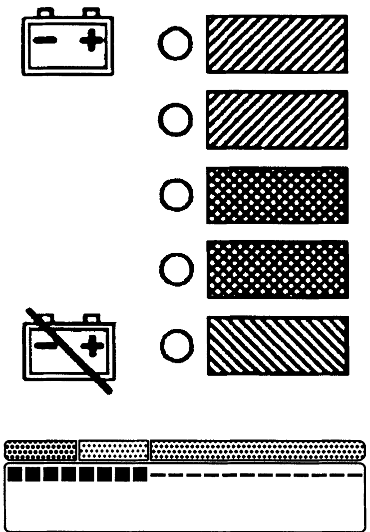
BATTERY INDICATORS



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HYSTER

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General

WARNING

If the lift truck has been operated using a low battery, check all contactors for welded contacts before connecting a charged battery. Lift truck operation cannot be controlled if the contacts are welded.

CAUTION

Do not operate an electric lift truck with a discharged battery. Continued operation can damage contactors, motors, and the battery.

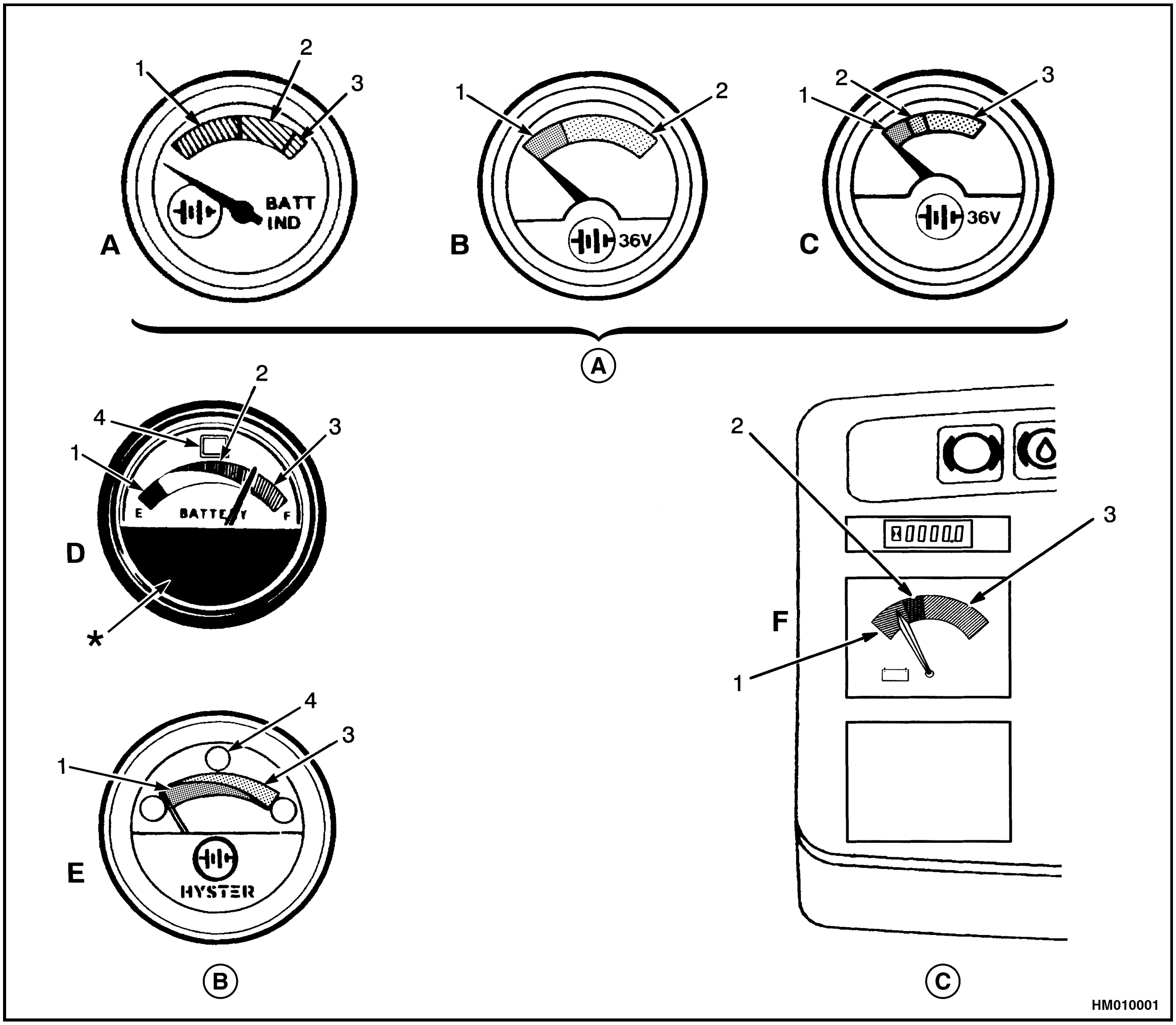
This section has a description and the repair and adjustment procedures for the different battery indicators used on electric lift trucks.

INDICATORS WITH METER MOVEMENTS

The lift truck can have one of two types of battery indicators. One type of indicator does not have Lift Interrupt and is not adjustable. See Figure 1. The other type of battery indicator has Lift Interrupt and is adjustable for different batteries or operating conditions. See Figure 2. The indicator that does not have Lift Interrupt is a voltmeter. The face of the meter has a green and red band. Some meters also have a yellow band between the red and green bands. During operation, the indicator needle moves from the green to the red band to indicate a discharged battery. When the battery is fully charged, the needle is in the green band.

The early (D of Figure 1) battery indicator with Lift Interrupt automatically measures the charge of the battery. A separate controller for the meter has an electronic circuit. This circuit controls the meter movement, a warning light (early units only), and an electronic switch for the main hydraulic pump. The circuit can remember the charge on the battery when the battery is disconnected and connected. The meter face has a band that is red at the left end and green at the right. Some indicators have a split area with green on top and yellow on the bottom. Some other meters have a yellow band between the red and green bands. The needle location indicates the battery charge level. When the needle is at the edge of the red area of the band, the warning light illuminates if the indicator has one. At this point, the battery has approximately 5% (reserve) capacity remaining. If the reserve is used, the needle enters the red band and power to the hydraulic pump motor is interrupted until the battery is charged or replaced. Normally there is enough battery power to move the lift truck to a battery charger or to a place where a charged battery can be installed. When the needle of the indicator is in the red band, the battery must be charged or changed. Continued operation will damage the battery, contactors, or motors.

Another of the battery indicators with Lift Interrupt is also a gauge type instrument (E of Figure 1). A separate controller for this indicator has an electronic circuit that controls the indicator needle, a red warning light, and an electronic switch for the main hydraulic pump. The circuit can remember the charge on the battery when the battery is disconnected and connected. This gauge indicator has a band that is a split area with green on the top and red on the bottom. The needle location indicates the battery charge level. When the battery has been discharged so the warning light illuminates, there is still some capacity in the battery. If operation is continued, power to the main hydraulic pump circuit is interrupted (specific gravity is approximately 1.140). This action prevents the operation of the main hydraulic pump. Normally there is enough battery power to move the lift truck to a battery charger or to a place where a charged battery can be installed. When the warning light illuminates, the battery must be charged or changed. Continued operation will damage the battery, contactors, or motors.

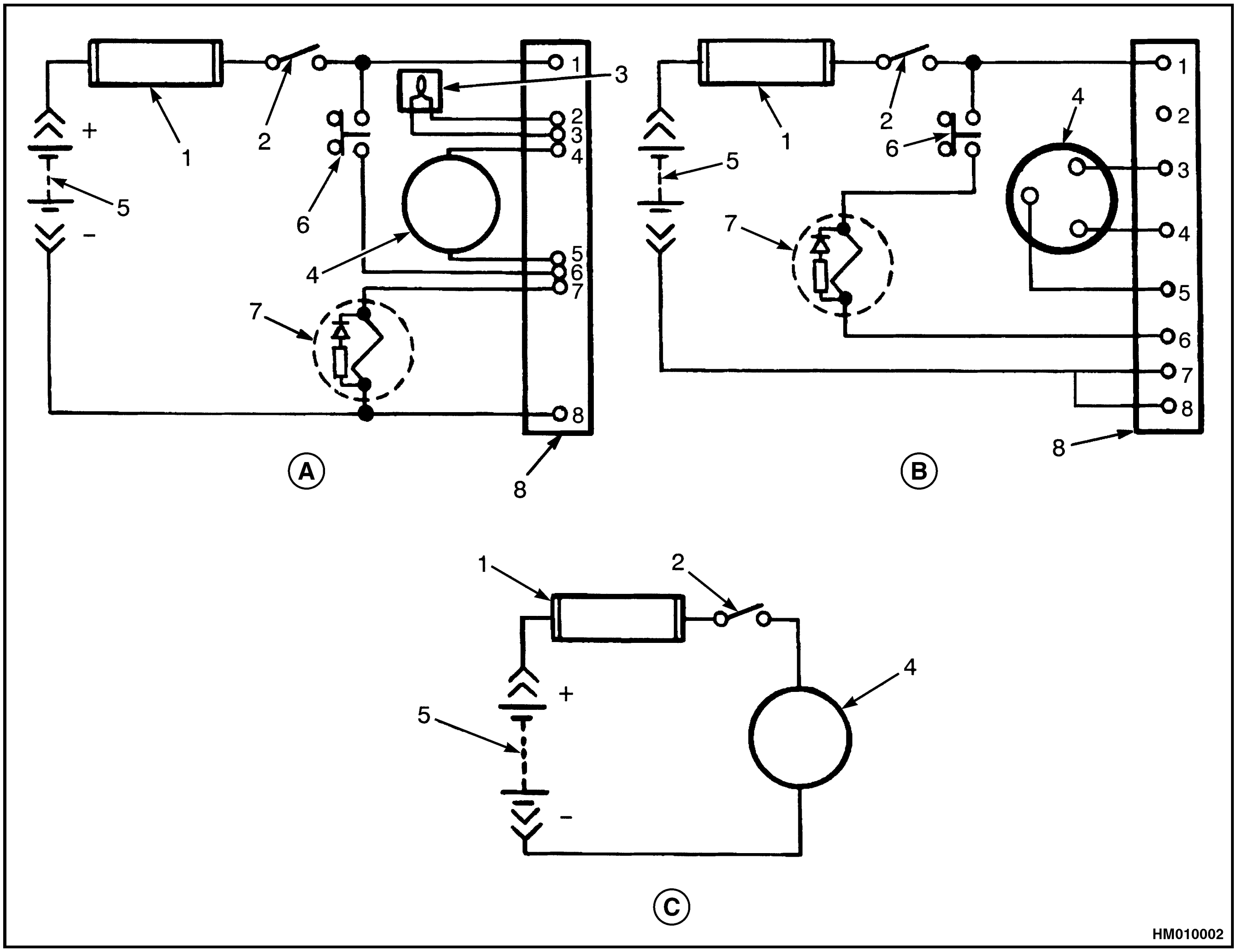


A. BATTERY INDICATORS WITHOUT LIFT INTERRUPT
B. BATTERY INDICATORS WITH LIFT INTERRUPT
C. BATTERY INDICATOR WITHOUT LIFT INTERRUPT

1. RED BAND
2. YELLOW BAND
3. GREEN BAND
4. LIGHT (LIFT INTERRUPT INDICATOR)

*LOWER METER FACE CAN BE DIFFERENT THAN SHOWN.

Figure 1. Battery Indicators With Meter Movements



A. BATTERY INDICATOR, EARLY MODELS (WITHOUT INTERRUPT)
B. BATTERY INDICATOR, LATER MODELS (WITH LIFT INTERRUPT)
C. BATTERY INDICATOR (WITHOUT LIFT INTERRUPT)

1. FUSE
2. KEY SWITCH
3. LIFT INTERRUPT INDICATOR LIGHT
4. BATTERY INDICATOR
5. BATTERY
6. PUMP MOTOR SWITCH
7. PUMP MOTOR CONTACTOR
8. CONTROLLER TERMINAL STRIP

Figure 2. Electrical Circuits for Battery Indicators With Meter Movements

BATTERY INDICATORS WITH LCD OR LED DISPLAYS

NOTE: The Lift Interrupt function on lift trucks that have the EV-100ZX or the EV-T100 motor controllers is part of the control card. These lift trucks also have one of three display panels. The early Basic Display Panel has a mechanical meter for a battery indicator (voltmeter). See Figure 1. Later basic display panels have a set of vertical LEDs beside colored bars. The Performance Display Panel has a bar scale of Light Emitting Diodes (LEDs) for the battery indicator. See Figure 3. The battery indicators discussed here do not use mechanical meters to show the battery charge.

There are battery indicators that are parts of display panels or meter faces that include other indicators. See the section **Instrument Panel Indicators and Senders** 2200 SRM 143for these other indicators.

Some of these battery indicators also have the Lift Interrupt function to help prevent damage to motors, contactors, and batteries. Lift Interrupt prevents motor operation of the main (lift) hydraulic pump when the battery discharges to a value too low for continued operation.

Some of the battery indicators have a Liquid Crystal Display (LCD) to show the state of charge of the battery. Others have red, yellow, and green LEDs to show the state of charge.

Liquid Crystal Displays

Display Panels Description (ZX or Earlier Motor Controllers)

These battery indicators use LCDs, using numeric digits to show the battery condition. This same LCD also shows other functions. See the section **Instrument Panel Indicators and Senders** 2200 SRM 143for the other functions. The function that is being displayed is indicated by a light at the symbol for that function. The symbol for the battery indicator function is a battery.

The EV-100/200 LX Series motor controller can have a display panel that includes the Battery Indicator Function. There can also be a round (meter style) indicator that includes the Battery Indicator Function. The battery indicator reading is shown on the four-digit LCD display when the function LED indicator at the battery symbol is illuminated. See Figure 3. Also see Figure 4.

There is one indicator that has a round face, green LED function indicators for the hourmeter, and service and battery indicator, as well as an LCD display. See Figure 4. The LCD display shows the value for each of the three functions when that function's LED is illuminated. This battery indicator is a voltmeter without LIFT interrupt and is installed on some lift trucks with the LX series of motor controller.

This battery indicator uses the traction control shunt to measure the current during operation. This current and battery voltage is checked at the same time for an accurate reading of battery voltage with a load (during use). By employing such a method, a more accurate reading is provided than from previous battery indicators used on earlier lift trucks. This method can also make operation of the lift truck different when the battery is low or when a different battery is connected because it generates more usage of the battery.

The battery indicator function shows the battery charge represented by numbers between 0 and 100. The digital display will flash when the digital display reads 19. At a display of 9 (80% discharged), the control will disable the lift pump circuit. After the circuit has disabled the lift pump, charge or change the battery.

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 of the control card. The battery voltage can be too high or too low. A status code of -16 (too high) or -15 (too low) will show on the instrument panel display. A battery with the correct voltage can also be over discharged from use or for other reasons and can have a voltage that is less than the minimum rated range.

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 the weakest battery is not damaged.

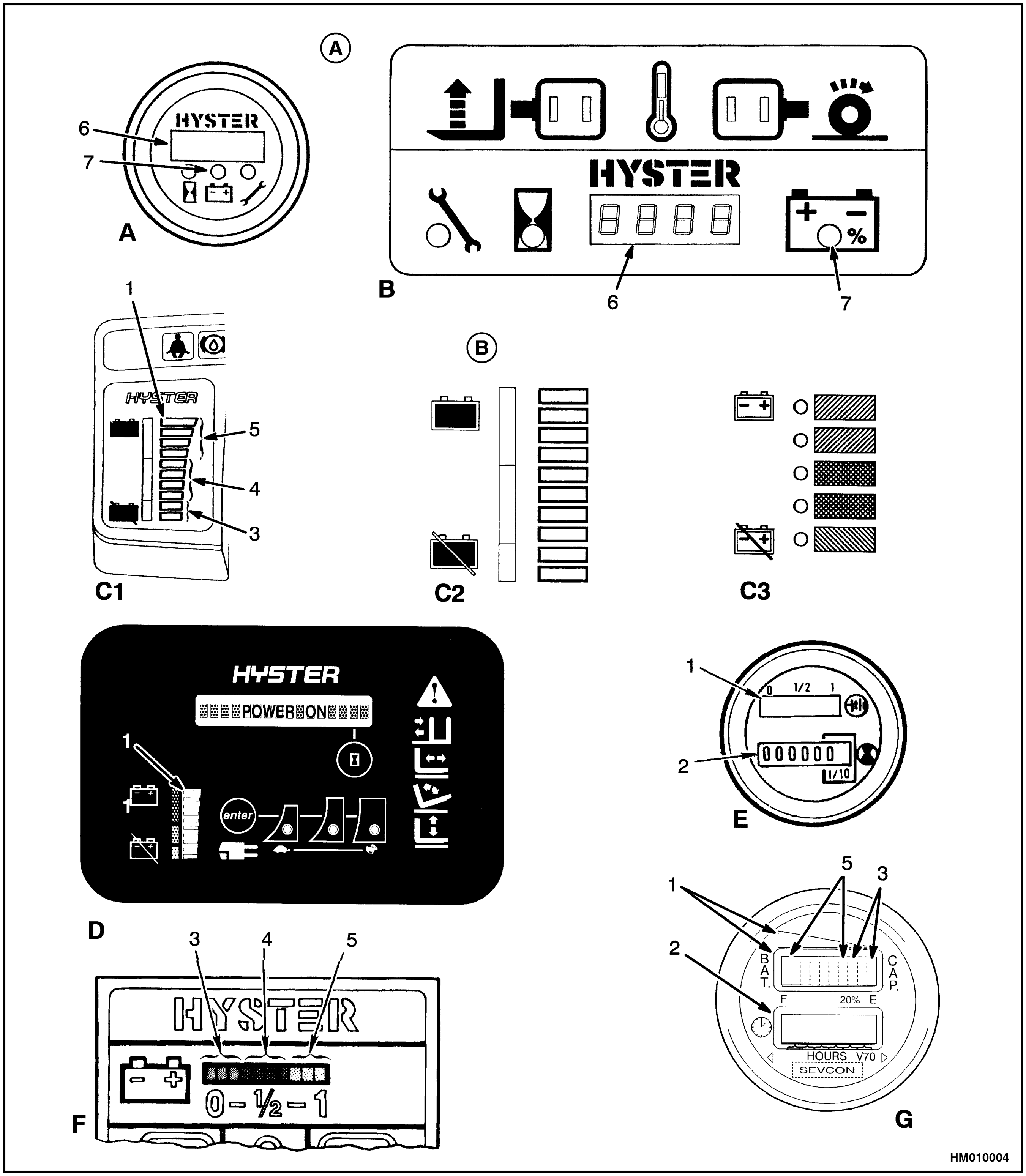
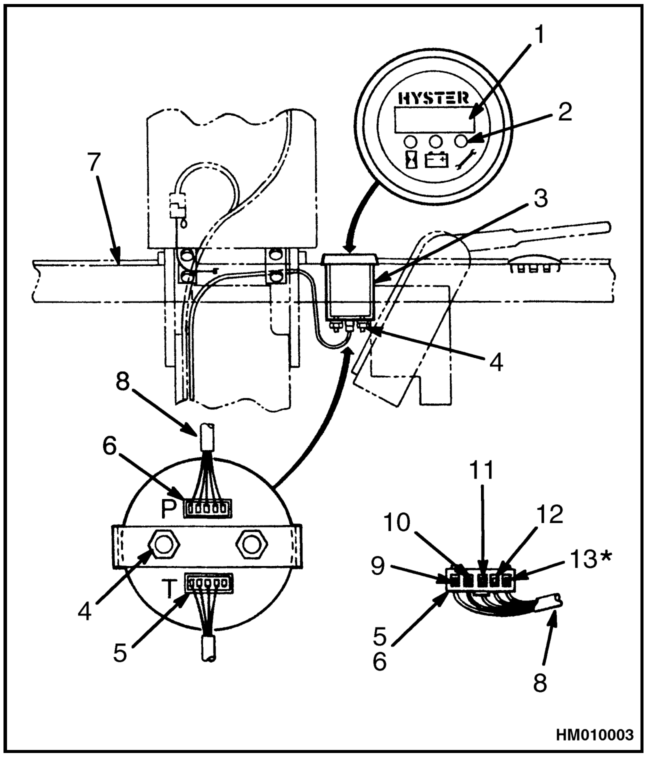


Figure 3. Battery Indicators with LCD or LED Displays (ZX, SEVCON, or Earlier Motor Controllers)

Legend for Figure 3

A. BATTERY INDICATORS WITH LIQUID CRYSTAL DISPLAYS (LCD)
B. BATTERY INDICATORS WITH LIGHT EMITTING DIODES (LEDS)

1. BATTERY INDICATOR LED DISPLAY
2. HOURMETER DISPLAY
3. RED LEDS
4. YELLOW LEDS
5. GREEN LEDS
6. LIQUID CRYSTAL DISPLAY
7. LIGHT TO INDICATE DISPLAY IS FOR BATTERY



1. FOUR-DIGIT DISPLAY
2. GREEN FUNCTION INDICATORS
3. MOUNT BRACKET
4. MOUNT NUTS
5. TRACTION PLUG
6. PUMP PLUG
7. INSTRUMENT PANEL
8. TO CONTROL CARD
9. GRN
10. BARE
11. BLK
12. NTRL
13. RED*

*TRACTION PLUG ONLY

Figure 4. LX Series Instrument Panel Display Battery Indicator

CAUTION

Do not try to adjust the battery indicator function or any other function without following the procedures in section EV-100/200 LX Series Diagnostic Motor Controller and Handset 2200 SRM 460. Damage to the control card or battery can occur if the handset is not connected and used correctly.

Adjustment of the battery indicator is part of the other adjustments of the control card. These adjustments must be made using the handset for the LX Series motor controllers. The operation of the handset and the adjustment of this and other functions is in the section **EV-100/200 LX Series Diagnostic Motor Controller and Handset** 2200 SRM 460.

SEM Display Panels Description

These SEM Display Panels are on the instrument panel (dash) to the right of the steering column. Both SEM Display Panels (Standard and Premium) have an LCD screen. See Figure 5. The screen is a display for the operator and is the display for the battery indicator. The Battery Discharge Indicator (BDI) uses a bar graph as a fuel gauge for the battery state-of-charge. See Figure 6. As the battery discharges, the bar gets shorter to show less fuel. The green band near the bar shows the normal operating range for the battery. The yellow band is the area in which the battery can still be operated without damage. This band is yellow to indicate the battery is nearing the point of discharge where it can be damaged with continued hard use. The red band indicates the discharge condition where battery damage can occur. The battery indicator symbol will come on at this time. Charge the battery immediately to prevent battery damage. Continued operation will cause lift interrupt (if enabled) to occur to help prevent battery damage. At lift interrupt, the last two segments of the bar graph are the only ones shown and are alternately **ON** and **OFF**. The lift pump motor will not operate and there will be a reduction of travel speed.

Light Emitting Diode Displays

WARNING

If the lift truck has been operated using a low battery, check all contactors for welded contacts before connecting a charged battery. Lift truck operation cannot be controlled if the contacts are welded.

CAUTION

Do not operate an electric lift truck with a discharged battery. Continued operation can damage contactors, motors, and the battery.

These battery indicators use Light Emitting Diodes (LEDs) of different colors to show the battery condition. There can be a round (meter style) indicator that includes the Battery Indicator Function and separate hourmeter function. See E in Figure 3. There can also be several styles of display panels that include the battery indicator function. These display panels are used on the XL and XM series of lift trucks with the EV-100/200LX, EV-100ZX, and EV-T100ZX motor controllers. The control card of the ZX motor controllers have the Lift Interrupt feature, which can be programmed on or off by qualified personnel using the correct equipment.

Description LX Series

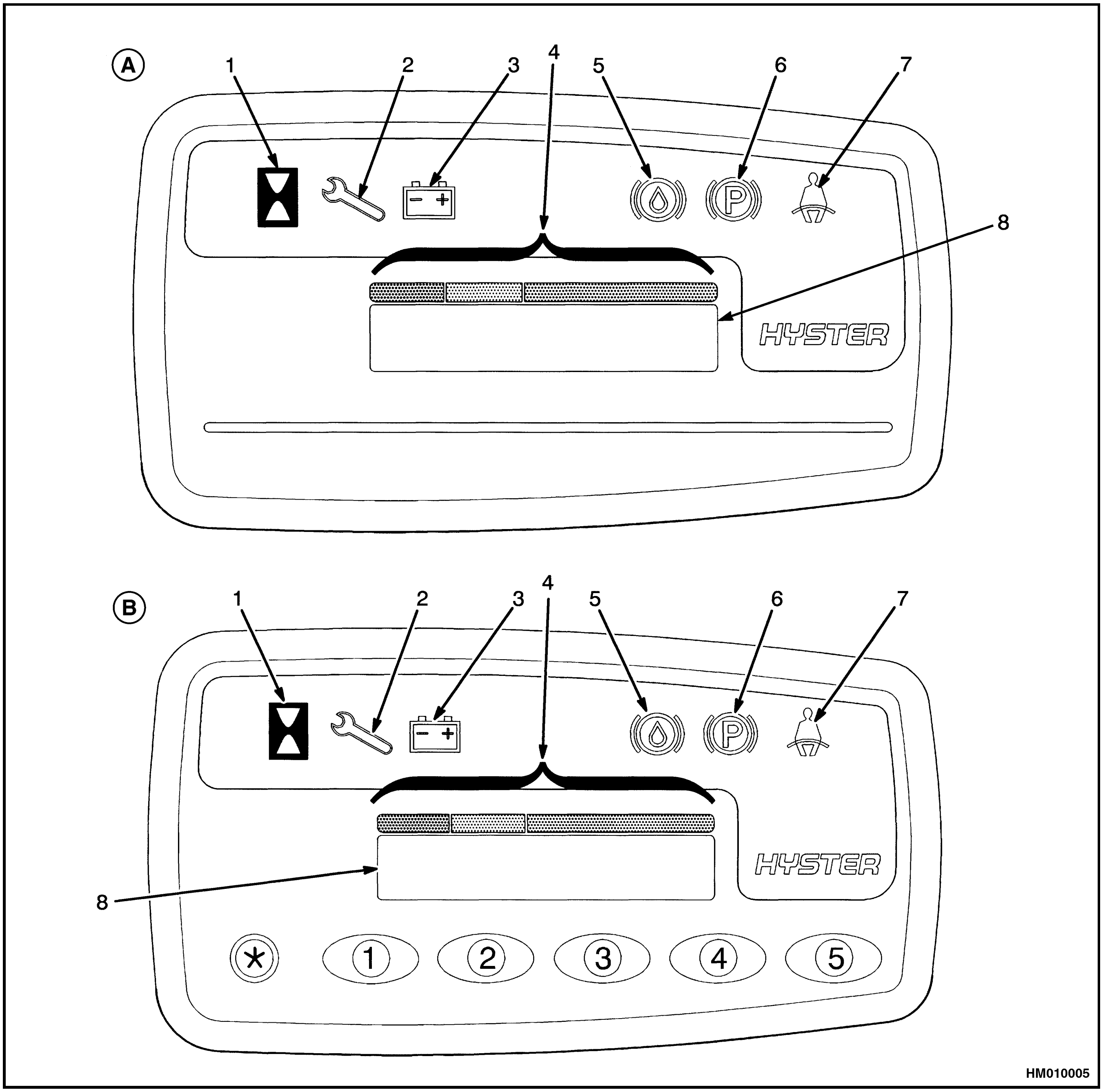
This battery indicator has a band of LEDs that operate when the battery is connected. See F in Figure 3. If the LED at the far right is the only LED illuminated, the battery has a full charge. As the battery discharges, the next LED to the left will go on and the previous LED will go off. When the battery needs charging, the next-to-last LED will flash. If the last two LEDs are flashing alternately, the battery is discharged to the point where damage can occur. Continued operation with the LEDs flashing can damage the battery, motors, or the contactors. The system will automatically reset when a charged battery is connected.

The display panel with the horizontal LED display is installed on some lift trucks with the LX series of motor controller. This battery indicator is a scale with a series of 10 LEDs in three colors (green, yellow, red). As the battery voltage decreases during operation, different LEDs illuminate to indicate a discharged battery. No more than two LEDs are illuminated at one time. When the battery is fully charged, the two green LEDs at the end of the scale are illuminated. When the battery discharges during operation, the LEDs illuminate from right to left (green to red). All lift trucks with this type of warning indicator display have a lift interrupt. When the battery is discharged to the red section of the battery discharge indicator, the last two LEDs begin to flash just before the lift interrupt is enabled. When the last two LEDs are illuminated continuously, the controller for the battery discharge indicator stops the power to the hydraulic pump motor. This action prevents the lift truck from lifting. Enough battery power is normally available to move the lift truck to a battery charger or to a place where a charged battery can be installed.

With a fully charged battery, the controller provides approximately a 5-volt signal at terminal 4 to the display. As the battery discharges, the signal at terminal 4 decreases toward zero voltage. When the last red LED begins to flash, the battery is approximately 70% discharged (specific gravity is approximately 1.150). The controller for the battery indicator opens the circuit to the hydraulic pump when the battery is 80% discharged (specific gravity is approximately 1.140).

The controller for the battery discharge indicator for this LED display panel is in the same case as the controllers used for other Hyster Company lift trucks, but will not operate the same. The adjustments for the controller are set by the manufacturer and normally are not changed. If adjustments are required, see the Battery Indicators Replacement section for the instructions on adjustments. The adjustment procedure for this controller is the same as the other controllers used in Hyster Company lift trucks.

NOTE: If the controller must be replaced, make sure Hyster part number 372036 is used. Controllers with other part numbers will not operate correctly.

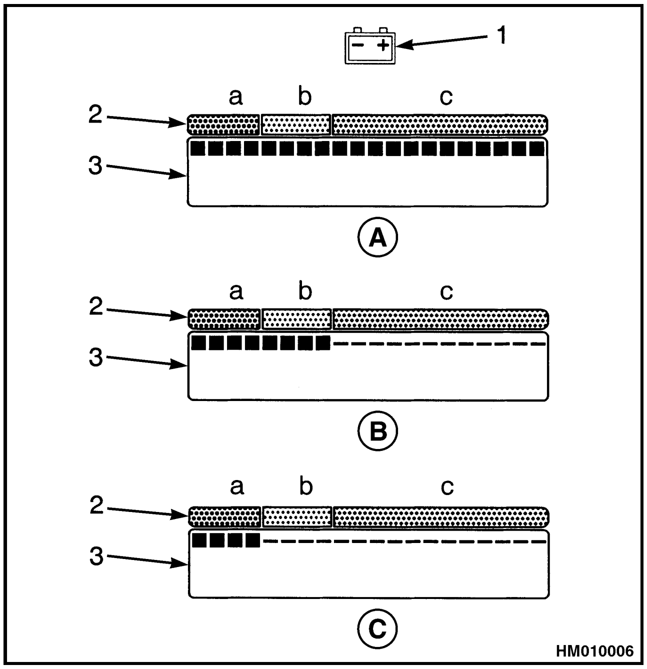


A. STANDARD DISPLAY PANEL

B. PREMIUM DISPLAY PANEL

1. HOURMETER INDICATOR SYMBOL
2. SERVICE REMINDER INDICATOR
3. LOW BATTERY INDICATOR
4. BATTERY DISCHARGE INDICATOR (BDI)
5. BRAKE FLUID TOO LOW SYMBOL
6. PARKING BRAKE SYMBOL
7. SEAT BELT SYMBOL
8. LCD SCREEN

Figure 5. Battery Indicator With SEM Display Panel



A. FULLY CHARGED
B. DISCHARGED TO YELLOW AREA
C. DISCHARGED TO RED AREA

1. BATTERY SYMBOL
2. COLOR BAR
   A. RED
   B. YELLOW
   C. GREEN
3. LCD SCREEN WITH SEGMENTS ON

Figure 6. Battery Discharge Display of SEM Display Panels

ZX Series Display Panels Description

The EV-100 ZX Series motor controller can have an instrument panel display that includes two types of Battery Indicators. The earlier Basic Display Panel has a battery indicator without lift interrupt (voltmeter). This meter has a green, yellow, and red band on the meter face to indicate the voltage of the battery. See F in Figure 1. The needle starts in the green band with a fully charged battery and moves to the red band as the battery discharges.

Later basic display panels have a battery indicator that is a scale with a series of five round LEDs in three colors (green, orange, red). See C3 of Figure 3. There are two green LEDs and bars at the top, two orange LEDs and bars in the center, and a red LED and bar at the bottom. As the battery voltage decreases during operation, different LEDs illuminate to indicate a discharged battery. No more than two LEDs are illuminated at one time. When the battery is fully charged, the two green LEDs of the scale are illuminated. When the battery discharges during operation, the LEDs illuminate from top to bottom (green to red).

All lift trucks with this type of warning indicator display have a lift interrupt. When the battery is discharged to the red section of the battery discharge indicator, the red LED begins to flash just before the lift interrupt is enabled. When the red LED is illuminated continuously, the controller for the battery discharge indicator stops the power to the hydraulic pump motor. This action prevents the lift truck from lifting. Enough battery power is normally available to move the lift truck to a battery charger or to a place where a charged battery can be installed.

The Performance display panel has a battery indicator with a series of 10 LEDs in three colors (green, orange, red) that have a rectangular shape. See C1 and C2 in Figure 3. As the battery voltage decreases during operation, different LEDs illuminate to indicate a discharged battery. No more than two LEDs are illuminated at one time. When the battery is fully charged, the two green LEDs at the top of the scale are illuminated. When the battery discharges during operation, the LEDs illuminate from top to bottom (green to red). All lift trucks with this type of warning indicator display have a lift interrupt. When the battery is discharged to the red section of the battery discharge indicator, the last two LEDs begin to flash just before the lift interrupt is enabled. When the last two LEDs are illuminated continuously, the controller for the battery discharge indicator stops the power to the hydraulic pump motor. This action prevents the lift truck from lifting. Enough battery power is normally available to move the lift truck to a battery charger or to a place where a charged battery can be installed.

With these Performance display panels, when the battery is discharged to approximately 70 to 75%, the red LED bars are illuminated and the lift interrupt function will not permit operation of the hydraulic motor. The battery must be charged or a charged battery must be installed before lift truck operation can continue. The top green bar will be illuminated when the battery is more than 90% charged.

The battery charge indicator uses the traction control shunt to measure the current during operation. The current and battery voltages are checked at the same time for an accurate reading of battery voltage with a load (during use). This method permits better use of the battery charge.

The controller 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. The battery voltage can be too high or too low. A status code of -16 (voltage too high) or -15 (voltage too low) will indicate on the digital display. A battery with the correct voltage can also be deeply discharged from use or other reasons and can have a voltage that is less than the minimum rated range.

Batteries that have different ampere 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 of the EV-100ZX motor controller so the weakest battery is not damaged. Follow the procedure for adjusting traction Function 14 in the section **EV-100ZX™ Motor Controller** 2200 SRM 557 or the section **EV-T100™ Motor Controller** 2200 SRM 581.

SEVCON POWERGAUGE™ Battery Display Panel Description

The SEVCON POWERGAUGE™ has been designed to display battery capacity by employing an electronic microprocessor. This microprocessor recognizes the state-of-charge of the battery and has a compensating characteristic to obtain maximum accuracy.

This display panel utilizes a 10-bar LED display (seven green, three red) to indicate the state-of-charge of the battery. See item G in Figure 3.

When the battery is fully charged, the green LED next to the F symbol is illuminated to its highest point (there are seven stages of green that can be highlighted). As the battery voltage decreases during operation, different LEDs illuminate to indicate a discharged battery. When the battery reaches 20% of the charge level, the first red LED lights up. If no action is taken to charge the battery, it will continue to discharge and the second and third red LEDs will illuminate. These last two red LEDs will flash alternately to alert the operator for the need to recharge the battery. Once this point is reached, and after a period of 30 seconds of no electrical activity, power to the hydraulic controls is interrupted. This is known as Lift Interrupt or Lift Lockout. This action prevents the lift truck from lifting. Enough battery power is normally available to move the lift truck to a battery charger or to a place where a charged battery can be installed.

The lower window on the display panel shows a six-digit LCD hourmeter counter indicating hours and tenths of hours. The hourmeter will operate automatically every time a voltage variation occurs. It will operate for 30 seconds by the last voltage variation before stopping. A flashing clock symbol will then alert the operator that the hourmeter has been activated. The hourmeter requires no additional wiring.

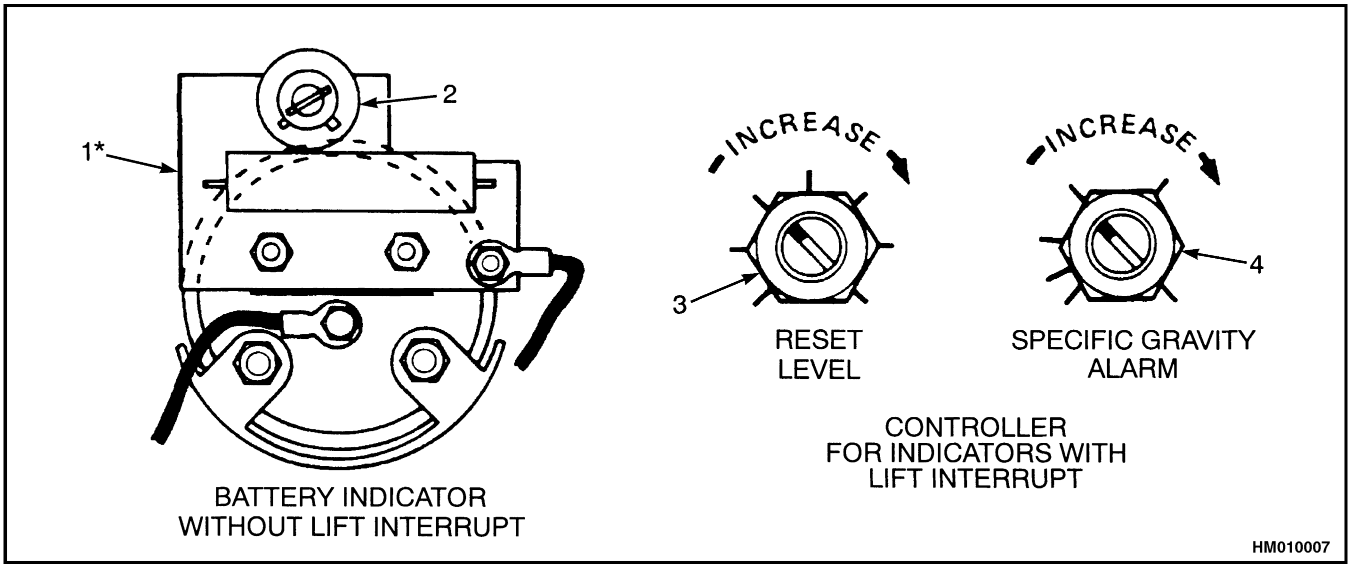
The unit is multi-voltage and automatically recognizes 24-36-48 and 72 volts. The 80-volt models require a simple connection between pins 1 and 4. The unit automatically resets itself when the battery voltage goes above 2.09 volts per cell. Specific Gravity is set at 1.210.

Battery Indicators Without Lift Interrupt Adjustment (Early Models)

The indicator is set at the factory for a specific gravity. This reference voltage is for a battery discharged to a specific gravity of approximately 1.130. This voltage will be different for certain batteries, conditions, capacity, or temperature. Specific applications can cause different settings. The setting must not be below the discharge point. See the battery manufacturer for the discharge point. Adjust the indicator as follows:

NOTE: It is important that the battery is at the exact specific gravity for adjustment. This setting is the reference voltage for indicator adjustment.

1. Check specific gravity of battery during operation of the lift truck until battery discharges to 1.130 (or value needed).
2. Find screwdriver slot on printed circuit board for calibration potentiometer. See Figure 7.
3. Operate hydraulic system at relief setting and hold at this position.
4. Adjust calibration potentiometer so needle is in center of red band.



1. PRINTED CIRCUIT BOARD
2. CALIBRATION POTENTIOMETER
3. RESET POTENTIOMETER
4. SPECIFIC GRAVITY ALARM POTENTIOMETER

*NOT USED ON ALL INDICATORS.

Figure 7. Battery Indicator (Early Models)

Battery Indicators With Lift Interrupt Adjustment (Early Models)

The controller for the battery indicator has two factory-set adjustments. The adjustments are made with the RESET potentiometer and the SPECIFIC GRAVITY ALARM potentiometer. See Figure 7.

RESET POTENTIOMETER

The RESET potentiometer determines the level to which the battery must be charged before the indicator indicates fully charged. The RESET potentiometer is set at the factory to C. The RESET function operates only when a battery has been disconnected for at least 15 seconds and another battery connected. The replacement battery must be charged to at least 90% of its capacity.

Turning the RESET potentiometer from C toward G (clockwise) increases the voltage at which the battery is accepted. The specific gravity of the battery must be more than 1.245.

Turning the RESET potentiometer from C toward A decreases the voltage at which the battery is accepted. The specific gravity of the battery is less than 1.245.

If a battery that is connected does not have the correct specific gravity, the indicator will remain in its original position.

SPECIFIC GRAVITY ALARM

The SPECIFIC GRAVITY ALARM potentiometer determines the level at which the LIFT interrupt function occurs. The potentiometer is set at the factory to N. The N setting is equal to 1.73 volts per cell.

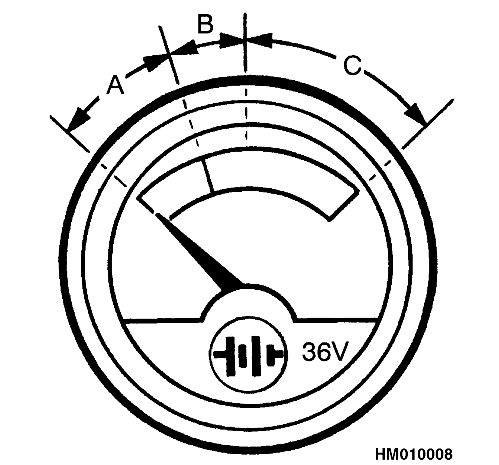
Turning the SPECIFIC GRAVITY ALARM potentiometer from N toward K lets the battery discharge more before lift interrupt occurs.

Turning the SPECIFIC GRAVITY ALARM potentiometer from N toward P lets the battery discharge less before lift interrupt occurs.

Battery Indicators Without Lift Interrupt Check (Later Models)

There is no adjustment for these indicators. The voltage range, however, can be checked. Check the voltage settings as shown in Table 1. When the hydraulic system is at the relief setting, the indicator is set to indicate a specific gravity of 1.150. At this time the needle is in the middle of the red band. Replace the indicator if it does not operate correctly.

Table 1. Battery Indicator (Later Models)



Type	Voltage Range		
	A	B	C
12V	8.5 volts	10 volts	13 volts
24V	17 volts	20 volts	26 volts
36V	25 volts	30 volts	40 volts
48V	34 volts	40 volts	52 volts
72V	51 volts	60 volts	78 volts
80V	57 volts	67 volts	87 volts

Battery Indicators With Lift Interrupt Adjustment (Later Models)

The following procedures for the battery indicator apply to both the gauge type LED indicator and the LED display indicator, shown as E and F in Figure 3.

The controller for the battery indicators has two factory-set adjustments. The adjustments are made with the RESET potentiometer and the DISCHARGE potentiometer. See Figure 8.

RESET POTENTIOMETER

The RESET potentiometer determines the level to which the battery must be charged before the indicator indicates fully charged. The RESET potentiometer is set at the factory to C. The RESET function operates only when a battery has been disconnected for at least 15 seconds and another battery connected. The replacement battery must be charged to at least 90% of its capacity.

The RESET potentiometer increases the voltage at which the battery is accepted when turned from C toward G (clockwise). The specific gravity of the battery must be more than 1.245.

The RESET potentiometer decreases the voltage at which the battery is accepted when turned from C toward A . The specific gravity of the battery is less than 1.245.

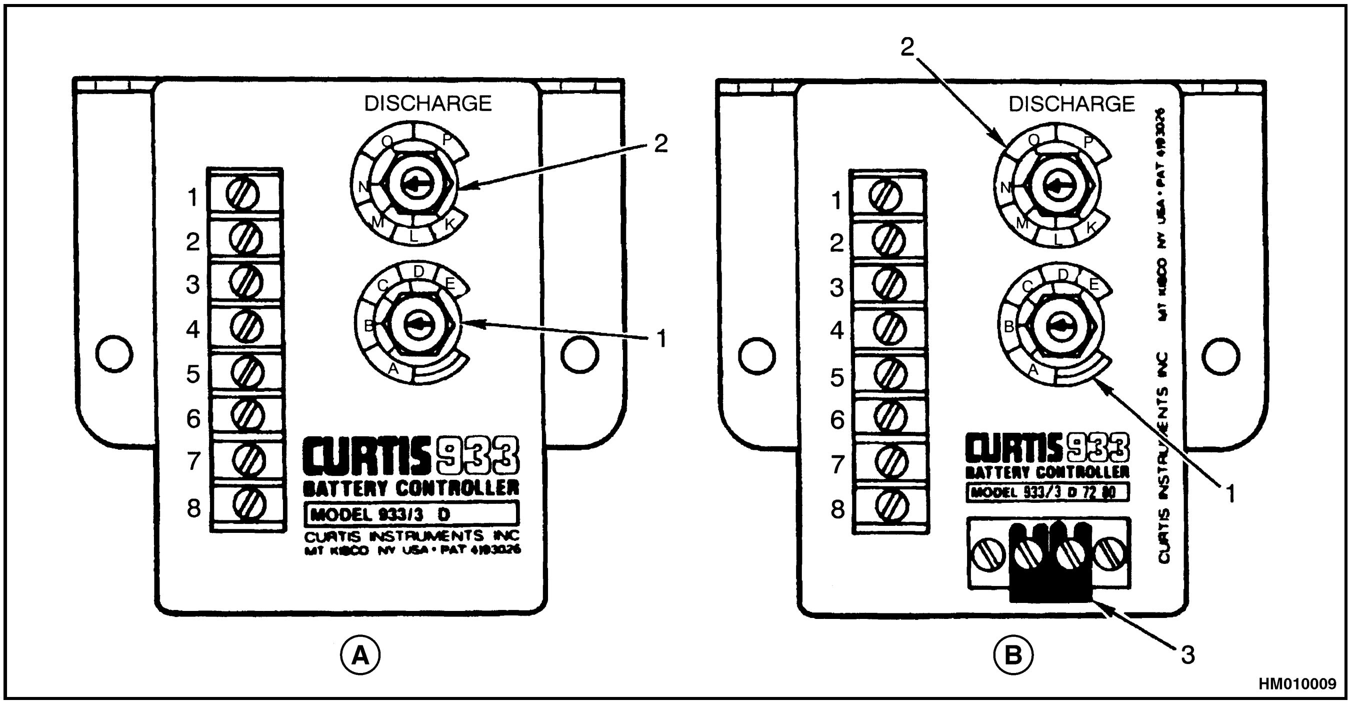
If a battery that is connected does not have the correct specific gravity, the indicator will remain in its original position.

DISCHARGE POTENTIOMETER

The DISCHARGE potentiometer determines the level at which the LIFT interrupt function occurs. The potentiometer is set at the factory to N. The N setting is equal to 1.73 volts per cell.

Turning the DISCHARGE potentiometer from N toward K lets the battery discharge MORE before LIFT interrupt occurs.

Turning the DISCHARGE potentiometer from N toward P lets the battery discharge LESS before LIFT interrupt occurs.



A. 36/48 VOLT

1. RESET POTENTIOMETER
2. DISCHARGE POTENTIOMETER

B. 72/80 VOLT

3. JUMPER (REMOVED FOR 80-VOLT OPERATION)

Figure 8. Battery Indicator Controller (Later Models)

LED Display With Lift Interrupt

NOTE: If battery negative and battery positive are not connected, the display will not operate.

To check the LEDs of the display (F in Figure 3), connect battery negative to terminal 13B and battery positive to terminal to 71, then connect two volts to terminal 72. The second yellow LED will illuminate. Connect four volts to terminal 72. The second green LED will illuminate. With zero volts or an open at wire 72, the first red LED will flash.

Curtis 933-1 Meter Check and Adjustment

CHECK

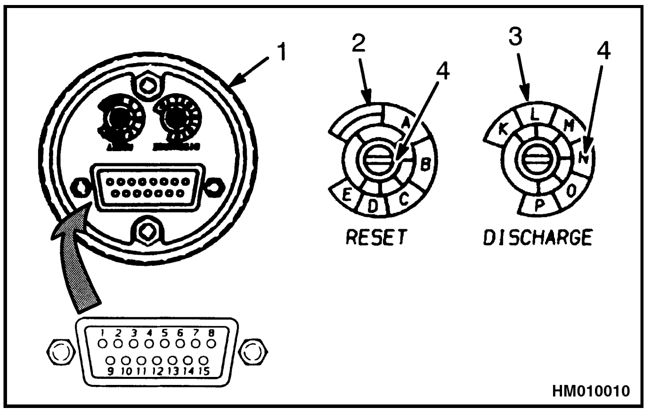
NOTE: This meter has several functions and internal electronic circuits. See A of Figure 3. To make sure the meter is correctly connected and operating correctly, it is necessary to do the following checks. It is only necessary to do these checks if the meter operation is not correct when the adjustments are correctly set. Make sure RESET is set to B and DISCHARGE is set to N. Also make sure there is no jumper installed at the 15-pin meter connector for 48-volt units. There MUST be a jumper wire connected between pins 15 and 4 for 36-volt units.

It is necessary to remove the meter assembly from the display panel to do most of the following checks. Remove the display panel and meter assembly as described in of this section. Hold or fasten the meter and display panel so damage does not occur to the devices or electrical connections. Connect the 15-pin connector to the back of the meter. Connect the 18-pin connector to the back of the display panel.

Access to the connector pins is at the back of the 15-pin connector. The front view of the connector is shown in Figure 9. Make sure the voltmeter probes are touching the correct connector pins.

Reset Check

This check will find out if the meter will reset to Full after a charged battery is connected. Two different checks can be used: Open Circuit (used with a partially charged battery) or High Voltage (used with a fully charged battery). Make sure the meter RESET adjustment is set to B before doing either check. See Figure 9.



15-Pin Connector* (Circuit Board to Meter)	
Pin	**Function**
1	Battery Positive (B+)
2	Key Switch
3	No Connection
4	Jumper from #15
5	No Connection
6	Lockout (+)
7	Lockout (−)
8	Battery Negative (−)
9-11	Hourmeter
12	No Connection
13	No Connection
14	No Connection
15	Jumper to 34 for 36 or 72 volt operation. No jumper for 12, 48, or 80 volt operation

1. BACK OF METER
2. RESET ADJUSTMENT
3. DISCHARGE ADJUSTMENT
4. SLOT

*15 PIN CONNECTOR AND WIRES FOR THE METER CONNECTOR ARE PART OF THE CIRCUIT BOARD OF THE DISPLAY PANEL.

Figure 9. Curtis 933-1 Meter Reset and Discharge Adjustments

CAUTION

Make sure the meter probes do not damage the connector pins or other components. Make sure the meter probes touch only the correct connector pins.

Open Circuit

Disconnect the battery at the battery connector, then connect the battery again. Measure the voltage between pins 1 and 8 using a digital voltmeter. This voltage must be 2.09 volts minimum per cell.

Example - 36 V battery: 18 cell truck battery × 2.09 volts
= 37.62 volts minimum

Example - 48 V battery: 24 cell truck battery × 2.09 volts
= 50.16 volts minimum

If the voltage is less than the minimum, the meter must not reset. Do the check again using a battery with a higher charge. If the voltage measured is more than the minimum voltage and the meter will not reset, the meter has a malfunction.

If the voltage is less than the minimum and the meter does reset to Full, the internal battery (memory battery) of the meter can be discharged. The meter will still show a correct discharge condition IF a charged battery is connected and is not disconnected during the life of that battery's charge.

NOTE: New meters have a Full reading in their memories. The first connection to a battery will always show a Full charge. After the first connection, the meter will indicate normally according to the battery that is connected.

High Voltage

The meter must reset to Full if the voltage between pins 1 and 8 is 2.35 volts per cell for 6 minutes or more continuously.

Example - 36 V battery: 18 cell truck battery × 2.35 volts
= 42.3 volts minimum

Example - 48 V battery: 24 cell truck battery × 2.35 volts
= 56.4 volts minimum

The voltage must be above the minimum voltage continuously for at least 6 minutes. If the meter will not reset to Full, the meter has a malfunction.

Discharge Check

This check will find out if the meter correctly shows the discharge of the battery. The meter checks the charge condition of the battery when the battery is supplying power (in use). It takes a minimum of 30 minutes for the meter to change from Full to Empty. Connect a battery that has less than the minimum voltage shown in the example. Operate the tilt circuit to use power from the battery.

The voltage between pins 1 and 8 must be less than 2.0 volts per cell to make the meter indicate empty. Check that the voltage is less than 2.0 volts per cell.

Example - 36 V battery: 18 cell truck battery × 2.0 volts
= 36.0 volts maximum

Example - 48 V battery: 24 cell truck battery × 2.0 volts
= 56.0 volts maximum

If the voltage is less than the maximum voltage for 30 minutes and the meter does not indicate Empty, the meter has a malfunction.

Lockout Check

This check will find out if the lockout function is correct. Lockout prevents operation of the lift circuit when a battery is discharged too far. Lockout will not occur until the two left LEDs illuminate alternately. A short circuit between pins 6 and 7 of the 15-pin connector is the correct condition for a charged battery. There must be an open circuit between pins 6 and 7 during lockout.

<u>No Lockout</u>

If the lift circuit will still operate when the two left LEDs illuminate alternately, disconnect the battery connector. Disconnect the 15-pin connector from the back of the meter. Use an ohmmeter to check for a short circuit between pins 6 and 7 at the display panel half of the 15-pin connector. Make sure to measure between the correct pins. The connector shown in Figure 9 is the meter half of the connector. If there is a short circuit, the display panel or truck wiring has a short circuit. If there is no short circuit, the meter must have a malfunction causing a short circuit.

<u>Lockout With Charged Battery</u>

If the lift circuit will not operate even when the two left LEDs are NOT illuminated alternately, check for a short circuit between pins 6 and 7. If there is no short circuit, the meter has a malfunction.

<u>Lockout Too Soon</u>

Check for less than a 1% drop in battery voltage at the meter. Use a digital voltmeter to check the voltage between pin 1 (−) of the 15-pin connector and the positive terminal of the battery. Operate the tilt system and record the voltage. Check the voltage between pin 8 (+) of the 15-pin connector and the negative terminal of the battery. Operate the tilt system and record the voltage. Add the two recorded voltage readings. Check the voltage between the battery terminals. The sum of the recorded voltages must be less than 1% of the measured battery voltage. If the battery voltage is 38 volts, the recorded voltage must be less than 0.38 volt.

LEDs Do Not Illuminate

The discharge LEDs are illuminated by voltage through the key switch at pin 2. Check for truck voltage between pin 2 (+) and pin 8 with the key switch **ON** and the battery connected. If there is truck voltage and the LEDs are not illuminated, the meter has a malfunction.

Hourmeter Check

The LCD of the hourmeter will illuminate when there is power at pins 1 and 8. Use a digital voltmeter to check for voltage between pins 1 (+) and 8. If there is truck voltage and the LCD is not illuminated, the meter has a malfunction.

Hourglass Icon

The icon flashes when the hourmeter is operating. Make sure the key is **ON** and the battery is connected. Check for truck voltage between pin 1 (+) and 8 and between pin 2 (+) and 8. There must also be truck voltage between pins 9, 10, or 11 and pin 8 (−). If the icon is not flashing, the meter has a malfunction.

Install the meter and display panel as described in SEM Display Panel Replacement this section.

ADJUST

There are two adjustments for the Curtis 933-1 meter. The adjustments are made on the back of the meter. There is one adjustment screw for setting the reset level and one adjustment screw for setting the discharge level.

Adjust the Curtis 933-1 meter as follows:

1. Disconnect battery and remove key from key switch.
2. Look at back of Curtis meter. Use a screwdriver to rotate both adjustment screws of meter counterclockwise against the stop.
3. The slot in each adjustment screw will be aligned near the first letter. Use the screwdriver to turn RESET adjustment screw so slot is aligned near center of area B. See Figure 9.
4. Use the screwdriver to turn DISCHARGE adjustment screw so slot is aligned near center of area N.

SEVCON POWERGAUGE™ Adjustment

Models BCC and BHC of the SEVCON BDI are manufactured with a selector on the back side, just behind the bracket. Refer to Figure 3, item G. This allows for the modification of the Lift Interrupt (or Lockout) relay level. By changing the relay level, the electronic microprocessor will set the battery discharge parameters according to the different curves programmed in the software. See Table 2.

Table 2. SEVCON Discharge Curve Selector Positions

Discharge Curve Position	Approximate Average Volts per Cell at Lift Interrupt
0	1.73
1	1.57
2	1.65
The shaded row in the table indicates the factory setting.	

Table 2. SEVCON Discharge Curve Selector Positions (Continued)

Discharge Curve Position	Approximate Average Volts per Cell at Lift Interrupt
3	1.68
4	1.73
5	1.78
6	1.82
7	1.84
8	1.86
9	1.89
A	1.91
B	1.93
The shaded row in the table indicates the factory setting.	

Curtis Dash Display Assembly

DESCRIPTION/FEATURES

The dash display is a rectangular front-mounted display unit that interfaces with both the Main Interface Board and the traction motor controller. It is used exclusively with the Curtis Traction Motor Controllers. For additional information, see the **Traction Motor Controller and Handset** section for your lift truck.

Two different versions of the dash display are available, depending on ambient temperature.

Standard models .... −25 to 70°C (−13 to 158°F).
Freezer option .... −40 to 70°C (−40 to 158°F).

The dash display contains the following features:

1. Ten-bar LED battery state of charge indication.
2. Sixteen-character English messages for status, warnings, and faults.
3. Three "button selectable" hourmeters (Traction, Lift, and Total Hours).

4. Three "button selectable" drive modes.
5. Four hydraulic function indicator lights.
6. Low-battery lift interrupt indication and permissive output.

OPERATION

1. The Battery Indicator has a 10-bar multicolor diode (LED) to indicate battery charge status. See Figure 10. The bars are green, yellow, and red. As power is used the LEDs will turn off, starting with green, then yellow, then red. The red LED second from the bottom, will flash indicating a nearly discharged battery. The bottom red LED will alternately flash with the LO-Battery indicator LED (a crossed battery symbol), indicating a discharged battery. The lift function will be disallowed at this point. Continued operation with a discharged battery can damage the battery, motor, or the contactors.

2. The Message Center is a 16-character, dot matrix liquid crystal display (LCD) with green backlighting. The 16-character, alphanumeric display shows the hourmeter readings, lift truck performance status, and warning or fault conditions. When a warning message is received, the warning/fault indicator (6) will blink as a yellow light. When a fault message is received, the warning/fault indicator (6) will blink as a red light.

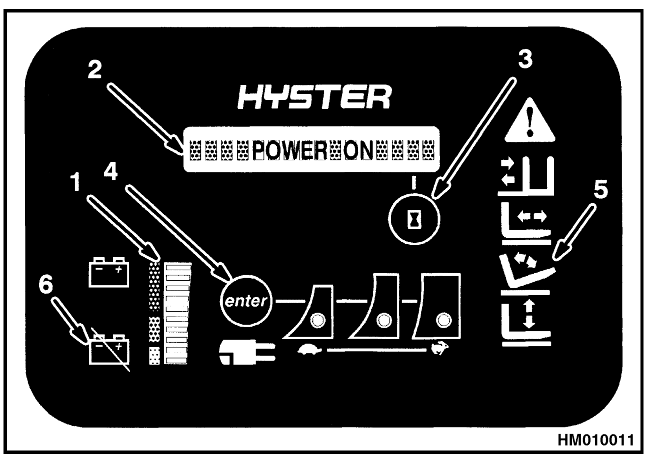


Figure 10. Curtis Dash Display

3. The Instrument Display Hourmeter switch is controlled by the operator and is used for on-demand display of hourmeter information. The hourmeter data can be displayed at any time by pressing the hourmeter switch. The switch is marked with an hourglass symbol. Press once to display truck hours to 1/10 of an hour. Press twice to display drive motor hours. Press three times to display the lift motor hours. Press four times to return to the normal display mode. After 30 seconds the display will return to the normal display mode, which indicates the current operational status of the truck.

4. The Drive Mode Display allows the operator to select the level of performance for the traction motor controller most suited to the application. There are three drive mode levels, which are programmed at the factory.

   a. Turtle mode provides slower acceleration, reduced top speed, and maximized energy efficiency. It is also a valuable setting when training new operators.

   b. Mid mode reduces acceleration with full travel speed.

   c. Rabbit mode provides maximum acceleration and travel speed.

Operation of the drive mode switch will cause the green indicators and corresponding drive modes to increase through each of the levels from Turtle to Mid to Rabbit. When the key switch is turned off, the selected drive mode is retained. When the battery is disconnected, the drive mode returns to Rabbit mode. The rates of acceleration and travel speeds are programmable and can be adjusted by qualified service personnel. For additional information, see the section **Traction Motor Controller and Handset** for your lift truck. Refer to PROGRAMMING THE TRACTION MOTOR CONTROLLER.

5. The LED Function Selection Lights display the selected hydraulic function. Status messages will be displayed for Lift, Tilt, Reach, and Sideshift. The function selection lights will display the current hydraulic function, independent of the present LCD display.

The instrument display is powered whenever the key switch is on. The dashboard contains an internal backup battery, capable of memory retention of the battery indicator and hourmeter readings when the battery is disconnected.

TESTING

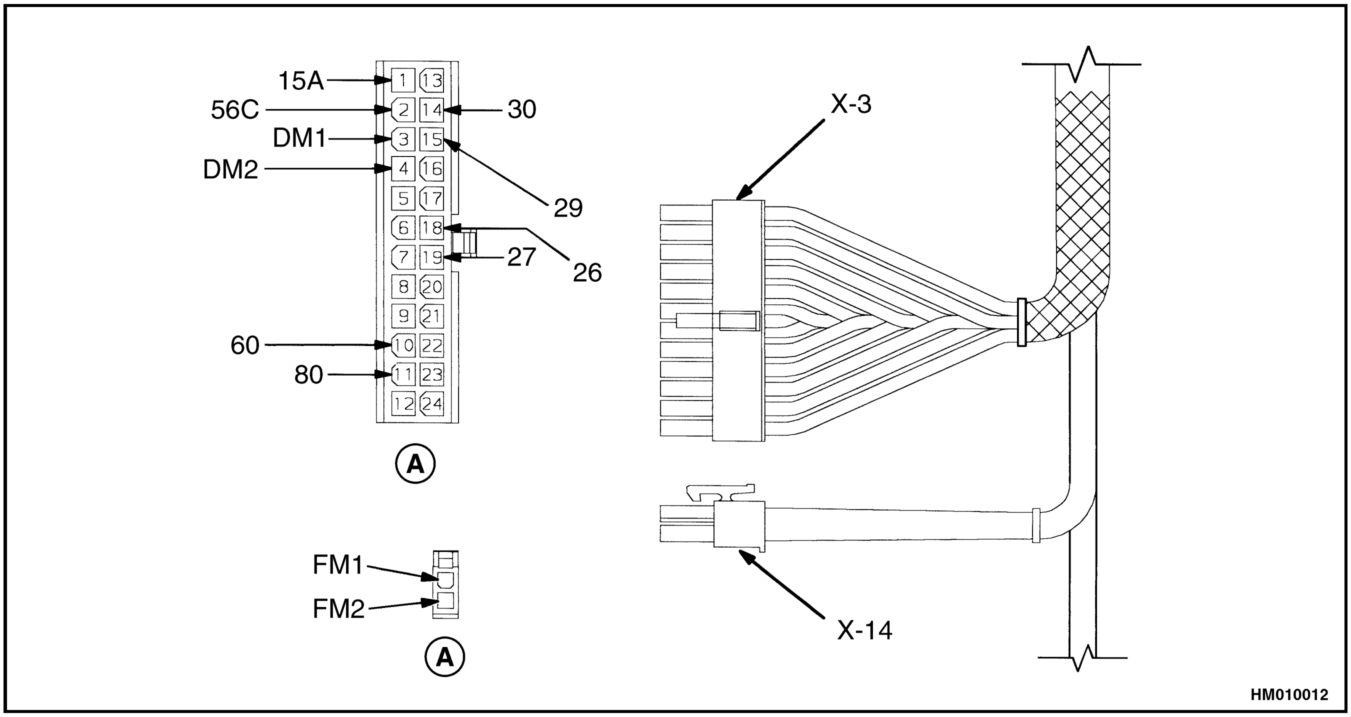
Inoperative Dash Display Assembly

If the dash display is blank (no display, LEDs etc.), with the key switch **ON** and the main contactor energized, see the section **Electrical System** for your lift truck. Refer to STATUS, WARNING AND FAULT CODES, BLANK DASH DISPLAY for troubleshooting procedures.

Inoperative Drive Mode Selection

Communication from the dash display to the traction motor controller occurs through two wires, DM1 and DM2. See Figure 11. Wires DM1 and DM2 are located in the X-6 connector of the dash display and in the X-3 connector at the traction motor controller. A digital signal is carried to tell the traction motor controller to operate in one of the three drive modes (Turtle, Mid, or Rabbit modes).

If pressing the mode selection button causes the green LED mode indicators to change, but truck performance appears unchanged, see the next section to check the communication from the dash display to the traction motor controller.



A. FRONT VIEW

Figure 11. Traction Motor Controller Connection Pin-Out

Troubleshooting With a Programmer Handset

Using the Programmer Handset, enter the TEST MENU. See the section **Traction Motor Controller and Handset** for your lift truck for instructions. Check the MODE A INPUT and the MODE B INPUT. See Table 3 for the correct inputs.

Table 3. Dash Display Drive Mode Inputs

Test Menu	Drive Mode		
	Turtle	Middle	Rabbit
Mode A Input	OFF	ON	ON
Mode B Input	ON	OFF	ON

If the communication is occurring as shown in Table 3, but correct operation is still suspect, program the traction motor controller using the handset as follows:

1. Enter PROGRAM MENU on handset. See the section **Traction Motor Controller and Handset** for your lift truck. Refer to PROGRAMMING THE TRACTION MOTOR CONTROLLER.
2. Program M1 (turtle mode) MAX SPEED to 40%.
3. Program M2 (mid mode) MAX SPEED to 70%.
4. Program M3 (rabbit mode) MAX SPEED to 100%.
5. Operate truck in each drive mode and check for different top speeds.

If the speeds are all different and in the proper order, then the mode selection feature is working correctly.

If top speed does not change between the different drive modes, the traction motor controller may be faulty. See the section **Traction Motor Controller and Handset** for your lift truck. Refer to TRACTION MOTOR CONTROLLER, TESTING.

6. Reprogram the traction motor controller to the correct values. See the section **Traction Motor Controller and Handset** for your lift truck. Refer to PROGRAMMING THE TRACTION MOTOR CONTROLLER.

Troubleshooting Without a Programmer Handset

CAUTION

Only use a digital volt ohmmeter during this test procedure. Use of other test equipment can cause the internal components of the dash display and/or traction motor controller to malfunction.

If a Programmer Handset is not available, communication from the dash display to the traction motor controller can be checked using a digital volt ohmmeter. Check the voltage levels on wires DM1 and DM2 by looking at traction motor controller connector pins 3 and 4, with respect to B− terminal of the traction motor controller. See Figure 11.

NOTE: Do not disconnect the wire harness at the dash display or the traction motor controller. Voltage checks must be performed with all connections in place.

The voltages should be as shown in Table 4.

A constant "High" can indicate an open in the respective circuit. A constant "Low" can indicate a short in the respective circuit. Undefined can indicate an open in both circuits.

Table 4. Dash Display Drive Mode Test Voltages

Test Point	Drive Mode			
	Turtle	Middle	Rabbit	Undefined
DM1/ Pin 3	High	Low	Low	High
DM2/ Pin 4	Low	High	Low	High
High is anything greater than +10.0 volts. Low is anything less than +5.0 volts. UNDEFINED (HIGH/HIGH) indicates DEFAULT MODE DEFAULT MODE = TURTLE MODE				

If the voltages at DM1 and DM2 are correct in relation to the different drive modes, but lift truck operation does not reflect the changes, the problem could be that the three different drive modes are not programmed differently or that the traction motor controller is faulty. A Programmer Handset is necessary for further troubleshooting.

Refer to Troubleshooting With a Programmer Handset.

No Warnings or Faults Displayed

DRIVE CTRL FAULT may appear on the dash display.

Communication from the traction motor controller to the dash display occurs through two wires, FM1 and FM2. Wires FM1 and FM2 are located in the X-14 connector of the traction motor controller and in the

X-6 connector at the dash display. These two wires carry a digital code for warnings and faults concerning the traction controller.

During normal operation (no faults or warnings displayed), the voltage between FM1 and battery−, and FM2 and battery−, should both be less than +5.0 volts. See Table 5.

During the three faults, the voltage between FM1 and battery−, and/or FM2 and battery−, will change. See Table 5.

A constant "High" can indicate an open in the respective circuit. A constant "Low" can indicate a short in the respective circuit.

Table 5. Dash Display Status/Warning/Fault Test Voltages

Test Point	Status/Warning/Fault			
	Normal	Throttle Fault	Drive Controller Hot	Drive Controller Fault
FM1	Low	Low	High	High
FM2	Low	High	Low	High
High is anything greater than +10.0 volts. Low is anything less than +5.0 volts.				

⚠ CAUTION

Do not ground the pins of the traction motor controller during this test. The X-14 plug (2-wire) at the traction motor controller must be disconnected from the traction motor controller for this test.

If the dash display is not showing a fault or warning and you suspect it is not reporting legitimate traction motor controller related faults and/or warnings, a test can be performed to verify proper dash operation. Disconnect the X-14 connector from the traction motor controller. See Figure 11. Connect a jumper wire between battery−, and FM1 and/or battery−, and FM2 at the X-14 connector as shown in Table 6.

Table 6. Testing Dash Display Status/Warning/Fault Inputs

Wire # at X-14 Plug	Status/Warning/Fault			
	Normal Status Display POWER ON etc.	DRIVE CTRL. FAULT THROTTLE FAULT	DRIVE CTRL. HOT SPEED REDUCED	DRIVE CTRL. FAULT
FM1	Jumper to Battery−	Jumper to Battery−	Open (no connection)	Open (no connection)
FM2	Jumper to Battery−	Open (no connection)	Jumper to Battery−	Open (no connection)

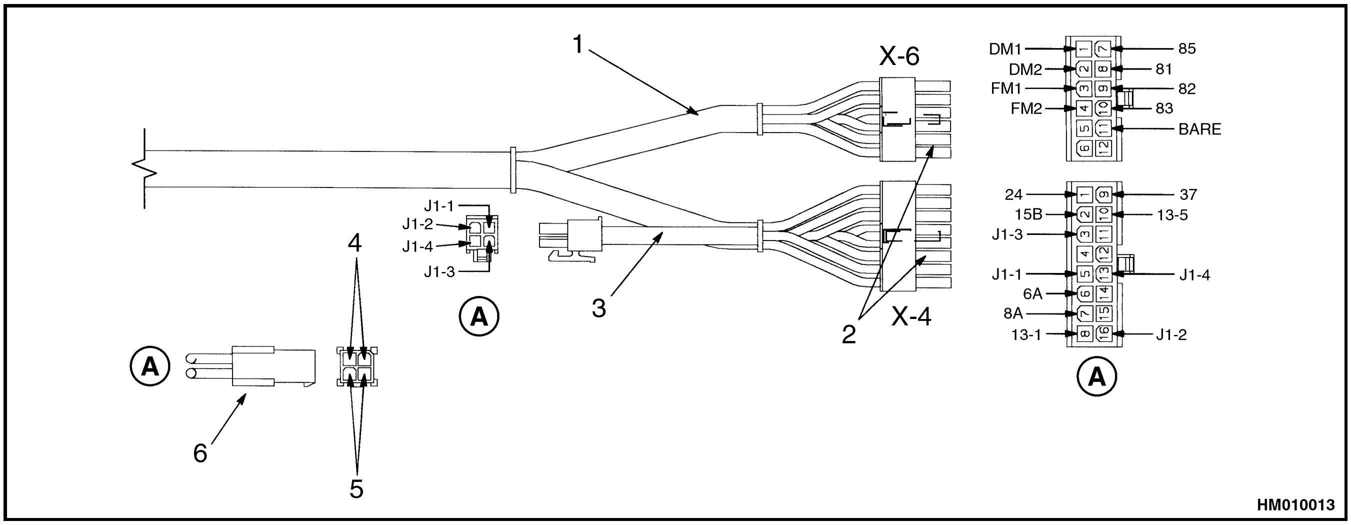
MIB/Dash Display Communication

Communication from the Main Interface Board (MIB) to the dash display and from the dash display to the MIB occurs through a shielded four conductor cable. This cable carries signals concerning lift interrupt, hourmeter input, travel direction, and MIB generated STATUS, WARNING, OR FAULT information. For additional information, see the section **Electrical System** for your lift truck. Refer to STATUS, WARNING AND FAULT CODE TROUBLESHOOTING, "SIGNAL SOURCE."

Lift Interrupt

Wire 85 carries the lift interrupt signal from the dash to the MIB. Normally this signal is low (less than +5.0 volts) when the BDI is not flashing. When the BDI is in the red flashing zone (lift interrupt), then the signal will be high (greater than +10.0 volts).

If you suspect a dash display lift interrupt circuit malfunction, you can bypass the lift interrupt function of the dash display. Connect a jumper wire from battery− to the #85 wire of the X-6 plug at the dash display assembly. See Figure 12. If lift still does not operate properly, disconnect the battery and check the continuity of wire 85 from the dash display X-6 plug to the MIB J1 plug. If wire 85 tests good, check MIB codes and troubleshoot. For additional information and the MIB plug pin out, see the **Electrical System** section for your lift truck.



A. FRONT VIEW

1. DASH DISPLAY WIRE HARNESS
2. TO DASH DISPLAY
3. X-15 CONNECTOR
4. WIRE "A"
5. WIRE "B"
6. X-15A JUMPER ASSEMBLY (USED ON 24-VOLT TRUCKS ONLY)

Figure 12. Dash Display Voltage Selection Jumper Location

If lift interrupt does not occur when the BDI is in the red flashing zone, then wire #85 may be shorted to battery– or another wire. If wire #85 tests good check MIB codes and troubleshoot. See the section **Electrical System** for your lift truck.

Lost MIB Signal Displayed

Wires 81, 82, and 83 carry signals which are used to transfer information (serial communications link) to the dash display concerning all STATUS, WARNING, and FAULT information not previously discussed. Troubleshooting of these signals cannot be done with normal equipment. If LOST MIB SIGNAL is displayed on the dash display, you can only check the continuity of these wires. If the wires test good, verify the correct operation of the dash display and MIB.

Lift Pump Hourmeter Input

The lift pump hourmeter input is from wire 37, which comes from the HMR (hourmeter relay) signal relay. See Figure 12. The contacts of the HMR are closed when the lift pump contactor is energized. If the lift pump hourmeter is not functioning properly, check for battery volts at wire 37 plug X-4 at the dash display with the lift pump operating. If necessary, check for battery volts at the HMR relay, wires 10 and 37 (lift pump contactor energized). Also check for battery volts across wires 85 and 87 (lift pump contactor energized). If the signal is at the dash pin 1-9 but the meter does not accrue lift pump time, the dash display has failed. See the section **Wiring Schematics and Diagrams** for your lift truck for wire and component identification.

Forward/Reverse Hourmeter Inputs

Drive (forward and reverse) hourmeter input is from wires 6 and 8. If the drive hourmeter is not functioning properly, check for battery volts at dash display during travel. For forward travel, check pin 4 through 6, wire 6. For reverse travel, check pin 4 through 7, wire 8.

REMOVE

The dash display is located in the front cover over the battery compartment. The dash display assembly cannot be repaired and must be replaced if testing determines it to be faulty.

1. Move lift truck to safe, level area. Turn the key switch **OFF** and remove key. Put a DO NOT OPERATE tag on multifunction control handle. Put blocks under the drive wheels to keep the lift truck from moving. See the section **Periodic Maintenance** for your lift truck. Refer to HOW TO PUT A LIFT TRUCK ON BLOCKS.

WARNING

Disconnect the battery and separate the connector before opening the compartment cover or inspecting or repairing the electrical system. If a tool causes a short circuit, the high current flow from the battery can cause an injury or parts damage.

2. Disconnect and separate battery connector.
3. Remove hydraulic tank dipstick.
4. Remove socket head capscrews retaining battery compartment cover. Remove battery compartment cover.
5. Disconnect two plugs, X-4 and X-6, from rear of dash display assembly.
6. Remove two thumbscrews and retainers securing dash display assembly to instrument panel. Remove dash display assembly.

INSTALL

1. Adjust potentiometer on rear of dash display assembly. Refer to Dash Display, Adjust (Setup, Early Models) in this section.
2. Connect two plugs, X-4 and X-6, to rear of dash display.
3. Position dash display assembly in instrument panel. Install retainers and thumbscrews to rear of dash display to retain dash display assembly to instrument panel.
4. Install battery cover.
5. Install hydraulic tank dipstick.
6. Connect battery.
7. Remove blocks from under drive wheels, remove DO NOT OPERATE tag, and install key.

ADJUST (SETUP, EARLY MODELS)

The early models of the dash display assembly has two adjustment potentiometers. The potentiometers are located on the back of the dash assembly between the connectors. See Figure 13. Trucks are shipped from the factory with the potentiometers adjusted as follows:

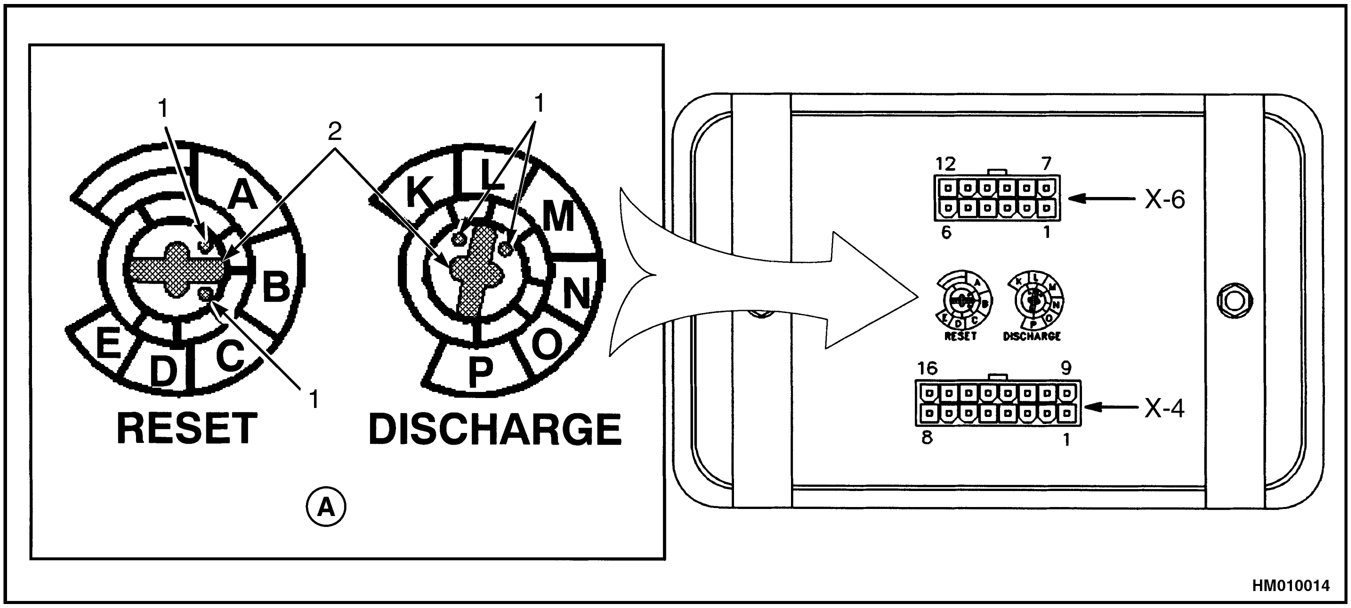
RESET B
DISCHARGE L

Adjustment is performed by inserting a small screwdriver through the access hole in the rear of the dash display and into the long slot of the adjustment screw. See Figure 13. Rotate the screwdriver fully clockwise to align the blade with E (reset potentiometer) or P (discharge potentiometer). Rotate the potentiometer counterclockwise to the desired setting. Dots on one end of the screwdriver slot indicate which end should be aligned with the appropriate setting.

The RESET potentiometer determines the level to which the battery must be charged before the indicator will reset to display a charged battery. The RESET potentiometer is set at the factory to B. Batteries with open circuit voltages greater than 2.09 volts per cell will cause the battery indicator to read fully charged. The RESET function operates only when a battery has been disconnected for at least 15 seconds and another battery connected. The replacement battery must be charged to at least 90% of its capacity.

The RESET potentiometer increases the voltage at which the battery is accepted when turned from B toward E (clockwise). The specific gravity of the battery must be more than 1.245.

The RESET potentiometer decreases the voltage at which the battery is accepted (indicator resets to display a charged battery) when turned from B toward A. The specific gravity of the battery is less than 1.245. See Table 7 for alternate settings.



A. EXPLODED VIEW

1. DOT
2. SCREWDRIVER SLOT

Figure 13. Battery Indicator Adjustment

If a battery that is connected does not have the correct specific gravity, the battery indicator will remain in its original position.

The DISCHARGE potentiometer determines the level at which the LIFT interrupt function occurs. The potentiometer is set at the factory to L. The L setting is equal to 1.63 volts per cell.

Table 7. Battery Indicator Reset Adjustment

Reset Potentiometer Position	Approximate Average Volts per Cell Required for Reset
—	2.00
A	2.06
B	2.09
C	2.12
D	2.15
E	2.18
The shaded row in the table indicates the factory setting.	

ADJUST (SETUP, LATER MODEL)

The later model (1483668) of dash display assembly has no adjustment potentiometers. Instead it is Setup using the following procedures:

1. Install dash display properly in lift truck and turn key switch **OFF**. While holding down both the hourmeter and drive mode switches on the display, turn the key switch to **ON**. After approximately 5 seconds, the following message should appear on the display:
   "ENTER PASSWORD THEN ENTER 000"

2. Press the hourmeter ("increment") switch until the number 3 appears instead of the 0. Then press the drive mode ("enter") switch to enter the 3. The LCD message should now be:
   "PASSWORD 030"

3. Press the hourmeter switch until the number 5 appears instead of the 0. Press the enter switch to enter the 5. The LCD message should now be:
   "PASSWORD 350"

4. Press the hourmeter switch until the number 7 appears instead of the 0. Press the enter switch to enter the 7. The LCD message should now be:
   "DISCHARGE 1.63"

If this message appears, the password has been accepted and the parameters can be changed as required. Press the enter switch again to keep the presently viewed parameter. If the password was not accepted, normal operation of the display will continue without any change to the parameters. The procedure must then be repeated again from the beginning.

NOTE: This procedure has to be done quickly for the changes to take effect.

5. Press the hourmeter switch to increment the setting of the discharge profile to the next value. When the correct setting (in accordance with the battery manufacturer's recommendations) is displayed, press the enter switch to enter the setting. The LCD message should now be: "RESET 2.09"

6. Press the hourmeter switch to increment the setting of the reset profile to the next value. When the correct setting (in accordance with the battery manufacturer's recommendations) is displayed, press the enter switch to enter the setting. The LCD message should now be: "MOTOR TYPE SX"

7. Press the hourmeter switch to toggle the setting of the motor type from SX (SEPEX) to SW (Series Wound). When the desired setting is displayed, press the enter switch.

At this point, the dash display will return to normal operation.

Battery Display Indicators (BDI) only look at voltages and are not affected by varying ampere hour capacity of the battery.

For example: A 100 ampere load will affect the voltage and the Curtis™ BDI on a 500 ampere per hour battery the same as a 200 ampere load on a 1000 ampere per hour battery. The residual capacity is the same on a percentage basis and the BDI response will be similar.

Battery Indicators Replacement

1. Disconnect battery connector from battery.
2. Put tags on meter wires for correct connection during installation. Remove printed circuit board (early models) from indicator. Remove bracket, then remove indicator.
3. Install replacement indicator in panel. Install bracket and printed circuit board.
4. Connect wires according to tags made during removal and check for proper operation. Adjust battery indicator as described in Curtis Dash Display Assembly, Adjust (Setup, Early Models).

Battery Indicator Controller Replacement

To replace the controller, disconnect the battery connector from the battery. Put tags on the wires and disconnect them from the controller. Install the replacement controller and connect the wires. Check for proper operation. Adjust the controller as described in Battery Indicators With Lift Interrupt Adjustment (Early Models).

Display Panel Components Replacement

Each of the display panel assemblies, Basic, Performance, and Curtis Dash Display for the N30-45XMR, N25-30XMDR, and N50XMA lift trucks, can be replaced as a unit.

NOTE: Most parts of the Basic display panel can be replaced. However, the LED indicators cannot be replaced separately. The LEDs are part of the circuit board assembly.

NOTE: The only replaceable parts of the Performance display panel are the O-ring seal, key switch, wires to the key switch, and the housing that fastens to the steering column. All other parts of the panel must be replaced as a single unit. See Replacing Display Panel Assembly of this section.

See the section **Instrument Panel Indicators and Senders** 2200 SRM 143 to replace any of the panels or the replaceable parts. Adjust the panels as described in Checks and Adjustments.

SEM Display Panel Replacement

NOTE: The battery indicators of these SEM Display Panels cannot be replaced without replacing the complete SEM Display Panel.

WARNING

Before replacing the SEM Display Panels, fully lower all parts of the mast and tilt it forward until the tips of the forks touch the ground. This action will prevent the mast from lowering suddenly if the control lever is accidently moved.

Always disconnect the battery, remove the key, and discharge the capacitor(s) of the motor controllers before replacing the SEM Display Panels. Discharge the capacitor(s) by holding the horn button down until the horn stops making a sound.

Never have any metal on your fingers, arms, or neck. These metal items can accidentally make an electrical connection and cause an injury.

CAUTION

A short circuit and damage can occur if wires are not installed correctly. Make sure wire connectors do not touch the other meter terminals or wire connectors, metal brackets, or the bracket mounting nuts. Make sure the wires are not pulled tight and are not touching other parts to damage the insulation.

The SEM Display Panel is fastened in the instrument panel. The SEM Display Panel cannot be repaired and must be replaced if it has a malfunction. See Figure 14.

REMOVE AND REPLACE

The SEM Display Panel is in the instrument panel (dash). The SEM Display Panel cannot be repaired and must be replaced if it has a malfunction. These SEM Display Panels must be replaced as a unit.

1. Disconnect battery connector. Make sure capacitors of motor controller(s) are discharged as described in the warning.
2. Disconnect the plug connector on back of SEM Display Panel. Access is under instrument panel.
3. Remove two nuts that fasten SEM Display Panel and mount bracket. Remove nuts and bracket. Lift SEM Display Panel up out of instrument panel.
4. Install replacement SEM Display Panel in instrument panel.
5. Install mount bracket and mount nuts. Tighten nuts that fasten SEM Display Panel in instrument panel and install the plug connector.

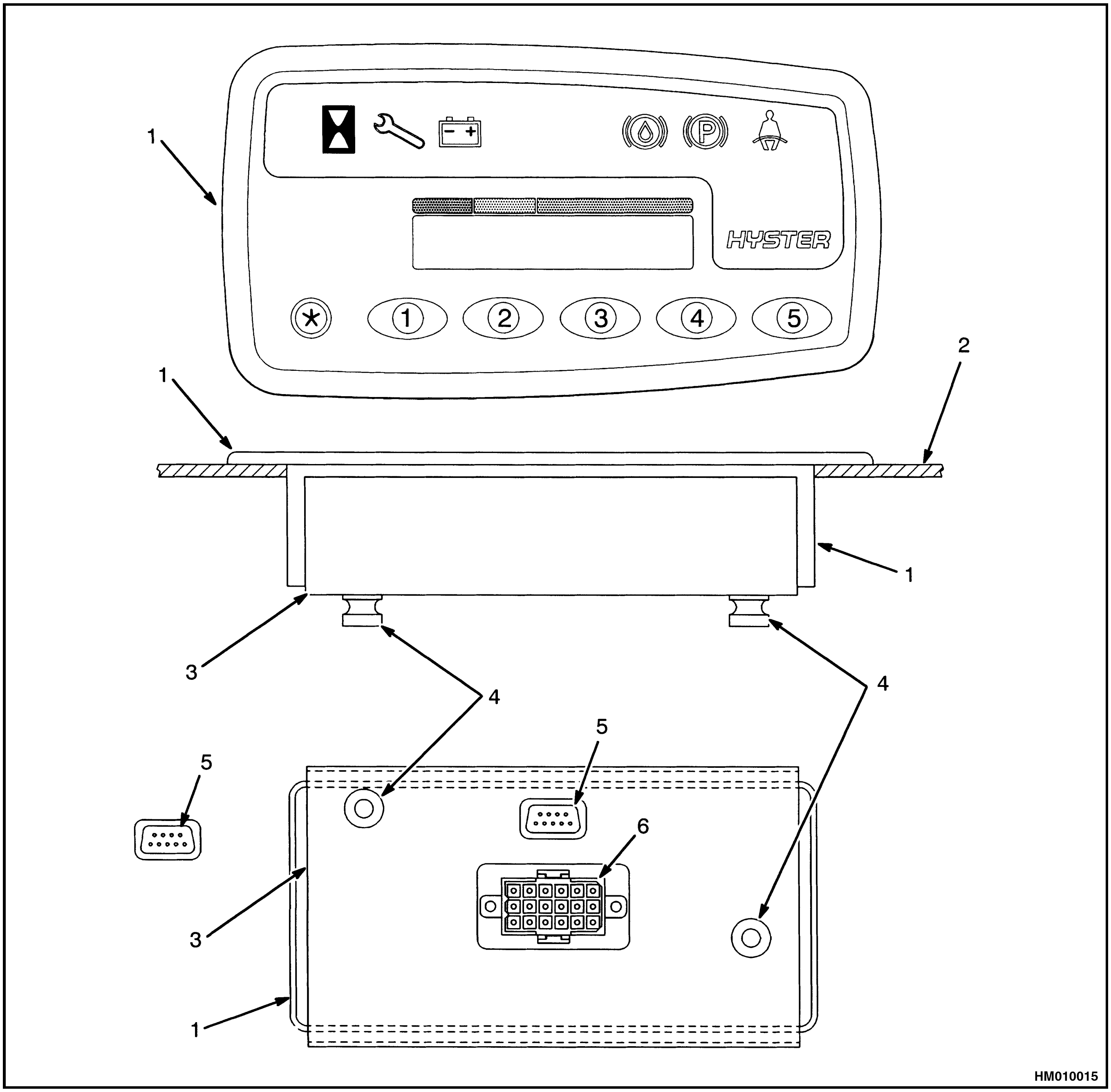
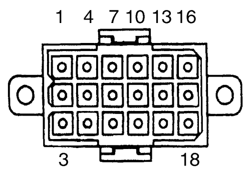


Figure 14. Mounting of SEM Display Panel

Legend for Figure 14

Pin	Function	Pin	Function
1	No Connection	9	Battery Negative (–)
2	Battery Shunt	10-12	No Connection
3	No Connection	13	Parking Brake Switch
4	Traction Control TRX	14	Brake Fluid Switch
5	Traction Control RCV	15	Seat Switch Output
6	Pump Control TRX	16	Seat Switch B+ Input
7	Pump Control RCV	17	Key Switch (IGN)
8	No Connection	18	Battery Positive (+)



HM010015

18-Pin Connector

1. SEM DISPLAY PANEL
2. INSTRUMENT PANEL
3. MOUNT BRACKET
4. MOUNT NUT
5. CONNECTOR FOR PERSONAL COMPUTER CONNECTION
6. 18-PIN CONNECTOR

NOTES