SERVICE REPAIR

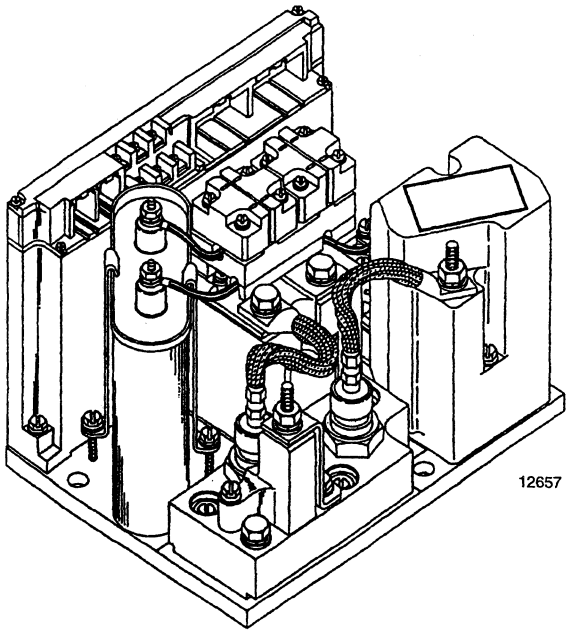
MANUAL

Hyster B168 (J40XL, J50XL, J60XL, J2.00XL, J2.50XL, J3.00XL) Electric Forklift

HYSTER

EV-100LXT/LX/LXP/LXD
EV-200LXT/LX
MOTOR CONTROLLER & DIAGNOSTIC HAND SET

DESCRIPTION, CHECKS, REPAIRS, ADJUSTMENTS AND TROUBLESHOOTING



HYSTER

PART NO. 897409

2200 SRM 460

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure that all slings, chains or cables are correctly fastened and that the load being lifted is balanced. Make sure that 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 and working area clean and in order.

- 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 that all nuts, bolts, snap rings and other fastening devices are removed before using force to remove parts.

- Always fasten a DO NOT OPERATE sign to the controls of the unit when making repairs or if the unit needs repairs.

- Make sure you follow the **WARNING** and **CAUTION** notes in the instructions.

- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area has ventilation.

CONTENTS

INTRODUCTION 1
GENERAL 1
DESCRIPTION 1
DIAGNOSTIC CONTROL CARD 1
Status Codes 3
HAND SET 3
INSTRUMENT PANEL DISPLAY 4
Hourmeter Functions 4
Battery Indicator Function 4
CONTROL CARD CONNECTION 5
CHECKS AND ADJUSTMENTS 14
GENERAL 14
Function Codes 14
Connecting the Control Card for Bench Checks and Adjustments 15
Connecting the Hand Set to a Control Card Installed in a Lift Truck 16
CHECKING AND ADJUSTING FUNCTION SETTINGS 17
General 17
HOW TO CONNECT AND CHECK HAND SET 17
HOW TO CHECK AND ADJUST FUNCTIONS 17
FUNCTION DESCRIPTIONS 18
Traction Control Cards (EV-100/200 LXT/LX) 18
Pump Control Card (EV-100/200 LXP) 22
Dual Motor Traction Control Card (EV-100 LXM/LXDX/LXDT) 23
FUNCTION TABLES 27
REPAIRS 47
TROUBLESHOOTING 48
GENERAL 48

This section is for the following models:
E1.25-1.75XL (E25-35XL) E2.00-3.00XL (E40-60XL)
E3.50-5.50 (E70-120XL) J25-35B
J1.25-1.75XL J2.00-3.00XL (J40-60XL)
N40-45FR, R30E/EA/EF, R30XM/XMA/XMF/XMS
J1.60-2.00XMT (J30-40XMT)
E30FR, E40FR, and E50FR

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INTRODUCTION

GENERAL

This section has the description, checks, adjustments and repairs of the control cards for the EV-100 **LX/LXT/LXP/LXM/LXDX/LXDT** and the EV-200 **LX/LXT/LXP** motor controllers. The **LX/LXT/LXP/LXM/LXDX/LXDT** is the nomenclature to identify the controllers that have the "**LX**" series of diagnostic control cards. There is a description of the hand set and how it is used to check and adjust the control cards. A description and the replacement of the instrument panel display is also included.

The operation and most components of these controllers are basically the same as the EV-100 and EV-200 motor controllers. All of the power components used with this EV-100/200 "**LX**" series are the same as used with other EV-100/200 motor controllers. The control cards are the major differences. The "**LX**" series of diagnostic control cards have the basic control features of the other EV-100/200 cards and some additional features. Not all control features are available on all of the different types of control cards of the series. Some control cards can have multiple features. These features include the following:

- Static Return to Off (SRO) (includes Start Sw.)
- Pulse Monitor Trip (PMT) (Traction Only)
- Pedal Position Plugging
- Field Weakening (FW)
- Regenerative Braking (RB)
- Creep Speed (C/S)
- Controlled Acceleration (C/A)
- Current Limit (C/L)
- 1A Timed Pick Up (1A P.U.)
- 1A Drop Out (1A D.O.)
- 1A Thermal Hold Off
- Ramp Start
- Full Power Transition
- Stored Status Code (Diagnostics)
- Speed Limits
- Internal Resistance Compensation
- Steer Pump Time Delay
- Pump Motor Control (PX card only)

Some of the differences between the EV-100/200 control cards and the EV-100/200 "**LX**" series of diagnostic control cards are given in the following list:

- Contactor coil drivers within the control card
- Diagnostics (automatic tests or checks)
- Hourmeter function (control card display for the instrument panel is not installed on all units)
- Battery Discharge Indicator function (LXT and LXDT card only) (control card display for the instrument panel is not installed on all units)

The "**LX**" series of controllers have an output to operate a digital display with four digits. A digital display unit (instrument panel display) is available for the instrument panel of some lift trucks. A hand set with a digital display is also available. All of the control settings are set using the hand set. There are NO manual adjustments (trim pots) on these control cards.

The basic (motor speed and direction) operation of the EV-100/200 "**LX**" series of motor controllers is the same as the EV-100 controller. For an operational description of the traction or pump motor controllers, see the section **EV-100 MOTOR CONTROLLER, 2200 SRM 287**. For repairs, see the sections **EV-100 MOTOR CONTROLLER, 2200 SRM 288** or **EV-200 MOTOR CONTROLLER, 2200 SRM 414**. These motor controllers are made for Hyster Company by the General Electric Company.

Hyster electric lift trucks use a two-wire electrical system. There is no common ground connection through the frame. Both the positive supply and the negative return current flows are through wires and cables. There must be a minimum resistance of 50,000 ohms between the electrical circuits and the frame of the lift truck.

DESCRIPTION

DIAGNOSTIC CONTROL CARD

The control card is a printed circuit board with electronic parts in a plastic case. The control card has four plug connectors and a terminal strip with six screw connections. The control wires of the plugs and terminal-

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strips connect the control card to the lift truck circuits and the other circuits of the motor controller. The screw connections of the terminal strips are inputs from control components of the lift truck. The plugs for the control card are Plug A, Plug B, Plug Y and Plug Z. See FIGURE 3. Plugs A and B are six pin plugs. The purpose of the wires connected to these plugs can be different for different control cards. Plug Y is a 14 pin plug that connects the instrument panel display or hand set to the control card. Some pins of Plug Y are also used to connect the control card to the Truck Management Module or other auxiliary control cards. Plug Z is also a 14 pin plug that connects the oscillator part of the control card to other circuit components. The 14 pins on Plug Z have the same functions as the pins of other EV-100/200 control cards. The pin numbers are also the same, for the same function, for both the EV100/200 "**LX**" series and the other EV-100/200 control cards.

TABLE 1 - STATUS CODES LIST

STATUS CODE	DESCRIPTION
	CARD INPUTS
BLANK	No input voltage to card and/or display
-01	No seat switch input *
-02	FWD switch closed on initial start
-03	REV switch closed on initial start
-04	Start switch input low after start
-05	Start or brake switch did not close
-06	Accelerator depressed - no direction selected
-07	Accelerator input voltage too high
-08	Accelerator input voltage too low or power to control card after key sw. ON
-09	Both FWD and REV switches closed at same time
-10	Both right and left steer angle switches are closed at same time
-11	Start switch is closed when the key is moved to the **ON** position*
-15	Battery volts too low
-16	Battery volts too high
-17	Wrong card type selection
	CONTACTOR PANEL
-23	Forward or reverse contactor coil current low
-24	Voltage at T2 too high
-25	1A contactor does not open or opens too slowly
-26	Shorted coil driver for RB, SP or FW contactor
	SCR PANEL
-41	Open thermal protector or control over temperature
-42	Motor sensor input missing (green wire)
-43	Motor sensor input missing (yellow wire)
-44	SCR 1 did not turn off correctly
-45	SCR 1 did not turn on correctly
-46	"Look ahead" (T2 volts high)
-47	SCR 2 does not turn on correctly
-48	"Look ahead" (T2 volts low)
-49	SCR 5 does not turn on correctly
-50	C1 volts low
-51	C1 volts high with high motor current
-52	C1 volts high with low motor current
-53	SCR 1 does not turn off during plugging
-54	Shorted F, R or 1A driver
-57	Current sensor output voltage polarity check

*Not used on all models of lift trucks. Status codes in this group will flash on the display.
NOTE: Motor speed is decreased with a Motor Over Temperature code at the normal function setting.

STATUS CODE	DESCRIPTION
	REGENERATIVE BRAKING*
-70	Current sensor input missing (yellow wire)
-71	Current sensor input missing (green wire)
-72	Regenerative braking contactor does not energize
-73	Regenerative braking contactor does not deenergize or deenergizes slowly
-74	Regenerative braking contactor energizes too slowly
-75	SCR 1 does not turn off during regenerative braking
-76	C1 voltage too high during regenerative braking
	TRUCK MANAGEMENT*
-90	Traction Motor Over Temperature* ★ [Left]
-91	★ [Pump Motor Over Temperature*]
-92	★ [Traction Motor Over Temperature/Right*]
-93	Pump Motor Over Temperature* or
-93	★ [Traction Brush Wear/Right*]
-94	Traction Brush Wear* ★ [Left]
-95	Pump Motor Brush Wear*
	PUMP CONTROL*
-117	Wrong card type selection
-123	Pump contactor coil current low
-124	Voltage at T2 too high
-141	Open thermal protector or control over temperature
-142	Motor sensor input missing (green wire)
-143	Motor sensor input missing (yellow wire)
-144	SCR 1 did not turn off correctly
-145	SCR 1 did not turn on correctly
-146	"Look ahead" (T2 volts high)
-147	SCR 2 does not turn on correctly
-148	"Look ahead" (T2 volts low)
-149	SCR 5 does not turn on correctly
-150	C1 volts low
-151	C1 volts high with high motor current
-152	C1 volts high with low motor current
-154	Shorted #2 PUMP driver
-157	Current sensor output voltage polarity check

NOTE: ★ [ ] for TRUCK MODELS J1.60, J1.80 and 2.0XMT (J30XMT, J35XMT and J40XMT) only.

The diagnostics circuits of the control card check the static and operating conditions of the control and power circuits for the motor. The control card will show a status code on the display connected to Plug Y if the diagnostic circuits find a condition that is not correct. The display connections are at Plug Y of the control card. Some lift trucks can have a instrument panel display that will show the status codes from the traction and pump control cards.

Status Codes (See TABLE 1)

The Status Codes are code numbers for different symptoms that the control card can sense. The control card will show this code number on the digital display of the instrument panel display (optional on some units) or the hand set. The control card will flash the status code on the display. Every third display will show the battery charge instead of the status code.

The control card senses the following incorrect inputs: inputs that are too high or too low, inputs that have the wrong polarity, inputs in the wrong sequence or correct inputs that occur at the wrong time.

NOTE: A status code display does not always mean that there is a malfunction. A temporary operating condition can cause a status code display.

The status codes all have a (-) before the numbers. If the battery is disconnected, the "-" will be missing on the hand set display when a battery is connected again. If a status code number is flashing on the digital display, checks and adjustments cannot be done. Refer to TABLE 1 and Troubleshooting to find and correct the malfunction. There are no checks or adjustments for the status codes. These code numbers are only codes to help identify a possible malfunction. TABLE 1 has a short description of the different status codes.

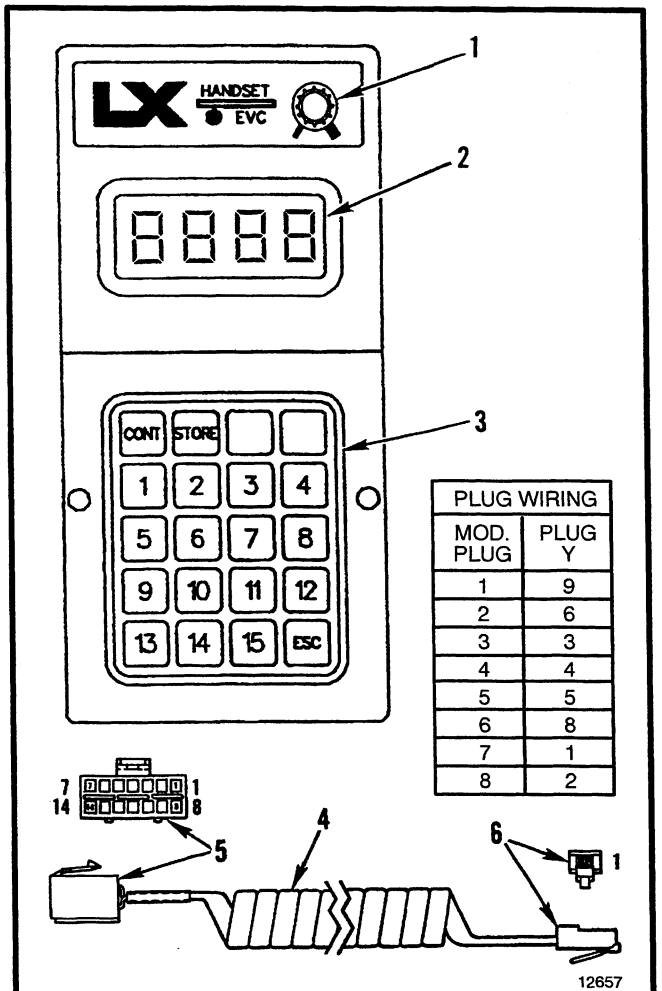
TROUBLESHOOTING in this section has a table for each status code. The tables have a more complete description of the status code, the circuit that has the incorrect input, the symptom and the possible causes.

HAND SET

The hand set is a tool with many functions. The tool can be used **ONLY** with the EV-100 or 200 **"LX"** series SCR motor controllers. The hand set is used to monitor traction or pump motor functions, show status codes (possible fault symptoms) and adjust the settings of the control cards. The hand set **must** be used to set the values for the control card functions. It consists of a Light Emitting Diode (LED) display, a keyboard for data entry and an adjustment knob for changing function values. See FIGURE 1. The purpose of the hand set is to allow **Authorized Personnel** to monitor and adjust the following:

- Monitor system status codes for both traction and pump SCR systems
- Monitor the intermittent status codes
- Monitor the state of charge of the battery on systems with LXT control cards
- Monitor the hourmeter readings on the traction and pump SCR systems

NOTE: These first four function values above will also show on the instrument panel display.



1. ADJUSTMENT KNOB
2. LED DISPLAY
3. KEYBOARD
4. COIL CORD
5. PLUG Y (14 PIN)
6. MODULAR PLUG (8 PIN HAND SET)

FIGURE 1 - HAND SET

- Monitor or adjust the following control functions:
  - Creep Speed
  - Controlled Acceleration and 1A Time
  - Current Limit
  - Steering pump time delay and define signal input (seat sw. or directional sw.)
  - Plugging distance (Current)
  - Pedal position plug range or disable
  - 1A Drop Out Current or Disable
  - Field Weakening Drop Out
  - Field Weakening Pick Up
  - Regenerative Braking Current Limit
  - Regenerative Braking Drop Out
  - Speed Limit Points (SL1, SL2 and SL3)
  - Internal resistance compensation for battery state of charge indication
  - Battery voltage (36/48V is auto ranging)
- Selection of type of card operation:
  - Traction with Field Weakening
  - Traction with Speed Limits
  - Traction with Regenerative Braking and Field Weakening
  - High or low current limit for all of the above

NOTE: The vehicle will operate with the hand set connected, however, the adjustment knob **MUST be set fully clockwise** to make sure the control can operate at top speed.

INSTRUMENT PANEL DISPLAY (Optional on Some Units)

The instrument panel display, for these control cards, is a display unit with four digits and three indicators. See FIGURE 2. The indicators show which function value is displayed by the digits. The unit is available for the instrument panel of some lift trucks. Not all functions are available on all lift truck models. The following functions are available: Battery Indicator, Status Codes, Traction Hourmeter and Pump Hourmeter.

The digits show the operating hours when the function indicator (FIGURE 2) on the left-hand side is ON. When the middle indicator is ON, the digits show the charge condition of the battery. The right-hand indicator is **ON** when the digits show the status code.

Hourmeter Functions

The hourmeter function of the instrument panel display is controlled by the EV-100/200 **"LX"** series control card. There can be a display for the operating time of the traction circuit. On some units, there can also be a display for the operating time of the pump circuit. Only those units that have the EV-100 **"LX"** series pump control card can have the optional pump hourmeter function.

The instrument panel display shows the operating time of 0000 to 9999 hours. The traction time is shown for four seconds after the lift truck has been operating and the key is turned to the **OFF** position. If there is a pump hourmeter, the pump time will now be shown for another four seconds.

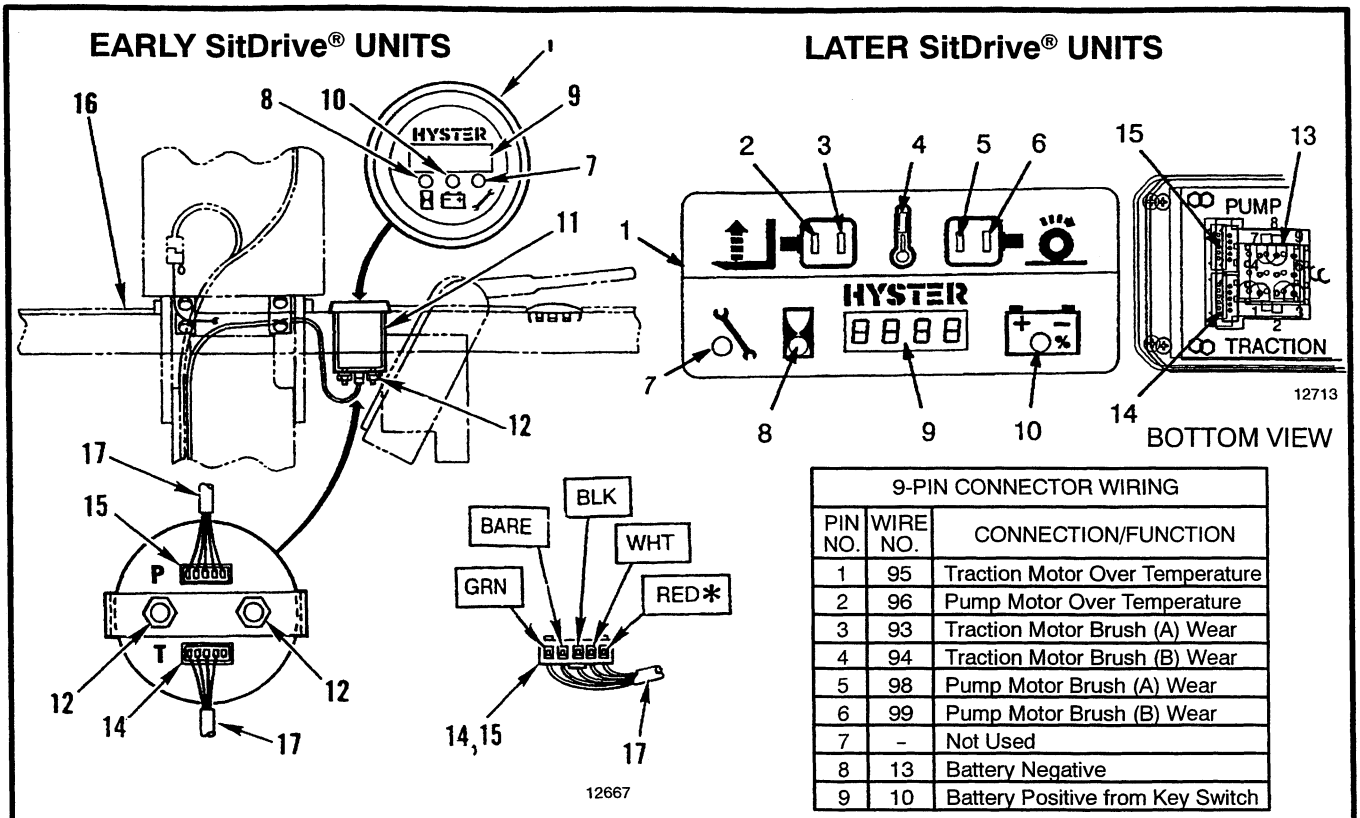
Battery Indicator Function

This battery indicator uses the traction control shunt to measure the current during operation. This current and battery voltage are checked at the same time for an accurate reading of battery voltage with a load (during use). This method is much more accurate than other battery indicators used on earlier lift trucks. This method can also make operation of the lift truck different when the battery is low or a different battery is connected. This method allows more usage of the battery.

The battery indicator function shows the battery charge represented by numbers between 100 and 0 The digital display will flash when the digital display reads 19. At a display of 9, the control will disable the lift pump circuit. After the circuit has disabled the lift pump, charge or change the battery.

Battery Indicator Value	Battery State of Charge / Condition
100	100 % / Fully Charged Battery
19	30 % / Display Begins Flashing
9	20 % / Lift Interrupt Occurs

The control also checks the battery voltage each time a battery is connected. The traction control will prevent lift truck operation if the battery voltage is not correct as set by traction Function 15. A status code of -16 (too high) or -15 (too low) will show on the instrument panel display. The battery can have a voltage that is too high or too low. A battery with the correct voltage can also be over discharged from use or other reasons and have a voltage that is less than the minimum of the voltage range.



9-PIN CONNECTOR WIRING		
PIN NO.	WIRE NO.	CONNECTION/FUNCTION
1	95	Traction Motor Over Temperature
2	96	Pump Motor Over Temperature
3	93	Traction Motor Brush (A) Wear
4	94	Traction Motor Brush (B) Wear
5	98	Pump Motor Brush (A) Wear
6	99	Pump Motor Brush (B) Wear
7	-	Not Used
8	13	Battery Negative
9	10	Battery Positive from Key Switch

*TRACTION CARD PLUG ONLY

1. DISPLAY UNIT
2. BRUSH WEAR INDICATOR, HYDRAULIC MOTOR (YELLOW LED)
3. TEMPERATURE ALARM, HYDRAULIC MOTOR (RED LED)
4. TEMPERATURE ALARM (RED LED) (ILLUMINATES WITH ITEM 3 OR 5)
5. TEMPERATURE ALARM, TRACTION MOTOR (RED LED)
6. BRUSH WEAR INDICATOR, TRACTION MOTOR (YELLOW LED)
7. STATUS CODE FUNCTION INDICATOR (GREEN LED)
8. HOUR METER FUNCTION INDICATOR (GREEN LED)
9. FOUR DIGIT DISPLAY
10. BATTERY FUNCTION INDICATOR (GREEN LED)
11. MOUNT BRACKET
12. MOUNT NUTS
13. 9-PIN MOTOR CONNECTOR
14. TRACTION CARD CONNECTOR
15. PUMP CARD CONNECTOR
16. INSTRUMENT PANEL
17. TO CONTROL CARD PLUG Y

NOTE: For truck models J30XMT, J35XMTand J40XMT see **ELECTRICAL SYSTEM, 2200 SRM 577** for instrument panel display.

NOTE: For truck models J1.60, J1.80XMT and J2.00XMT see **ELECTRICAL SYSTEM, 2200 SRM 585** for instrument panel display.

FIGURE 2 - INSTRUMENT PANEL DISPLAY

Batteries that have different amp hour ratings or are of different ages can sometimes be used in the same lift truck. It can be necessary to adjust traction Function 14 so that the weakest battery is not damaged. Follow the procedure for adjusting traction Function 14 in the Checks and Adjustments.

CONTROL CARD CONNECTION

All connections between the control card or control cards and any other electrical component are made at the edge of the card. See FIGURE 3. These connections are made at the four connector plugs: Plug A (PA 1 through

6), Plug B (PB 1 through 6), Plug Y (PY 1 through 14) or Plug Z (PZ 1 through 14). There are also six screw terminals for connections (TB 1 through 6).

Plugs A and B and the screw terminals have some of the same function as on the earlier EV-100 and EV-200 control cards. The Plug Z has basically the same connections as the Plug C on the earlier (before "LX") control cards. Plug Y is an additional plug and has the connections for the diagnostics and digital display signals.

TABLE 2 through TABLE 8 show the connections for the single motor control card, the pump control card and the dual motor control card.

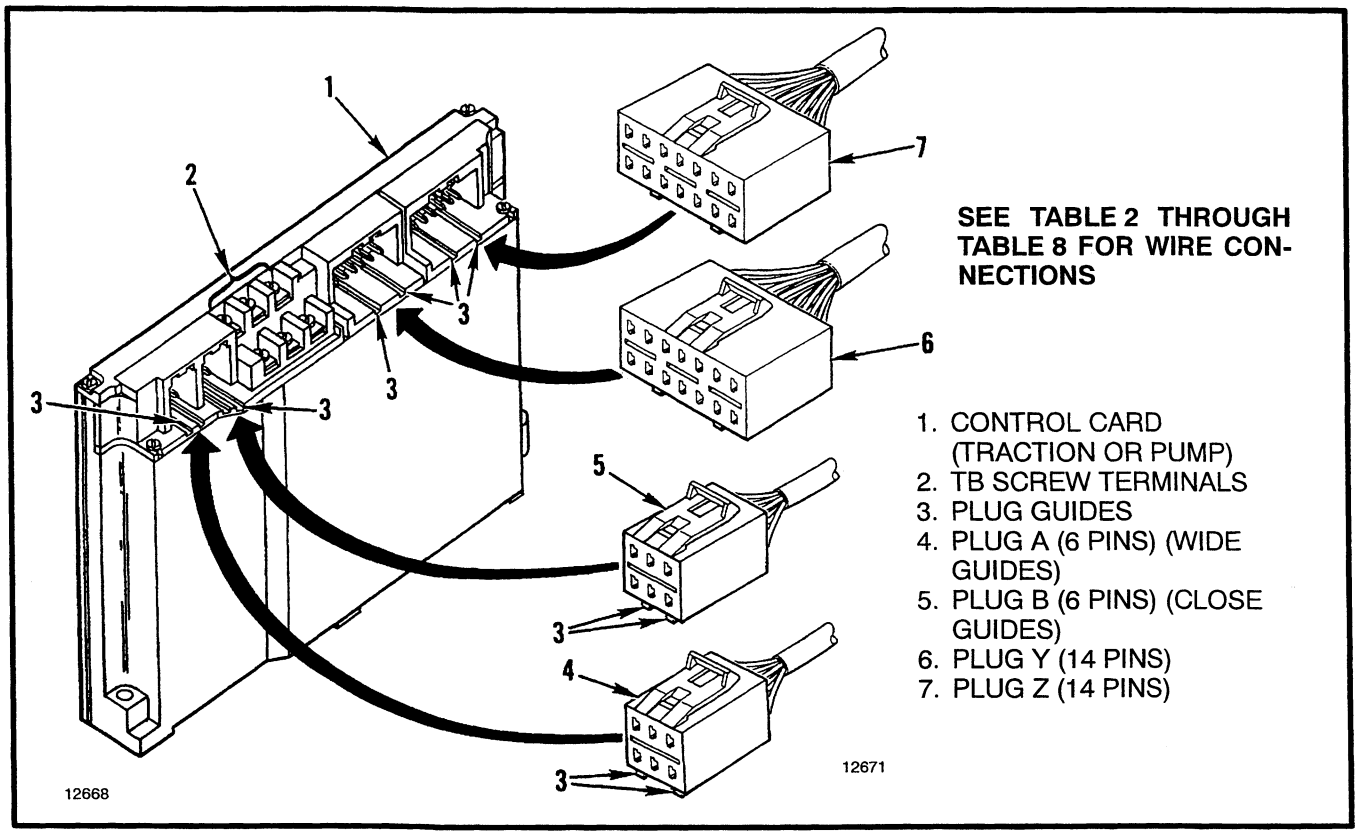


FIGURE 3 - CONTROL CARD CONNECTIONS

TABLE 2 - TERMINAL AND PLUG WIRE CONNECTIONS FOR SINGLE MOTOR TRACTION CIRCUIT

PLUG OR TERM. NO.	WIRE	FUNCTION
PA1	-	Not used
PA2	50	BDI pump interrupt signal
PA3	7	Auxiliary hourmeter input
PA4	*	Not used with standard control - Speed Limit 2 input or regen. sensor 2 (YEL)
PA5	*	Not used with standard control - Speed Limit 3 input or regen. sensor 2 (GRN)
PA6	*	Not used with standard control - Speed Limit 1 input or motor A2 input (w/regen.)
PB1	37	Field weakening contactor coil driver
PB2	31	Regenerative braking contactor coil driver (with regenerative braking only)
PB3	60	Steering pump motor coil driver
PB4	27	Forward contactor coil driver
PB5	23	Reverse contactor coil driver
PB6	41	1A contactor coil driver
TB1	29	Accelerator potentiometer input
TB2	15A	Start switch input
TB3	7	Seat switch input - Voltage input from timer circuit
TB4	10	Key switch input - Battery voltage supply from key switch
TB5	6	FORWARD direction switch input
TB6	8	REVERSE direction switch input
PY1	WHT	Instrument panel display number 4 input
PY2	BLK	Instrument panel display number 3 input
PY3	GRN	Instrument panel display number 1 input
PY4	BAR	Instrument panel display number 2 input
PY5	E	Instrument panel display number 5 input
PY6	RED	Not used
PY7		Not used
PY8	90	Truck Management Module (TMM) 1A 9 - Not used on all models of lift trucks
PY9	91	Truck Management Module (TMM) 1A 7 - Not used on all models of lift trucks
PY10	92	Truck Management Module (TMM) 1A 2 - Not used on all models of lift trucks
PY11		Not used
PY12		Not used
PY13		Not used
PY14		Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

* See the **DIAGRAMS** SRM section for your lift truck model for the correct wire number.

TABLE 3 - TERMINAL AND PLUG WIRE CONNECTIONS FOR SINGLE MOTOR TRACTION CIRCUIT WITH SCR PUMP MOTOR CONTROLLER

PLUG OR TERM. NO.	WIRE	FUNCTION
PA1	-	Not used
PA2	50	Status code 93 input
PA3	7	Status code 90 input
PA4	22	Status code 94 input
PA5	21	Status code 94 input
PA6	17	Status code 91 input
PB1	37	Status code 95 input
PB2	31	Status code 95 input
PB3	60	Battery Discharge Indicator enable signal input
PB4	27	Pump (PMT) coil driver
PB5	23	1A coil driver
PB6	41	Status code 92 input
TB1	29	Accelerator potentiometer input
TB2	15A	SL1 input
TB3	7	SL2 input
TB4	10	Key switch input - Battery voltage supply from key switch
TB5	6	SL3 input
TB6	8	SL4 input
PY1	WHT	Instrument panel display number 4 input
PY2	BLK	Instrument panel display number 3 input
PY3	GRN	Instrument panel display number 1 input
PY4	BARE	Instrument panel display number 2 input
PY5	RED	Instrument panel display number 5 input
PY6	-	Not used
PY7	-	Not used
PY8	90	Signal wire between Traction and Pump cards - From Pump card PY12
PY9	91	Signal wire between Traction and Pump cards - From Pump card PY11
PY10	92	Signal wire between Traction and Pump cards - From Pump card PY10
PY11	-	Not used
PY12	-	Not used
PY13	-	Not used
PY14	-	Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used at Traction Card - No color or number shown for Pump Card
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

TABLE 4 - TERMINAL AND PLUG WIRE CONNECTIONS FOR
SCR PUMP MOTOR CONTROLLER
EXCEPT TRUCK MODELS J1.60, J1.80 and J2.00XMT (J30XMT, J35XMT and J40XMT)

PLUG OR TERM. NO.	WIRE	FUNCTION
PA1	-	Not used
PA2	96	Status code 93 input
PA3	95	Status code 90 input
PA4	93	Status code 94 input
PA5	94	Status code 94 input
PA6	101	Status code 91 input
PB1	98	Status code 95 input
PB2	99	Status code 95 input
PB3	50	Battery Discharge Indicator enable signal input
PB4	27	Pump (PMT) coil driver
PB5	-	1A coil driver (Not used)
PB6	102	Status code 92 input
TB1	-	Not used
TB2	51	SL1 input
TB3	52	SL2 input
TB4	10	Key switch input - Battery voltage supply from key switch
TB5	55	SL3 input
TB6	53	SL4 input
PY1	WHT	Instrument panel display number 4 input
PY2	BLK	Instrument panel display number 3 input
PY3	GRN	Instrument panel display number 1 input
PY4	BARE	Instrument panel display number 2 input
PY5	-	Not used
PY6		Not used
PY7	-	Not used
PY8	-	Not used
PY9	-	Not used
PY10	92	Signal wire between Traction and Pump cards - To Traction card PY10
PY11	91	Signal wire between Traction and Pump cards - To Traction card PY9
PY12	90	Signal wire between Traction and Pump cards - To Traction card PY8
PY13	-	Not used
PY14	-	Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used at Traction card - No color or number shown for Pump card
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

TABLE 5 - TERMINAL AND PLUG WIRE CONNECTIONS FOR
DUAL MOTOR CONTROLLER
TRACTION CARD TYPE LXM
EXCEPT TRUCK MODELS J1.60, J1.80 and J2.00XMT (J30XMT, J35XMT and J40XMT)

PLUG OR TERM. NO.	WIRE	FUNCTION
PA1	*	Power steering contactor coil driver
PA2	-	Not used
PA3	*	Auxiliary hourmeter input
PA4	*	Inside motor reverse switching signal
PA5	*	Right motor drop out switching signal
PA6	*	Left motor drop out switching signal
PB1	*	Forward right motor contactor coil driver
PB2	*	Forward left motor contactor coil driver
PB3	*	Reverse right motor contactor coil driver
PB4	*	Reverse left motor contactor coil driver
PB5	*	1A contactor coil driver
PB6	*	D contactor coil driver
TB1	*	Accelerator potentiometer input
TB2	*	Start switch input
TB3	*	Seat switch input - Voltage input from timer circuit
TB4	*	Key switch input - Battery voltage supply from key switch
TB5	*	FORWARD direction switch input
TB6	*	REVERSE direction switch input
PY1		Not used
PY2		Not used
PY3		Not used
PY4		Not used
PY5		Not used
PY6		Not used
PY7		Not used
PY8		Not used
PY9		Not used
PY10		Not used
PY11		Not used
PY12		Not used
PY13		Not used
PY14		Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

* See the **DIAGRAMS** SRM section for your lift truck model for the correct wire number.

TABLE 6 - TERMINAL AND PLUG WIRE CONNECTIONS FOR
DUAL TRACTION MOTOR CONTROLLER
TRACTION CARD TYPE LXDX, LXDT
TRUCK MODELS J30XMT, J35XMT and J40XMT (J1.60, J1.80 and J2.0XMT)

PLUG OR TERMINAL NO.	WIRE NO. OR COLOR	FUNCTION
PA1	60	Power steering contactor coil driver
PA2	56	Battery Discharge Indicator pump interrupt signal
PA3	-	Not used (auxiliary hourmeter input)
PA4	55	Inside motor reverse switching signal (left/right 90° turn)
PA5	51	Right traction motor cut-out switching signal (60° turn)
PA6	52	Left traction motor cut-out switching signal (60° turn)
PB1	27	Forward contactor coil driver - right motor
PB2	24	Forward contactor coil driver - left motor
PB3	23	Reverse contactor coil driver - right motor
PB4	26	Reverse contactor coil driver - left motor
PB5	41	1A contactor coil driver
PB6	75	AC contactor coil driver
TB1	29	Accelerator potentiometer input
TB2	15	Start switch input
TB3	7	Seat switch input
TB4	10	Key switch input - Battery voltage supply from key switch
TB5	6	Forward direction switch input
TB6	8	Reverse direction switch input
PY1	WHT	Instrument panel display number 3 input
PY2	BLK	Instrument panel display number 4 input
PY3	GRN	Instrument panel display number 5 input
PY4	BARE	Instrument panel display number 9 input
PY5	RED	Instrument panel display number 1 input
PY6	-	Not used
PY7	-	Not used
PY8	109	Signal wire between traction and pump cards or traction card and TMM 1 module
PY9	110	Signal wire between traction and pump cards or traction card and TMM 1 module
PY10	111	Signal wire between traction and pump cards or traction card and TMM 1 module
PY11	-	Not used
PY12	-	Not used
PY13	-	Not used
PY14	-	Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

NOTE: Not all connections are used on all models or with all options.

TABLE 7 - TERMINAL AND PLUG WIRE CONNECTIONS
FOR SCR PUMP MOTOR CONTROLLER
LIFT PUMP CARD TYPE PX or TMM 1 MODULE
TRUCK MODELS J30XMT, J35XMT and J40XMT (J1.60, J1.80 and J2.0XMT)

PLUG OR TERMINAL NO. WITH SCR LIFT PUMP CONTROL	PLUG OR TERMINAL NO. WITH TMM 1 MODULE	WIRE NUMBER OR COLOR	FUNCTION
PA1	TB5	105	Right traction motor brush wear indicator (Status code 93 input)
PA2	TB6	106	Right traction motor brush wear indicator (Status code 93 input)
PA3	TB1	100	Left traction motor hi temperature indicator (Status code 90 input)
PA4	TB8	103	Left traction motor brush wear indicator (Status code 94 input)
PA5	TB10	104	Left traction motor brush wear indicator (Status code 94 input)
PA6	TB3	102	Lift pump motor hi temperature indicator (Status code 91 input)
PB1	TB11	107	Lift pump motor brush wear indicator (Status code 95 input)
PB2	TB12	108	Lift pump motor brush wear indicator (Status code 95 input)
PB3	-	88	Battery Discharge Indicator enable signal input
PB4	-	28	Pump (PMT) coil driver
PB5	-	-	Not used (1A coil driver)
PB6	TB4	101	Right traction motor hi temperature indicator (Status code 92 input)
TB1	-	-	Not used
TB2	-	51	SL1 input (Slow hoist / Auxiliary # 2)
TB3	-	52	SL2 input (Tilt)
TB4	-	10	Key switch input Battery voltage supply from key switch
TB5	-	83	SL3 input (Auxiliary # 1)
TB6	-	53	SL4 input (Fast hoist)
PY1	-	WHT	Instrument panel display number 6 input
PY2	-	BLK	Instrument panel display number 7 input
PY3	-	GRN	Instrument panel display number 8 input
PY4	-	BARE	Instrument panel display number 10 input
PY5	-	-	Not used
PY6	-	-	Not used
PY7	-	-	Not used
PY8	TB9	109	Signal wire between traction and pump cards or traction card and TMM 1 module
PY9	TB7	110	Signal wire between traction and pump cards or traction card and TMM 1 module
PY10	TB2	111	Signal wire between traction and pump cards or traction card and TMM 1 module
PY11	-	-	Not used
PY12	-	-	Not used
PY13	-	-	Not used
PY14	-	-	Not used
PZ1	-	BLK	Signal wire from SCR 1 thermal protector
PZ2	-	BRN	Battery negative
PZ3	-	YEL	Signal wire from current sensor
PZ4	-	GRN	Signal wire from current sensor
PZ5	-	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	-	Not used at traction card - No color or number shown for Pump card
PZ7	-	WHT	Battery positive
PZ8	-	BLU/WHT	Signal wire to SCR 1 gate
PZ9	-	BLU	Signal wire from SCR 1 cathode
PZ10	-	WHT/RED	Signal wire to SCR 2 gate
PZ11	-	RED	Connection between filter for SCR 2 and control card
PZ12	-	WHT/PUR	Signal wire to SCR 5 gate
PZ13	-	PUR	Connection between filter for SCR 5 and control card
PZ14	-	ORN	Sensor wire for voltage check across capacitor C1

NOTE: Not all connections are used on all models or with all options.

TABLE 8 - TERMINAL AND PLUG WIRE CONNECTIONS
FOR TRACTION CARD TYPE
TRUCK MODELS E30ER, E40ER and E50ER

PLUG OR TERMINAL NO.	WIRE NO. OR COLOR	FUNCTION
PA1	60	Power steering contactor coil driver
PA2	50	Battery Discharge Indicator pump interrupt signal
PA3	39	Auxiliary hourmeter input
PA4	55	Speed limit traction motor over temp.
PA5	30	Right traction motor dropout switch (36° Turn)
PA6	31	Left traction motor dropout switch (36° Turn)
PB1	27	Forward contactor coil driver - right motor
PB2	24	Forward contactor coil driver - left motor
PB3	23	Reverse contactor coil driver - right motor
PB4	25	Reverse contactor coil driver - left motor
PB5	41	1A contactor coil driver
PB6	40	D contactor coil driver
TB1	29	Accelerator potentiometer input
TB2	15	Start switch input
TB3	-	Not used
TB4	10	Key switch input - Battery voltage supply from key switch
TB5	6	Forward direction switch input
TB6	8	Reverse direction switch input
PY1	GRN	Instrument panel display number 4 input
PY2	RED	Instrument panel display number 3 input
PY3	BLK	Instrument panel display number 1 input
PY4	WHT	Instrument panel display number 2 input
PY5	BRN	Instrument panel display number 5 input
PY6	-	Not used
PY7	-	Not used
PY8	YEL	Brush wear indicator
PY9	-	Not used
PY10	-	Not used
PY11	-	Not used
PY12	-	Not used
PY13	-	Not used
PY14	-	Not used
PZ1	BLK	Signal wire from SCR 1 thermal protector
PZ2	BRN	Battery negative
PZ3	YEL	Signal wire from current sensor
PZ4	GRN	Signal wire from current sensor
PZ5	GRY	Signal wire from SCR 1 thermal protector
PZ6	-	Not used
PZ7	WHT	Battery positive
PZ8	BLU/WHT	Signal wire to SCR 1 gate
PZ9	BLU	Signal wire from SCR 1 cathode
PZ10	WHT/RED	Signal wire to SCR 2 gate
PZ11	RED	Connection between filter for SCR 2 and control card
PZ12	WHT/PUR	Signal wire to SCR 5 gate
PZ13	PUR	Connection between filter for SCR 5 and control card
PZ14	ORN	Sensor wire for voltage check across capacitor C1

NOTE: Not all connections are used on all models or with all options.

CHECKS AND ADJUSTMENTS

GENERAL

⚠ WARNING

When a replacement card is installed, it must be adjusted using the procedures and settings shown in this section. Do NOT operate the lift truck before checking and adjusting the setting for each function. Setting numbers that are not correct for your lift truck can damage the electrical system and cause the truck to operate differently than normal. This different operation of the truck can result in personal injury.

If function settings are changed, tell all operators of the lift truck that the truck can operate differently now.

This section has the control card checks and adjustments that can be made using the hand set. The control card checks and adjustments are usually made with the control card installed in the lift truck. Bench checks and adjustments can also be made with the control card connected as shown in FIGURE 4. The checks show the stored setting numbers that have been stored for the different control card functions. This section also includes a description of each of the different functions. The function settings can be adjusted using the adjustment knob of the hand set. See FIGURE 1.

There are no checks or adjustments in this section for the other traction control components. To check, adjust or repair these other components, see the sections **EV-100 MOTOR CONTROLLER, 2200 SRM 288** or **EV-200 MOTOR CONTROLLER, 2200 SRM 414**.

Function Codes

The Function Codes are code numbers for the different functions that can be set for the "LX" series control cards. The hand set **must** be used to adjust the settings for the control card functions. There is a description of the function settings for the different control cards in CHECKING AND ADJUSTING FUNCTION SETTINGS of this section. TABLE 9 also has a list and a short description of the different functions. TABLE 10 through TABLE 28 have the correct setting numbers for the different functions on each control card.

TABLE 9 - FUNCTION CODES

FUNCTION CODE	DESCRIPTION
	FOR CARDS - EV-100/200 LXT & LX
1	Stored Status Code
2	Creep Speed
3	Controlled Acceleration and 1A Time
4	Current Limit
5	Plugging Distance (Current)
6	1A Drop Out Current
7	Field Weakening Pick Up (Current)
8	Field Weakening Drop Out (Current)
9	Regen. Braking Current Limit
10	Regen. Start
11	Speed Limit 1 (SL1)
12	Speed Limit 2 (SL2)
13	Speed Limit 3 (SL3)
14	Internal Resistance Compensation BDI
15	Battery Volts - BDI
16	Pedal Position Plug
17	Card Type Selection - Nominal Battery Volts
18	Steer Pump Time Delay
	FOR CARD - EV-100 LXM
1	Stored Status Code
2	Creep Speed
3	Controlled Acceleration and 1A Time
4	Current Limit
5	Plugging Distance (Current)
6	1A Drop Out Current
7	PA4 Input Switch Function Selection
11	Speed Limit 1 (PA5 or PA6)
12	Speed Limit 2 (PA4)
13	Speed Limit 3
14	Internal Resistance Compensation BDI
15	Battery Volts
16	Pedal Position Plug
17	Card Type Selection - Nominal Battery Volts
18	Steer Pump Time Delay
	FOR CARD - EV-100/200 LXP
1	Stored Status Code
2	Internal Resistance Compensation Start (Current)
3	Controlled Acceleration and 1A Time
4	Current Limit
7	Controlled Acceleration Compensation
11	Speed Limit 1 (SL1)
12	Speed Limit 2 (SL2)
13	Speed Limit 3 (SL3)
14	Speed Limit 4 (SL4)
16	Internal Resistance Compensation
17	Card Type Selection - Nominal Battery Volts

TABLE 9 - (Continued)

FUNCTION CODE	DESCRIPTION
TRUCK MODELS J1.60XMT, J1.80XMT and J2.0XMT (J30XMT, J35XMT and J40XMT)	
FOR CARD - EV-100 LXDX and LXDT	
1	Stored Status Code
2	Creep Speed
3	Controlled Acceleration and 1A Time
4	Current Limit
5	Plugging Distance (Current)
6	1A Drop Out Current
7	Field Weakening
11	Speed Limit 1 (PA5 or PA6)
12	Speed Limit 2 (PA4)
13	N/A
14	Internal Resistance Compensation BDI
15	Battery Volts
16	Pedal Position Plug
17	Card Type Selection - Nominal Battery Volts
18	Steer Pump Time Delay
FOR CARD - EV-100 LXPX	
1	Stored Status Code
2	Internal Resistance Compensation Start (Current)
3	Controlled Acceleration and 1A Time
4	Current Limit
7	Controlled Acceleration Compensation
11	Speed Limit 1 (SL1) Slow Lift + 4th Function (Auxiliary # 2)
12	Speed Limit 2 (SL2) Tilt
13	Speed Limit 3 (SL3) 3rd Function (Auxiliary # 1)
14	Speed Limit 4 (SL4) Fast Lift
16	Internal Resistance Compensation
17	Card Type Selection - Nominal Battery Volts

⚠ WARNING

NEVER attempt to adjust any of the function settings without using the procedures and setting numbers given in this section.

Connecting the Control Card for Bench Checks and Adjustments (See FIGURE 4)

⚠ CAUTION

The control card can be damaged if power is not correctly connected or disconnected. Always disconnect the battery connector before connecting or disconnecting the control card plugs.

NOTE: The bench supply voltage does not need to be the same as the voltage of the lift truck.

The hand set can also be used to check and adjust the functions of the control card when it is connected to a bench power supply for bench checks and adjustments. The following parts are required: (1) a power source to supply a minimum of 24 DC volts at 0.5 Amps (two 12 volt automotive batteries connected in series will work) (a max. of 84 VDC @ 0.5 amps can also be used), (2) an electrical plug to connect to the Plug Z connector of the control card, (3) a switch for the circuit, (4) approximately 45 cm (18 inches) of 18 gage wire and (5) a hand set. If batteries are not used, the power supply must have a full bridge rectifier with a filter. Make the connections for the bench checks and adjustments as follows:

1. Connect the switch and a Plug Z (Hyster part number 1308651) to the power source using the wire as shown in FIGURE 4.

2. Make sure the switch is in the **OFF** position and connect the wire to TB4 as shown in FIGURE 4.

3. Connect Plug Z to the control card Plug Z connector and the hand set to the Plug Y connector.

NOTE: There are no connections to the Plug A or B connectors of the control card.

NOTE: The bench checks and adjustments are done using the same procedures described in the following pages.