setting Drive Modes

1. Turn key switch **OFF**.
2. Remove drive unit compartment cover.
3. Connect adapter harness to handset.

NOTE: It may be necessary to remove the MDI harness connector from the controller to install the adapter harness.

NOTE: Connect and disconnect the handset only with the key switch in the **OFF** position.

4. Connect adapter harness to controller.
5. Turn key switch **ON**.
6. The handset will turn **ON**. See Figure 3.
7. Press buttons 1 and 5 simultaneously.
8. The screen will display CONFIG MENU.
9. Scroll through the menus using button 1 or 2 to the SET OPTIONS menu.
10. Enter this menu by pressing button 3.
11. Press button 5 or 6 to set Drive Modes to **OFF**.
12. Press button 4 to exit this menu.
13. The handset will prompt, "Are you sure?"
14. Press ENTER (button 3) to retain settings or OUT (button 4) to discard settings.
15. Press OUT (button 4) to exit to the main menu.
16. Turn the key switch **OFF** to save the "Drive Modes OFF" parameter change. The key switch must be cycled before attempting to make any additional parameter changes.
17. Turn the key switch **ON** to confirm the Drive Mode is OFF. Then enter the MAIN MENU and change the parameters outlined in Table 1.

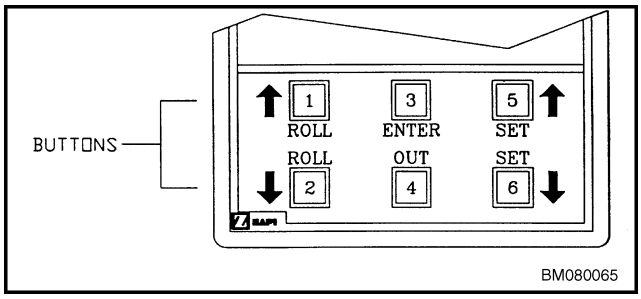


Figure 3. ZAPI™ Handset

Table 1. Parameters

Parameter	Description	Value and Affect	Factory Default
ACCELERATION DELAY	Adjusts truck acceleration.	0 = short or rapid acceleration 9 = long or slow acceleration	0
DECELERATION DELAY	Adjusts truck deceleration according to throttle position.	0 = short or rapid deceleration 9 = long or slow deceleration	5
RELEASE BRAKING	Adjusts motor braking strength or regenerative braking when throttle is released. This determines coast distance.	0 = soft braking 9 = strong braking	7
INVERSE BRAKING	Adjusts plugging rate.	0 = long or soft plugging 9 = short or rapid plugging	9
CUTBACK SPEED	Speed control for trucks in optional mode.	0 = slow 9 = fast (not used)	9
MAX SPEED FORW	Adjusts maximum speed in forward direction, forks trailing.	0 = minimum 9 = maximum	4
MAX SPEED BACK	Adjusts maximum speed in reverse direction, forks leading.	0 = minimum 9 = maximum	4
LIFT MAX TIME	Adjusts the maximum time for lifting forks.	0 = minimum or approximately 5 seconds 9 = maximum or approximately 65 seconds	9
AUXILIARY TIME	Adjusts the maximum time for auxiliary hydraulic functions.	0 = minimum or approximately 1.5 seconds 9 = maximum or approximately 6 seconds	5

TESTER MENU

NOTE: The Tester function can be used to troubleshoot multiple systems simultaneously while the truck is in operation.

The most important input or output signals can be measured in real time using the TESTER function of the handset. The handset acts as a multimeter to read voltage, current, temperature, switch state, and other functions.

1. BATTERY VOLTAGE = battery voltage, nominal value = 24V.
2. MOTOR VOLTAGE = armature voltage obtained, shown in volts.
3. MOTOR CURRENT = armature current during traction (positive value) or braking (negative value) in amps.
4. FIELD CURRENT = field current in the selected traction direction in amps.
5. EVP VOLTAGE = proportional lowering valve coil voltage.
6. TEMPERATURE = controller temperature, °C.
7. ACCELERATOR = directional control voltage received from control handle.
8. LIFTING CONTROL = proportional lifting voltage received from control handle.
9. TILLER SWITCH = control handle switch input, ON/OFF.
10. FORWARD SWITCH = forward direction request from control handle card, ON/OFF.
11. BACKWARD SWITCH = backward direction request from control handle card, ON/OFF.
12. LIFTING SWITCH = lifting function request from control handle card, proportional lift switch, ON/OFF.
13. LOWERING SWITCH = lowering function request from control handle card, proportional lowering switch, ON/OFF.
14. FORK LIFT SWITCH = lifting function request from control handle card, ON/OFF.
15. FORK LOW SWITCH = lowering function request from control handle card, ON/OFF.
16. R-SHIFT SWITCH = sideshift right switch, ON/OFF.
17. L-SHIFT SWITCH = sideshift left switch, ON/OFF.
18. BELLY SWITCH = traction reversing switch to the controller or traction reversing request from control handle card, ON/OFF.
19. SNAIL SWITCH = snail request from control handle card allows machine to drive with control handle up, turtle speed switch, ON/OFF.
20. HORN SWITCH = horn request from control handle card, ON/OFF.
21. SW4-SW9 = auxiliary function jumper.
22. BATTERY MODEL = battery-type of input switch, ON/OFF. ON = flooded battery (input closed), OFF = sealed battery (input open).
23. BATTERY CHARGE = battery charge indication, %.

SET OPTION MENU

DRIVE MODES	ON	The truck has three performance modes, each with a fixed set of parameters. This function is enabled by setting DRIVE MODES = ON.
	OFF	DRIVE MODES disabled.
		Custom Performance Mode is enabled, the adjustable parameters on Table 1 can be adjusted.

ZAPI™ HANDSET

NOTE: The ZAPI handset will display the code: V1.07 (or a higher number) for 1 to 2 seconds every time the key switch is turned to the ON position. This code represents the EEPROM software version and DOES NOT INDICATE A FAULT CODE.

The ZAPI™ handset must be connected to the controller before turning on the key. The handset must have an adapter harness to connect to the controller. The handset and adapter harness are available from your Hyster dealer. Connect the handset to plug D. The handset can remain connected to the controller while running, and the parameters can be changed in real time. In this case, it is necessary to go in a standby condition (truck at rest) before switching **OFF** the controller in order to store the new values in the EEPROM.

This section describes the ZAPI™ handset functions. Six buttons provide the capability of changing or reading the parameters.

NOTE: After a modification, save the new values by pushing out, then enter to confirm. (Screen prompts will guide the user.)

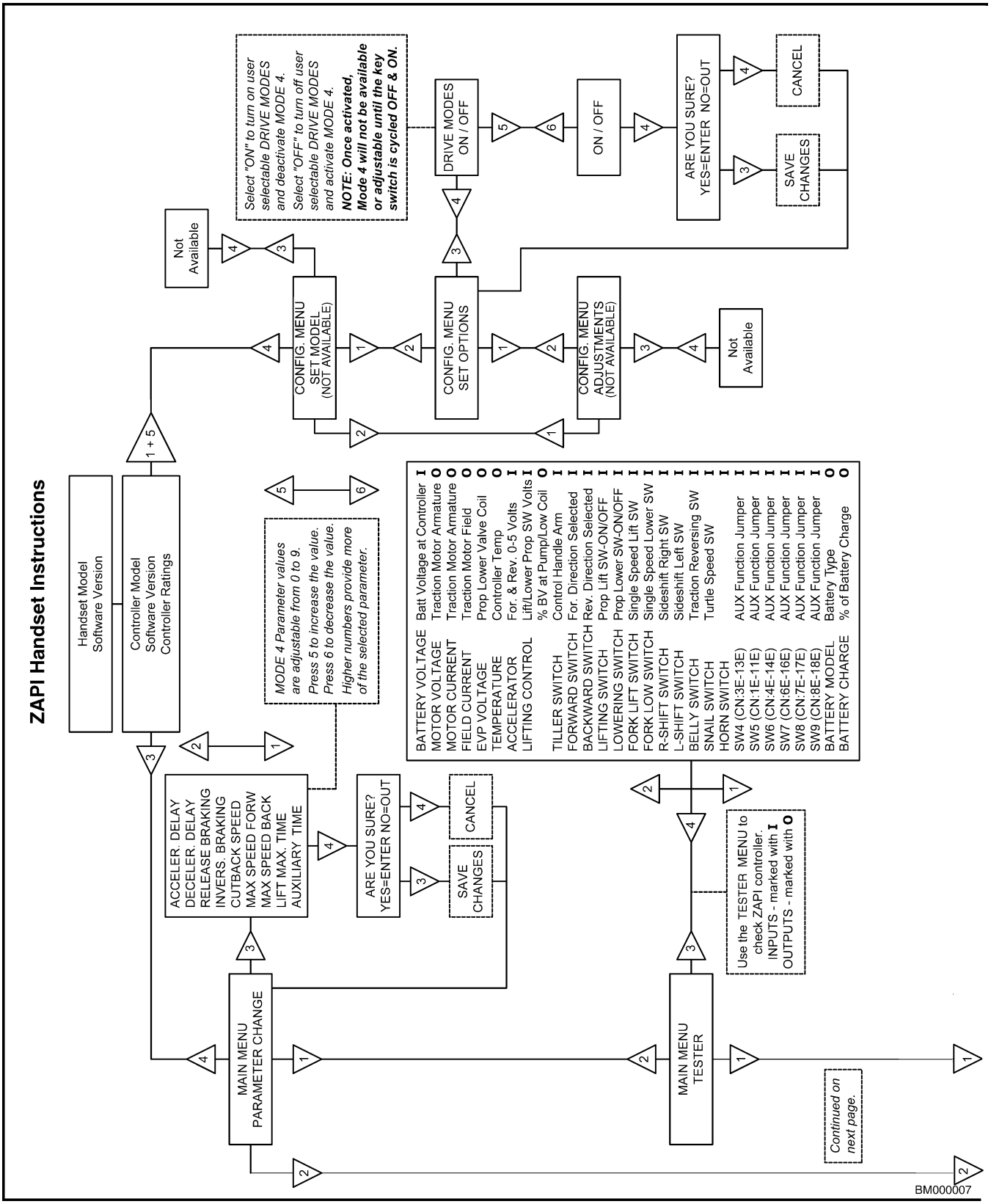
To navigate the menu options, numbers inside the triangles in the following map correspond to the same number on the handset keyboard buttons. The orientation of the triangle indicates the way to the next function. See Figure 3.

NOTE: Connect and disconnect the handset only with the key switch in the **OFF** position.

For additional handset description, see Figure 4.

1	Roll-Up	Push to scroll up.
2	Roll-Down	Push to scroll down.
3	Enter	Push to enter a submenu or to confirm a change.
4	Out	Push to exit a selected menu or to refuse a change.
5	Set-Up	Push to increase a parameter value.
6	Set-Down	Push to decrease a parameter value.

NOTES


ZAPI Handset Instructions
Handset Model
Software Version
Controller Model
Software Version
Controller Ratings
1 + 5
MAIN MENU
PARAMETER CHANGE
ACCELER. DELAY
DECELER. DELAY
RELEASE BRAKING
INVERS. BRAKING
CUTBACK SPEED
MAX SPEED FORW
MAX SPEED BACK
LIFT MAX. TIME
AUXILIARY TIME
ARE YOU SURE?
YES=ENTER NO=OUT
SAVE CHANGES
CANCEL
MODE 4 Parameter values are adjustable from 0 to 9.
Press 5 to increase the value.
Press 6 to decrease the value.
Higher numbers provide more of the selected parameter.
MAIN MENU
TESTER
Use the TESTER MENU to check ZAPI controller.
INPUTS - marked with I
OUTPUTS - marked with O
BATTERY VOLTAGE Batt Voltage at Controller I
MOTOR VOLTAGE Traction Motor Armature O
MOTOR CURRENT Traction Motor Armature O
FIELD CURRENT Traction Motor Field O
EVP VOLTAGE Prop Lower Valve Coil O
TEMPERATURE Controller Temp O
ACCELERATOR For. & Rev. 0-5 Volts I
LIFTING CONTROL Lift/Lower Prop SW Volts I
% BV at Pump/Low Coil O
TILLER SWITCH Control Handle Arm I
FORWARD SWITCH For. Direction Selected I
BACKWARD SWITCH Rev. Direction Selected I
LIFTING SWITCH Prop Lift SW-ON/OFF I
LOWERING SWITCH Prop Lower SW-ON/OFF I
FORK LIFT SWITCH Single Speed Lift SW I
FORK LOW SWITCH Single Speed Lower SW I
R-SHIFT SWITCH Sideshift Right SW I
L-SHIFT SWITCH Sideshift Left SW I
BELLY SWITCH Traction Reversing SW I
SNAIL SWITCH Turtle Speed SW I
HORN SWITCH I
SW4 (CN:3E-13E) AUX Function Jumper I
SW5 (CN:1E-11E) AUX Function Jumper I
SW6 (CN:4E-14E) AUX Function Jumper I
SW7 (CN:6E-16E) AUX Function Jumper I
SW8 (CN:7E-17E) AUX Function Jumper I
SW9 (CN:8E-18E) AUX Function Jumper I
BATTERY MODEL Battery Type O
BATTERY CHARGE % of Battery Charge O
Continued on next page.
CONFIG. MENU
SET MODEL
(NOT AVAILABLE)
Not Available
CONFIG. MENU
SET OPTIONS
Select "ON" to turn on user selectable DRIVE MODES and deactivate MODE 4.
Select "OFF" to turn off user selectable DRIVE MODES and activate MODE 4.
NOTE: Once activated, Mode 4 will not be available or adjustable until the key switch is cycled OFF & ON.
DRIVE MODES
ON / OFF
ON / OFF
CONFIG. MENU
ADJUSTMENTS
(NOT AVAILABLE)
Not Available
ARE YOU SURE?
YES=ENTER NO=OUT
SAVE CHANGES
CANCEL
BM000007

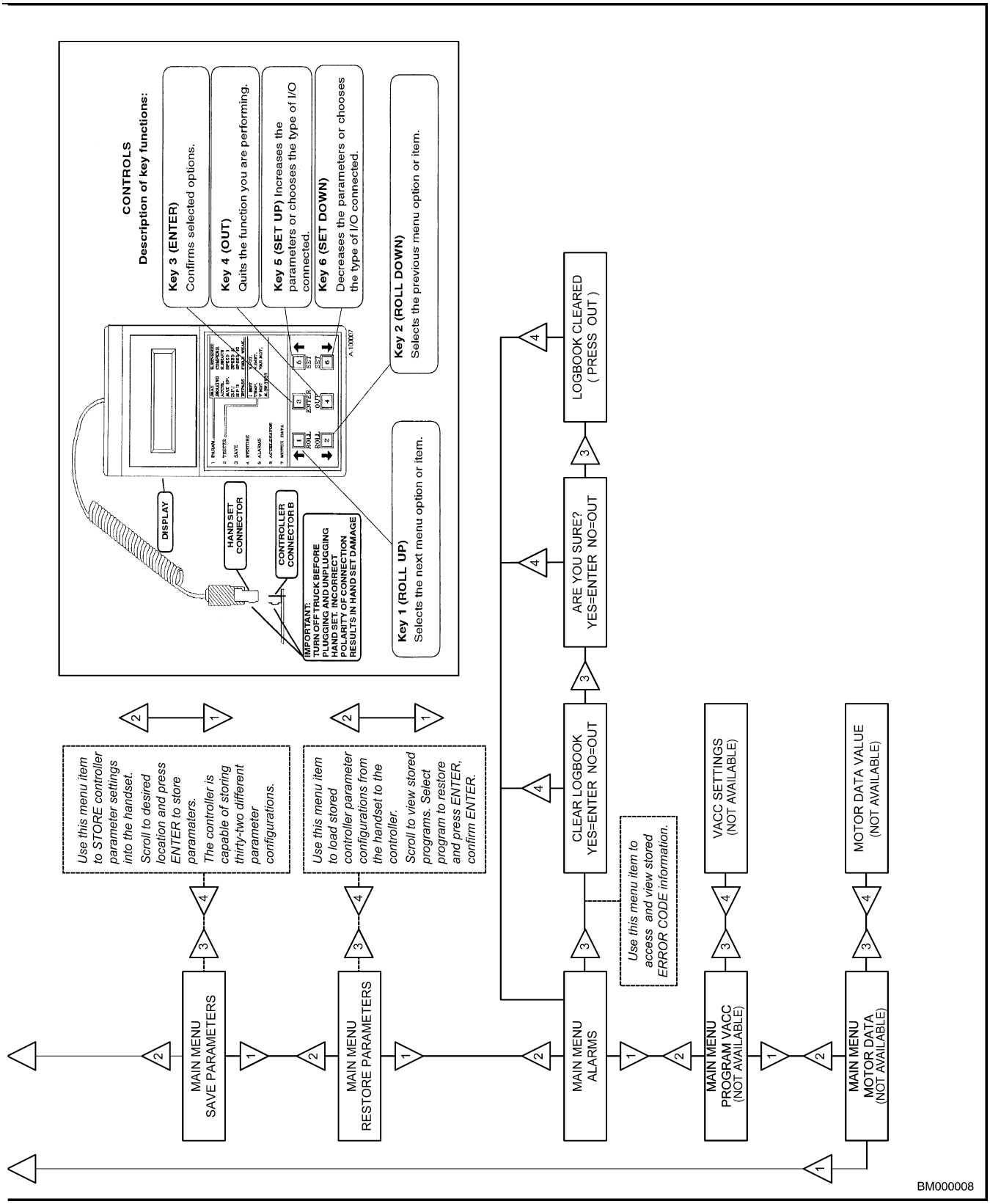


Figure 4. ZAPI™ Handset Instructions

Alarm Code Diagnostics

ALARM CODE DIAGNOSTIC PROCEDURE

NOTE: The dash indicator will display the code: EP 107 (or a higher number) for 1 to 2 seconds every time the key switch is turned to the ON position. This code represents the EEPROM software version and DOES NOT INDICATE A FAULT CODE.

When an alarm code(s) has been detected, the following procedure should be performed to properly read the codes and eliminate unnecessary procedures during troubleshooting.

CAUTION

Always turn the key switch to the OFF position when connecting and disconnecting the handset or laptop cable into the truck controller.

NOTE: If you are using a USB connection to your laptop, the cables and adaptors must be connected to both the laptop and the lift truck controller before the laptop is first started (booted) up.

1. Connect the Zapi™ Handset or laptop to the lift truck controller. Turn the handset or laptop on. Turn the lift truck key switch to the ON position and view the handset display. See Table 2.

Table 2. Example Handset Software Versions

ZAPI CONSOLE V 3.07

NOTE: The handset will briefly display the handset software version for 1.5 seconds before changing to the second screen. Wait for the second screen to appear with the controller software version.

2. Write down the controller software version information and hourmeter reading that is displayed on the second screen of the handset. See Table 3.

Table 3. Example Controller Software Versions

MPB NA V 1.08 24 V - 180 A 000369 **or** SC P18 V 1.04 24 V - 180 A 00369 **or** COMBI - USA4 V 1.06 24 V - 180 A 000369

NOTE: The lower right hand numbers represent the hours since controller installation which may differ from total truck hours as shown on the digital dash indicator (DDI).

3. Go to "Alarm Menu." Press Enter.

4. Write down both lines of the alarm code. Then scroll to the next alarm code and record both lines again. Continue until the alarm codes repeat with identical information. Example: You will see five alarm codes as you scroll if five alarms have been generated, then they will repeat. The codes contain the actual alarm code (EVP NOT OK), controller hours at time of last occurrence (1350h), number or occurrences (#15), temperature at time of last occurrence (in Celsius (35C)). See Table 4.

Table 4. Example Alarm Code

EVP NOT OK 1350h #15 35C

5. After all the alarm codes have been written down, then clear the log book by selecting "Clear the Log." The Zapi handset will ask "Are You Sure?" Press "Enter" then press "Out."

NOTE: DO NOT disconnect or turn off the handset or laptop at this time.

6. Cycle the key switch to start the lift truck in the normal mode. Operate the lift truck until the alarm code reoccurs (faults out). Then, go back to the Alarm Code menu and write down the alarm codes which are now present. These alarms should be investigated first to isolate the most prominent malfunctions.

NOTE: If the THERMAL PROTECTION alarm codes are generated, use the Tester Function = Temperature. If the controller sees 75°C (175°F) or below −10°C (14°F), it will reduce electrical current to the motors and regular performance of the lift truck will slow down.

You can operate the truck with the Tester Function activated and monitor the controller's internal temperature in real time. For additional heat dissipation, fold up several layers of aluminum foil and place it between the controller mounting base and the mounting plate to fill any air pockets in the mating surfaces which will impede conductivity and prevent the heat from flowing from the controller heat sink into the mounting plate of the controllers. The use of "conductivity paste' is not recommended.

CAUTION

If the battery has been disconnected and reconnected with the key switch in the ON position, a voltage spike can cause corruption of the Zapi controller EPROM.

Remember to use the "Tester" function to check switch input from the control handle to the controller. This procedure will also alert you if the controller has been changed but the control handle card has not been reprogrammed.

Zapi controller menu items:

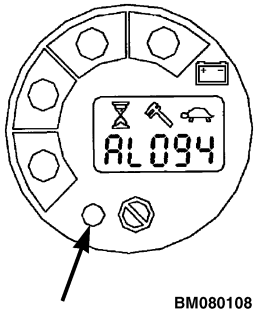
- ACCELERATOR = Volts Percent % = Shows Variable Voltage From Traction Thumbwheel (FWD or REV)
- FORWARD AND BACKWARD SWITCH = "OFF to "ON"
- LIFTING CONTROL = Volts Percent % = Lifting and Lowering = Proportional Switches (Control Handle Card Must be Calibrated)
- LIFTING AND LOWERING SWITCH = "OFF" to "ON"
- BELLY, HORN, SNAIL SWITCHES = "OFF" to "ON"
- SW8 = Gray Button for Alt Functions = "OFF" to "ON" (Reach and Counterbalance)
- ETC.

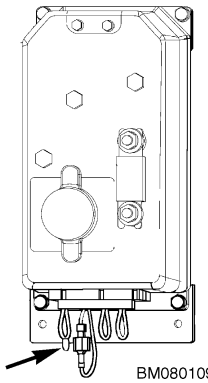
Troubleshooting

<table>
<tr><th>Dash Display</th><th>Controller LED</th><th>Handset or PC</th></tr>
<tr><td>LCD display
Red LED Fault Indicator

(Trucks equipped with optional dash display)</td><td>Red LED
Located at base of motor controller.

(Trucks without dash display)</td><td>Error codes stored under Main Menu Alarms

Message displayed on Handset or PC</td></tr>
<tr><td> 

BM080108</td><td> 
BM080109</td><td rowspan="2">CORRESPONDING SCHEMATIC SHOWING CIRCUITS TO BE CHECKED OR COMPONENTS AFFECTED</td></tr>
<tr><td colspan="2">CONDITION
TRUCK RESPONSE

POSSIBLE CAUSES AND TEST PROCEDURES</td><td>LOGIC
(Brief description of the reason behind truck exhibited malfunction.)</td></tr>
</table>

NOTE: General error code information is provided by the Dash Display and Red LED at the base of the controller. In most instances, it will be necessary to use a handset or a PC to further define the possible causes and test procedures.

NOTE: The dash indicator will display the code: EP 107 (or a higher number) for 1 to 2 seconds every time the key switch is turned to the ON position. This code represents the EEPROM software version and DOES NOT INDICATE A FAULT CODE.

Dash Display	Controller LED	Handset or PC
No LEDs or LCDs illuminated	LED OFF	Handset does not operate

CONDITION

Dash display, controller LED, and truck inoperative with key switch in **ON** position.

TRUCK RESPONSE

Travel and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- B+ and/or B- missing at controller.

  Confirm battery is connected and of proper voltage.

  Verify key switch is **ON**.

  Verify brake override circuit is connected in run position.

  Verify continuity between batteries negative (at battery) and -B power wire connection (at controller).

  If no continuity, check:

  Power wiring between battery and controller.

  Verify continuity between battery positive (at battery) and B-12 connection (at controller).

  If no continuity, check:

  Fuse 3 for open.

  Key switch continuity in **ON** position.

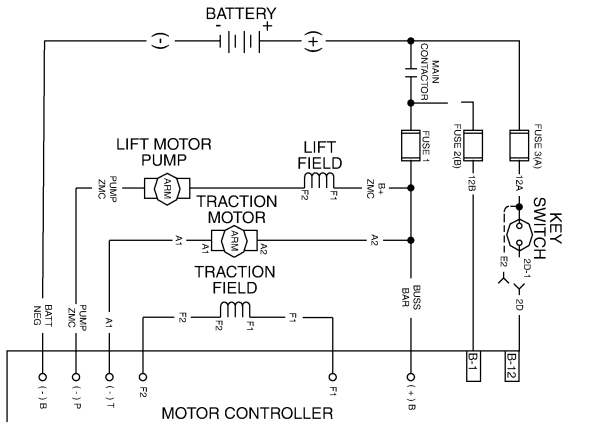
  Wiring battery + to main contactor to fuse 3 to key switch, to controller B-12 connection.

- Defective motor controller.

  Check for battery voltage between B-12 and B- power wire connection at controller.

  If correct battery voltage, replace controller.

Refer to the section **Electrical System** 2200SRM1026 or **Electrical System** 2200SRM1007 for more information on troubleshooting electrical system circuits and components.



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LOGIC

Occurs when there is no power to the controller or the controller is defective.

Dash Display	Controller LED	Handset or PC
No LEDs or LCDs illuminated	LED OFF	No error codes present

CONDITION

Dash display and/or controller LED inoperative.

TRUCK RESPONSE

Travel and hydraulic functions normal.

POSSIBLE CAUSES AND TEST PROCEDURES

- Open connection between dash display and controller.

  Verify harness connections at MDI and connector D on controller.

  Verify continuity of wires between MDI and controller.

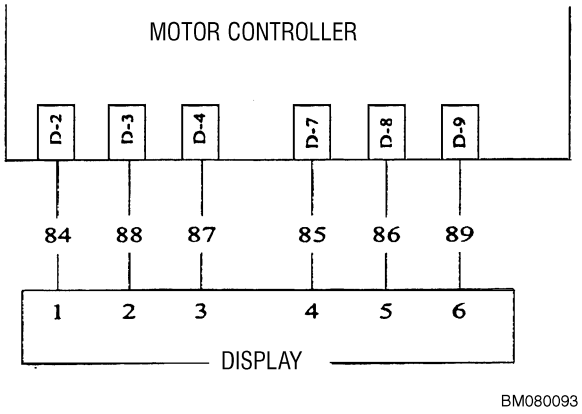
- Defective dash display.

  Connect handset to controller and confirm communication to handset.

  If handset operates correctly, replace MDI.

- Defective LED.

  Disconnect LED and connect handset. If handset works, replace LED.



LOGIC

Occurs when the MDI or LED receives no signal, or MDI or LED is damaged.

Dash Display	Controller LED	Handset or PC
No LEDs or LCDs illuminated	LED OFF	NO COMMUNICATION

CONDITION

Dash display and/or controller LED inoperative.

TRUCK RESPONSE

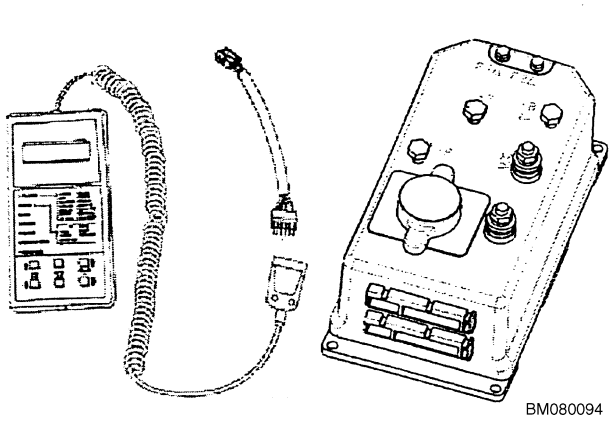
Travel and hydraulic functions normal.

POSSIBLE CAUSES AND TEST PROCEDURES

- Defective controller.

  Connect handset to controller and confirm communication to handset.

  If handset will not communicate with controller, replace controller.



LOGIC

Occurs when controller does not send a signal to the MDI or LED.

Dash Display	Controller LED	Handset or PC
No Alarm	LED OFF - No Flashes	INCORRECT START

CONDITION

Improper startup sequence by operator.

TRUCK RESPONSE

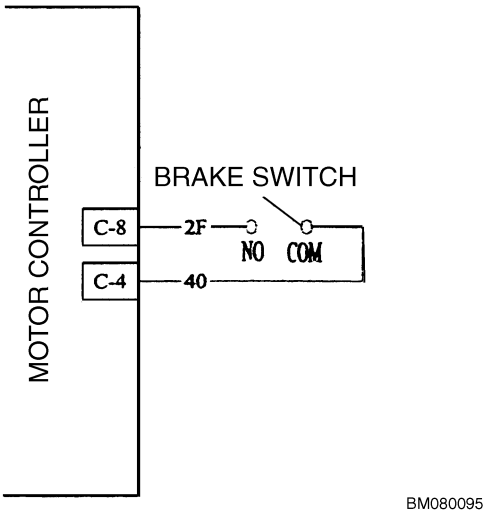
Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Check that all switches are in the neutral position.
- Throttle or hydraulic function selected at key **ON**. Steer handle in run position at key **ON**.

  Return steer handle to full upright position. Return throttle to neutral. Release all hydraulic function controls.

  If fault remains, attach handset and go to test menu.
- Check brake switch, it should be off. If steer handle is in vertical position and reading is not **OFF**, check brake switch for damage, interference, or shorts.
- Check accelerator - Should be 0 volts at neutral. If not, repeat control card calibration. If this does not correct the problem, test the control card. Refer to Control Card Functional Test in this section.
- Check hydraulic inputs – Should be 0 volts. If not, recalibrate tiller card. Follow auto-learn procedure listed in steering. If this does not clear fault, check buttons for damage or interference. Replace damaged or faulty buttons.



LOGIC

Fault occurs when controller receives input that has not followed the proper operational sequence.

Dash Display	Controller LED	Handset or PC
AL01	1 Flash	VACC NOT OK

CONDITION

Connection/communication error between tiller card and traction controller.

TRUCK RESPONSE

Traction and hoist functions disabled.

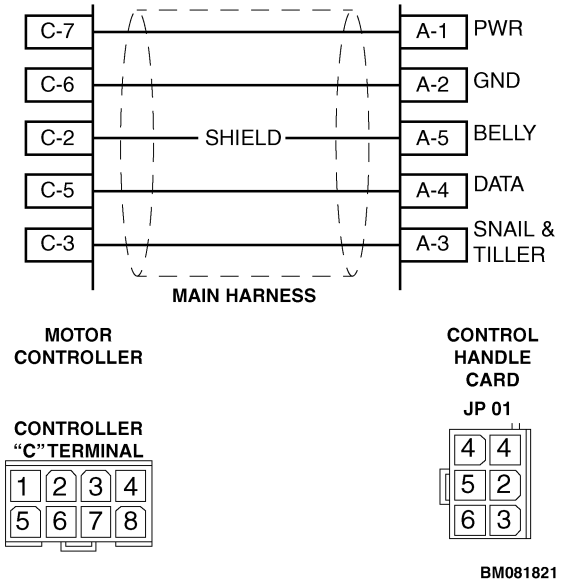
POSSIBLE CAUSES AND TEST PROCEDURES

- Control card throttle calibration is out of range.

  Install handset. Go to tester function of handset. If accelerator output is >1V (20%) and the enable switch is open, recalibrate control card.

- Control card throttle damaged or Cam Magnetic Holder not aligned with Alignment Window.

  Replace control card if needed.



LOGIC

Occurs when accelerator voltage from serial control card is higher than 1V (20%) before neutral switch is closed.

Dash Display	Controller LED	Handset or PC
AL01	1 Flash	PUMP VACC NOT OK

CONDITION

Connection/communication error between control card and traction controller.

TRUCK RESPONSE

Traction and hoist functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- A lift/lower switch is damaged or defective.

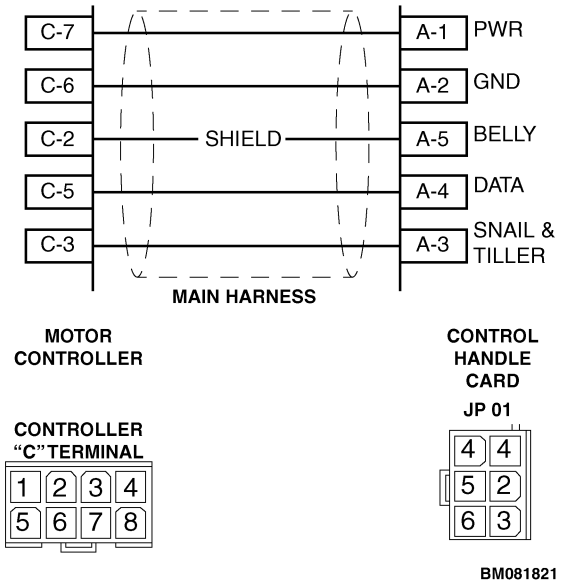
  Install handset. Go to tester function. Check lifting control and EVP voltage." Check on/off switches and proportional switches for smooth, linear operation. Replace damaged switches.

- Control card lift/lower switch calibration is out of range.

  Install handset. Go to tester function. Check lifting control and EVP voltage. Output of proportional hydraulic controls should be less than 1V (20%) at neutral.

  Recalibrate control card.

- Replace control card if needed.



LOGIC

Occurs if the output of one on the hydraulic controls is higher than 1V (20%) at start.

Dash Display	Controller LED	Handset or PC
AL01	1 Flash	FORW + BACK

CONDITION

Connection/communication error between control card and traction controller.

TRUCK RESPONSE

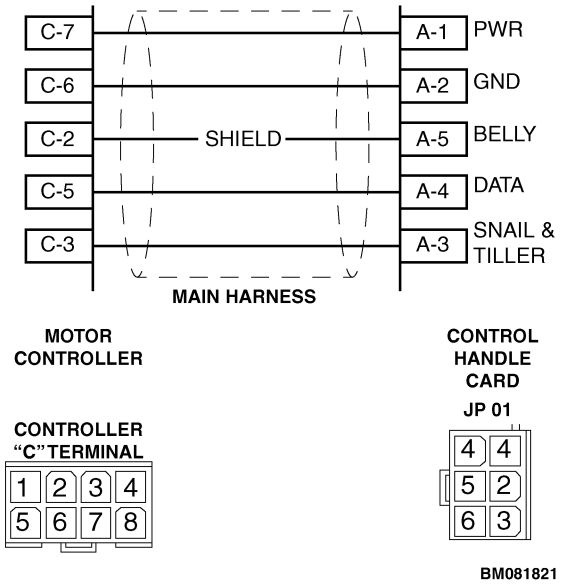
Traction and hoist functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Control card throttle device is damaged or defective.

  Install handset. Go to tester function. If forward switch and backward switch are both on at the same time, card may be damaged.

  Replace the control card if needed.



LOGIC

Occurs if controller receives signal for forward and reverse directions simultaneously.

Dash Display	Controller LED	Handset or PC
AL01	1 Flash	SERIAL ERROR #1

CONDITION

Connection/communication error between control card and traction controller.

TRUCK RESPONSE

Traction and hoist functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Loose or damaged electrical connection between control card and controller.

  Verify connection at controller.

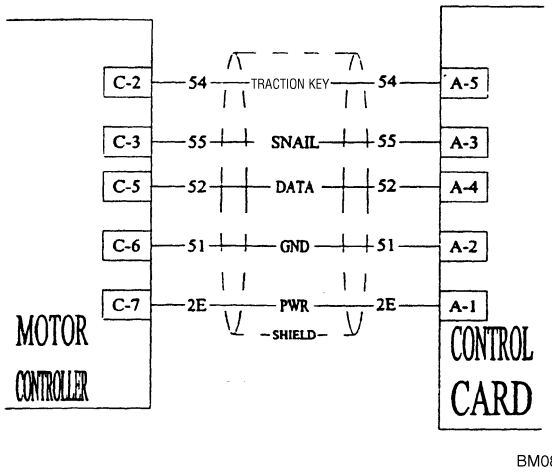
  Verify wire harness connection at base of steer handle.

  Verify connection at control card.

- Damaged or defective control card.

  Measure voltage at pin 5, connector C, on the controller. With control card disconnected, this should be about 12V; with the card connected, it should be about 5V. 0V or 12V with the card connected means that the card may be damaged.

  Test the control card. Refer to Control Card Functional Test in this section.



LOGIC

No information or incorrect information has been sent from the control card to controller.

Dash Display	Controller LED	Handset or PC
AL01	1 Flash	INPUT ERROR #1

CONDITION

Connection/communication error between control card and traction controller.

TRUCK RESPONSE

Traction and hoist functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

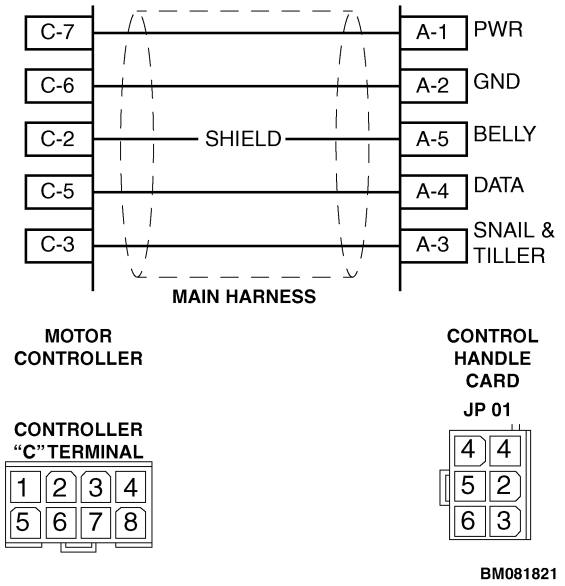
- Traction reversing switch is not connected.

  Install handset. Go to tester function. Check for operation of traction reversing switch.

  Verify that traction reversing switch cover is making contact with switch on control card.

- Possible damaged or defective control card.

  Replace the control card if needed.



LOGIC

Traction Reversing Switch data signal is not present and hardware signal is present.