

INTRODUCTION

GENERAL

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

CAUTION

Do not operate an electric lift truck with a

discharged battery. Continued operation can damage contactors, motors and the battery.

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.

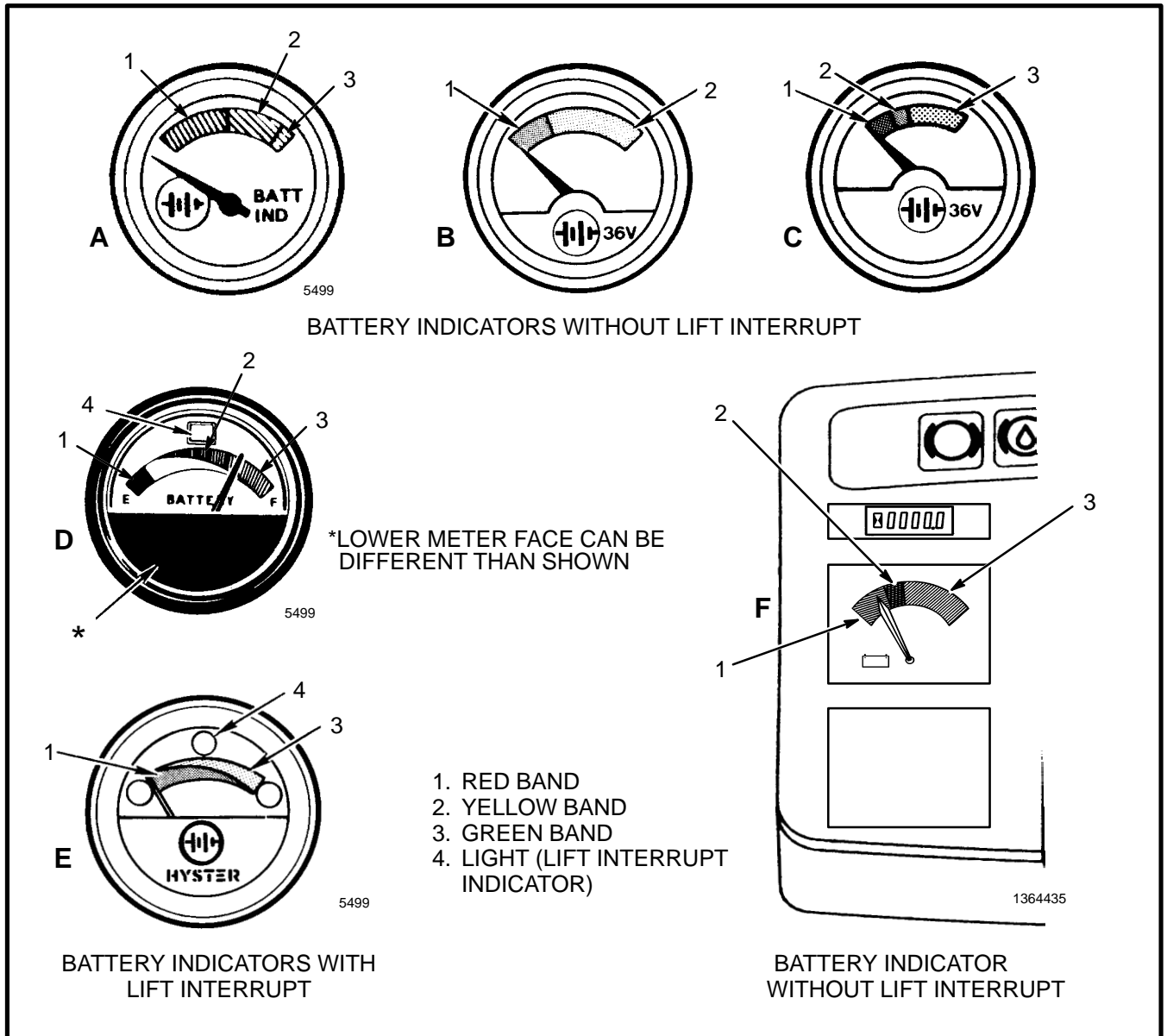


FIGURE 1. BATTERY INDICATORS WITH METER MOVEMENTS

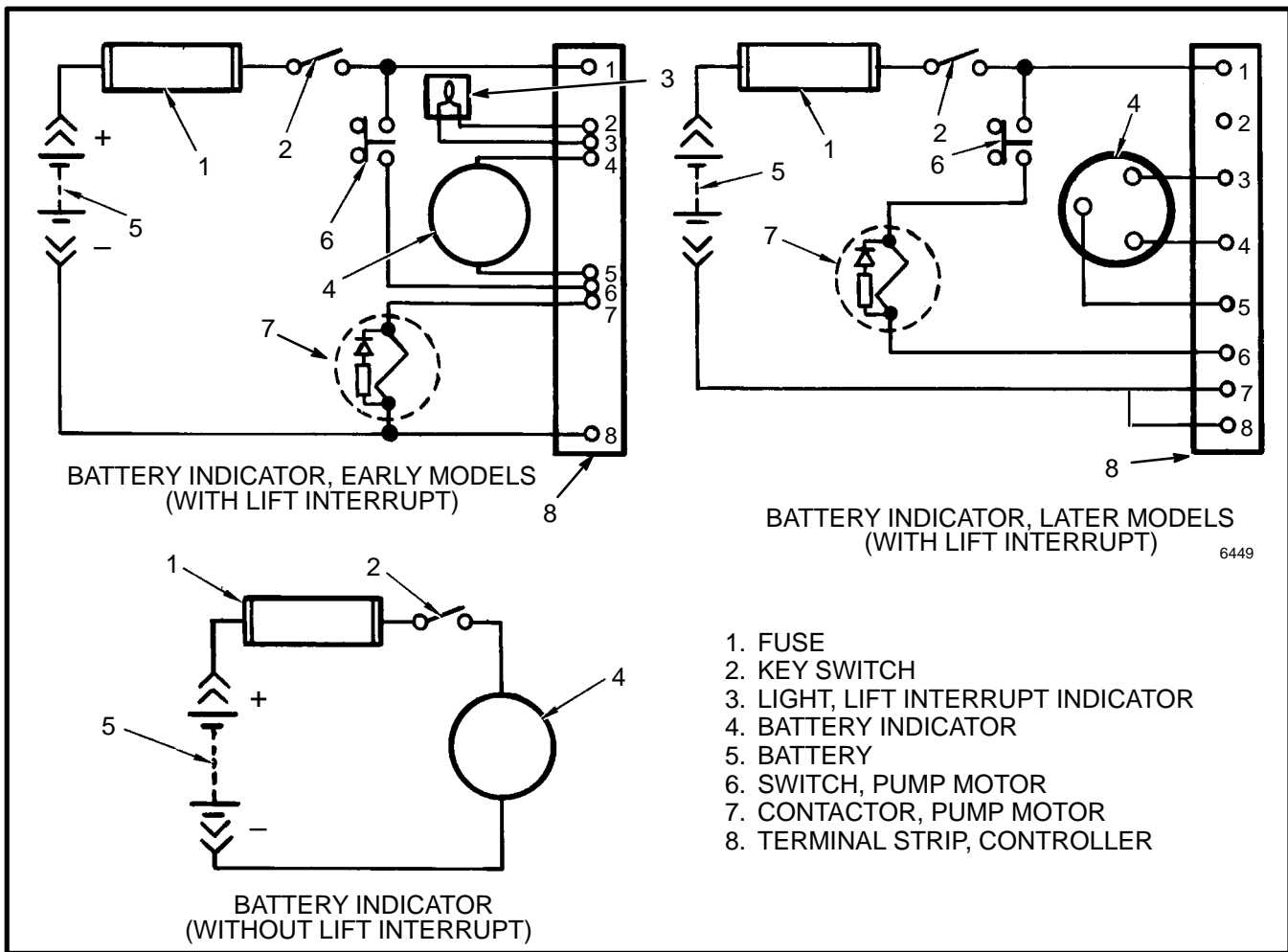


FIGURE 2. ELECTRICAL CIRCUITS FOR BATTERY INDICATORS WITH METER MOVEMENTS

INDICATORS WITH METER MOVEMENTS (See FIGURE 1. and FIGURE 2.)

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. The other type of battery indicator HAS Lift Interrupt and is adjustable for different batteries or operating conditions. 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

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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 that 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.

BATTERY INDICATORS WITH LCD OR LED DISPLAYS (See FIGURE 4.)

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 two display panels. The Standard Display Panel has a mechanical meter for a battery indicator (voltmeter). See FIGURE 1. The Enhanced Display Panel has a bar scale of Light Emitting Diodes (LED's) for a battery indicator. See FIGURE 4. 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 143** for 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 Light Emitting Diodes (LED's) to show the state of charge.

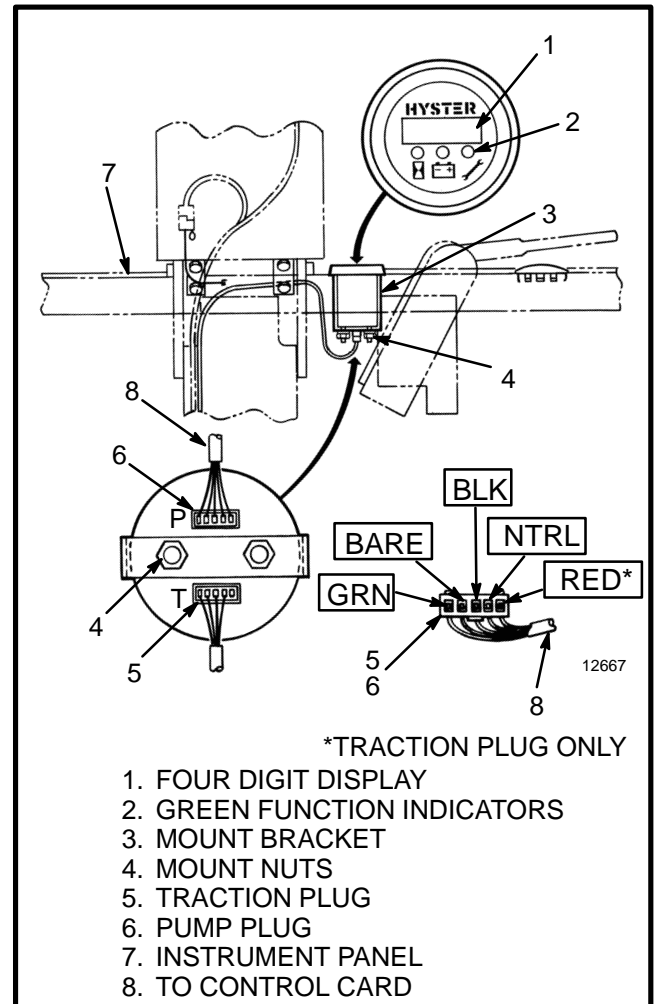


FIGURE 3. "LX" SERIES INSTRUMENT PANEL DISPLAY BATTERY INDICATOR

Liquid Crystal Displays

These battery indicators use Liquid Crystal Displays (LCDs) using numerical digits to show the battery condition. This same LCD also shows other functions. See the section **INSTRUMENT PANEL INDICATORS AND SENDERS, 2200 SRM 143** for 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 4. Also see FIGURE 3.

There is one indicator that has a round face, green LED function indicators for the hourmeter, service and battery indicator as well as an LCD display. See FIGURE 3. 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 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 the 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 other reasons and 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 that the weakest battery is not damaged.

Adjustment of the battery indicator is part of the other adjustments of the control card. These adjustments must be made using the hand set for the "LX" Series motor controllers. The operation of the hand set and the adjustment of this and other functions is in the section **EV-100/200 LX SERIES DIAGNOSTIC MOTOR CONTROLLER AND HAND SET, 2200 SRM 460.**

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 HAND SET, 2200 SRM 460. Damage to the control card or battery can occur if the hand set is not connected and used correctly.

Light Emitting Diode Displays

These battery indicators use Light Emitting Diodes (LED's) 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 of FIGURE 4. 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-100/200 "LX", EV-100 "ZX" and EV-"T"100ZX 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 LED's that operate when the battery is connected. See F of FIGURE 4. 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 LED's are flashing alternately, the battery is discharged to the point where damage can occur. Continued operation with the LED's 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 LED's in three colors (green, yellow, red). As the battery voltage decreases during operation, different LED's illuminate to indicate a discharged battery. No more than two LED's are illuminated at one time. When the battery is fully charged, the two green LED's at the end of the scale are illuminated. When the battery discharges during operation, the LED's illuminate from right to left (green to red). All lift trucks with this type of

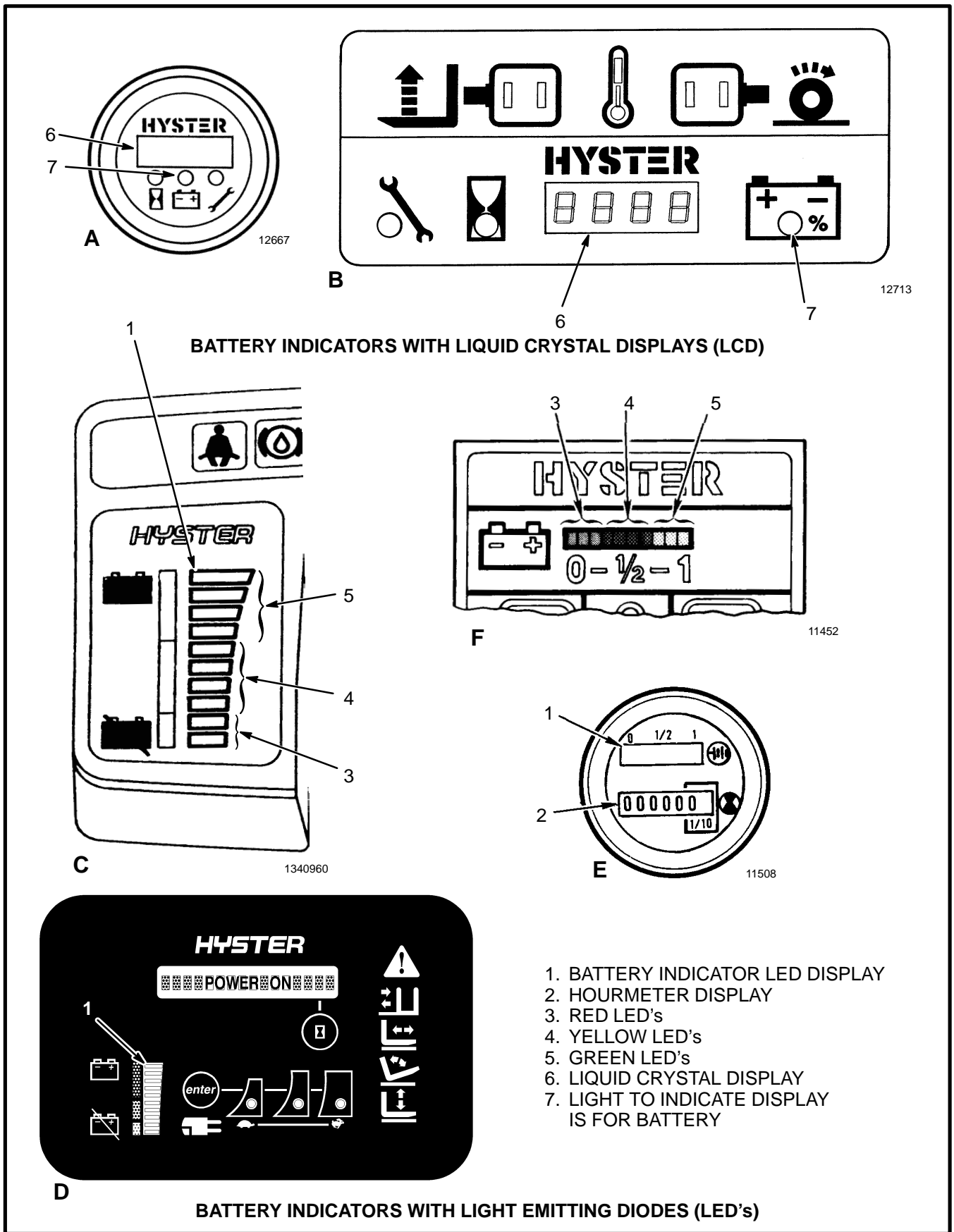


FIGURE 4. BATTERY INDICATORS WITH LCD OR LED DISPLAYS

warning indicator display have a lift interrupt. When the battery is discharged to the red section of the battery discharge indicator, the last two LED's begin to flash just before the "lift interrupt" is enabled. When the last two LED's 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 REPAIRS 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 that Hyster part number 372036 is used. Controllers with other part numbers will not operate correctly.

DESCRIPTION, "ZX" SERIES DISPLAY PANELS

The EV-100 "ZX" Series motor controller can have an instrument panel display that includes two types of Battery Indicators. See **C** of FIGURE 4. The Standard 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. The Enhanced Display Panel has a battery discharge indicator with lift interrupt. This indicator shows the battery charge with a LED bar graph.

There are four green bars, four orange bars, and two red bars. When the battery is discharged during operation, the LED bar that is illuminated decreases sequentially from the top green bar through the orange bars to the red

bars. 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. 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 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 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 that the weakest battery is not damaged. Follow the procedure for adjusting traction Function 14 in one of the following: the section **EV-100ZX™ MOTOR CONTROLLER, 2200 SRM 557** or the section **EV-T100™ MOTOR CONTROLLER, 2200 SRM 581**.

DESCRIPTION CURTIS 1215 DISPLAY PANEL

This display panel has a LED bar graph to show the battery charge that is very similar to the "ZX" display panel. See **D** of FIGURE 4. This panel is used exclusively with the Curtis 1215 TRACTION MOTOR CONTROLLER for the N30-45XMR, N25-30XMDR and N50XMA lift trucks. See the section, **Curtis 1215-9102 TRACTION MOTOR CONTROLLER AND HAND SET, 2200 SRM 608** for additional information.

The battery indicator has a 10 bar multicolor LED display to indicate the battery charge status. The bars are green, yellow and red. As power is used, the LED's 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 disabled at this point. Continued operation with a discharged battery can damage the battery, motor or the contactors. 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 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. A status code of -16 (voltage too high) or -15 (voltage too low) will indicate on the digital display. The battery can have a voltage that is too high or too low. A battery with the correct voltage can also be deeply discharged from use or other reasons and have a voltage that is less than the minimum of the voltage 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 the controller to prevent battery damage. Follow the adjustment procedures in the section **Curtis 1215-9102 TRACTION MOTOR CONTROLLER AND HAND SET, 2200 SRM 608**.

CHECKS AND ADJUSTMENTS

BATTERY INDICATORS WITHOUT LIFT INTERRUPT, EARLY MODELS (See FIGURE 5.)

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 different 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:

1. Check the specific gravity of the battery during operation of the lift truck until the battery discharges to 1.130 (or value needed).

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

2. Find the screwdriver slot on the printed circuit board for the calibration potentiometer. See FIGURE 5.

3. Operate the hydraulic system at the relief setting and hold at this position.

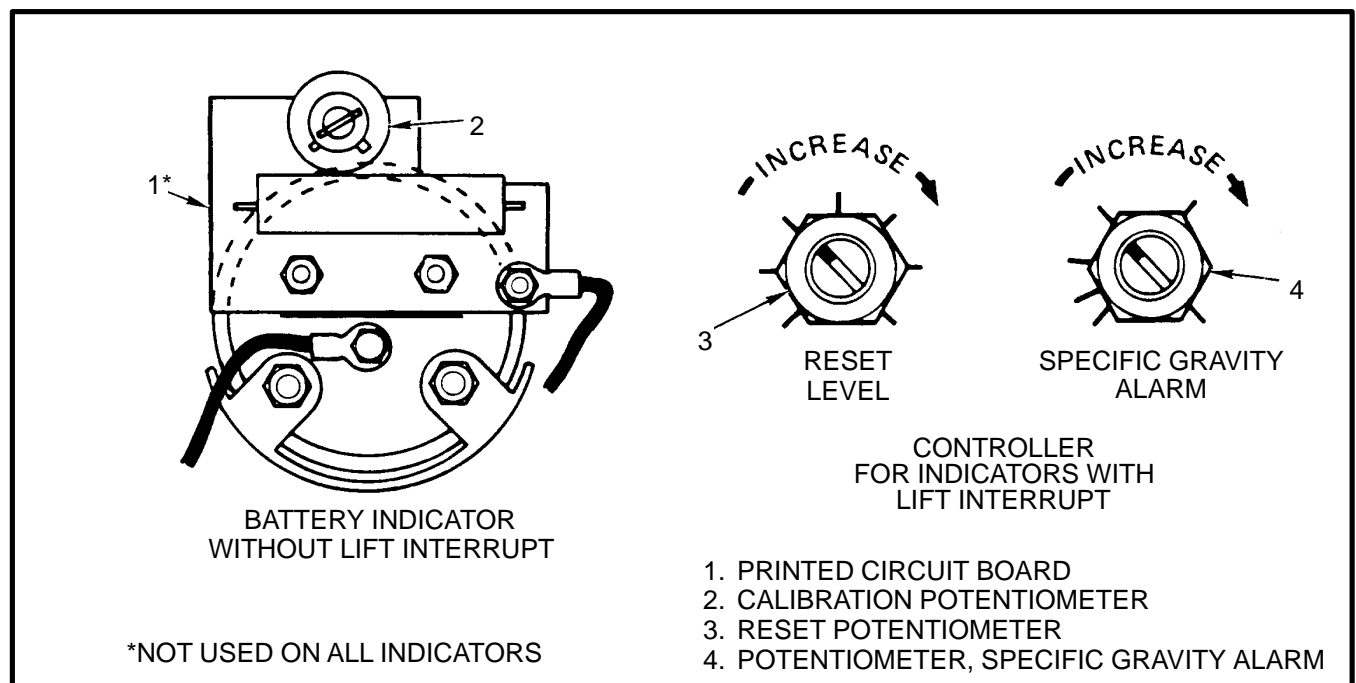


FIGURE 5. BATTERY INDICATOR, EARLY MODELS

4. Adjust the calibration potentiometer (item 2) so that the needle is in the center of the red band.

BATTERY INDICATORS WITH LIFT INTERRUPT, EARLY MODELS (See FIGURE 5.)

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.

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.

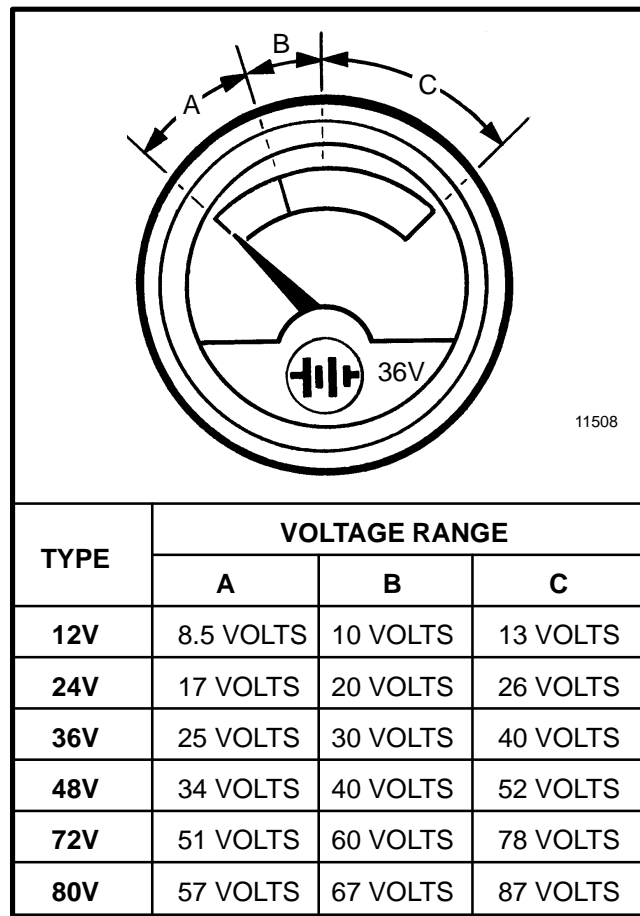


FIGURE 6. BATTERY INDICATOR, LATER MODELS

BATTERY INDICATORS WITHOUT LIFT INTERRUPT, LATER MODELS (See FIGURE 6.)

There is no adjustment for these indicators. The voltage range, however, can be checked. Check the voltage settings as shown in FIGURE 6. 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.

BATTERY INDICATORS WITH LIFT INTERRUPT, LATER MODELS (See FIGURE 7.)

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 4.

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

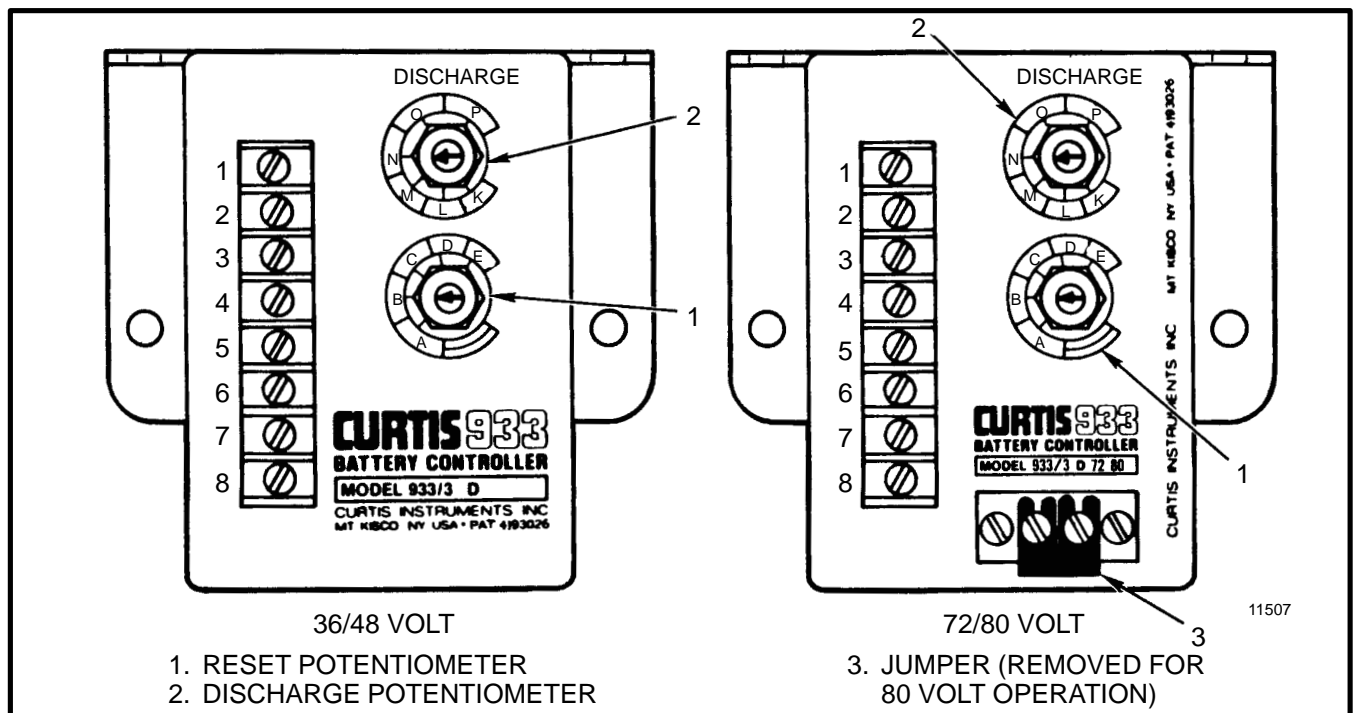


FIGURE 7. BATTERY INDICATOR CONTROLLER, LATER MODELS

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.

LED DISPLAY WITH LIFT INTERRUPT

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

To check the LED's of the display (**F** in FIGURE 4.), connect battery negative to terminal 13B, 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.

CHECKING CURTIS 933-1 METER (See FIGURE 4. and FIGURE 8.)

NOTE: This meter has several functions and internal electronic circuits. See **A** of FIGURE 4. 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 DIS-

CHARGE is set to N. Also make sure that 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 earlier in “Replace A Display Panel” of this section. Hold or fasten the meter and display panel so that 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 8. 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 8.

CAUTION

Make sure the meter probes do not damage the connector pins or other components. Make sure that 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 – 36V battery: 18 cell truck battery X 2.09 volts
= 37.62 volts minimum

Example – 48V battery: 24 cell truck battery X 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 six minutes or more continuously.

Example – 36V battery: 18 cell truck battery X 2.35 volts
= 42.3 volts minimum

Example – 48V battery: 24 cell truck battery X 2.35 volts
= 56.4 volts minimum

The voltage must be above the minimum voltage continuously for at least six 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 – 36V battery: 18 cell truck battery X 2.0 volts
= 36.0 volts maximum

Example – 48V battery: 24 cell truck battery X 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.

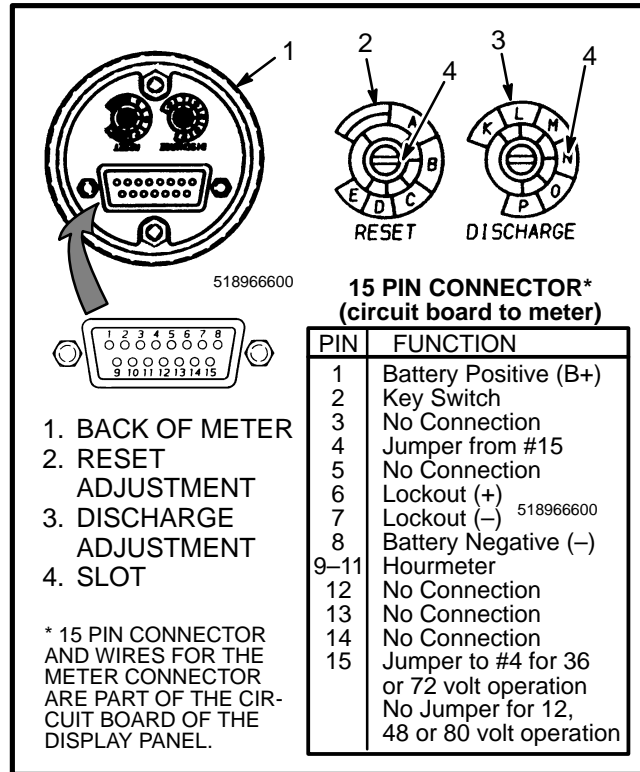


FIGURE 8. CURTIS 933-1 METER RESET AND DISCHARGE ADJUSTMENTS

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 LED's (Light Emitting Diodes) 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.

No Lockout

If the lift circuit will still operate when the two left LED's 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 8. 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.

Lockout With Charged Battery

If the lift circuit will not operate even when the two left LED's 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.

Lockout Too Soon

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.

LED's Do Not Illuminate

The discharge LED's 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 LED's are not illuminated, the meter has a malfunction.

Hourmeter Check

The LCD (Liquid Crystal Display) 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.

Hour Glass 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 “Replace A Display Panel” of this section.

ADJUSTMENT OF CURTIS 933-1 METER (See FIGURE 8.)

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 the battery and remove the key from the key switch.
2. Look at the back of the Curtis meter. Use a screwdriver to rotate both adjustment screws of the meter anti-clockwise against the stop.
3. The slot in each adjustment screw will be aligned near the first letter. Use the screwdriver to turn the RESET adjustment screw so that the slot is aligned near the center of area B. See FIGURE 8.
4. Use the screwdriver to turn the DISCHARGE adjustment screw so that the slot is aligned near the center of area N.

CHECKING CURTIS 1215 BATTERY INDICATOR (See FIGURE 4. and FIGURE 10.)

NOTE: The Curtis 1215 Battery Indicator is part of the display panel for the N30-45XMR, N25-30XMDR and

N50XMA lift trucks. See **D** of FIGURE 4. A Programmer Hand Set is available for checking and setting the motor controller and display panel, but the following procedure uses a digital volt ohmmeter. See the following **SERVICE MANUAL** sections for more information, troubleshooting and repair of the parts of the display panel:

1215-9102 TRACTION MOTOR CONTROLLER AND HAND SET, 2200 SRM 608
ELECTRICAL SYSTEM, 2200 SRM 609
INSTRUMENT PANEL INDICATORS AND SENDERS, 2200 SRM 143

NOTE: If the display panel is blank (no LCD display or LED's) with the key in the **ON** position and the main contactor energized, there is a major malfunction. See the section **ELECTRICAL SYSTEM, 2200 SRM 609** of your **SERVICE MANUAL** for additional information.

⚠ CAUTION

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

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

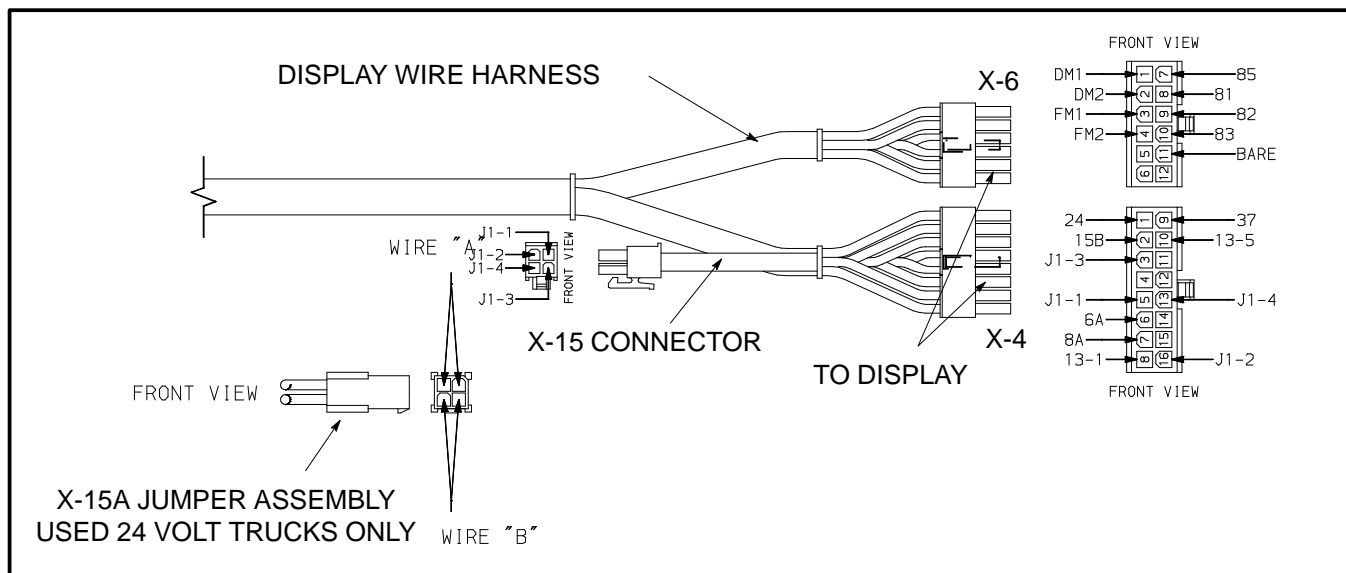


FIGURE 9. CURTIS 1215 DISPLAY PANEL CONNECTIONS AND WIRE LOCATIONS

Check the lift interrupt signal at the connector on the back of the display panel. See FIGURE 9. Wire 85 carries the lift interrupt signal from the display panel to the control card of the motor controller. Normally, this signal is low (less than +5.0 volts) when the bottom red LED is not flashing. When this LED is flashing (Lift Interrupt), the voltage at wire 85 will be high (greater than +10 volts).

If the lift pump will not operate when the bottom red LED is not flashing, you can bypass the lift interrupt function of the display. Connect a jumper wire from battery negative to the wire 85 pin (7) of the X-6 connector shown in FIGURE 9.

If the lift circuit still does not operate, disconnect the battery, remove the jumper and check the continuity of wire 85. Check from pin 7 of the X-6 connector to the J1 connector of the control card of the motor controller. See the section **ELECTRICAL SYSTEM, 2200 SRM 609** of the **SERVICE MANUAL** for your lift truck. If there is continuity between the connectors pins, wire 85 is good. Check the status codes and the motor controller as described in **2200 SRM 609**.

If lift interrupt will not prevent lift pump operation when the bottom red LED is flashing, wire 85 can have a short

circuit to battery negative or another wire. This short-circuit will prevent the +10 volt signal from getting to the control card of the motor controller. If wire 85 does not have a short-circuit, check the status codes and the motor controller as described in **2200 SRM 609**.

ADJUSTING CURTIS 1215 BATTERY INDICATOR (See FIGURE 4. and FIGURE 10.)

The display panel (**D** of FIGURE 4.) has two adjustment pots. The pots are located on the back of the assembly between the connectors. See FIGURE 10. Lift trucks are shipped from the factory with the pots adjusted as follows:

- RESET "B"
- DISCHARGE "L"

Adjustment is performed by inserting a small screwdriver through the access hole in the rear of the display and into the long slot of the adjustment screw. See FIGURE 10. Rotate the screwdriver fully clockwise to align the blade with E (reset pot) or P (discharge pot). Rotate the pot counterclockwise to the desired setting. Dots on one end of the screwdriver slot indicate which end should be aligned with the appropriate setting.

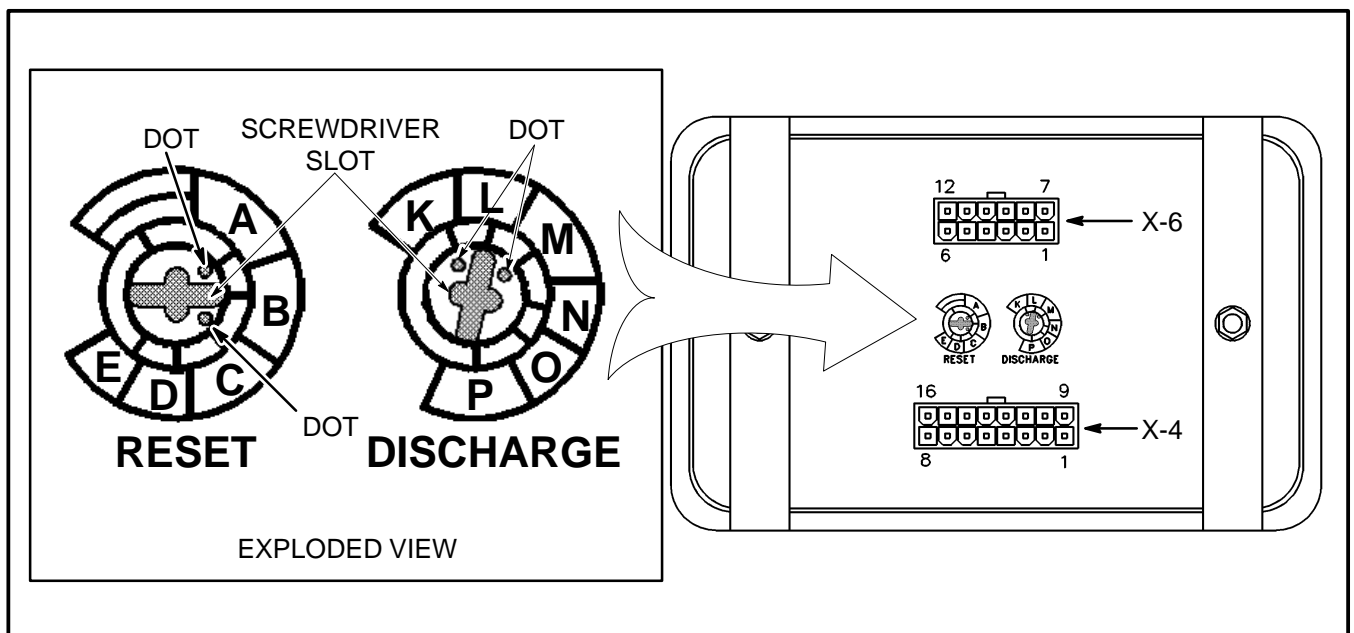


FIGURE 10. BATTERY INDICATOR ADJUSTMENT

TABLE 1. BATTERY INDICATOR RESET ADJUSTMENT

Reset Pot 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.	

The RESET potentiometer determines the level at 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 1. for alternate settings.

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.

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

Turning the DISCHARGE potentiometer from L toward P lets the battery discharge LESS before LIFT interrupt occurs. See TABLE 2. for alternate settings.

TABLE 2. BATTERY INDICATOR DISCHARGE ADJUSTMENT

Discharge Pot Position	Approximate Average Volts per Cell at Lift Interrupt
K	1.56
L	1.63
M	1.68
N	1.73
O	1.78
P	1.82
The shaded row in the table indicates the factory setting.	

Voltage Selection

Voltage selection (24 or 36 volt battery) is achieved by means of an “X-15A” jumper assembly. The “X-15A” jumper assembly is plugged into the “X-15” connector for 24 volt battery operation only. No jumper is used for 36 volt battery operation. The jumper assembly, when used, is located in the main truck wire harness beneath the display panel. See FIGURE 9.

REPAIRS

BATTERY INDICATORS

Replacement

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

CONTROLLER FOR THE BATTERY INDICATOR

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.

tion. Adjust the controller as described in CHECKS AND ADJUSTMENTS.

DISPLAY PANEL COMPONENTS

Each of the display panel assemblies, Standard, Enhanced and Curtis 1215 for the N30–45XMR, N25–30XMDR and N50XMA lift trucks, can be replaced as a unit.

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

NOTE: The only replaceable parts of the Enhanced 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.