LMS-350A

INSTALLATION AND OPERATION INSTRUCTIONS

L® **LOWRANCE ELECTRONICS, INC.**
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IMPORTANT!

YOU MUST HAVE THE OPTIONAL LGC-1 GPS MODULE ATTACHED TO THE LMS-350A TO USE THE POSITION AND NAVIGATION FEATURES ON THIS PRODUCT.

WARNING!

USE THIS PRODUCT ONLY AS AN AID TO NAVIGATION. A CAREFUL NAVIGATOR NEVER RELIES ON ONLY ONE METHOD TO OBTAIN POSITION INFORMATION.

CAUTION

The LGC-1 GPS receiver, (like all GPS navigation equipment) will show the shortest, most direct path to a waypoint. It provides navigation data to the waypoint regardless of obstructions. Therefore, the prudent navigator will not only take advantage of all available navigation tools when travelling to a waypoint, but will also visually check to make certain a clear, safe path to the waypoint is always available.

NOTICE!

As of this writing, the Department of Defense (DOD) has not declared the GPS navigation system operational. The system is still in a testing phase. Satellites can be turned off or accuracy can be degraded at will by the system operators. Remember that the LMS-350A, or any GPS receiver is only as accurate as the system it's using.

All features and specifications subject to change without notice.
All screens in this manual are simulated.

SONAR TABLE OF CONTENTS

INTRODUCTION

The LMS-350A is a high quality, wide screen sonar with performance that is second to none in its class. Using menu features and "soft-key" operation, the LMS-350A is also one of the easiest-to-use sonars that Lowrance has ever built. The wide "ClearVision" screen shows the underwater world with high resolution and detail. The display and keyboard are also lighted for night operation. The LMS-350A also has digital depth, boat speed, surface water temperature, and distance travelled (log) displays (requires an optional ST-T speed/temperature sensor).

If you purchase and install a LGC-1 GPS module, the LMS-350A can show position and navigation information. Utilizing Rockwell's NavCoreV technology, this GPS receiver is second to none in it's class.

MOUNTING - Bracket Mount

The LMS-350A can be mounted on it's gimbal bracket or in-dash mounted. Brackets are supplied for both configurations, however if the dash is thicker than 1/2", a special bracket will have to be purchased to mount the unit in the dash. You can install the LMS-350A on its bracket in any convenient location, provided there is clearance behind the unit when it is tilted for the best viewing angle. Holes in the bracket base allow wood screw or through-bolt mounting. You may need to place a piece of plywood on the back of thin fiberglass panels to secure the mounting hardware. Make certain there is enough room behind the unit to attach the power and transducer cables.

FRONT

SLOT   **BREAK OUT SLOT**
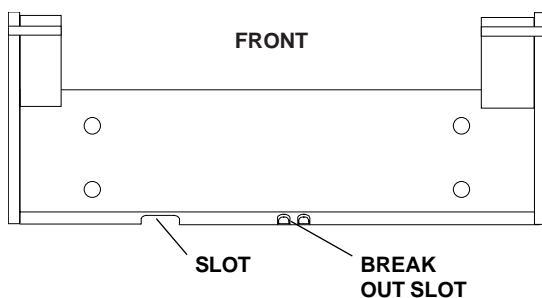
You will need to drill a hole in the dash for the power and transducer cables. The smallest hole that will pass one power or transducer plug is one inch. After the hole is drilled, pass the transducer connector up through the hole first, then pass the power cable down through it.

After the cables have been routed, fill the hole with a good marine sealing compound. Offset the bracket to cover the hole. Route the power cable through the slot and break out one of the other slots in the bracket for the transducer cable.

IN-DASH MOUNTING

The LMS-350A can be installed in the dash with the supplied hardware if the dash is 1/2" thick or less. Determining the dash thickness can be difficult, however, if you remove a gauge from the dash, you can easilly measure the thickness. Try this in an area that's close to the location that you wish to install the unit, since the thickness can vary significantly in some boats. Make certain there is clearance behind the dash for the unit and there is enough room to tighten the bolts on both sides of the unit.
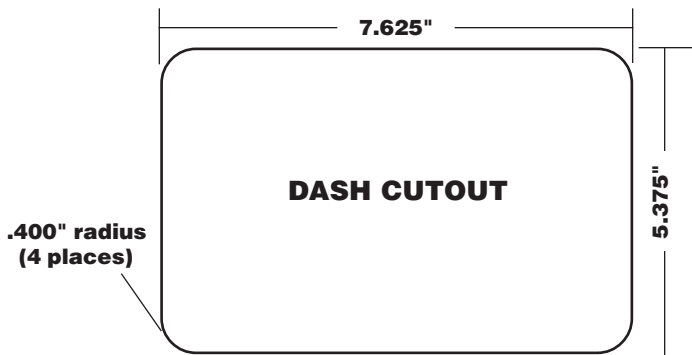
Once you've determined the location for the unit, cut the hole according to the drawing shown above. Measure carefully before cutting! After cutting the dash, place the gasket supplied with the LMS-350A around the unit and place the unit in the hole.

Supplied with the LMS-350A are rubber pads, bolts, washers, and cam clamps to attach the LMS-350A to the dash. Peel the adhesive backing off the rubber pads and place one on each side of the LMS-350A in the location where the cam clamp will touch the back side of the dash. Using the hardware supplied with the unit, attach the LMS-350A to the dash. Make certain that the cam clamp on the left side of the unit is pointing down and the cam clamp on the right side of the unit is pointing up before you start tightening the bolts.
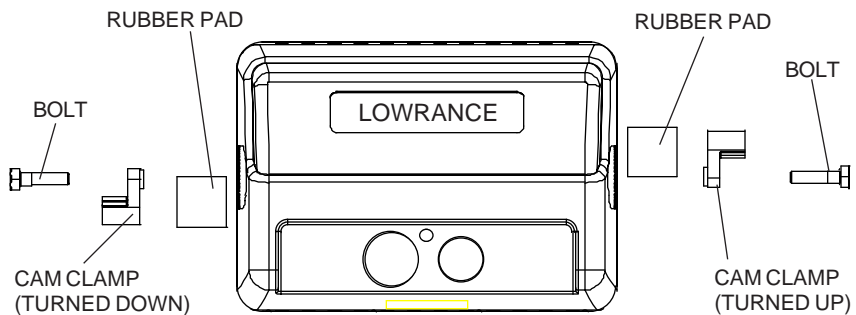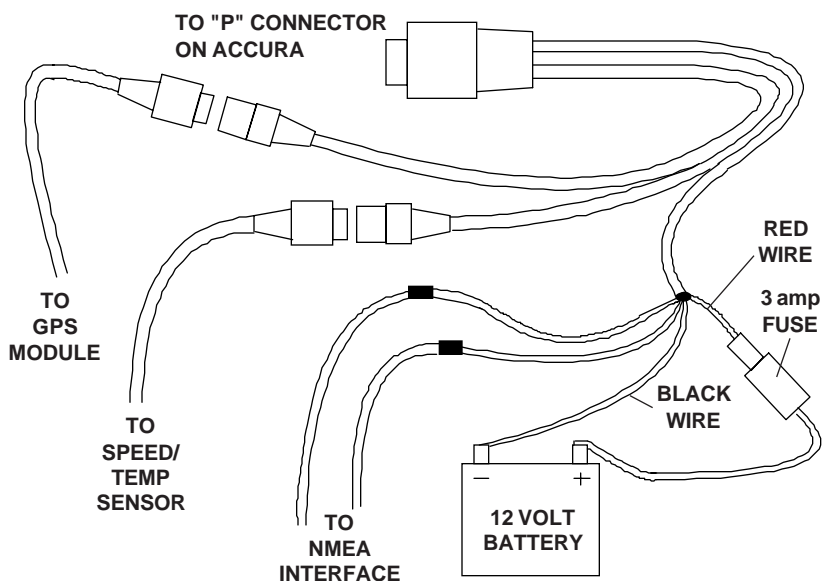
POWER CONNECTIONS

The LMS-350A works from a twelve-volt battery system. For the best results, attach the power cable directly to the battery. You can attach the power cable to an accessory or power buss, however you may have problems with electrical interference. Therefore, it's safer to go ahead and attach the power cable directly to the battery. If the cable is too short, splice #18 gauge wire onto it. The power cable has four wires; red, black, green, and white. Red is the positive lead, black is negative or ground. Make certain to attach the in-line fuse holder to the red lead as close to the power source as possible. For example, if you have to extend the power cable to the battery or power buss, attach one end of the fuse holder directly to the battery or power buss. This will protect both the unit and the power cable in the event of a short. The LMS-350A uses a 3-amp fuse.

IMPORTANT!

Do not use this product without a 3-amp fuse wired into the power cable! Failure to use a 3-amp fuse will void your warranty.

If you're installing an optional speed/temperature sensor, read the speed/temperature sensor's installation manual for mounting instructions. Route the sensor's cable to the LMS-350's power cable and plug it into the connector marked "SPEED/TEMP CABLE"
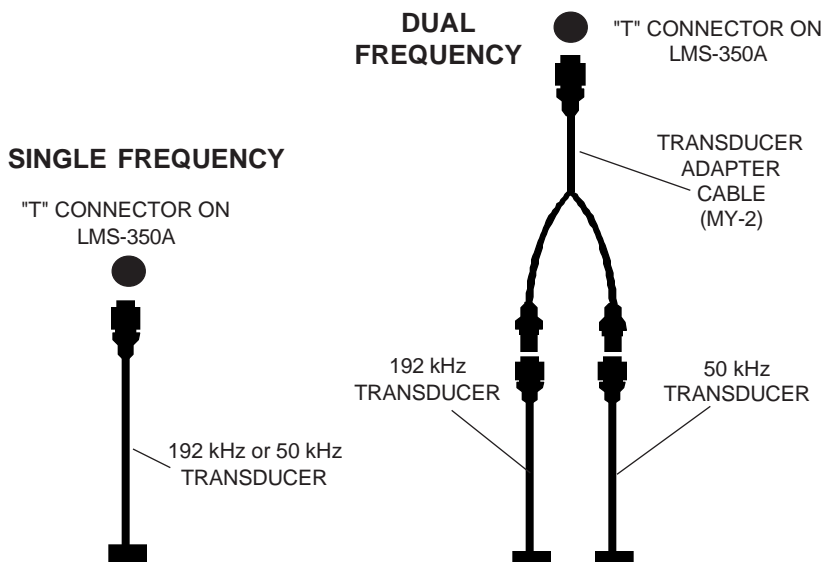

LMS-350A POWER CONNECTIONS

The white wire is for a NMEA interface. The LMS-350A sends data to another electronic navigation devices through the white wire. It receives data from a differential (DGPS) beacon receiver through the green wire. If the white and green wires are not used, tape their ends so that they cannot short.

To connect a device to the LMS-350's NMEA output (white wire), attach a shielded, twisted pair cable from the device's NMEA intput to the white wire on the LMS-350's power cable. Solder the ground conductor of the twisted pair and the shield to the black wire on the power cable. Do not connect the shield to the other device. Use the green and black wires in the same manner to attach a DGPS recevier's output to the LMS-350's input (green wire). See the other instrument's manual and the NMEA section in this manual for more information.

TRANSDUCER CONNECTIONS
The LMS-350A has dual frequency capability. It can operate at 50 or 192 kHz, separately, or at the same time. The connection diagram below shows the proper method to attach the transducers to the LMS-350A. See the transducer owner's manual for transducer installation instructions. If dual frequency (simultaneous) operation is desired, a 50 kHz transducer and the MY-2 transducer adapter cable must be purchased separtately.

See page 18 for more information on dual frequency operation.

DUAL FREQUENCY

"T" CONNECTOR ON LMS-350A

TRANSDUCER ADAPTER CABLE (MY-2)

SINGLE FREQUENCY

"T" CONNECTOR ON LMS-350A

192 kHz TRANSDUCER

50 kHz TRANSDUCER

192 kHz or 50 kHz TRANSDUCER

OPTIONAL GPS MODULE INSTALLATION

The GPS module can be installed on a flat surface or (with the supplied adapter) on a pole. Mount the module in an area that guarantees a clear view of the sky at all times. In order for the module to receive the signals from the satellites, it must not be obstructed. An ideal location is on a cabin roof, or deck. The gunnels also make a good location. Attaching the pole mounting adapter lets you install the module on a one inch mast. However, for lightning protection, the antenna shouln't be the highest part of the boat.

Surface Mounting - With Access

If you have access underneath the mounting surface, use the gasket supplied with the GPS module as a template. Drill four 5.5 mm (7/32") holes and one 17 mm (11/16") hole for the module's cable. Attach the cable to the module and pass it down through the hole in the gasket and the mounting surface. Use 5 mm screws, flat washers, and lock washers to fasten the GPS module to the mounting surface. Route the cable to the LMS-350A.
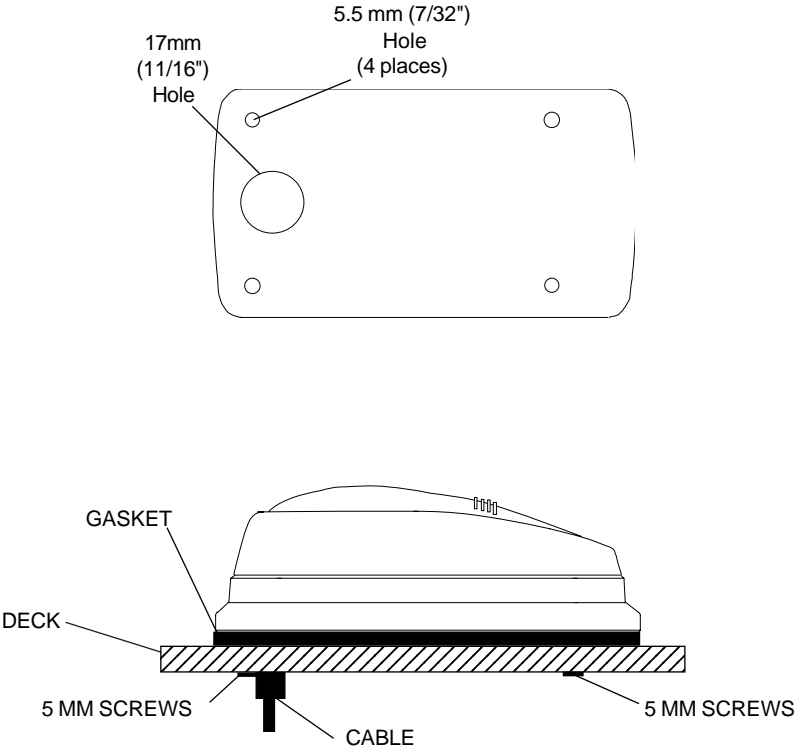
Surface Mounting - Without Access

If you don't have access to the back side of the mounting surface, use the "cleats" supplied with the LMS-350A. (Note: This is assuming you can "snake" the module's cable to a location that is accessable. A hole will still need to be drilled in the mounting surface for the cable.) Using the gasket as a template, mark and drill the 17 mm (11/16") hole for the cable. Attach the cable to the module and drop the other end of the cable through the gasket and down the hole. Place the module on the gasket. Slide the "cleats" onto each end of the module and (using the cleats as templates) mark four holes for 5 mm (#10) mounting screws. Drill the holes, then replace the cleats on the module and fasten them to the mounting surface with 5 mm (#10) screws. Route the cable to the LMS-350A.

"CLEAT"

MARK AND
DRILL FOUR
PLACES

GPS MODULE

"CLEAT"

GASKET

CABLE
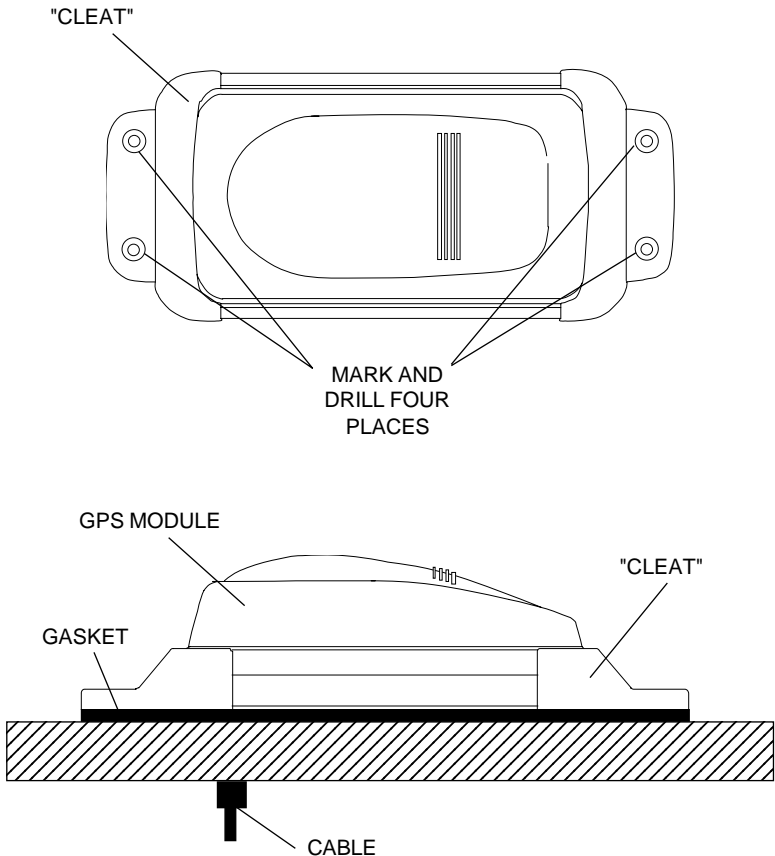
Pole Mount

First, thread the pole mounting adapter onto the mounting pole or ratchet base. Align the pole mounting adapter so the module will face the bow of the boat. Install and tighten the set screw into the pole mounting adapter and tighten it securely. This should prevent the GPS module from unscrewing from the pole. Place the gasket onto the pole mounting adapter. Now attach the cable to the GPS module and pass the cable through the gasket, pole mounting adapter, and pole. Set the GPS module on top of the pole mounting adapter and align the four threaded holes in the module with the holes in the pole mounting adapter. Using the four stainless steel 5 mm screws and lock washers supplied with the LMS-350A, attach the pole mounting adapter to the GPS module. This completes the assembly.

GPS MODULE

SET
SCREW

POLE
MOUNTING
ADAPTER
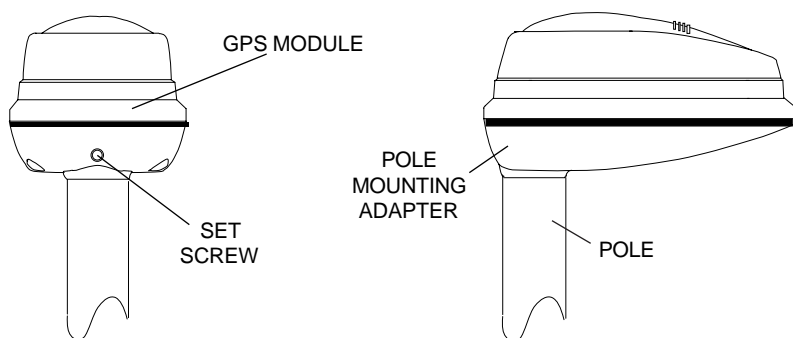
POLE

If the pole or mast you're using isn't hollow or if the hole in the middle of the pole is too small for the connectors, use the cable mounting adapter supplied with your unit. Thread the cable mounting adapter into the GPS pole mounting adapter. Then thread the pole into the cable mounting adapter. Route the cable down the outside of the pole.

GPS MODULE

CABLE
MOUNTING
ADAPTER

POLE

CABLE
MOUNTING
ADAPTER

POLE
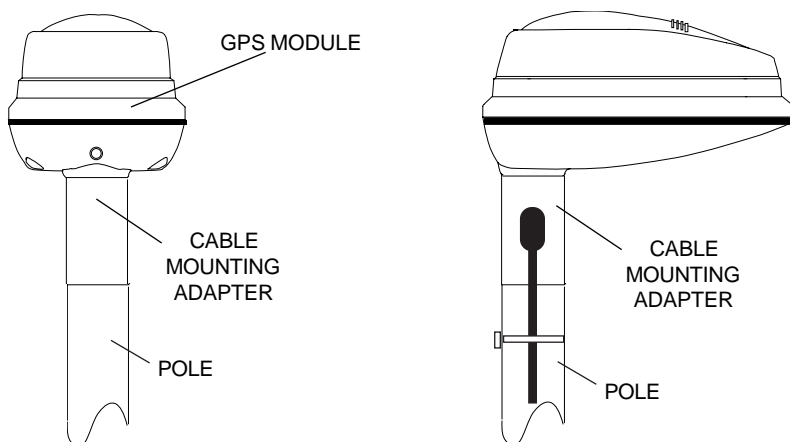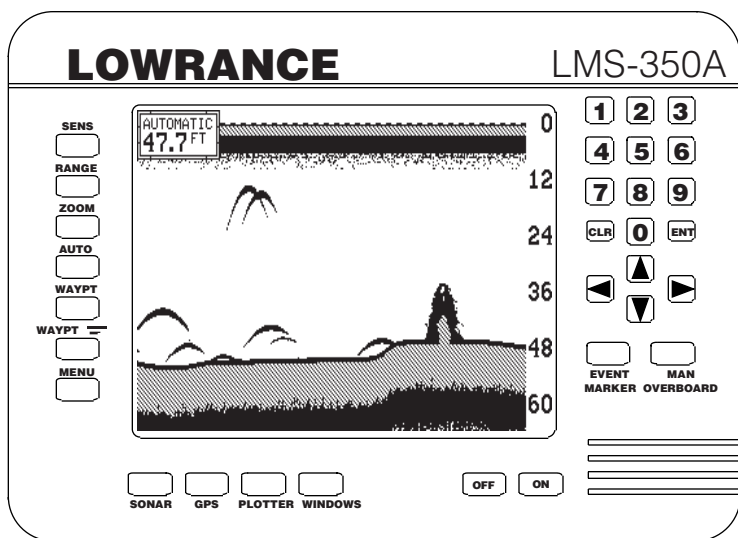
KEYBOARD

The keyboard has keys arranged in a vertical column on the left plus a horizontal row at the bottom. A ten-key pad and arrow keys on the right side of the screen lets you enter and change data on the screen. The keys in the left column are used for sonar and menu selections. The menu key in the bottom left corner of the keyboard activates the first menu page. The keys along the bottom of the screen are used to switch between the sonar, optional GPS, and windows modes.

SONAR - Press this key to switch to the sonar display.

GPS - The GPS navigation displays show when you press this key.

PLOTTER - Press this key to show the GPS Plotter display.

WINDOWS - This key gives you access to the windows mode, which lets you customize displays.

SENS - Press this key to adjust the unit's sonar sensitivity.

RANGE - This key lets you adjust the sonar's range.

ZOOM - The LMS-350A gives you 2X and 4X zoom capability with this key.

AUTO - This turns the automatic feature off and on.

WAYPT - Press this key to save and recall waypoints.

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WAYPT QUICK SAVE - Pressing this key instantly saves your position.

MENU - Press this key to show the menus and gain access to most functions.

CLR - This key clears menus and erases entries from the screen.

ENT - This key is used to enter numbers and make selections.

ARROW KEYS - These keys are used to make menu selections and to move objects on the screen.

ON - The ON key turns the LMS-350A on.

OFF - Press and HOLD the Off key to turn the LMS-350A off.

DISPLAY - General
The lights are turned on for approximately ten seconds when the LMS-350A is first turned on. Menus appear at the same time. To keep the lights on, press the key adjacent to the Light label. It controls the backlighting used on the display and keyboard. If you don't want the lights on, wait ten seconds and the lights will automatically turn themselves off. The menus will also disappear after ten seconds, or you can turn them off by pressing the CLR key on the left side of the zero (0) key.

The Metric label at the top of the screen works the same way. Press the key adjacent to the Metric label to change the depth from feet to meters. This also changes the temperature display to degrees Celsius, speed to knots, and log to kilometers.

The Display menu on the right side of the screen let you adjust the display's contrast for the best viewing angle. Pressing the left arrow key decreases the contrast, the right arrow increases it. After setting the contrast for the best viewing angle, press the CLR key to erase the menu or wait approximately ten seconds and it will automatically erase. See the Display Contrast section for more information on this feature.
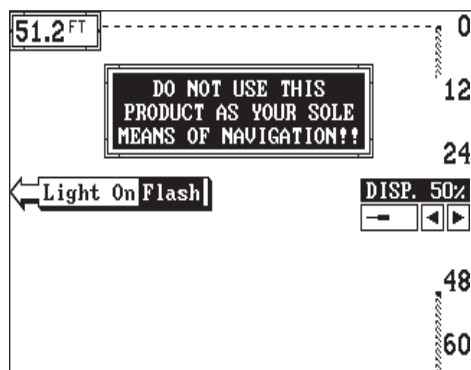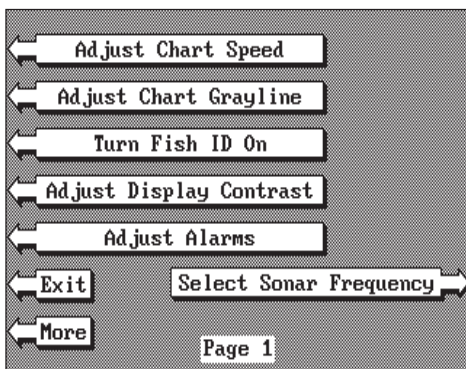
When the LMS-350A is first turned on, the display will appear similar to the one at left. The word "AUTOMATIC" in

the upper left corner of the display indicates the automatic feature is on. The digital bottom depth also showsin this box.

MENUS

The LMS-350A uses menus extensively to guide you through the functions and features of the unit. The menu key accesses many of these features, allowing you to customize the unit to your particular needs and water conditions. Although you may have to leave one menu and enter another to reach the desired function, all you have to do is press the key next to the "More" label to select the next menu. To return to the sonar screen, simply press the key next to the "Exit" label or press the CLR key.

Adjust Chart Speed
Adjust Chart Grayline
Turn Fish ID On
Adjust Display Contrast
Adjust Alarms
Exit   Select Sonar Frequency
More   Page 1

HELP

An extremely useful feature incorporated into the LMS-350A series is the Help menus. Virtually every feature has a help menu label that, when pressed, gives one or more pages of text describing how to use that feature. For example, pressing the AUTO key brings up a menu letting you switch the unit into or out of the automatic mode. A help label also appears on the screen. Pressing the key adjacent to the help label gives you a description of how automatic works and how it affects different functions.

WINDOWS

You can change the displays on the LMS-350A by using the windows feature. This lets you customize displays to your own fishing or boating situations. This feature gives you 22 different window screens.

The screens available in the windows mode are divided into two or more windows per screen. Each screen of windows is called a "group". Group "A" as shown at right has the digital displays in one window and the sonar chart in the other.

DEPTH (FT)
48.0
TEMP. (°F)
72.6
SPEED (MPH)
8.6
LOG (MI)
19.3
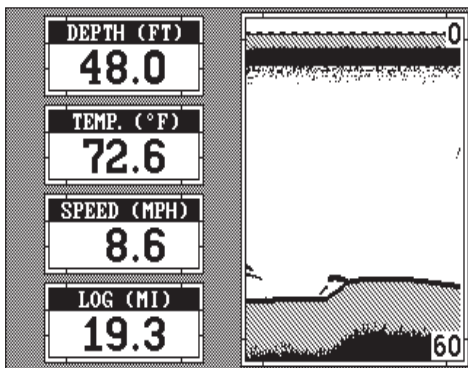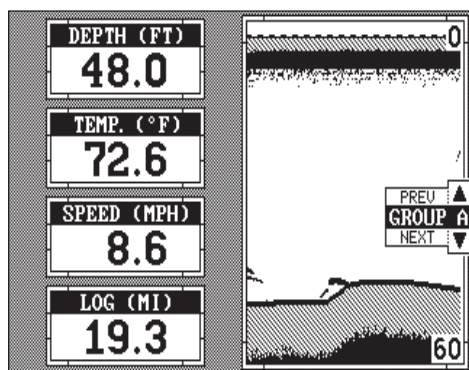
To use the windows feature, first press the WINDOWS key. A screen similar to the one shown at left appears. The menu on the right side of the screen lets you switch between the "pages" of displays. These are lettered "A" through "V". Group "A" shows first. Press the down arrow key to move forward through the screens. Press the up arrow key to move backward. For example, pressing the down arrow key once shows the group "B" screen. To return to the full sonar screen, press the "SONAR" key.
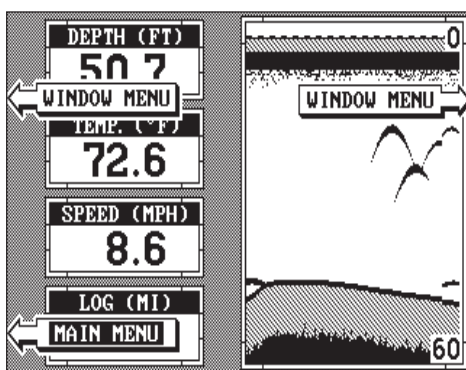
Every one of the group screens can be modified to some extent. For example, press the MENU key while group "A" is displayed. Three new labels appear on the display as shown above. Two of these labels are window menus. Pressing the key adjacent to one of the "window menu" labels gives you a menu with functions that relate only to that window. For example, if you press the key adjacent to the window menu label on the sonar chart window, the screen will clear and you will have a new menu with selections such as "ADJUST CHART SPEED" and "ADJUST GRAYLINE". Other window menus let you change the sonar frequency or turn the Fish ID feature on.
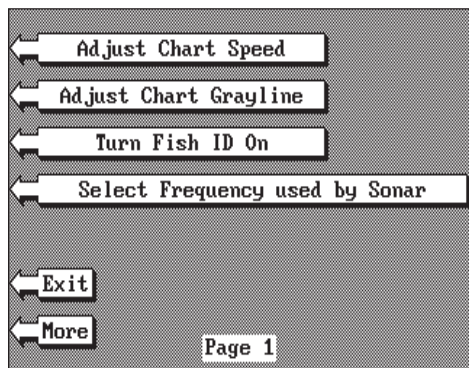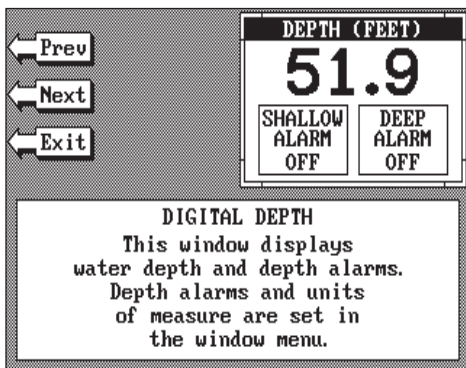
To exit from a window menu,

press the CLR key.

VIEWING WINDOWS OPTIONS

To see all of the available window options, press the WINDOWS key, then press the MENU key. Now press the key adjacent to the "MAIN MENU" label. Finally, press the key next to the "VIEW ALL WINDOWS" label. The screen at right appears.

```
 ┌──Prev    ┌──────────────────┐
 │          │    DEPTH (FEET)  │
 ┌──Next    │      51.9        │
 │          │ SHALLOW │ DEEP   │
 ┌──Exit    │ ALARM   │ ALARM  │
 │          │ OFF     │ OFF    │
            └──────────────────┘
       ┌──────────────────────────┐
       │     DIGITAL DEPTH        │
       │   This window displays   │
       │ water depth and depth    │
       │ alarms.                  │
       │ Depth alarms and units   │
       │ of measure are set in    │
       │   the window menu.       │
       └──────────────────────────┘
```
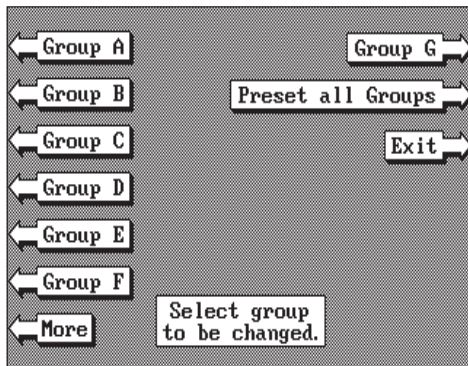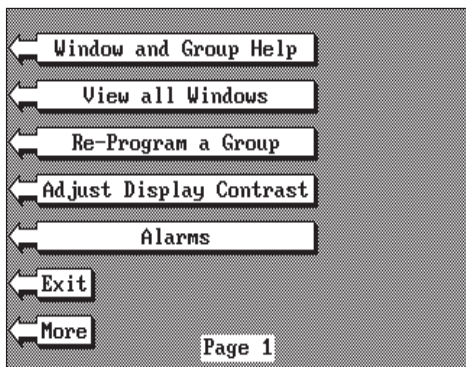
The first window appears in the upper right corner of the screen. A description of the screen shows in the box at the bottom of the screen. Now press the key adjacent to the "NEXT" label. This changes the displayed window and description.

When you've finished viewing the windows, press the CLEAR key.

MODIFYING GROUPS

To modify or "customize" a group, first press the WINDOWS key, then press the MENU key. Now press the key adjacent to the "MAIN MENU" label at the bottom of the screen. The screen shown at right appears.

```
 ◄── Window and Group Help
 ◄── View all Windows
 ◄── Re-Program a Group
 ◄── Adjust Display Contrast
 ◄── Alarms
 ◄── Exit
 ◄── More         ┌────────┐
                  │ Page 1 │
                  └────────┘
```

```
 ◄── Group A          Group G ──►
 ◄── Group B      Preset all Groups ──►
 ◄── Group C          Exit ──►
 ◄── Group D
 ◄── Group E
 ◄── Group F
 ◄── More    ┌──────────────┐
            │ Select group │
            │ to be changed.│
            └──────────────┘
```

Now press the key adjacent to the "RE-PROGRAM A GROUP" label. The screen shown below appears.

Select the letter of the group you wish to customize by pressing the key adjacent to the group's label. If the label isn't shown on this page, press the key adjacent to the "MORE" label. In this example, the key
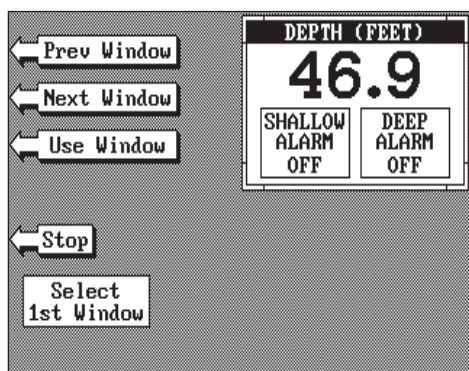
next to the "GROUP A" label was pressed. The screen shown at the top of the next page appears.

The depth window appears in the upper right corner of the screen. Press the key adjacent to the "NEXT WINDOW" label to move through the windows. If you reach the last window, or if you wish to go backwards through the windows, press the key next to the "PREV WIN-DOW" label. When the desired window is on the screen, press the key next to the "USE WINDOW" label. The screen clears, placing the new window in the upper left corner of the screen. If the new window takes up half the screen, the unit will place it on the left side of the screen.

Continue with the window selections until the screen is filled. The unit will stay in the windows mode using your new customized screen. If you don't want to fill a screen and only use one, two, or three windows in a group, simply press the key adjacent to the "STOP" label. This saves the group and exits the modify windows mode.

Remember, you can always return to the full screen sonar mode by pressing the "SONAR" key in the bottom left corner of the LMS-350A. To switch back to your customized screen from the full screen sonar, simply press the WINDOWS key, then use the down arrow key to switch to the group you customized.

NOTE: The LMS-350A saves all window changes in memory. It keeps these changes even if power is turned off. However, a preset does erase all window changes and returns to the standard windows.

RESETTING ALL GROUPS
To return all of the groups to their factory settings without turning the unit off and on again, press the WINDOWS key, then press the MENU key, then press the key adjacent to the "MAIN MENU" label. Now press the key adjacent to the "RE-PROGRAM A GROUP" label. Finally, press the key

SONAR OPERATION

AUTOMATIC

When the LMS-350A is first turned on, the Automatic feature is enabled. This is indicated by the word "AUTO" at the top of the screen. The Automatic feature adjusts the sensitivity and range so the bottom signal is displayed in the lower half of the screen at all times.
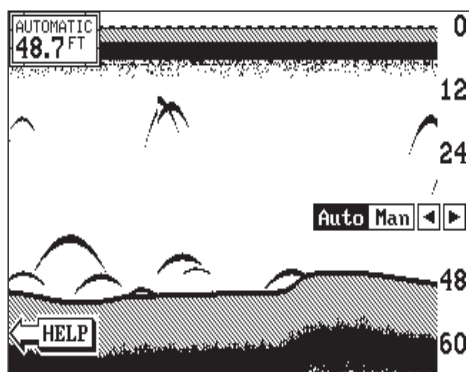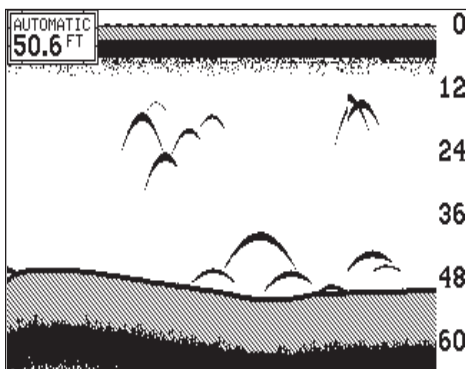
To turn Automatic off, first press the AUTO key. A menu appears at the bottom of the screen above the left and right arrows. Press the left arrow key to switch to the manual mode. The letters "Man" appear in the upper left corner of the display, indicating the unit is in the manual mode. To turn Automatic on, press the AUTO key again, then press the right arrow key.

Remember, when the LMS-350A is in the automatic mode, you have a limited adjustment range on the Sensitivity control and no control over the Range. Zoom adjusts differently in automatic than manual, also.

SENSITIVITY

The sensitivity key on the LMS-350A controls the ability of the unit to pick up echoes. A low sensitivity level excludes much of the bottom information, fish signals, and other target information. High sensitivity levels enables you to see this detail, but it can also clutter the screen with many undesired signals. Typically, the best sensitivity level shows a good solid bottom signal with Grayline and some surface clutter.

When the LMS-350A is in the Automatic mode, the sensitivity is automatically adjusted to keep a solid bottom signal displayed, plus a little more. This gives it the capability to show fish and other detail.

However, situations occur where it becomes necessary to increase or decrease the sensitivity. This typically happens when you wish to see more detail, so an increase in sensitivity is indicated. The procedure to adjust it is the same whether the unit is in the automatic or manual mode.

To adjust the sensitivity, press the SENS key. The sensitivity adjust menu appears on the right side of the screen.

The sensitivity menu has left and right arrows, plus a horizontal bar graph. The graph gives a visual indication of the sensitivity level. The number above the arrows also shows the percentage of sensitivity in use.

To increase the sensitivity level, press the right arrow key. As you press the key, the menu's bar graph will grow wider and the percentage will increase in value. You can also see the difference on the chart record as it scrolls. When the sensitivity is at the desired level, release the key.
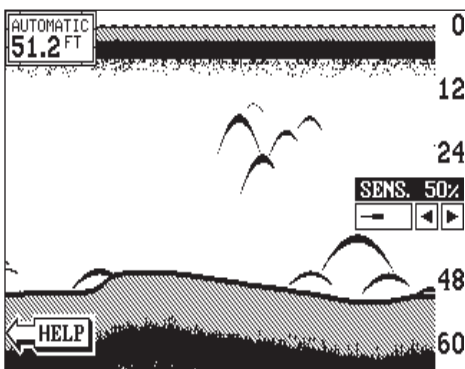
To decrease the sensitivity level, press the key adjacent to the left arrow. The bar graph and percentage will decrease. When the sensitivity is at the desired level, release the key.

When you reach either the maximum or minimum limit, a tone sounds. To turn the menus off, press the CLR key or wait a few seconds and the menus will automatically disappear.

RANGE - Automatic

When turned on for the first time, the LMS-350A automatically places the bottom signal in the lower half of the screen. This is called Auto Ranging and is part of the automatic function. The range cannot be changed manually while the unit is in automatic.

RANGE - Manual

The LMS-350A gives you control over the range when it's in the manual mode. There are two different methods used to change the range. The first way changes only the lower limit by pressing the arrow keys. On the screen shown below, the lower limit is 60 feet. The upper limit is zero. The second method lets you change both the upper and lower limits. This let's you create a "zoom" window down to five feet in virtually any combination of upper and lower limits. For example, a range with a 15 foot upper limit and a 45 foot lower limit creates a 30 foot zoom window. If the original range was zero to sixty feet, then this created a 2X zoom.
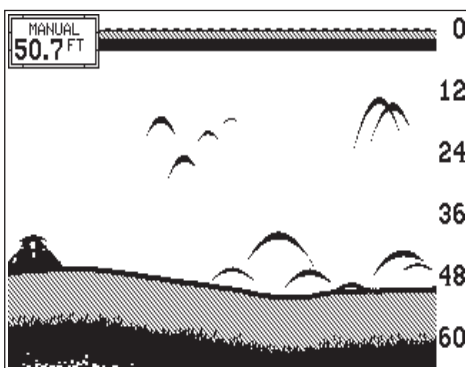

To change the range, first make certain the LMS-350A is in the manual mode. Next, press the RANGE key. The range adjustment menu appears on the right side of the display. To change only the lower limit, simply press the up or down arrow keys to decrease or increase the range. The available ranges are 0-5, 10, 20, 30, 40, 60, 100, 150, 200, 300, 500, 800, 1000, 1500, 2000, 3000, and 5000 feet. After the desired range is displayed, press the CLEAR key to erase the range menu.

NOTE: The maximum depth capability of the LMS-350A depends on the transducer installation, water and bottom conditions, and other factors. The performance of the LMS-350A will vary from day-to-day because of changing conditions.
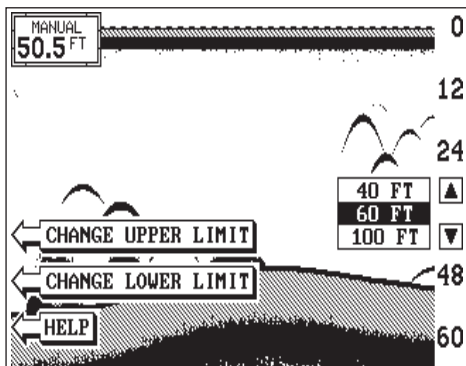
To change an upper or lower limit using the numbered keys, first press the RANGE key, then press the key next to either the "CHANGE UPPER LIMIT" or "CHANGE LOWER LIMIT" labels. On the screen shown at right, the key next to the "CHANGE UPPER LIMIT" was pressed. Now enter the desired depth, using the numbered keys. In this example, we en-

tered 35 feet. Now press the ENT key. The LMS-350A erases the range menus from the screen, and uses the new range you entered as shown below.
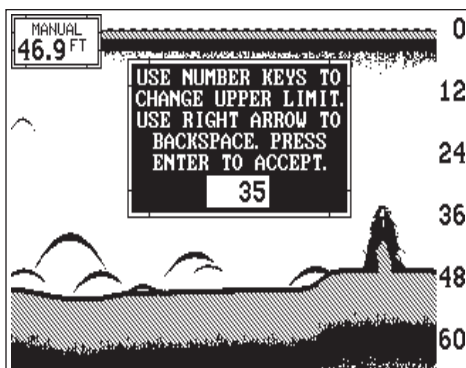
To change the lower limit, simply repeat the above steps, but press the key next to the "CHANGE LOWER LIMIT" label. Now enter the desired lower limit and press the ENT key. The LMS-350A erases the lower limit menus and changes the lower limit to the one you specified.
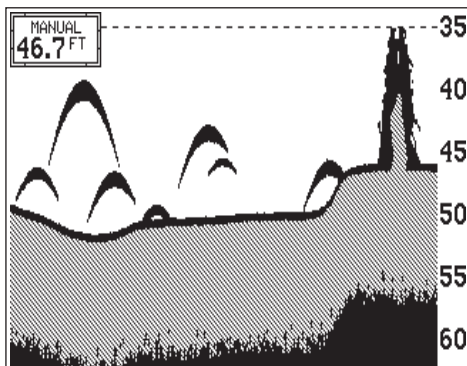
If you make a mistake while entering a limit, simply press the CLR key to erase the numbers. To exit from either the upper limit or lower limit entry screen, simply press the CLR key again.

ZOOM
Enlarging or "zooming" the picture is a common method used to show small detail and fish signals. The LMS-350A gives you two different zoom sizes, plus a split screen zoom option. The zoom operation and adjustment is different in the automatic and manual modes.

ZOOM - AUTOMATIC MODE
To zoom the display in the automatic mode, first press the ZOOM key. All targets on the display are enlarged four times normal size automatically. The menus shown at the top of the next page also appear.
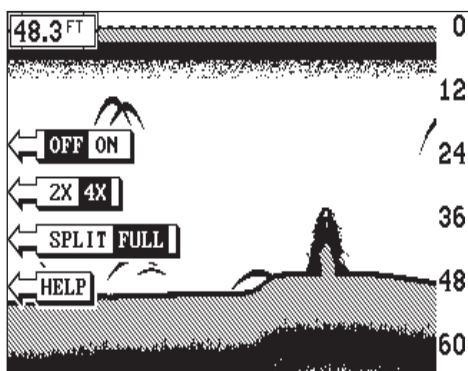
next to the "RESET ALL GROUPS" label.

Turn the zoom feature on (or off) by pressing the key adjacent to the "OFF/ON" label.
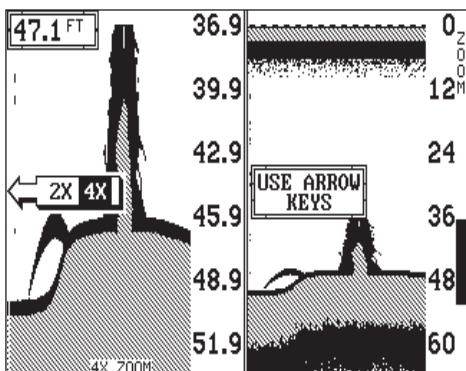
Pressing the key adjacent to the "2X/4X" label enlarges echoes from two times to four times their normal size.

To switch between the split screen zoom and full screen zoom, press the key adjacent to the "SPLIT/FULL" label. The screen instantly splits into two sections. All targets on the left are shown at four times the size of the ones on the right. If you switch to the 2X zoom mode, echoes on the left side of the screen are shown at twice the size as the ones on the right. The echoes that scroll across the screen are the exact same echoes on both sides of the screen. They're simply enlarged on the left side. This feature tracks the bottom, keeping it on the display at all times, when the automatic feature is on. Once you've set the zoom as desired, press the CLR key to erase the menus.

ZOOM - MANUAL MODE

When you press the zoom key while the unit is in the manual mode, the screen shown below appears. All of the menus on this screen work identically as described above. However, one additional menu item is shown when the unit is in the manual mode: "ADJUST".

To adjust the zoom, press the key adjacent to the "ADJUST" label. A screen similar to the one below appears. A zoom bar and adjust arrows appear on the screen. The echoes on the left side of the screen are the ones that appear between the top and the bottom of the zoom bar. Press the up or down arrow keys to move the zoom bar up or down. As you adjust the zoom bar, the echoes move on the left side of the screen at the same time. The zoom adjust menus will automatically clear a few seconds after you've pressed the last key. Remember, the LMS-350A won't track

the bottom when it's in the
manual mode.

MENU - PAGE 1

CHART SPEED
The rate echoes scroll across
the screen is called the chart
speed. It's adjustable by first
pressing the menu key, then
pressing the key adjacent to
the "Adjust Chart Speed" label.
The chart speed menu appears
on the right side of the screen. Increase the chart speed by pressing the

right arrow key or decrease it
by pressing the left arrow key.
The percentage of chart speed
in use changes as the arrow
keys are pressed. The bar chart
also gives a graphical indica-
tion of the chart speed. You
can see the change on the
screen (both on the menu and
on the chart record) as you
press the keys. After you've
made the adjustment, press
the CLR key to erase the menu.
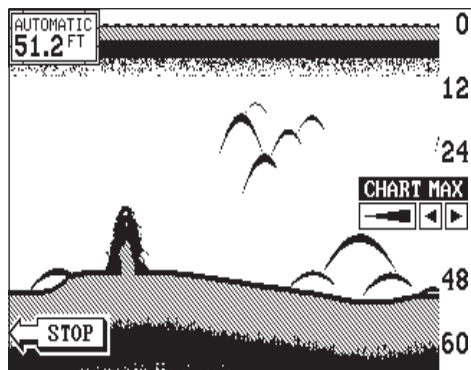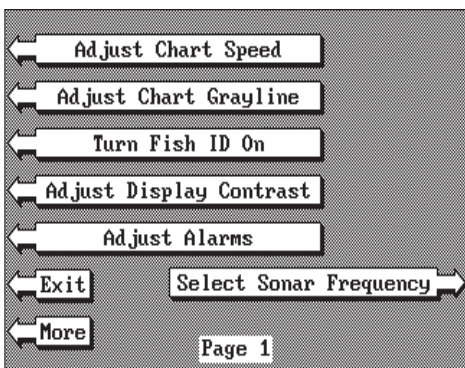
To stop the chart, press the key adjacent to the "STOP" label in the unit's
lower left corner. To start the chart, press the key next to the "START"
label.

GRAYLINE®
GRAYLINE lets you distinguish between strong and weak echoes. It
"paints" gray on targets that are stronger than a preset value. This allows
you to tell the difference between a hard and soft bottom. For example, a
soft, muddy or weedy bottom returns a weaker signal which is shown with
a narrow or no gray line. A hard bottom returns a strong signal which
causes a wide gray line.

If you have two signals of equal size, one with gray and the other without,
then the target with gray is the stronger signal. This helps distinguish
weeds from trees on the bottom, or fish from structure.
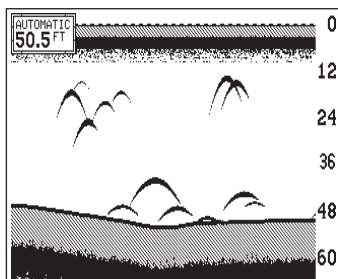
GRAYLINE® ON

GRAYLINE® OFF

GRAYLINE is adjustable. Since GRAYLINE shows the difference between strong and weak signals, adjusting the sensitivity may require a different GRAYLINE level, also. The level chosen by the LMS-350A at power on is usually adequate for most conditions. Experiment with your unit to find the GRAYLINE setting that's best for you.

To adjust GRAYLINE, press the MENU key, then press the key adjacent to the "Adjust Chart Grayline" label. A screen similar to the one at right appears. Now press the left arrow key to decrease the gray level. Press the right arrow key to increase it. The percentage of GRAYLINE in use changes as the arrow keys are pressed. The bar chart also gives a graphical indication of the GRAYLINE level. You can see the change on the screen (both on the menu and on the chart record) as you press the keys. After you've made the adjustment, press the CLR key to erase the menu.
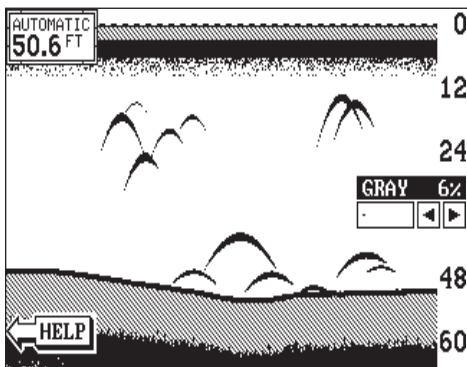
FISH I.D.
The Fish I.D. feature identifies targets that meet certain conditions as fish. The micro-computer analyses all echoes and eliminates surface clutter, thermoclines, and other signals that are undesirable. In most instances, remaining targets are fish. The Fish I.D. feature displays symbols on the screen in place of the actual fish echoes. There are four fish symbol sizes: tiny, small, medium, and large. These are used to designate the relative size between targets. In other words, it displays a small fish symbol when it thinks a target is a small fish, a medium fish symbol on a larger target, etc.

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outwards from a group of limbs is the hardest object for the Fish I.D. feature to distinguish from fish. You may see Fish I.D. symbols on the screen when actually, there are no fish. Practice with the unit in both the Fish I.D. mode and without to become more familiar with the Fish I.D. feature.

To turn the Fish I.D. feature on, press the menu key, then press the key adjacent to the "Turn Fish-ID On" label. Echoes will continue to scroll across the screen, however, the surface clutter at the top will no longer be displayed. Any targets the micro-computer determines are fish will be displayed as fish symbols. To turn the Fish I.D. feature off again, first press the menu key. Next, press the key adjacent to the "Turn Fish I.D. Off" label. The menu immediately disappears and the sonar screen returns.

Remember, the Fish I.D. feature can't be used when the LMS-350A is in the manual mode. If you turn the Fish I.D. feature on when the LMS-350A is in manual, the micro-computer will turn the automatic feature on. If you turn automatic off when the Fish I.D. feature is on, the Fish I.D. feature will be turned off also.

The micro-computer is sophisticated, but it can be fooled. It cannot distinguish between fish and other suspended objects such as trotlines, turtles, submerged floats, air bubbles, etc. Individual tree limbs extending

DISPLAY CONTRAST

The unit's display contrast is adjustable to suit different lighting conditions. To adjust it, first press the menu key. The first menu page appears. Now press the key next to the "Adjust Display Contrast" label. A screen similar to the one below appears. Now press the key adjacent to the left arrow to decrease the contrast. Press the key adjacent to the right arrow to increase it. The percentage of contrast in use changes as the arrow keys are
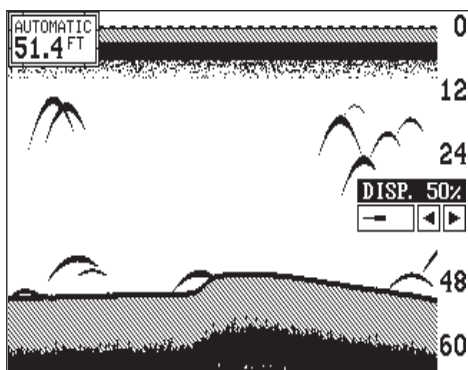
ALARMS

The LMS-350A has three different types of sonar alarms. The first is the Fish Alarm. It sounds when the Fish I.D. feature determines an echo or group of echoes is a fish. Another alarm is the Zone Alarm which consists of a bar. Any echo that appears inside this bar triggers the alarm. The last alarm is called the Depth Alarm. Only the bottom signal will trigger this alarm. This is useful as an anchor watch, a shallow water alert, or for navigation.

To adjust an alarm, first press the MENU key. Now press the key next to the "Adjust Alarms" label. The screen shown below appears. Press the key next to the "Set Depth or GPS Alarms" to adjust the shallow or deep digital alarms.Press the key next to the "Set Zone Alarm" to adjust the zone alarm. The fish alarm doesn't have an adjustment. It's either on or off.
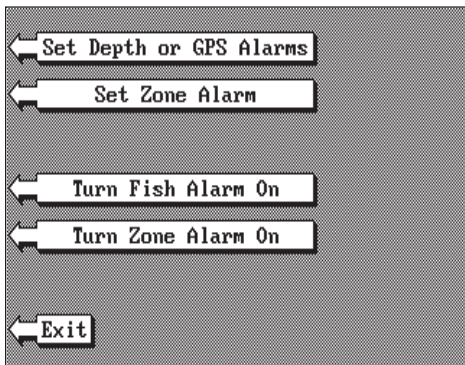
The following section describes each sonar alarm and its limits.

FISH ALARM

Use the fish alarm for a distinctive audible alarm when fish or other suspended objects are detected by the Fish I.D. feature. A different tone sounds for each fish symbol size shown on the display.

To turn the fish alarm on, press the MENU key, then press the key next to the "Adjust Alarms" label. The screen shown above appears. Now press the key next to the "Turn Fish Alarm On" label.

To turn the fish alarm off, repeat the above steps. The label on the Alarms menu now reads "Turn Fish Alarm Off". Press the key next to that label to turn the fish alarm off.

DEPTH ALARMS

The depth alarms sound a tone when the bottom signal goes shallower than the shallow alarm's setting or deeper than the deep alarm's setting. For example, if you set the shallow alarm to ten feet, the alarm will sound a tone if the bottom signal is less than ten feet. It will continue to sound until you mute it or until the bottom goes deeper than 10 feet. The deep alarm works just the opposite. It sounds a warning tone if the bottom depth goes deeper than the alarm's setting. Both depth alarms work only off t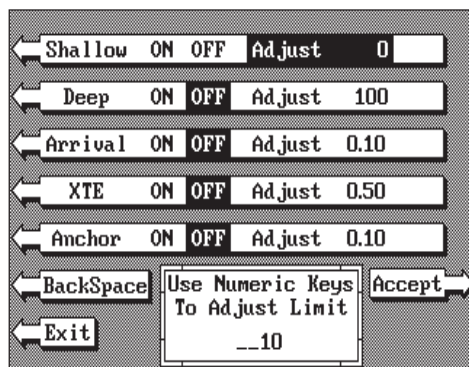he digital bottom depth signals. No other targets will trip these alarms. These alarms can be used at the same time or by themselves.
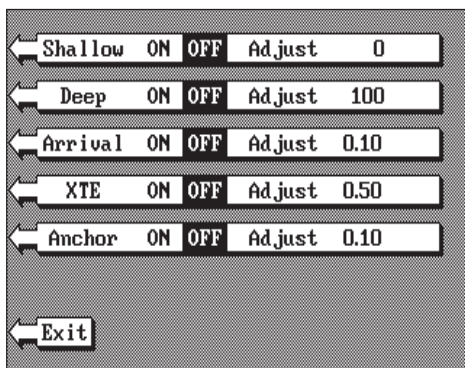
To set the depth alarms, first press the MENU key, then press the key next to the "Adjust Alarms" label. The screen on the previous page appears. Now press the key next to the "Set Depth Alarms" label. The screen at the top of this page appears.

To adjust the shallow alarm, press the key next to the "Shallow" label. To adjust the deep alarm, press the key next to the "Deep" label. Both alarms adjust identically. We'll use the shallow alarm as an example. Pressing the key next to the "Shallow" label moves the black box from the "OFF" postion to the "Adjust". A new screen appears as shown at right. Use the numbered keypad on the right side of the unit to enter the shallow alarm setting. We used 10 feet in this example. After you've entered the desired alarm depth, press the ENT key. This enters the alarm depth into memory. Now press the key next to the "Exit" label. The shallow alarm is now set. If the bottom goes shallower than 10 feet, the alarm will sound and a warning message appears on the screen at the same time. A label also appears letting you mute the alarm, if desired.

ZONE ALARM

The zone alarm consists of a bar that appears on the right side of the screen. Any echo that appears on the screen between the top and bottom of the zone alarm's bar will "trip" the zone alarm.

Note: The zone alarm isn't available in the Windows mode.
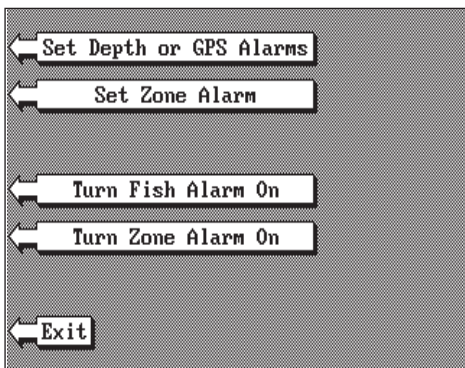
To set the zone alarm, press the MENU key. Now press the key next to the "Adjust Alarms" label. Finally, press the key next to the "Set Zone Alarm" label. A screen similar to the one shown below appears.

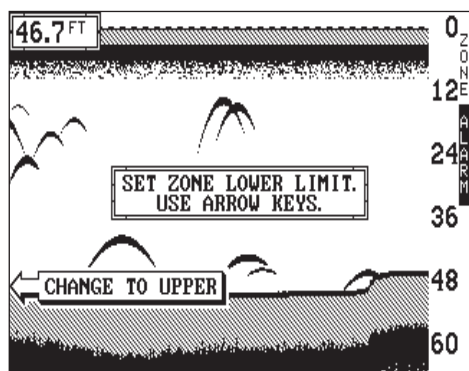The zone alarm bar shows on the right side of the screen. Use the arrow keys to move the bottom of the bar higher or lower. To move the top of the bar, first press the key next to the "CHANGE TO UPPER" label. Now use the arrow keys to move the top of the bar higher or lower. When you have the zone alarm bar set as desired, press the CLR key to erase the menus.

The above steps automatically turn the zone alarm on if it was off. To turn the zone alarm off, press the MENU key, then press the key next to the "Adjust Alarms" label. Now press the key next to the "Turn Zone Alarm Off"label at the bottom of the screen.

Normally, the zone alarm bar disappears from the screen after you make adjustments. To leave the zone alarm bar on the screen all of the time, see the "Display Zone Alarm Bar" section in this manual for instructions.

SONAR FREQUENCY

The LMS-350A operates from 50 or 192 kHz, either independently or simultaneously. The sonar unit comes with a 192 kHz transducer, other optional transducers are available. See the transducer diagram on page 3 for single or dual transducer connections. The chart can operate from a different frequency than the digital sonar.
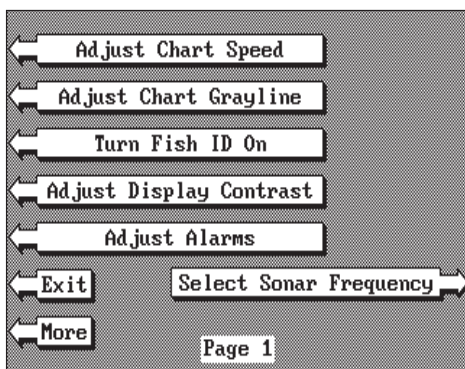
The LMS-350A chart's operating frequency is 192 kHz when it's first turned on. To change frequencies, first press the MENU key. The menu shown above appears. Next, press the key adjacent to the "Select Sonar Frequency" label. The screen shown at left appears.

This menu lets you change the frequency of both the chart and the digital sonar. Typically, you should use the 192 kHz frequency in shallow water and the 50 kHz frequency in deep water.
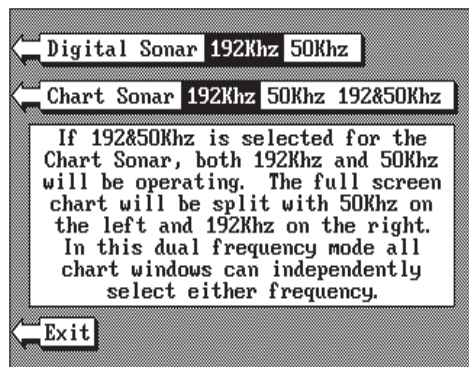
Now press the key adjacent to the desired frequency, either 50 kHz, 192 kHz, or both 50 and 192 kHz-split screen operation. (Note: Only the chart can operate at both frequencies at the same time.) The unit will begin scrolling echoes across the display. The frequency in use will also be displayed at the bottom of the screen.

NOTE: The 192 kHz frequency for both the chart and digital sonar is enabled when the LMS-350A is turned on for the first time or after a preset. This feature is saved in the battery-backed-up memory.

CHART DUAL FREQUENCY OPERATION

Sensitivity and Grayline® adjust differently when the Dual Frequency feature is enabled. The LMS-350A lets you make changes to the sensitivity and Grayline on one side of the screen without affecting the other. To adjust the sensitivity, for example, first press the SENS key. The screen shown at right appears. To adjust the sensitivity for the left, or 50 kHz side of the screen, press the key adjacent to the "192kHz 50kHz" label. Now press the left arrow key to decrease the sensitivity or the right arrow to increase it. When you're finished, press the CLR key to erase the menus.
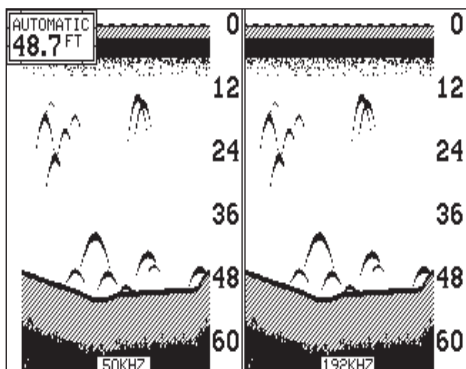
Dual Frequency, Split Screen Mode
(Left chart is operating at 50 kHz, right chart is 192 kHz.)

Note: If no frequency identification shows at the bottom of the screen, then the 192 kHz frequency is in use. The letters "50 kHz" always show at the bottom of the screen when the 50 kHz frequency is in use.

Remember, to use the 50 kHz frequency, you must have a 50 kHz transducer attached to the unit. If you wish to use both 192 and 50 kHz frequencies at the same time, you must have both transducers plus a MY-2 adapter cable attached to the unit. See the transducer connections section at the front of this manual for more information.

pressed. The bar chart also gives a graphical indication of the contrast level. You can see the change on the screen as you press the keys. After you've made the adjustment, press the CLR key to erase the menu.

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ADJUST BACK LIGHT LEVEL

The LMS-350A has internal lights for the display and keyboard. To adjust the intensity of the lighting, press the MENU key, then press the key adjacent to the "More" label. Now press the key next to the "Adjust Backlight Level" label. The screen shown below appears. Now press the left arrow key to decrease the light level. Press the right arrow key to increase it. The percentage of back light in use
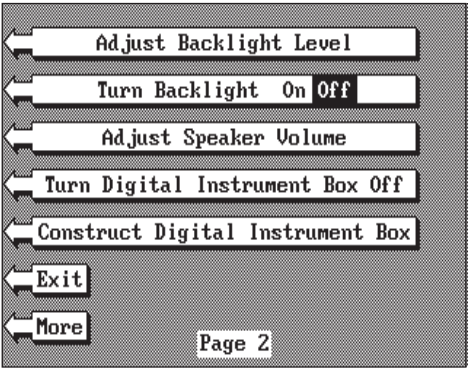
changes as the arrow keys are pressed. The bar chart also gives a graphical indication of the level. After you've made the adjustment, press the CLR key to erase the menu.

BACK LIGHT ON/OFF

To turn the back lighting on, first press the MENU key, then press the key next to the "More"
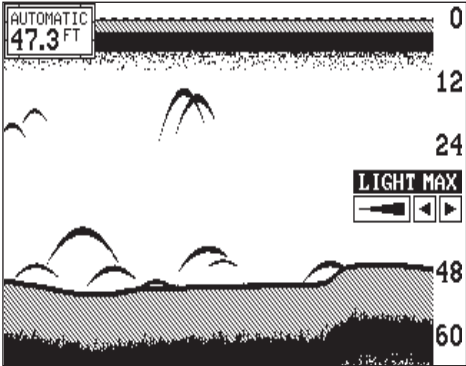
ADJUST SPEAKER VOLUME

The volume of the speaker's amplifier is adjustable. To change the volume, press the MENU key, then press the key adjacent to the "More" label. Now press the key next to the "Adjust Speaker Volume" label. A screen appears with the speaker volume adjust menu which is similar to the light adjust menu shown above. A musical tune sounds to indicate the current speaker volume. Now press the left arrow key to decrease the volume level. Press the right arrow key to increase it. The percentage of volume in use changes as the arrow keys are pressed. The bar chart also gives a graphical indication of the level. After you've made the adjustment, press the CLR key to erase the menu.

TURN DIGITAL INSTRUMENT BOX OFF

The digital box is displayed in the upper left corner of the full sonar screen. It has the digital depth and automatic/manual indicators. To turn this box off, press the MENU key then the key next to the "More" label, then the key adjacent to the "TURN DIGITAL INSTRUMENT BOX OFF" label. Repeat the above steps to turn the box on.

CONSTRUCT DIGITAL INSTRUMENT BOX

The LMS-350A can display the depth, speed, surface water temperature, and distance log in the upper left portion of the screen. When the LMS-350A is first turned on, only the depth is displayed. You can turn each digital display on as desired or turn all of them off, as desired.

To select the digital displays menu, first press the menu key, then press the key next to the "More" label. Next, press the key adjacent to the "CONSTRUCT DIGITAL INSTRUMENT BOX" menu. A screen appears that is similar to the one below.
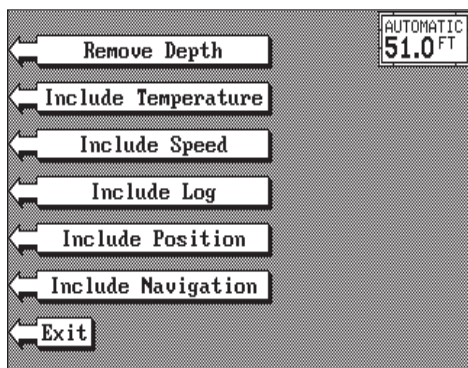
Now press the key adjacent to the desired display. For example, to turn the temperature display on, press the key adjacent to the "Include Temperature." label. Once you do this, the digital display in the corner of the screen will show the temperature in addition to the depth. The temperature menu label now shows "Remove Temperature".

You can turn each display on or off individually.

Press the CLR key to exit from this menu or wait approximately ten seconds and the menus will automatically clear.

Remember, to show speed, temperature, or distance log you must have an optional speed/temp sensor installed and connected to the LMS-350A.
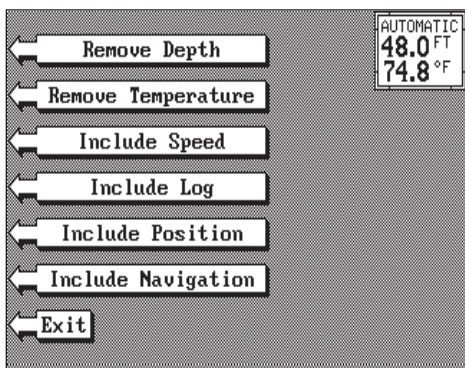
label. Finally, press the key next to the "Turn Backlight On Off" label. This moves the black box from "OFF" to the "ON" position. To turn the backlights off, repeat the same steps.

MENU - PAGE 3

DISPLAY ZOOM BAR

When the unit is in the zoom mode, the zoom bar doesn't normally show on the screen. The zoom bar shows the section of water on the right side of the screen that the zoom feature displays on the left side. To turn the zoom bar on continuously, first press the MENU key , then press the key next to the "More" label two times. The screen shown above appears. Now press the key next to the "Display Zoom Bar" label. A screen similar to the one at left appears. Note that turning the zoom bar on also turns the zoom feature on.
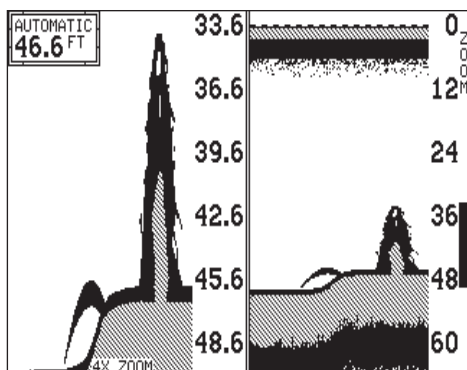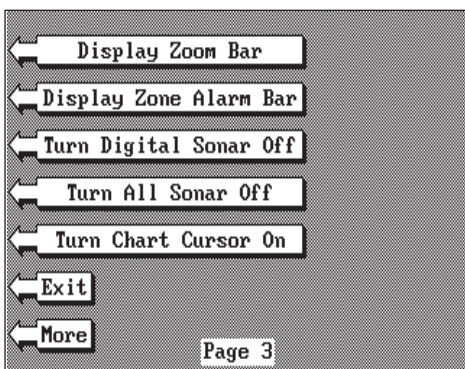
To turn the zoom bar off, repeat the above steps until the third menu page appears, then press the key adjacent to the "Remove Zoom Bar" label. This removes the zoom bar, but leaves the unit in the zoom mode. See the zoom section for more information on this feature.

DISPLAY ZONE BAR

When the zone alarm is on, the zone bar doesn't normally show on the screen. To turn the zone bar on continuously, first press the MENU key, then press the key next to the "More" label until the third menu page appears. Now press the key next to the "Display Zone Alarm Bar" label. The zone alarm bar appears on the right side of the

sonar screen as shown at right. This turns the zone alarm on at the same time.

To turn the zone bar off, repeat the above steps, until the third menu page appears, then press the key adjacent to the "Remove Zone Bar" label. Note

```
┌──────────────────────────┐
◄─┤   Display Zoom Bar       │
  └──────────────────────────┘
  ┌──────────────────────────┐
◄─┤ Display Zone Alarm Bar   │
  └──────────────────────────┘
  ┌──────────────────────────┐
◄─┤ Turn Digital Sonar Off   │
  └──────────────────────────┘
  ┌──────────────────────────┐
◄─┤   Turn All Sonar Off     │
  └──────────────────────────┘
  ┌──────────────────────────┐
◄─┤  Turn Chart Cursor On    │
  └──────────────────────────┘
  ┌──────┐
◄─┤ Exit │
  └──────┘
  ┌──────┐
◄─┤ More │          ┌────────┐
  └──────┘          │ Page 3 │
                    └────────┘
```
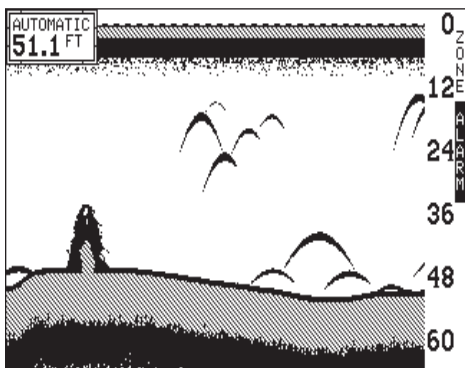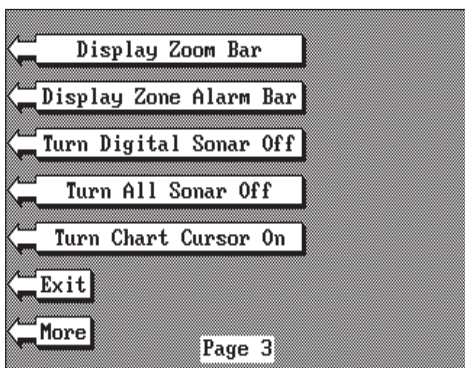
DIGITAL SONAR

When the LMS-350A is turned on for the first time, the digital depth display is located at the top left corner of the screen. This display comes from a separate digital sonar built into the unit. It displays only the bottom depth. If it loses the bottom, the last known depth will flash on the display. When the digital finds the bottom, it will automatically display the bottom depth again.

The digital sonar can be turned off, however this also turns all automatic features off also, such as auto sensitivity, auto ranging, and the Fish I.D. feature.

To turn the digital sonar off, press the Menu key, then press the key next to the "More" label until the third menu page appears. Now press the key adjacent to the "Turn Digital Sonar Off" label. To turn it back on again, repeat the same steps.

TURN ALL SONAR OFF

To turn the LMS-350A into a GPS-only unit, press the MENU key, then press the key next to the "More" label until the third menu page appears. Now press the key next to the "Turn All Sonar Off" label. This stops both the chart and the digital sonar. To turn both of the sonars on again, repeat the above steps, then press the key next to the "Turn All Sonar On" label.

CHART CURSOR

The LMS-350A has a chart cursor that lets you pinpoint a target's depth. The cursor is simply a movable horizontal line that extends across the display from right to left. A depth box at the far right end of the line shows the line's depth. In the example at the top of the next page, the chart cursor depth is 16.4 feet. To turn the chart cursor on, press the MENU key until the third menu screen appears as shown at the top of this page. Now press the key next to the "Turn Chart Cursor On" label. A screen similiar to the one at the top of the next page appears. To move the chart cursor, simply

press the up or down arrow keys. This lets you move the cursor to verify a target's depth.

To turn the chart cursor off, press the MENU key until the third menu screen appears. Now press the key next to the "Turn Chart Cursor Off" label. The LMS-350A returns to the sonar screen with the cursor turned off.

MENU - PAGE 4

FASTRAK

This feature converts all echoes to short horizontal lines on the display's far right side. The graph continues to operate normally. FASTRAK gives you a rapid update of conditions directly under the boat. This makes it useful for ice fishing, or when you're fishing at anchor. Since the unit is not moving, fish signals are long, drawn out lines on a normal chart display. FASTRAK converts the chart to a vertical bar graph.

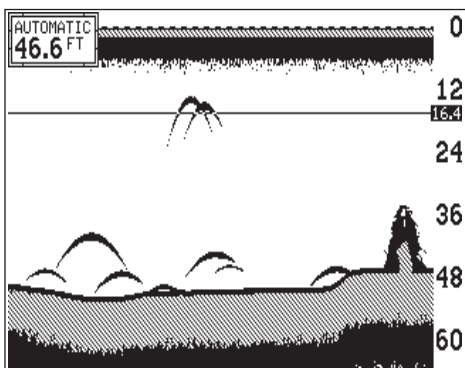To turn FASTRAK on, press the MENU key, then press the key next to the "More" label until the fourth menu page appears. Now press the key adjacent to the "Turn Chart Fastrak On" label. To turn it off, repeat the same steps. The "TURN FASTRAK OFF" label appears on this page when Fastrak is on. Press the key next to this label to turn it off.

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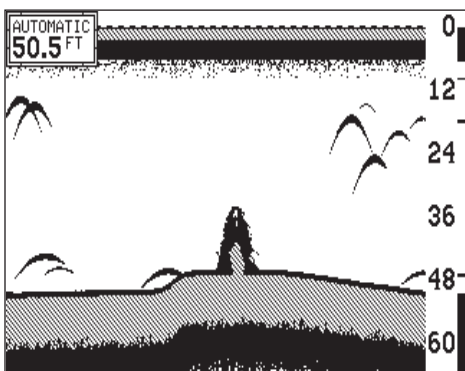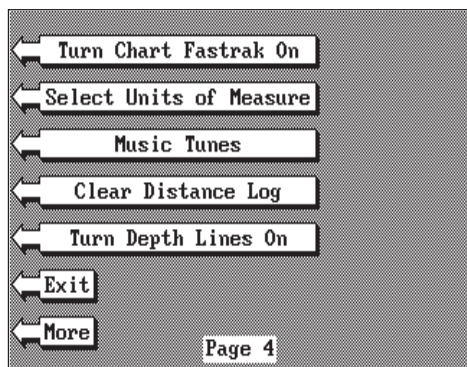
SELECT UNITS OF MEASURE

The LMS-350A can display the water depth in feet, fathoms, or meters, surface water temperature in degrees Fahrenheit or Celsius, speed in statute miles per hour, kilometers per hour, or knots, and distance (log) in miles, kilometers, or nautical miles.

```
Depth = [FT]  FM   M
Temp. = [°F]  °C
Speed = [MPH]  KN   KMH
LOG   = [MI]  NM   KM

Help
Exit
```
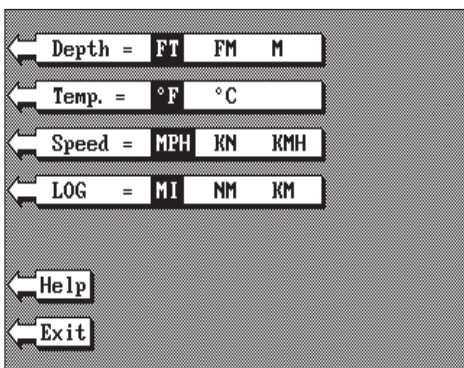
To change the units of measure, press the MENU key, then press the key next to the "More" label until the fourth menu page appears. Now press the key adjacent to the "Select Units of Measure" label. The screen shown below appears. The black box on each line shows the unit of measure currently in use. In the screen shown above, the units of measure are in feet for the depth, temperature in degrees Fahrenheit, speed is in statute miles per hour and log is in statute miles.

Press the key adjacent to the unit that you wish to change. For example, press the key next to the "Depth" label two times to switch from feet to meters. This moves the black box two times from the "FT" to the "M". When you have the units of measure set as desired, press the key next to the "Exit" label.

CLEAR DISTANCE LOG

If the optional speed/temperature sensor is attached to the LMS-350A, it starts counting distance as soon as the unit is turned on. It saves the distance in memory even when the unit is turned off. To reset the distance log to zero, press the MENU key, then press the key next to the "More" label until the "Clear Distance Log" label appears, then press the key adjacent to that label.

DEPTH LINES

The LMS-350A prints depth lines across the display that corresponds to the scales on the right side of the screen as shown on the screen at right. To turn the depth lines on, first press the MENU until the fourth menu page appears. Now press the key next to the "Turn Depth
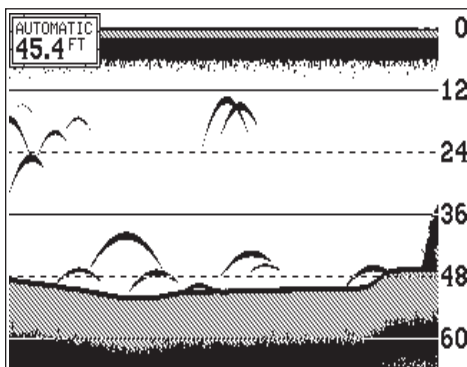
Lines On" label. A screen similar to the one shown at the bottom of the previous page appears. To turn the depth lines off, repeat the above steps. The label on the fourth menu page now reads "Turn Depth Lines Off". Press the key next to that label. The LMS-350A returns to the sonar screen.

MENU - PAGE 5

ADJUST CHART SURFACE CLARITY

The markings extending downward from the zero line on the chart are called "surface clutter." These markings are caused by wave action, boat wakes, temperature inversion, and other natural causes.
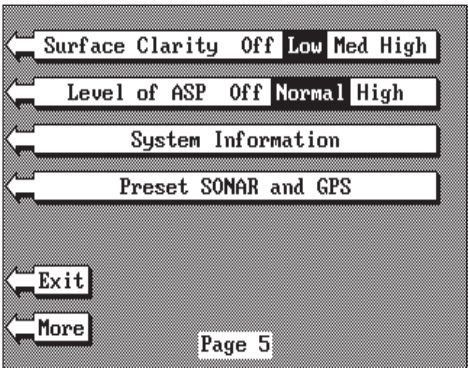
The Surface Clarity Control (SCC) reduces or eliminates surface clutter signals from the display. SCC varies the sensitivity of the receiver, decreasing it near the surface and gradually increasing it as the depth increases. The maximum depth that SCC will affect is 75% of the selected depth range. For example, on a 0-

60 foot range with maximum SCC, surface clutter will be reduced down to 45 feet.

There are three levels of SCC available on the LMS-350A: low, medium, and high. When it's turned on for the first time, the SCC level is low. To change it, press the MENU key, then press the key next to the "More" label until the fifth menu page appears. Now press the key adja-

cent to the "Surface Clarity" label until the black box is on the desired SCC level.
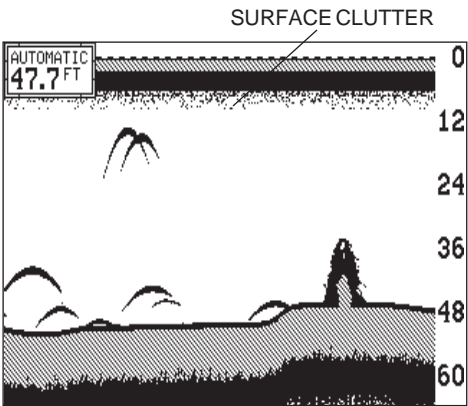
Press the key next to the "EXIT" label when you're finished.

33

ASP (Advanced Signal Processing)

The ASP feature is a noise rejection system built into the LMS-350A that constantly evaluates the effects of boat speed, water conditions, and interference. This automatic feature gives you the best display possible under most conditions.

The ASP feature is an effective tool in combating noise. In sonar terms, noise is any undesired signal. It is caused by electrical and mechanical sources such as bilge pumps, engine ignition systems and wiring, air bubbles passing over the face of the transducer, even vibration from the engine. In all cases, noise can produce unwanted marks on the display.

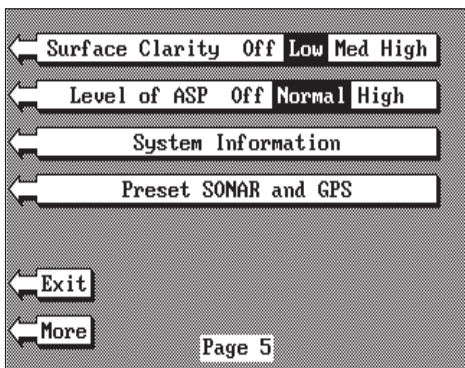The ASP feature has two levels - Normal and High. If you have high noise levels, try using the "High" ASP setting. However, if you are having trouble with noise, we suggest that you take steps to find the interference source and fix it, rather than continually using the unit with the high ASP setting. However, there are times when you may want to turn the ASP feature off. This allows you to view all incoming echoes before they are processed by the ASP feature.

To change the ASP level, press the MENU key, then press the key next to the "More" label until the fifth menu page appears. Then press the key next to the "Level of ASP" label until the desired level is obtained.

SYSTEM INFORMATION

The System Information menu gives you the date and revision number of the software used int the LMS-350A. To view this menu, press the Menu key, then press the key next to the "More" label until the fifth menu page appears. Now press the key next to the "System Information" label. A screen similar to the one at right appears. To return to the sonar screen, press the key next to the "Exit" label.
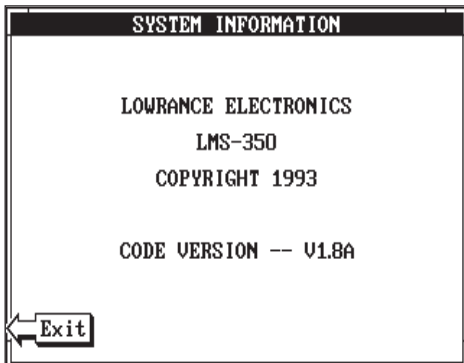
PRESET SONAR AND GPS

The LMS-350A has a built-in memory that saves all settings such as sensitivity, chart speed, keel offset, speed calibration, and more. Virtually all settings except for waypoint and route information is saved in this memory. (Waypoints, icons, and routes are saved in a separate memory.) Therefore, every time you turn the unit on, the settings are exactly as you left them.

However, you can return the LMS-350A to it's factory settings using the preset feature. This returns all sonar and GPS receiver settings at the same time. To use this feature, press the MENU key, then press the key next to the "More" label until the fifth menu page appears. Next, press the key adjacent to the "PRESET SONAR AND GPS" label. The screen will clear and return to the sonar display with the factory settings.

MENU - PAGE 6

ADJUST KEEL OFFSET

The keel offset feature lets you compensate for the transducer's location. Since this sonar unit measures the water depth from the face of the transducer, there can be a significant difference between the actual water depth and what is displayed on the unit. For example, suppose you mount a bolt-thru-hull transducer on the bottom of the boat. When you launch the boat you find that this location places the transducer three feet below the surface of the water. Therefore, the depth sounder always reads three feet shallower than the actual water depth. (In other words, if the bottom is 50 feet deep, the depth sounder will read 47 feet, if the transducer is mounted three feet below the surface.) The difference between the depth sounder's reading (47 feet) and the actual water depth (50 feet) is called the keel offset. In this example you will use a *positive* keel offset.
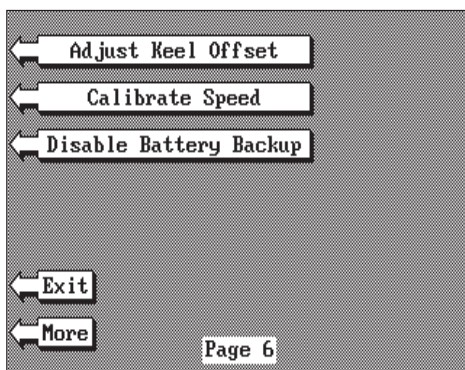
Another time you may wish to change the keel offset is if you want to know the bottom depth from the deepest part of the boat. For example, by careful measurment you find that the deepest part of the boat is four feet below the face of the transducer. By setting a *negative* keel offset of four feet, the sonar unit will show the bottom depth from the lowest part of the boat to the bottom.

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IMPORTANT!
The digital depth display is the only sonar that is affected by the keel offset feature! The chart will always show the distance from the face of the transducer.

To adjust the keel offset, first press the MENU key then press the key next to the "More" label until the sixth menu page appears. Now press the key next to the "Adjust Keel Offset" label. The screen shown below appears.

The digital depth displays in the upper left corner of the screen. The keel offset in use shows in the upper right corner. To set it, simply enter the desired depth using the numbered keys. Remember to add tenths. For example, to set the keel offset to three feet, first press the 3, then press the 0 key. Finally, press the ENT key.

To enter a negative keel offset, use the same steps as above, but press the key next to the "Keel - +" label.

To turn the keel offset feature off, enter "0.0" or press the CLR key.

When you have the keel offset at the desired setting, press the key next to the "Exit" label. The unit returns to the sonar screen, using the keel offset you entered.

CALIBRATE SPEED
The speed display on the sonar screens comes from the optional speed sensor - not the GPS receiver. To calibrate this sensor to your boat, first press the MENU key six times while a sonar screen is showing. Now press the key next to the "Calibrate Speed" label. The screen shown at the top of the next page appears.

Your current boat speed and distance log are shown in the upper left coner of the screen. The calibration in percent is shown in the upper right corner. Now enter the percent change that is needed to make the LMS-350's speed display match your actual speed. For example, if the LMS-350's speed display is five percent slower than your actual speed, then use a positive five percent. If the LMS-350's speed display is five percent faster than your actual speed, then use a negative five percent speed calibration. Press the key next to the "Calib - +" label to change the factor from positive to negative.
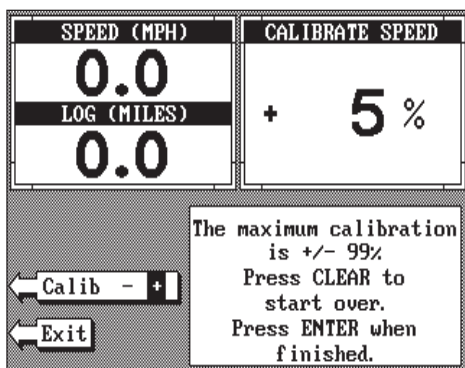
When you have the speedometer calibrated, press the key next to the "Exit" label to return to the sonar screen.

BATTERY BACKUP
The LMS-350A saves all system settings, such as windows, units of measure, alarm settings, and more in memory that is powered by an internal battery. This keeps the memory "alive" while the unit is turned off. The LMS-350A gives you the ability to turn this battery on or off. Turning it off causes the LMS-350A to "forget" all system settings each time you turn the unit off. This, in effect, presets the unit each time it's turned off.

To turn the battery backup off or on again, press the MENU key until the screen shown at right appears. Now press the key next to the "Disable Battery Backup" label. The unit returns to the last used sonar, GPS, windows, or plotter screen with the battery turned off. To turn it on again, repeat the above steps.
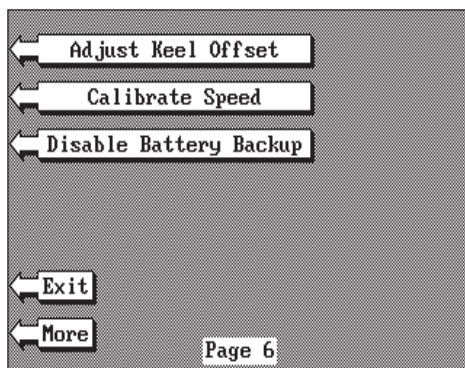
that this doesn't turn the zone alarm off. See the Alarms section for more information on the zone alarm.

TRANSDUCER CONE ANGLES

The sound waves from the transducer spread out into the water in a cone shaped beam. This looks much like the beam from a flashlight. The angle between the outside edges of the cone is the cone angle.

Lowrance offers a choice of transducers with either an 8 or 20 degree cone angle. The transducer supplied with the LMS-350A has a 20 degree cone angle. Typically, wide cone angle transducers (20 degrees) are ideal for operating in shallow to medium water depths. The 20 degree cone angle allows you to see more of the underwater world. In 15 feet of water the 20 degree cone covers an area about six feet across. The 8 degree transducer covers only about a two foot circle.

The 20 degree transducer is almost always the best to use in fresh water, the 8 degree mostly in salt water. In a deep water environment, (300 feet - fresh water, 100 feet - salt water) the narrow cone angle is more desirable. Since the sound energy is concentrated in a smaller area, it can penetrate to much deeper depths.

20 degree   8 degree

TRANSDUCER CONE ANGLES
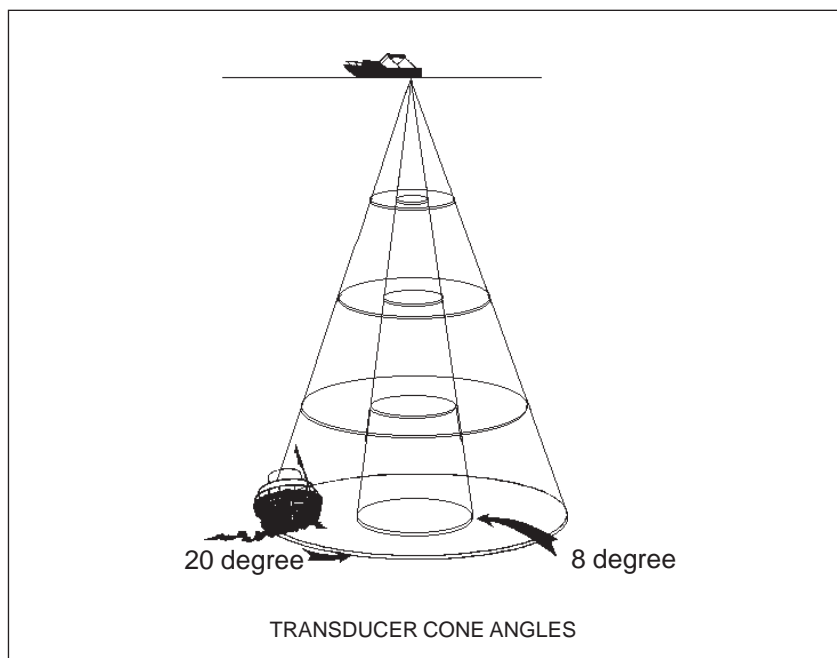
Both 8 degree and 20 degree transducers give accurate bottom readings, even though the bottom signal is much wider on the 20 degree model. This is because you are seeing more of the bottom. Remember, the shallow edge of the signal shows you the true depth. The rest of the signal tells you whether you are over rocks, mud, etc.

if the cone passes over a fish in shallow water, the signal displayed on the LMS-350A may not arch at all. This is due to the narrow cone diameter and the resolution limitations of the display.

FISH ARCHES
Fish arches are created when the cone of sound passes over a fish. The distance to a fish when the cone first strikes it is shown as "A" on the next page. When the center of the cone strikes the fish, the distance is shorter as shown "B". As the cone leaves the fish, the distance increases again as shown in "C".

Very small fish probably will not arch at all. Medium sized fish will show a

BOAT'S DIRECTION OF TRAVEL
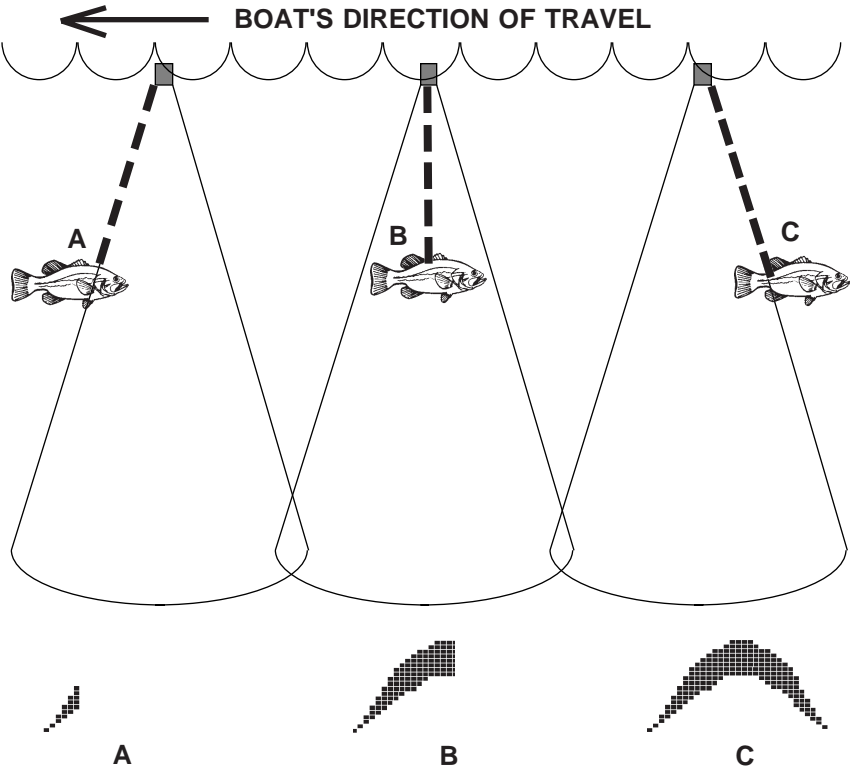
partial arch, or a shape similar to an arch if they're in deep water. Large fish will arch, but turn the sensitivity up in deeper water to see the arch. Because of water conditions, such as heavy surface clutter, thermoclines, etc., the sensitivity sometimes cannot be increased enough to get fish arches.

One of the best ways to get fish arches is to expand or "zoom" a segment of the water. For example, using the 2X or 4X zoom feature. The smaller the segment, the better the screen resolution will be. The zoom feature expands the echoes, making it easier to see detail. For the best results, turn the sensitivity up as high as possible without getting too much noise on the screen. In medium to deep water, this method should work to display fish arches.

If you see fish signals when the unit is in the manual mode, but don't get fish symbols when the Fish I.D. feature is on, try increasing the sensitivity. areas where fish are likely to be. Even if it's the first time on the water!

IMPORTANT
SERVICE INFORMATION!

If your unit is not working, or if you need technical help, please use the following troubleshooting section before contacting the factory customer service department. It may save you the trouble of returning your unit.

Unit won't turn on:
1. Check the power cable's connection at the unit. Also check the wiring.

2. Make certain the power cable is wired properly. The red wire connects to the positive battery terminal, black to negative or ground.

3. Check the fuse.

4. Measure the battery voltage at the unit's power connector. It should be at least 11 volts. If it isn't, the wiring to the unit is defective, the battery terminals or wiring on the terminals are corroded, or the battery needs charging.

Unit freezes, locks up, or operates erratically:
1. Electrical noise from the boat's motor, trolling motor, or an accessory may be interfering with the sonar unit. Re-routing the power and trans-ducer cables away from other electrical wiring on the boat may help. Route

the sonar unit's power cable directly to the battery instead of through a fuse block or ignition switch

2. Inspect the transducer cable for breaks, cuts, or pinched wires.

3. Check both the transducer and power connectors. Make certain both are securely plugged in to the unit.

Weak bottom echo, digital readings erratic, or no fish signals:
1. Make certain transducer is pointing straight down. Clean the face of the transducer. Oil, dirt, and fuel can cause a film to form on the transducer, reducing its effectiveness. If the transducer is mounted inside the hull, be sure it is shooting through only one layer of fiberglass and that it is securely bonded to the hull. Do NOT use RTV silicone rubber adhesive or Marinetex

2. Electrical noise from the boat's motor can interfere with the sonar. This causes the sonar to automatically increase its Discrimination or noise rejection feature. This can cause the unit to eliminate weaker signals such as fish or even structure from the display.

3. The water may be deeper than the sonar's ability to find the bottom. If the sonar can't find the bottom signal while it's in the automatic mode, the digital will flash continuously. It may change the range to limits far greater than the water you are in. If this happens, place the unit in the manual mode, then change the range to a realistic one, (for example, 0-100 feet) and increase the sensitivity. As you move into shallower water, a bottom signal should appear.

4. Check the battery voltage. If the voltage drops, the unit's transmitter power also drops, reducing its ability to find the bottom or targets.

Bottom echo disappears at high speeds or erratic digital reading or weak bottom echo while boat is moving
1. The transducer may be in turbulent water. It must be mounted in a smooth flow of water in order for the sonar to work at all boat speeds. Air bubbles in the water disrupt the sonar signals, interfering with its ability to find the bottom or other targets. The technical term for this is Cavitation.

2. Electrical noise from the boat's motor can interfere with the sonar. This causes the sonar to automatically increase its Discrimination or noise rejection feature. This can cause the unit to eliminate weaker signals such

as fish or even structure from the display. Try using resistor spark plugs or routing the sonar unit's power and transducer cables away from other electrical wiring on the boat.

No fish arches when the Fish ID feature is off:
1. Make certain transducer is pointing straight down. This is the most common problem if a partial arch is displayed. See the Fish Arch section in your owner's manual for more information.

2. The sensitivity may not be high enough. In order for the unit to display a fish arch, it has to be able to receive the fish's echo from the time it enters the cone until it leaves. If the sensitivity is not high enough, the unit displays the fish only when it is in the center of the cone.

3. Use the Zoom feature. It is much easier to display fish arches when zoomed in on a small range of water than a large one. For example, you will have much better luck seeing fish arches with a 30 to 60 foot range than a 0 to 60 foot range. This enlarges the targets, allowing the display to show much more detail.

4. The boat must be moving at a slow trolling speed to see fish arches. If the boat is motionless, fish stay in the cone, showing on the display as straight horizontal lines.

NOISE
A major cause of sonar problems is electrical noise. This usually appears on the sonar's display as random patterns of dots or lines. In severe cases, it can completely cover the screen with black dots, or cause the unit operate erraticly, or not at all.

To eliminate or minimize the effects of electrical noise, first try to determine the cause. With the boat at rest in the water, the first thing you should do is turn all electrical equipment on the boat off. Make certain the engine is off, also. Turn your LMS-350A on, then turn off ASP (Advanced Signal Processing). There should be a steady bottom signal on the display. Now turn on each piece of electrical equipment on the boat and view the effect on the sonar's display. For example, turn on the bilge pump and view the sonar display for noise. If no noise is present, turn the pump off, then turn on the VHF radio and transmit. Keep doing this until all electrical equipment has been turned on, their effect on the sonar display noted, then turned off.

If you find noise interference from an electrical instrument, trolling motor, pump, or radio, try to isolate the problem. You can usually re-route the sonar unit's power cable and transducer cable away from the wiring that

is causing the interference. VHF radio antenna cables radiate noise when transmitting, so be certain to keep the sonar's wires away from it. You may need to route the sonar unit's power cable directly to the battery to isolate it from other wiring on the boat.

If no noise displays on the sonar unit from electrical equipment, then make certain everything except the sonar unit is turned off, then start the engine. Increase the RPM with the gearshift in neutral. If noise appears on the display, the problem could be one of three things; spark plugs, alternator, or tachometer wiring. Try using resistor spark plugs, alternator filters, or routing the sonar unit's power cable away from engine wiring. Again, routing the power cable directly to the battery helps eliminate noise problems. Make certain to use the in-line fuse supplied with the unit when wiring the power cable to the battery.

When no noise appears on the sonar unit after all of the above tests, then the noise source is probably cavitation. Many novices or persons with limited experience make hasty sonar installations which function perfectly in shallow water, or when the boat is at rest. In nearly all cases, the cause of the malfunction will be the location and/or angle of the transducer. The face of the transducer must be placed in a location that has a smooth flow of water at all boat speeds. Read your transducer owner's manual for the best mounting position.

WINDOWS GROUP SUMMARY

All of the window groups used by the LMS-350A are shown on the following pages. To view these groups, simply press the WINDOWS key, then repeated press the down arrow key. This will "cycle" the unit through all groups. Remember, the optional LGC-1 GPS module must be connected to the unit for the navigation features to work.
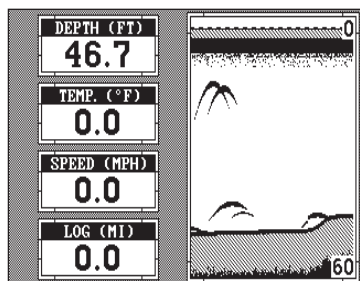
GROUP "A"
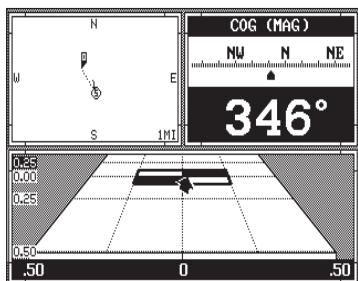
GROUP "B"

GROUP "C"

GROUP "D"

GROUP "E"
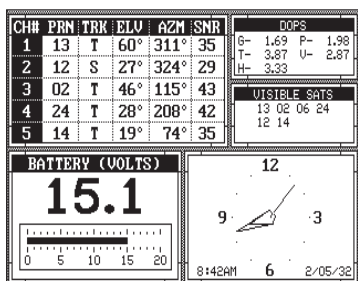
GROUP "F"
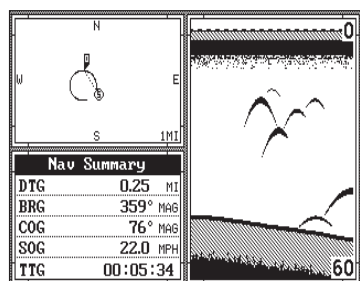
GROUP "G"
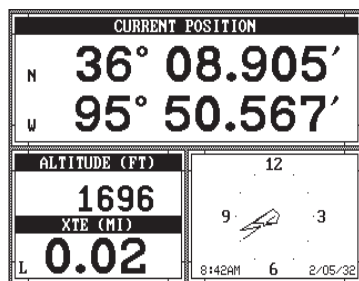
GROUP "H"
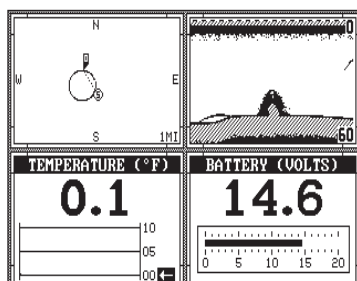
GROUP "I"
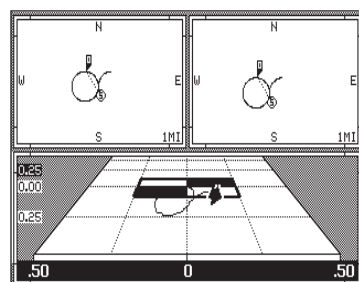
GROUP "J"
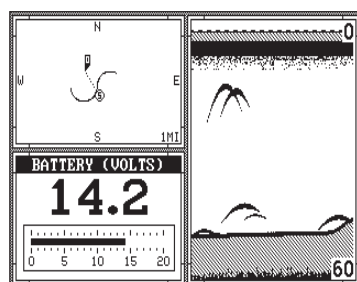
GROUP "K"
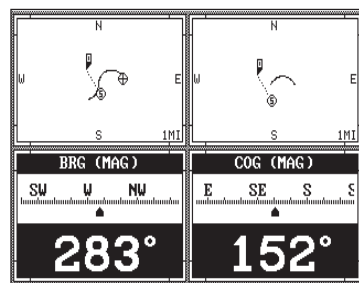
GROUP "L"
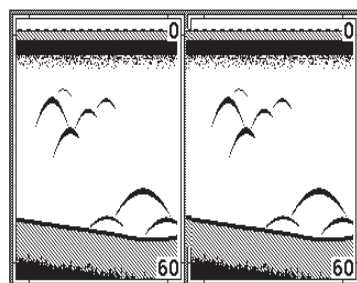
GROUP "M"
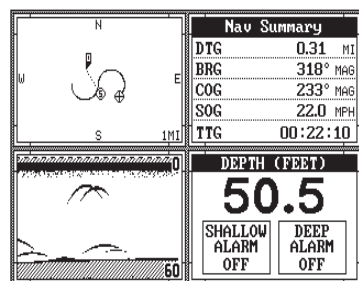
GROUP "N"
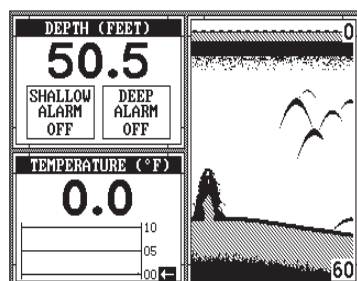
GROUP "O"
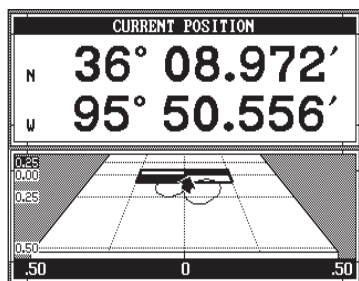
GROUP "P"
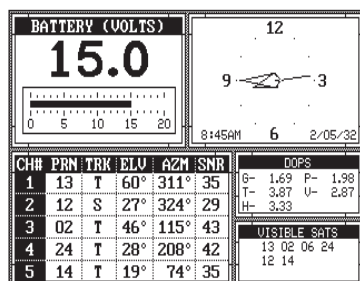
GROUP "Q"
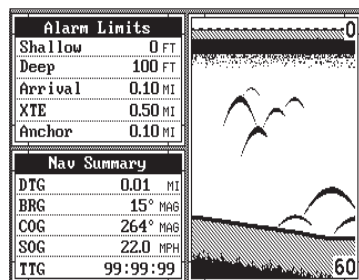
GROUP "R"
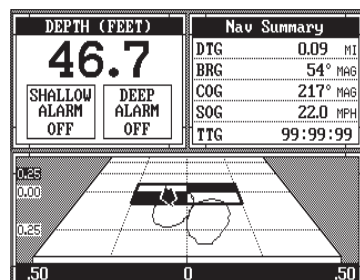
GROUP "S"
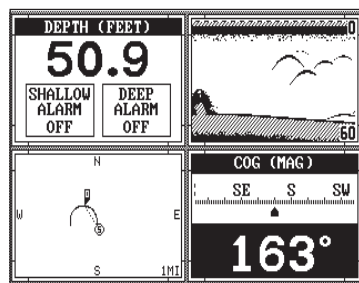
GROUP "T"
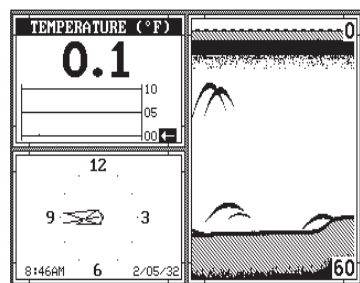
GROUP "U"
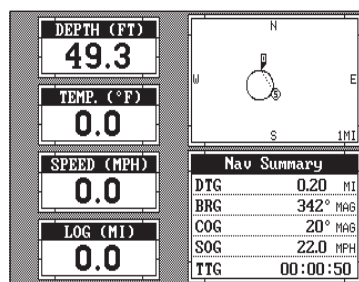
GROUP "V"

WINDOWS SUMMARY

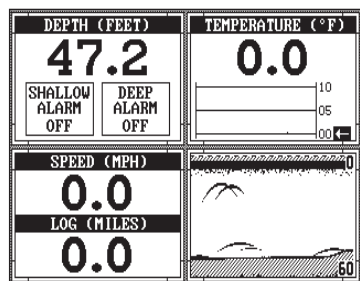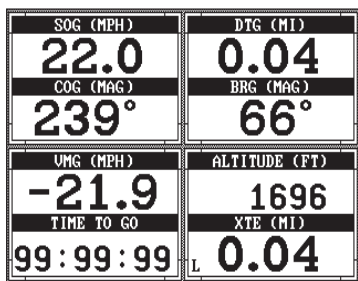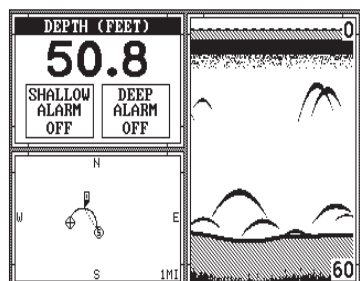All of the available windows used by the LMS-350A are shown on the following pages. To view these groups, simply press the WINDOWS key, then press the MENU key twice. Now press the key next to the "View all Windows" label. Press the key next to the "Prev" or "Next" labels to "cycle" the unit through all windows.

WINDOW #1

DEPTH (FEET)
50.5
SHALLOW ALARM OFF   DEEP ALARM OFF

DIGITAL DEPTH
This window displays water depth and depth alarms. Depth alarms and units of measure are set in the window menu.

WINDOW #2

TEMPERATURE (°F)
0.0

DIGITAL TEMPERATURE
This window displays water surface temperature. Units of measure and temperature graph range are set in the window menu.

WINDOW #3

SPEED (MPH)
0.0
LOG (MILES)
0.0

DIGITAL SPEED AND LOG
This window displays boat speed and distance log, determined by a paddle wheel. Units of measure are set in the window menu.

WINDOW #4

8:49AM   2/05/32
Clock Face
This is an analog clock. When locked on to satellites it will show local time with atomic accuracy.

WINDOW #5

COG (MAG)
SW   W   NW
270°

COURSE OVER GROUND
Course over Ground.
Units of measure are set in menu.

WINDOW #6

BRG (MAG)
N   NE   E
45°

BEARING TO WPT
Bearing to WPT.
Units of measure are set in menu.

WINDOW #7

SOG (MPH)
22.0
COG (MAG)
149°

SPEED/COURSE OVER GROUND
Shows Both Speed and Course over ground. Units of measure are set in menu.

DTG (MI)
0.25
BRG (MAG)
8°

DISTANCE TO GO/BEARING TO WPT
Shows the Distance to WPT.
as well as Bearing to WPT.
Units of measure
are set in menu.

WINDOW 8

VMG (MPH)
5.6
TIME TO GO
00:02:39

VELOCITY MADE GOOD/TIME TO GO
Shows Velocity made good toward
your WPT as well as the time
to go to your WPT.
Units of measure
are set in menu.

WINDOW #9

ALTITUDE (FT)
1696
XTE (MI)
R **0.01**
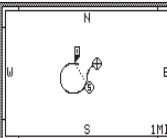
ALTITUDE/CROSSS TRACK ERROR
Shows Altitude as well as
your cross track errow to your WPT.
Units of measure
are set in menu.

WINDOW #10

PLOTTER
You may set any Plotter
Parameters independently
from the menu.

WINDOW #11

GPS POSITION HALF WINDOW
This window will show
the current position.

CURRENT POSITION
N **36° 09.055′**
W **95° 50.429′**

WINDOW #12
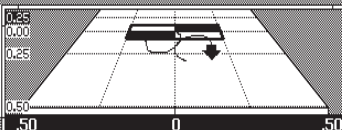
STEER HALF WINDOW
This window will show
how you are navigating
toward you WPT.

WINDOW #13

SATELLITE INFO HALF WINDOW
This window will show
all satellite information.

CH#	PRN	TRK	ELV	AZM	SNR
1	13	T	60°	311°	35
2	12	S	27°	324°	29
3	02	T	46°	115°	43
4	24	T	28°	208°	42
5	14	T	19°	74°	35

DOPS
G- 1.69 P- 1.98
T- 3.87 V- 2.87
H- 3.33

VISIBLE SATS
13 02 06 24
12 14

WINDOW #14

Nav Summary
DTG	0.31	MI
BRG	327°	MAG
COG	267°	MAG
SOG	22.0	MPH
TTG	00:02:12	

NAVIGATION SUMMARY
Displays all navigation
data needed to navigate.
Units of measure
are set in menu.

WINDOW #15

QUARTER CHART
Zoom is independent in any chart window. range, sens, gray, scc, and noise rejection are common to all windows.

WINDOW #16

HALF CHART
Zoom is independent in any chart window. Other settings are common to all.

WINDOW #17

FASTRAK
This takes the SONAR echoes and displays them like a vertical flasher.

WINDOW #18

DEPTH, TEMP., SPEED, & LOG.
One window of four digital instruments. Units of measure set in menu.

WINDOW #19

ALARM LIMITS
This window shows the current alarm settings. Limit settings are set in menu.

WINDOW #20

BATTERY VOLTAGE
This window displays the battery voltage as supplied to this product.

WINDOW #21

LMS-350A GPS OPERATION

IMPORTANT!

YOU MUST HAVE THE OPTIONAL LGC-1 GPS MODULE ATTACHED TO THE LMS-350A TO USE THE POSITION AND NAVIGATION FEATURES!

WARNING!

USE THIS PRODUCT ONLY AS AN AID TO NAVIGATION. A CAREFUL NAVIGATOR NEVER RELIES ON ONLY ONE METHOD TO OBTAIN POSITION INFORMATION.

CAUTION

The LGC-1 GPS receiver, (like all GPS navigation equipment) will show the shortest, most direct path to a waypoint. It provides navigation data to the waypoint regardless of obstructions. Therefore, the prudent navigator will not only take advantage of all available navigation tools when travelling to a waypoint, but will also visually check to make certain a clear, safe path to the waypoint is always available.

NOTICE!

As of this writing, the Department of Defense (DOD) has not declared the GPS navigation system operational. The system is still in a testing phase. Satellites can be turned off or accuracy can be degraded at will by the system operators. Remember that the LMS-350A, or any GPS receiver is only as accurate as the system it's using.

All features and specifications subject to change without notice.
All screens in this manual are simulated.

GPS TABLE OF CONTENTS

GPS - HOW IT WORKS

The Global Positioning System (GPS) is the best approach to navigation that has ever been devised. Conceived by the Department of Defense (DOD) and the United States military, the GPS system is an answer to their needs of 24 hour global positioning, 365 days a year.

Basically, the system works by using a constellation of satellites orbiting Earth 11,000 miles in space. There will be 21 satellites in orbit when the system is fully operational. Three more satellites will act as spares, for a total of 24. When all satellites are in place, at least four of them will be in view nearly anywhere on Earth twenty-four hours a day. The GPS receiver requires at least three satellites to give a "2D" fix. (A 2D fix is your position in latitude/longitude. A 3D fix is your latitude/longitude plus altitude.) When it locks on to at least four satellites, it displays a 3D fix.
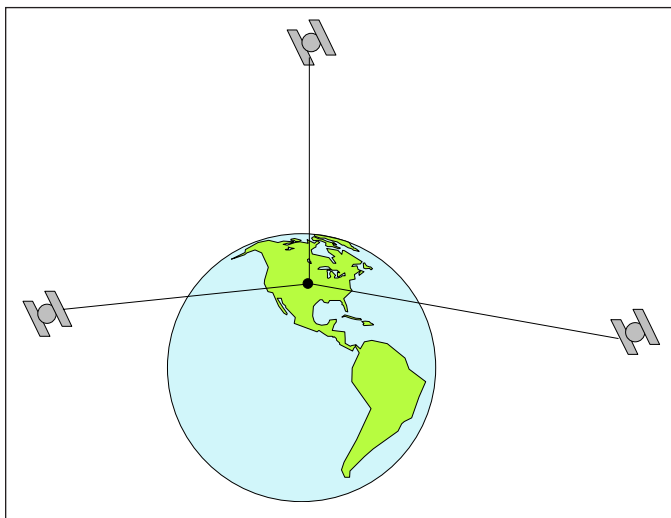
It takes three satellites to determine position.

As the receiver locks on to each satellite, it calculates the distance from the satellite by measuring the length of time it takes the radio signal to reach it. Each satellite has an extremely accurate clock that tells the receiver when the radio transmission started. The receiver compares that time against its own clock, thus it knows how long it took the radio signal (travelling at the speed of light!) to reach it. If you know time and speed, then you can calculate distance. Once you have this from three satellites, then the receiver can determine position.

ACCURACY

You may have heard tales of extraordinary accuracy from GPS receivers. The DOD requires accuracy of 10 to 15 meters from the satellite system. However, only the military gets this precision. The way the military keeps us and other unauthorized people from using the more precise system is coding. In other words, the data coming from the satellites is encrypted. Civilian GPS receivers use "C/A Code." It's accuracy is intentionally worse than the military's "P Code." In this manner, civilian users worldwide can benefit from excellent position fixes. Meanwhile, the military keeps the most accurate system away from potential enemies. Theoretically, C/A code can give accurate position fixes up to 15 meters. This is more than adequate for most people.

However (as of this writing), the military isn't satisfied with C/A's potential accuracy in the hands of the world. So, it's degrading it further with "Selective Availability" or SA. This is small, random errors intentionally added to the system so your accuracy will typically be within 100 meters. Of course, accuracy also depends on the angle of the satellite above the horizon, signal-to-noise ratio, the number of satellites tracked at one time (the more the better), and other factors. The smallest ranges on the plotter may not be usable if the SA is high. The present position symbol can move off the screen even while you're sitting still.

Don't let this discourage you, however. GPS by nature has much faster updates than other systems (such as Loran), and typically is much easier to use. Accuracy, even with SA on is still better than most other navigation systems. You've purchased one of the finest navigation instruments on the market today. We hope you'll enjoy it for many years to come.

The Lowrance LGC-1 GPS Module

This GPS receiver is currently used in all Lowrance GPS receivers. It's small, rugged, and fast. The five channel design lets it track all satellites in view and acquire up to five satellites at one time. It sends position information to the LMS-350A once every second. By incorporating Rockwell's GPS receiver technology with Lowrance's state-of-the-art design and manufacturing capabilities, Lowrance brings to the consumer the most advanced line of GPS marine navigation systems available in the world.
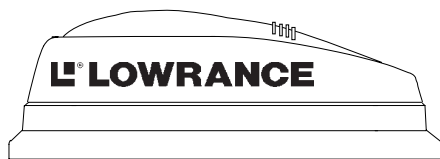
GETTING STARTED
Initialization - Power On
In order for the LMS-350A to lock onto the satellites, it must first find them. If you simply turn the unit on and wait, the unit will find the satellites by itself in 15 minutes or less. This is called "Cold Start." If you let it find the satellites, the time display will probably be wrong, since it will be showing UTC time or the time at Greenwich, England. However, all other navigation displays, including the position display will be correct. (You can set the time to your local time.) To speed up the satellite acquisition process, you can initialize the LMS-350A or "tell it where it is" the first time it's turned on. This initialization process is usually done only once and requires the following data:

1. Present position in latitude/longitude
2. Elevation above sea level (altitude)
3. Today's date and time

The unit usually only takes a few minutes or less to find the satellites once it's been initialized by the user.

After the power cable and GPS antenna module are installed, press the ON key, then press the GPS key. Next, press the MENU key. Now press the key next to the "Change GPS Settings" label. Finally, press the key next to the "SET LAT, LON, ALT, TIME, DATE" label. The screen shown below appears next.

This is the GPS setup screen. The settings now in use are shown at the top of the display. A black box surrounds the latitude box. If you're using the unit for the first time, these settings are probably wrong for your position and time. To change any of the numbers on this display, simply move the black box to the desired number using the arrow keys. As you move the box, the label at the bottom of the screen also changes. For example, to change the time, press the down arrow until the black box is on the time. The label at the bottom of the screen now shows "Change Time". Press the key next to this label. This lets you change the time, using the number keys at the top of the unit. See the following pages on setting the different items on this screen.
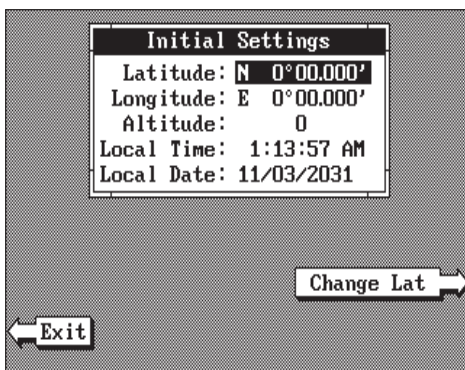
Note: If you don't use the "cold start" feature, then you will have to change all of the settings on this page to their correct values. In other words, you can't simply enter your present position and have the unit find the correct values by itself.

CHANGE POSITION

Use a chart to determine your position if you don't know it. The latitude/longitude that you enter doesn't have to be extremely accurate. Typically, if you enter a position within one degree of your present position, the LMS-350A should quickly find your actual latitude/longitude. To change your present position, first move the black box to the LATITUDE box (if it isn't already there). Next, press the key next to the "CHANGE LAT" label. The screen shown at right appears. Next, simply enter your present

```
┌─────────────────────────────────┐
│         Initial Settings        │
│   Latitude: N 35°50.00█'         │
│  Longitude: E  0°00.000'         │
│    Altitude:      0              │
│  Local Time:  1:13:57 AM         │
│  Local Date: 11/03/2031          │
└─────────────────────────────────┘

  ⟵ Latitude  N S          Accept Lat ⟶
  ⟵ Exit
```

latitude using the numbered keys. Notice that the position entered is in degrees, minutes, and hundredths of a minute. (Not seconds!) If you make a mistake, press the left or right arrow keys to move to the number in the latitude that needs changing. Press the key next to the "Latitude N S" label to change the latitude from north to south, if necessary. After the latitude has been entered, press the key next to the "Accept Lat" label.

The black box automatically moves to the longitude field after you enter the latitude. Now enter the longitude using the numbered keys. Be certain to enter a zero "0" as the first number in the longitude if it's less than 100 degrees! After you've entered the last number, press the key next to the "Longitude W E" label to change it from west to east, if necessary. When everything in the longitude field is correct, press the key next to the "Accept Lon" label.

CHANGE ALTITUDE

To enter your present altitude, move the black box to the Altitude field using the arrow keys. Now press the key next to the "Change Alt" label. The LMS-350A needs to know your elevation above sea level. (Not your height above the ground.) Again, an approximation is usually sufficient. Use the numbered keys to enter your altitude data. Press the key next to the "Altitude + -" label if your altitude is below sea level. For example, suppose you're in Death Valley and the spot you're standing in is 35 feet

below sea level. You would need to enter the numbers "35", then press the key next to the "Altitude + -" label to change it to -35 feet. Press the key next to the "Accept Alt" label when you're done.

```
┌─────────────────────────┐
│      Initial Settings   │
│   Latitude: N 35°50.000' │
│  Longitude: W 95°50.000' │
│   Altitude:   650█      │
│ Local Time:  1:13:57 AM │
│ Local Date: 11/03/2031  │
└─────────────────────────┘


◄─ Altitude  + ─          Accept Alt ─►
◄─ Exit
```

CHANGE TIME

To change the local time (the time at your position), press the arrow keys to move the black box to the "Local Time" field. Now press the key next to the "Change Time" label. The screen shown below appears.

Use the number keys to enter the time. Remember to enter a zero first if the time is less than 10. For example, enter 073000 for 7:30. Press the key next to the "Time AM PM" label to change the time from AM to PMPress the key next to the "Accept Time" label when you're finished.

```
┌─────────────────────────┐
│      Initial Settings   │
│   Latitude: N 35°50.000' │
│  Longitude: W 95°50.000' │
│   Altitude:    650      │
│ Local Time:  8:50:0█ AM │
│ Local Date: 11/03/2031  │
└─────────────────────────┘


◄─ Time   AM PM           Accept Time ─►
◄─ Exit
```

CHANGE DATE

To enter today's date, press the arrow keys to move the black box to the "Local Date" field. Now press the key next to the "Change Date" label. Use the number keys to enter the date. Press the key next to the "Accept Date" label when you're finished.

The numbers at the top of the screen should be correct. If they aren't, press the key next to the label that you need to change. If everything is correct, press the key next to the "Exit" label. The unit will switch to the position screen and start searching for the satellites currently in view. It should find the satellites and show a position in a few minutes.

COLD START

When the LMS-350A is turned on for the first time "out of the box", it automatically sends a "cold start" message to the GPS receiver. You also can send a cold start message to the receiver.

If the unit can't lock on to the satellites using the data you've given it, or if it has trouble finding the satellites, perhaps it is using the wrong data. This can happen if you've entered the wrong data by accident. For example, given it east longitude instead of west. Or if you've moved a long distance with the unit turned off.

To send a cold start message to the receiver, press the MENU key. Now press the key next to the "ChangeGPS Settings" label. Finally, press the key next to the "GPS "COLD" Start" label. The unit will begin a cold start technique to find the available satellites. It should lock on to them in 15 minutes or less. Remember, when it does, your local time and possibly date display will probably be wrong. Use the method shown previously to set the time and date to their proper local settings. Once this is done, an internal clock will keep the correct time, even when the unit is turned off. The GPS system updates this clock when the unit is locked on to the satellites.

POSITION/NAVIGATION DISPLAYS
The LMS-350A has a position screen, plotter, steering indicator, and a satellite information screen. These displays were designed to show the most important data. However, you can customize all of them to some extent through the "Change Display" feature on the first GPS menu screen. (There are other screens that can be customized by using the Windows feature. See the Windows section for more detail.) To customize these screens, see the "Customize" section.

IMPORTANT!
 If the data shown in digital numbers on any screen on this unit is flashing, then it means that data is invalid. Do not rely on that data if it is flashing. For example, if the position display is flashing, then the unit has lost the satellites and hasn't re-aquired them. The position that is flashing is your last known position, not your present position! Do not navigate with this unit until you have found the reason the unit has lost the satellites!

Each of the following screens is available by pressing a key at the bottom of the unit, except for the satellite information screen A detailed description of each screen follows.

SATELLITE INFORMATION SCREEN
The satellite information screen shows technical data about each satellite in view. To see this display, press the MENU key, then press the key next to the "Satellite Information" label. A screen similar to the one at the top of the next page appears.

The LMS-350A has a five channel GPS receiver. Data on each channel is shown at the top of the display. The channels are numbered one through five on the left side of the screen. Every satellite in the constellation has a number assigned to it, called the PRN. The PRN is the first number in the channel's row. TRK stands for "track." If the LMS-350A is tracking the satellite, then a "T" is placed in

CH#	PRN	TRK	ELV	AZM	SNR
1	13	T	60°	311°	35
2	12	S	27°	324°	29
3	02	T	46°	115°	43
4	24	T	28°	208°	42
5	14	T	19°	74°	35

```
DOPS
G-  1.69   P-  1.98
T-  3.87   V-  2.87
H-  3.33
```

```
VISIBLE SATS
13 02 06 24
12 14
```

```
POSITION
N  36°09.044'
W  95°50.415'
```

```
SOG
22.0 MPH
```

```
COG
127° MAG
```

```
DTG
0.14 MI
```

```
BRG
247° MAG
```

```
TIME/DATE
12:35:55 PM
2/19/1993
```

this column. If the LMS-350A is searching for the satellite, then a "S" appears. ELV is the elevation (height) of the satellite above the horizon from your position. AZM is the azimuth or direction of the satellite from your position. For example, if the azimuth of a satellite is 180 degrees, then it is due south. SNR is the signal-to-noise ratio. This tells you how strong the satellite's signal is. The higher the SNR number, the better.

The satellites that are visible in the sky from your position are shown in the right side of the screen under the "VISIBLE SATS" heading.

In the upper right corner of the screen are the DOPS displays. These show you the "Dilution Of Precision" (DOP) for the horizontal (HDOP), geometric (GDOP), position (PDOP), time (TDOP), and vertical (VDOP). The GDOP is the combination value of HDOP, VDOP, and TDOP. The smaller the GDOP's number is, the better. The GPS receiver selects satellites based on GDOP, therefore it always tries to use satellites that have good DOP values. These depend on the azimuth and elevation of the satellite, and any ground based obstructions.

Remember, the smaller the number - the better on all of the DOPs.

At the bottom of the screen are the Present Position (POSITION), Speed Over Ground (SOG), Course Over Ground (COG), Distance To Go (to waypoint) (DTG), Bearing (to waypoint) (BRG), and local time and date displays. These displays are customizable.

POSITION SCREEN
The position screen automatically appears after the LMS-350A is initialized or you can view this screen at any time by pressing the GPS key. The position display shows your present position in large numbers at the top of the screen and Speed Over Ground (SOG), Course Over Ground

(COG), Distance To Go (DTG) to waypoint, Bearing to waypoint, Time To Go (TTG) to waypoint, and local time and date displays at the bottom of the screen.

Your present position shows at the top of the screen in latitude/ longitude coordinates. This is shown in degrees, minutes, and thousandths of a minute. For example, on this page, the present position is 31 degrees, 8.655 minutes north latitude and 82 degrees, 50.445 minutes west longitude.
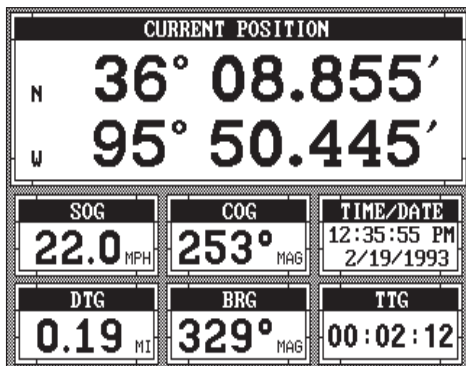
Please note that you must recall a waypoint to use the Bearing, Distance To Go, and Time To Go displays.

STEERING SCREEN
The steering screen shows a pictorial view of your boat and course travelled. This is called a Course Deviation Indicator or CDI. It also shows Distance To Go (DTG), Bearing to Waypoint (BRG), Route Name (RTE Name), Cross Track Error (XTE), Time To Go to Waypoint (TTG), and Waypoint Name (WPT Name). Press the MENU key, then press the key next to the "Steer Screen" to view this display.

Your present position is shown by the arrow. The arrow shows the direction the boat is heading relative to the waypoint. In theory, if you steer the boat with the arrow always pointing towards the waypoint, then you will arrive at the waypoint. The solid line extending from the arrow is your track or path you've taken. To travel directly to a waypoint, try to keep the arrow on the center line. The waypoint is depicted by a box at the top of the CDI display. As you approach the waypoint, the arrow and the box will move closer together. If you travel past the waypoint, the waypoint's box will move to the bottom of the display.

The numbers on the top left side of the screen are distance markers, showing the remaining distance to the recalled waypoint. If the numbers have
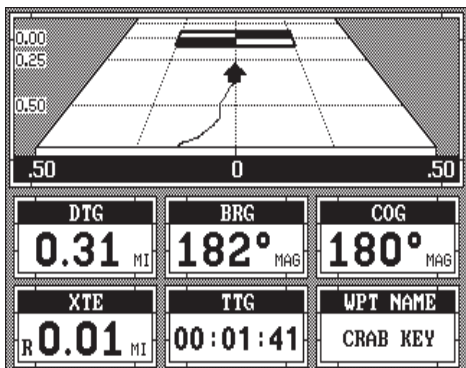
a black box surrounding them, then the distance markers is showing the distance PAST the waypoint. In other words, if the numbers are surrounded by a black box, then you have passed the waypoint and need to turn around.

The numbers immediately below the CDI are the CDI range in miles. This gives you an idea of how far off course you are. For example, if the arrow is halfway between the course line and the outside left line and the CDI range is 0.5 miles, then your cross track error is to the left 0.25 miles. The CDI range is the same as the CDI alarm setting. See the section on GPS alarms to change the CDI range.

Using the digital displays at the bottom of the screen with the graphical display at the top let you accurately steer the boat to a waypoint.

CUSTOMIZE SCREENS
The digital displays on the bottom half of the Position, Steering, and Satellite screens, plus the displays on the Plotter screen can be changed as desired. To show how this is done, we'll use the Position screen as an example.

To customize the Position Screen, first make certain it is showing by pressing the GPS key. Next, press the MENU key. The first GPS menu screen appears. Press the key next to the "CHANGE POSI- TION DISPLAY" label. The unit returns to the Position Screen with a black box around the Speed Over Ground (SOG) label . The letters "SOG" also flash. The black box and flashing letters identifies the Bearing box as "ready for change." To change the Bearing display, press the up or down arrow keys to select the data that you want to show inside the box.
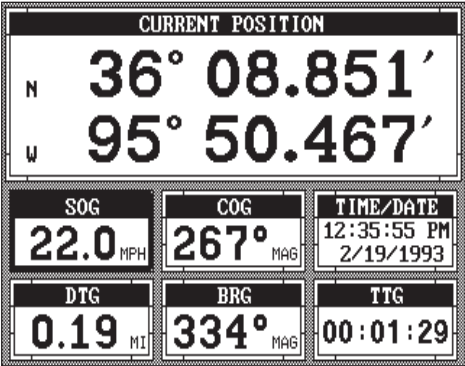
NORMAL DISPLAY

DISPLAY READY FOR CHANGE

In this example, we changed the Speed Over Ground (SOG) display to XTE (Cross Track Error) by pressing the up arrow key eight times.

To change another digital display, press the left or right arrow key. The label in the next digital display box changes as you press the arrow key. Again,

```
        CURRENT POSITION
N   36° 08.851′
W   95° 50.649′

   XTE          COG       TIME/DATE
L 0.09 MI     96° MAG    12:35:55 PM
                          2/19/1993
   DTG          BRG          TTG
 0.19 MI      30° MAG    00:01:27
```

press the up or down arrow key to change the display.
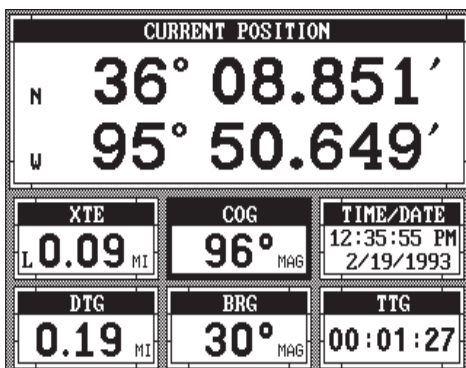
The digital displays available for use are:
BRG .... Bearing
SOG .... Speed Over Ground
DTG... Distance To Go
DEST WPT .... Destination Waypoint
POSITION .... Present Position
ALTITUDE .... Present Altitude
RTE NAME................................ Route Name
WPT NAME............................... Waypoint Name
TTG .... Time To Go
XTE .... Cross Track Error
TIME/DATE .... Local Time and Date
COG .... Course Over Ground
VMG .... Velocity Made Good
DEPTH .... Water Depth

When you have the display arranged as desired, press the CLR key. This "locks" the display. Every time you switch to this display, it will appear as you designed it, unless you preset the unit.

PLOTTER
The plotter lets you see your course and direction of travel on the screen. If you've recalled a waypoint, the plotter shows your starting location, present position, and destination. However, you do not have to recall a waypoint to use the plotter. The plotter also can show grid lines on the display. These grid lines show latitude and longitude lines that can help you visulize your position or the location of other objects.

To use the plotter, simply press the PLOTTER key. A screen similar to the one at the top of the next page appears.

The flashing cross is your present position. The solid line is your track, or path you have just traveled. The large square is a compass rose marked with North, South, East, and West. The square's height and width shows at the bottom of the screen. This is the distance from one side to the other and from the top to the bottom. Your present position is shown at the top of the screen.
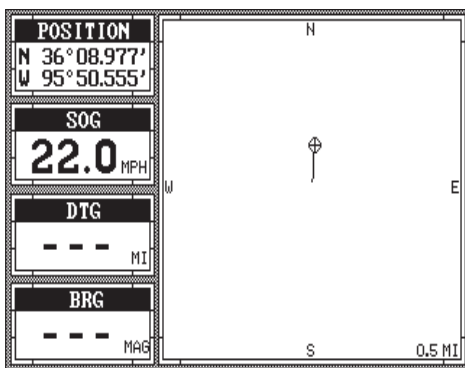
If your present position starts to move outside the square, the LMS-350A clears the display, then re-draws your present position closer to the center of the screen. Your present position will always be displayed on the plotter.

To clear the plotter screen, see the Plotter Menus section.

On the left side of the screen below the Present Position box are the Speed Over Ground (SOG), Distance To Go (DTG), and Bearing (BRG) digital displays. All of these displays are used only when a waypoint is recalled, except COG and Positioin which are always active. These displays also can be customized. See the Plotter Menus section for more detail.

PLOTTER CURSOR
The plotter cursor can help you determine the latitude/longitude of a waypoint or event marker. To use it, press the up or down arrow key while the plotter is displayed. A screen similar to the one below appears. Two new lines appear on the screen. These are the plotter cursor lines. The latitude/longitude position of the plotter cursor - not your present position shows at the top of the screen along with the distance and bearing from your present position to the intersection of the cursor lines. Use the arrow keys to move the cursor lines to the desired location. To erase the cursor lines, press the CLR key. This also will erase the

63
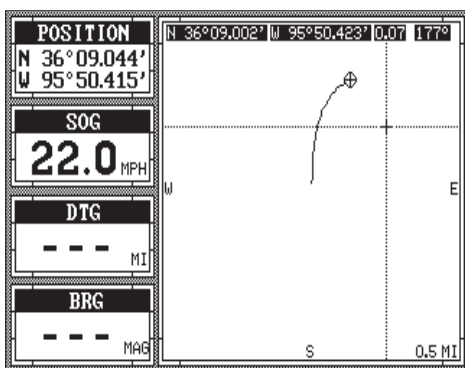
cursor position, distance, and bearing displays at the top of the screen.

PLOTTING WITH A WAYPOINT

Using the plotter with a recalled waypoint or route is an easy way to see the effects of wind and current on your boat. It also simplifies navigation. To use the plotter in this manner, first recall a waypoint or start a route. (See the Waypoint Recall section for more information.) Then press the PLOTTER key. A screen similar to the one above appears.
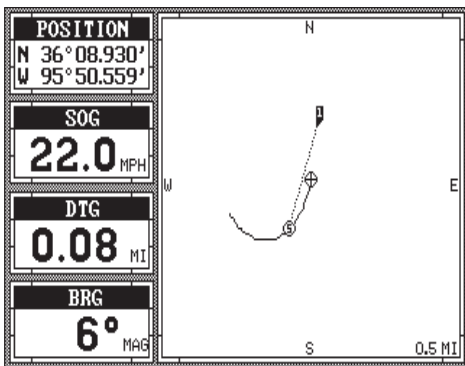
The "S" is your starting location. This was your position when you recalled the waypoint. The flashing circle with a cross is your present position. The "flag" with a number inside is the destination (recalled waypoint). The number inside the flag is the recalled waypoint number. In this example, waypoint number 10 is the destination. The dotted line is the shortest, most direct course from the starting point to the destination. Follow this line to get to the waypoint.

The arrival alarm is automatically set to sound a tone when you come within a preset distance to the destination when you recall a waypoint. See the section on alarms for more information about the arrival alarm.

PLOTTER MENUS

Pressing the MENU key while the plotter displays gives you a new set of menus that relate only to the plotter. There are two pages of plotter menus.

PLOTTER MENU - PAGE 1

CLEAR PLOT

To clear or erase the solid track line from the screen, use the "Clear Plot "menu selection. The plotter will continue to draw your track after this key is pressed, starting from your present position.
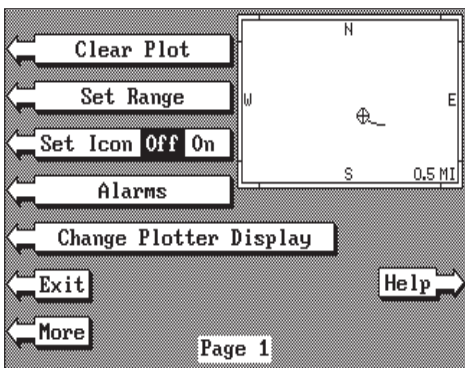
SET RANGE

Use the "Set Range" menu to change the plotter's range or distance across the plotter's display. The range is 1 statute mile when the LMS-350A is turned on for the first time. The available plotter ranges are .1, .2, .5, 1, 2, 5, 10, 20, 50, and 100 miles. This lets you "zoom in" to see small variations in your course or "zoom out" to see your starting position, present position, track, course, and destination.
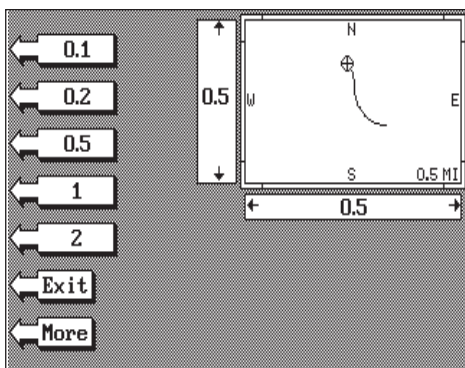
ICON ON/OFF

Pressing this key turns on the icons that you placed on the screen using the EVENT MARKER key. For more information on this feature, see the Event Marker section. This also turns on all of the waypoint icons, also.

ALARMS

Press this key for the alarms menu. For more information on the alarms, see the ALARMS section.

CHANGE PLOTTER DISPLAY

When the LMS-350A is first turned on, (or after a preset), the plotter screen has a column of digital displays on the left side of the screen. These displays can be changed or erased completely. This gives you a full-screen plotter.

To change the plotter display, press the MENU key while the plotter is displayed. Now press the key next to the "Change Plotter Display" label. The menu shown below appears. To change to a full-screen plotter display, press the key next to the "Full Screen Plotter" key. A plotter similiar to the one shown at the top of the next page appears.

To change digital display boxes, press the key next to the "Change Info Boxes". A screen similar to the one on the next page appears.
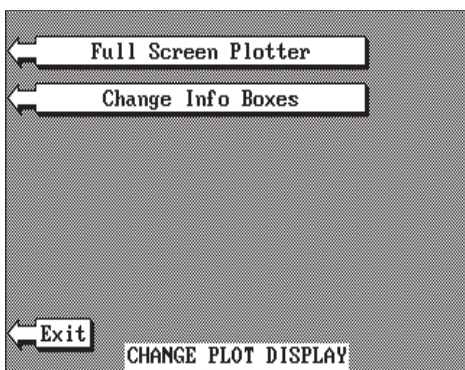
The unit returns to the plotter screen with a black box around the position display at the top of the screen as shown below. The word "POSITION" also flashes, identifying it as ready for change. Press the left or right arrow keys to change the data displayed in that box. For example, to change the Position display to Distance Go Go (DTG), press the right arrow key two times. To change an-other digital box, simply press the up or down arrow keys until the desired box's label is flashing. Then use the right or left arrow keys to select the display.
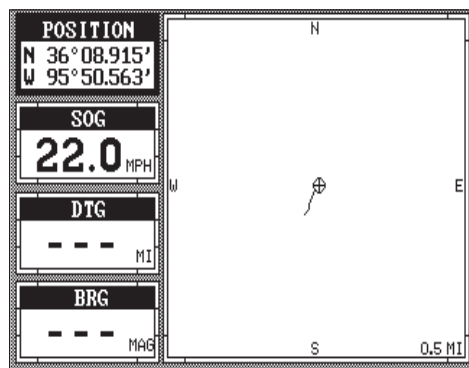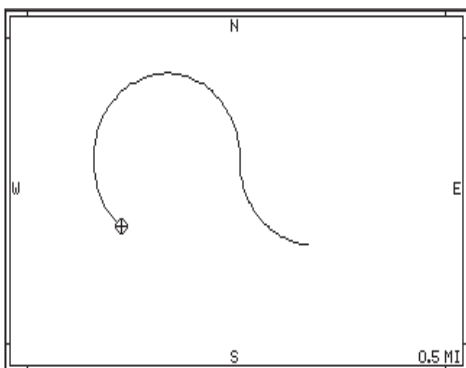
When you're finished, press the CLR key to exit.

PLOTTER MENU -PAGE 2

GOTO CURSOR

As mentioned previously, t he cursor lines can be used to place an icon or highlight a position. When you use the cursor lines, the position of the cross hairs on the display are shown at the top of the screen. Pressing the key next to the "GOTO CURSOR" label on the plotter menu causes the LMS-350A to show naviga-tion and steering data to the position shown by the cross hairs. This automatically turns the arrival alarm on, also.
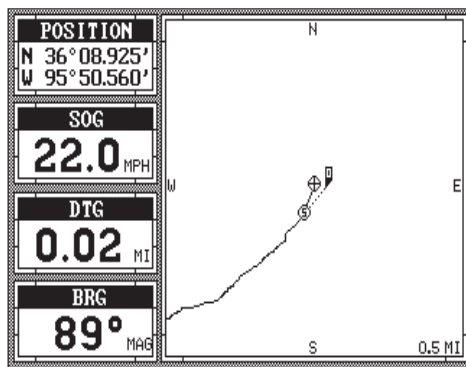
To use this feature, first move the cursor lines to the desired location on the plotter screen. Next, press the MENU key. Now press the key adjacent to the "More" label. Finally, press the key next to the "Go To User Cursor" label. The unit returns to the plotter screen. A waypoint flag appears on the screen (numbered "0") that was the location of the cursor cross hairs when you pressed the key next to the "Go To User Cursor" label. The digital displays on all screens will show navigation information to this new location. This includes the position, steering, and plotter displays. Remember, this is a temporary waypoint. It's erased when the unit is turned off or if it's preset.

PLOTTER UPDATE
The plotter shows your track by drawing a solid line behind your present position. The track is updated once every instantly when the unit is turned on for the first time. However, if you're travelling a long distance, the track line may end prematurely due to the limited number of dots available that plot the track. Using a longer update time To change the update rate, press the MENU key while the unit is in the plotter mode, then press the key next to the "More" label. Now press the key next to the "Plot Update Rate" label. The screen shown at right appears. The available plot update times are Instant, 2, 5, 10, and 20 seconds. Simply press the key next to the desired update time. The LMS-350A immediately returns to the plotter screen using the new time.
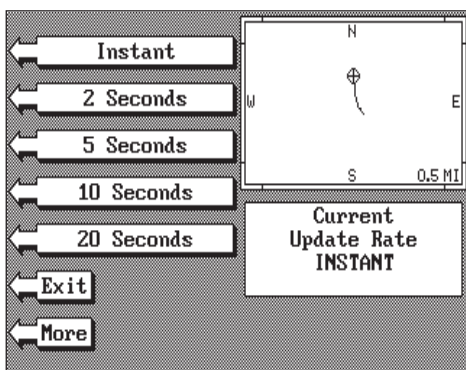
GRID LINES
The plotter can show latitude/ longitude grid lines by pressing the key next to the "Set Grid Off On" label on the second plotter menu page. To turn the grid lines off, repeat the previous step.
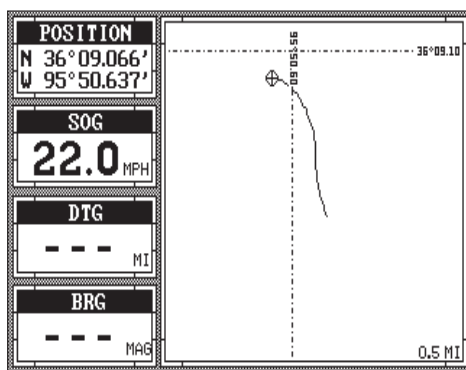
SELECT UNITS OF MEASURE

The LMS-350A can display distance in miles, kilometers, or nautical miles, velocity in miles per hour, kilometers per hour, or knots, bearing in degrees magnetic or true, altitude in feet or meters, and time in 12 hour or 24 hour format.

Goto User Cursor

Plot Update Rate

Set Grid Off On

Units Of Measure

Back Light On Off

Exit

More

Help

Page 2

Distance = MI NM KM

Velocity = MPH KN KMH

Bearing = MAG TRU

Altitude = FT M

Time = 12-HR 24-HR

Exit
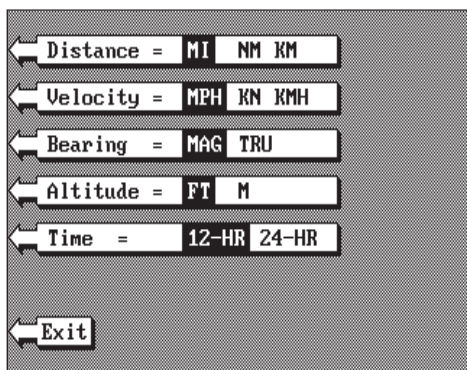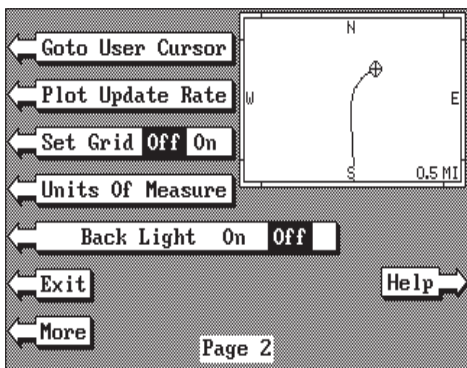
To change any these, first press the MENU key, then press the key adjacent to the "More" label. Now press the key next to the "SELECT UNITS OF MEASURE" label. The screen shown at left appears. The black box on each line shows the unit of measure currently in use. In the screen shown below, the units of measure are in statute miles for distance, miles per hour for velocity, degrees magnetic for bearing, altitude in feet, and time is in the 12 hour format (a.m./p.m.)

Press the key next to the unit that you wish to change. For example, press the key next to the Distance label twice to switch from miles to kilometers. This moves the black box two times from the "MI" to the "KM".

When you have the units of measure set as desired, press the key next to the "EXIT" label.

BACK LIGHT ON/OFF

To turn the back lighting on, press the MENU key, then press the key next to the "More" label. Now press the key next to the "Backlight On Off" label. This moves the black box from "OFF" to the "ON" position and turns the lights on. To turn the backlights off, repeat these steps.

EVENT MARKER

The LMS-350A can place event markers or "icons" on the plotter to mark fishing spots, shallow water, or other special locations. There are five different icons to choose from and there are 100 of each icon for a total of 500. You can place each icon individually, however, you can't erase a single icon once you've placed it. To erase an icon, you have to erase all of the icons in that group.
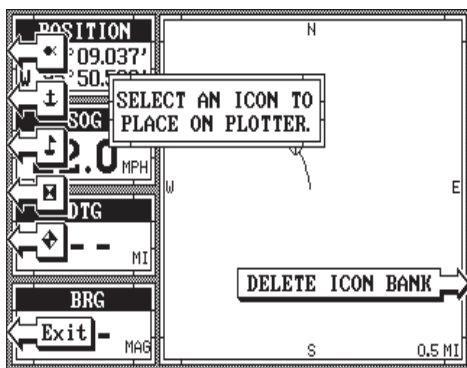
To place an icon, press the EVENT MARKER key. The screen shown above appears.

Now select one of the five icons shown on the left side of the screen by pressing the key next to the desired icon. As soon as you press the key, the LMS-350A places the icon at your present position. This icon always stays in this location. It's saved in memory so it will always show on the display, even if the unit is turned off and on again.

Note: When you place an icon, first make certain the icons are on. When the LMS-350A is first turned on or after a preset, the icons are automatically turned on. However, if you turn the icons off (using the Set Icons feature on the first plotter menu screen), then the icons won't show when you place an icon. The unit will place the icon, however it won't show until you turn the icons on.

Using the Event Marker with the Cursor

Normally, when you select an icon, it's placed on the plotter at your present position. However, you can place an icon anywhere on the plotter using the cursor. To do this, first press one of the arrow keys. This makes the plotter cursor lines appear on the display. Now move the lines to the desired position on the display by press-

ing the arrow keys. When it's at the desired location, press the EVENT MARKER key, then select an icon. The LMS-350A places the icon at the intersection of the plotter cursor lines.
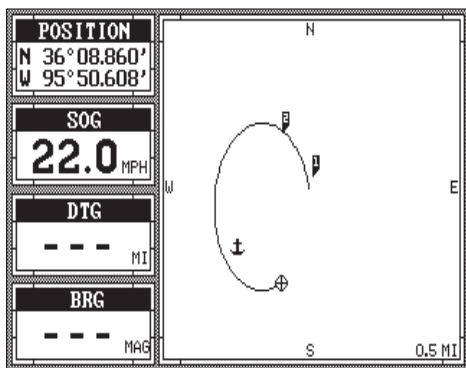
To erase the cursor lines, press the CLEAR key.

Erasing the Icons

Although you can place icons on the plotter individually, you can't erase them one at a time. You have to erase the whole group of icons. For example, if you've place 20 fish symbol icons, erasing one of them erases all 20.

To erase an icon, first press the EVENT MARKER key. Next, press the key next to the "DELETE ICON BANK" label. The screen shown above appears.
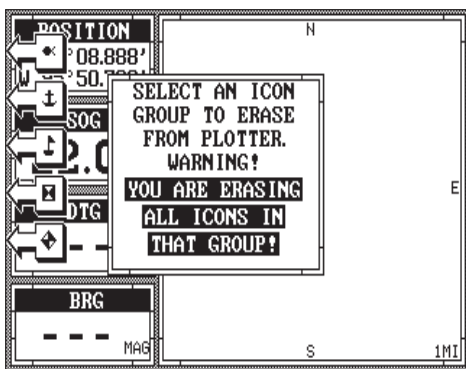
Now select the group of icons that you wish to erase by pressing the key next to the desired icon. After pressing the key, the LMS-350A erases all of the selected icons from the plotter.

WAYPOINT NAVIGATION

HOW TO SAVE A WAYPOINT

Waypoints are locations on the earth's surface that you wish to go or return to. Waypoints are useful for marking shipwrecks, hot fishing spots, and other fishing or navigation locations. Storing waypoint's in the LMS-350's memory makes it easy to return to any point in the world by simply pressing a few buttons. The LMS-350A can store up to 200 waypoints. You can store your present position as a waypoint or enter latitude/longitude positions as waypoints.

(Quick Save Feature)
The LMS-350A lets you save your present position as a waypoint with only
one key press. This "Quick Save" feature lets you easily save the position
of a wreck or other locations.

To save your present position as waypoint, simply press the WAYPT
QUICKSAVE key. The LMS-350A takes your present position and
assigns the first available waypoint number to it.

Saving Present Position - View and Save Method
The "Quick Save" feature doesn't let you select the waypoint number. You
have to use the next available number when using that method. The View
and Save method lets you pick the waypoint number that your present
position is stored in. (Note: You can store a position under a waypoint
number that already has a position assigned to it using this method.) To
save your present position, press the WAYPT key, then press the key next
to the "WPT Save" label. A screen similar to the one below appears.

The first waypoint number in
the list appears at the top of the
page. This is the number that
your present position will be
stored under. Your position at
the time you pressed the
WAYPT key is shown in the
"Current Position" box in the
middle of the screen. If you
wish to save the location in the
Current Position box under this
waypoint number, simply press
the key next to the "Use Cur-
rent Position" label. The position shown in the Current Position box also
will show in the waypoint location at the top of the screen. To save the
waypoint without naming it, simply press the key next to the "Save WPT"
label.

To save the location under a different waypoint number, press the key next
to the "Increase WPT #" label to increase the waypoint number (i.e. from
waypoint number 1 to 2). Press the key next to the "Decrease WPT#" label
to decrease the waypoint number. Or simply enter the desired waypoint
number using the numbered keys. Once you've decided the waypoint
number to save the location under, press the key next to the "Use Current
Position" label. Then press the key next to the "Save WPT" label. This will
store the location under the waypoint number you selected and return to

the last used position, plotter, or steering screen.

Enter New Waypoint

To save a location other than your present position, first press the WAYPT key, then press the key next to the "WPT Save" label. Using the up and down arrow keys, move the black box down to the latitude/longitude position. Now press the down

arrow key to the latitude position. Press the key next to the "Change Latitude" label. The screen shown below appears. Now enter the location you wish to save using the numbered keys. Use the left arrow key as a backspace if you make a mistake. In other words, pressing the left arrow key moves the black box over the last number entered. Notice that the

position entered is in degrees, minutes, and thousandths of a minute. (Not seconds!) Press the key next to the "Latitude N S" label to change the "N" to a "S", if your latitude is south. After you've entered the latitude, press the key next to the "Accept Lat" label. The waypoint save menu reappears. Next, using the arrow keys, move the black box to the longitude position and press the key next to the "Change Lon" label. Now enter the longitude. Make certain to add a zero to the longitude if it's less than 100 degrees. For example, if the longitude is 85 degrees, then enter "085". Press the key next to the "Longitude W E" label to change it from west to east, if necessary. Press the key next to the "Accept Lon" label when you've finished. The save waypoint menu appears with the position you entered in the waypoint position box at the top of the screen. If this position is correct, press the key next to

the "Save WPT" label.

Name a Waypoint

To assign a name to a waypoint, first press the key next to the "Increase WPT" or "Decrease WPT" label to move through the list of waypoints. When the desired waypoint appears in the window, press the down arrow key until the black box moves to the "NAME:" position. Now press the key next to the "Change Name" label. The screen

shown above appears.

Use the keys on both sides of the screen to enter the waypoint name. For example, to name a waypoint "COVE 1", press the ALARM key repeatedly until the letter "C" appears in the window. Next, press the right arrow key to move the black box to the next letter position. Now press the WAYPT RECALL key repeatedly until

```
         ┌───────────────────┐
 ◄ A B C D │    Save Wpt     │
         │WPT#:  1           │
 ◄ E F G H │NAME: COVE 1■     │
         │LAT : N --°--.---'  │
 ◄ I J K L │LON : W---°--.---' │
         ├───────────────────┤
 ◄ M N O P │USE THE ALPHA KEYS OR THE NUMERIC │
         │KEYS TO MAKE YOUR CHANGES. PUSH    │
 ◄ Q R S T │EVENT MARKER TO "ACCEPT" THE      │
         │CHANGE OR PUSH CLR TO "ABORT"      │
 ◄ U V W X │      YOUR CHANGES.               │
         ├───────────────────┤
 ◄ Y Z   │    Accept NAME  ► │
         └───────────────────┘
```

the "O" appears on the screen. Repeat this process until the entire name has been written on the screen. Now press the key next to the "Accept NAME" label. The LMS-350A returns to the waypoint save menu as shown above. To save the waypoint with this name, first press the key next to the "Save WPT" label. Now press the key next to the "Exit" label to exit this menu.

Erase a Waypoint

The Waypoint Erase feature lets you erase waypoints from the list. To erase a waypoint, first press the WAYPT key, then press the key next to the "WPT Save" label. Now press the key next to the "Increase WPT" or "Decrease WPT" label until the desired waypoint number appears on the screen. Simply press the key next to the "ERASE WPT" label. The

```
 ◄ Increase WPT# │     Save Wpt      │
                │WPT#:  2           │
 ◄ Decrease WPT# │NAME:              │
                │LAT : N 36°08.935' │
 ◄ Save WPT     │LON : W 95°50.554' │
                ├───────────────────┤
 ◄ ERASE WPT    │ Current Position  │
         ┌──────┴──────┐ 09.002'    │
         │   WAIT!!    │ 50.563'    │
         │DELETE WAYPOINT│          │
 ◄ NO    │ ARE YOU SURE?│     YES ► │
         └─────────────┘           │
 ◄ Exit                            │
```

screen shown above appears. A message appears on the screen that says "WAIT!! DELETE WAYPOINT ARE YOU SURE?." If you are certain this is the waypoint that you wish to erase, press the key next to the "YES" arrow. If not, press the key next to the "NO" arrow. Press the key next to the "YES" arrow to erase all information from the displayed waypoint number.

Recall a Waypoint

You must recall a waypoint in order to navigate to that position with the LMS-350A. To recall a waypoint, first press the WAYPT key, then press the key next to the "WPT Recall" label. The screen shown at the top of the

next page appears.

Now press the key next to the "Increase WPT" or "Decrease WPT" label until the desired waypoint number appears on the screen. Or simply enter the waypoint number using the numbered keys. When it does, simply press the key next to the "Go to Waypoint" label. The LMS-350A begins showing navigation data to the waypoint.

```
←[ Increase WPT# ]        ┌──── Recall Wpt ────┐
                          │ WPT#:   1          │
←[ Decrease WPT# ]        │ NAME:              │
                          │ LAT : N 36°08.915' │
                          │ LON : W 95°50.549' │
                          └────────────────────┘
                          ┌─── Navigation Info ─┐
                          │ DTG        0.18  MI │
←[ Goto Waypoint ]        │ Bearing   106°  MAG │
                          └─────────────────────┘

←[ Exit ]
```

ROUTES

A route gives you the ability to navigate to several waypoints without having to re-program the unit after arriving at each one. A route consists of two or more waypoints. When you travel on a route, the LMS-350A first shows navigation information to the first waypoint in the route. When you reach the first waypoint, (signalled by the Arrival Alarm), the LMS-350A automatically sequences to the next waypoint. Navigation information is shown to this waypoint and the process repeats. When you reach the last waypoint in a route, the arrival alarm sounds until you turn it off.

There are four steps required to create and follow a route. First, you must create and name the route. Next, select the waypoints used in the route. Then determine the starting waypoint. Next, tell the unit to follow the route. Finally, the unit will ask you if you wish to run the route forward or backward. After these steps are completed, the LMS-350A will start showing navigation data to the first waypoint on the route.

CREATING A ROUTE

To create a route, first press the MENU key, then press the key next to the "More" label. Finally, press the key next to the "Route Planning label. Now press the key next to the "Save/Edit Route" label. The screen shown at right appears.

This menu lets you select the route number, name the route, and choose the waypoints used in the route. Select the route that you wish to create by

```
←[ Increase RTE# ]       ┌ Route #   1 ──────┐
                         │ Name  :           │
←[ Decrease RTE# ]       ├───────────────────┤
                         │ WPT #   0 ─────────│
←[ Save RTE ]            │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
←[ ERASE RTE ]           │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
←[ Change ]              │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
←[ Exit ]                │ WPT #   0 ─────────│
                         │ WPT #   0 ─────────│
                         └───────────────────┘
```

pressing the key next to the "Increase" or "Decrease" RTE# labels. When the desired number appears, you can create or edit it.

Name a Route
To assign a name to a route, press the key next to the "Increase RTE#" or "Decrease RTE#" label to move through the list of routes. When the desired route number appears in the window at the top of the screen, press the down arrow key until the black box moves to the "Name" position. Now press the key next to the "Change" label. The screen shown below appears next.

Use the keys on both sides of the screen to enter the waypoint name. For example, to name a route "REEF 1", press the WAYPT key repeatedly until the letter "R" appears in the window. Next, press the right arrow key to move the black box to the next letter position. Now press the RANGE key. The letter "E" appears on the screen. Use the number keys

to enter numbers. Repeat this process until the entire name has been written on the screen. Now press the key next to the "Accept Name" label. The LMS-350A returns to the route menu. You can now enter the waypoints used in the route.
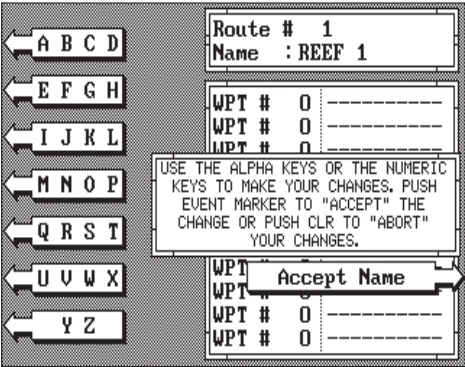
Waypoint Selection
If you've named a route, the black box should be on the "0" at the top of the waypoint list. If not, move the black box to the "0" using the up or down arrow keys. Now press the numbered key of the waypoint you wish to go to first in the route. For example, if you want waypoint number 8 to be first, press the 8 key. If you've named the waypoint, it shows in the blank space to the right of the waypoint number. Next, press the key next to the "Accept" label. The LMS-350A reverts to the menu shown at right.
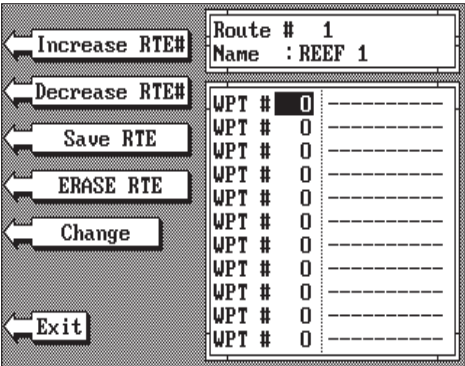
The cursor should now be on

the second waypoint line. Now enter the waypoint number for the second waypoint in the route. Press the key next to the "Accept" label. Continue entering the waypoints until all of the waypoints have been entered for the route. Then press the key next to the "Save RTE" label. This saves your route in memory.

IMPORTANT!
You must select waypoints in the order they are to be used in the route. In other words, suppose you want a route that consists of waypoint numbers 1, 3, and 5. However, you wish to travel to 3 first, then 1, and finally 5. In this case, you must select waypoint 3, 1, and 5 in that order when making the route.

FOLLOWING A ROUTE
To follow a route, press the MENU key, then press the key next to the "More" label, then press the key next to the "Route Planning" label. Finally, press the key next to the "Recall Route" label.The screen shown below appears. Route number one appears on the right side of the screen. The list of waypoints used in the route are shown beneath the route number and name. If you wish to recall a different route, press the key next to the "Increase RTE#" or "Decrease RTE#" label to cycle through the available routes.

After you've selected the desired route, you'll notice a black box surrounding the first waypoint in the route. This is the starting waypoint box. If you wish to start the route using the first waypoint in the route, simply press the key next to the "Start Route" label. However, if you wish to start the route using a different waypoint, simply use the down arrow key to move the black box to the desired waypoint number. Then press the key next to the "Start Route" label.

To follow a route backwards, press the key next to the "Reverse" label. For example, suppose you have three waypoints in a route and they're numbered 3, 6, and 2. If you travel forward through the route, the unit will show navigation data to waypoint number 3 first, then 6, and finally 2. If you travel backward through the route, the unit will start with waypoint number 2 first, then 6, and end with waypoint number 3. No matter if you travel forward or reverse through the route, when you reach the last

waypoint in the route, the arrival alarm sounds until you turn it off.
IMPORTANT!
Turning the arrival alarm off prevents the LMS-350A from sequencing to the next waypoint in the route. This, in effect, turns the route off. However, the unit will still show navigation data to the current waypoint in the route at the time the arrival alarm was turned off.

CANCEL NAVIGATION
To stop the LMS-350A from navigating to waypoint or navigating to a waypoint in a route, press the MENU key twice. Now press the key next to the "CANCEL NAVIGATION" label. This stops all navigation.

NOTE:
Canceling navigation does not erase the route or any waypoints from memory. It merely stops the LMS-350A from navigating.

MODIFYING A ROUTE
Any part of a route can be changed at any time. For example, suppose you have a route consisting of waypoints number 1, 2, and 3 and you wish to change waypoint number 3 to waypoint number 5. Simply press the MENU key, then press the key next to the "More" label, then press the key next to the "Save/Edit Route" label. Using the keys next to the "Increase" or

"Decrease RTE#" labels, se- lect the route number that you wish to change. The list of waypoints used in the route are shown beneath the route num- ber and name.

Using the down arrow key, move the black box to waypoint number 3. Simply use the num- bered keys to change the way- point from 3 to 5. Next, press

the key next to the "Accept" label. You've changed the waypoint from 3 to 5. Now press the key next to the "Save RTE" label. Finally, press the key next to the "Exit" label and you're finished.

Remember, any part of the route can be changed at any time.

ERASING A ROUTE
To erase a route, first press the MENU key, then press the key next to the "More" label. Now press the key next tot he "Route Planning" label. Finally, press the key next to the "Save/Edit Route" label. The route menu appears

as shown above. Now press the key next to the "Increase RTE#" or "Decrease RTE#" labels to cycle through the available routes.

After you've selected the desired route, press the key next to the "ERASE RTE" label. This erases the route from memory. Finally, press the key next to the "EXIT" label. This returns you to the GPS display.

GPS ALARMS

The LMS-350A has three GPS alarms. One is an arrival alarm that sounds when you come within a preset distance to a waypoint. Another is a cross track error alarm that sounds when you move off course more than the alarm's setting. The last GPS alarm is an anchor alarm that sounds when you move outside a preset radius. All of these alarms are set identically.

To adjust a GPS alarm, first press the MENU key, then press the key next to the "Alarms" label. The screen shown at right appears. Now press the key next to the desired alarm's label. In this example, the Arrival alarm is set. Pressing the key moves the black box from "OFF" to "Adjust". A new box appears at the bottom of the screen as shown at the bottom of this page. Using the numbered keys, enter the desired alarm "trip" distance. In this example, we're setting the arrival alarm to sound an alert if we come within 0.20 nautical miles of a waypoint. Once you've entered the desired numbers, press the key next to the "Accept" label. The black box automatically moves to the "ON" position and the number you entered
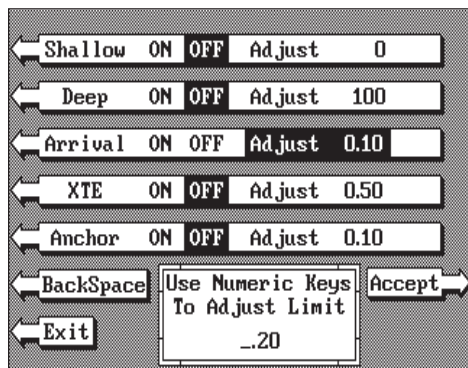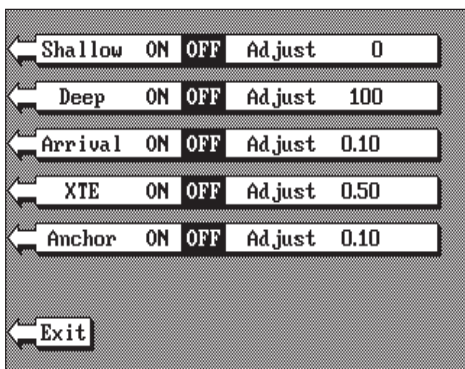
appears at the far right side of the alarm's label. You can set any other alarm on this page, or return to a navigation or plotter screen by pressing the key next to the "Exit" label. To turn an alarm off, simply press the ALARM key, then press the key next to the alarm label until the black box moves over "OFF".

The following section describes each GPS alarm and its limits.

ARRIVAL ALARM

The arrival alarm sounds a tone when your position is within the alarm's radius of a waypoint. For example, the alarm sounds if you come within .1 mile of a recalled waypoint if the arrival alarm's setting is .1 mile. The alarm is adjustable from .01 to 9.9 miles.

XTE ALARM

The XTE (cross track error) alarm sounds a tone when your cross track error is greater than the alarm's setting. Changing the XTE alarm also changes the XTE range on the steering screen. The alarm is adjustable from 0.0 to 9.9 miles.

ANCHOR ALARM

The anchor alarm sounds a tone when the present position moves outside a preset radius. For example, if you set the anchor alarm to .1 nautical mile (600 feet), then the alarm will sound if you move more than 600 feet from the location where you set the alarm. It's adjustable from 0.01 to 9.9 miles.

CHANGING GPS SETTINGS

For the fastest acquisition of satellites, the LMS-350A must be initialized when it's turned on for the first time. This is described at the beginning of the GPS section in this manual. However, if you need to change only one of the parameters (such as time), use the menu features in the "CHANGE SETUP" menu. To do this, press the MENU key, then press the key next to the "Change GPS Settings" label. Finally, press the key next to the "Set Lat, Lon, Alt, Time, Date" label. The screen shown below appears.

Using the menus on this menu pages, you can change the Initial Position, Time, Date, or Altitude without affecting any other initialization setting. All of these menus work identically to the ones described in the initialization section at the beginning of the GPS section. After you make a change, the unit returns to the GPS or plotter screen.
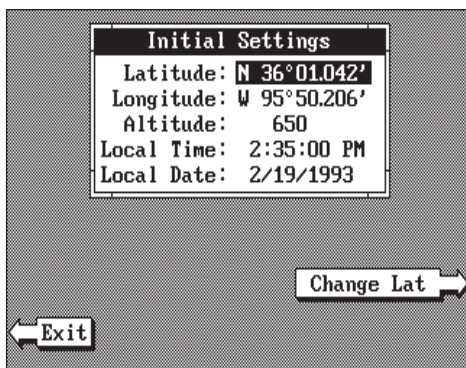
You may need to re-initialize the unit if you move a long distance (over 100 miles) with the unit off. In this example you would need to enter a new initial position to help the LMS-350A find the correct satellites quicker.

SELECT NMEA

The LMS-350A sends data out the white wire on the power cable according to standards set by the NMEA (National Marine Electronics Association). This allows the LMS-350A to send position, depth, and navigation information to "listener" units, such as charting instruments, autopilots, and other marine instruments. The LMS-350A uses the following NMEA data protocols: NMEA 0180 and 0183. NMEA 0180 sends steering information only. It's useful mainly for autopilots. NMEA 0183 sends depth, position, steering, speed, and more. In order to use this feature, the white wire on the power cable must be connected to the NMEA data input on the other instrument. See the installation section in the front of this manual for wiring connection information.

The LMS-350A also has the capability to receive differential data from a beacon receiver. This gives the unit much better accuracy than normal. However, before purchasing and installing a beacon receiver, make certain there are transmitters in the area you wish to use. Presently, the LMS-350A can use the Magnavox MX-50R or StarLink MRB-2A. Please note that the LMS-350A doesn't send NMEA 0183 data when the Magnavox MX-50R beacon receiver is activated.

NMEA SETUP

Once you connect the wiring properly, the LMS-350A must be told which NMEA data format to use. Consult the owner's manual of the other equipment to see which format it needs. Then set the LMS-350A as follows:

First, press the MENU key. Next, press the key next to the "Change GPS Settings" label. Now press the key next to the "Select NMEA/DGPS" label. The screen shown at right appears.
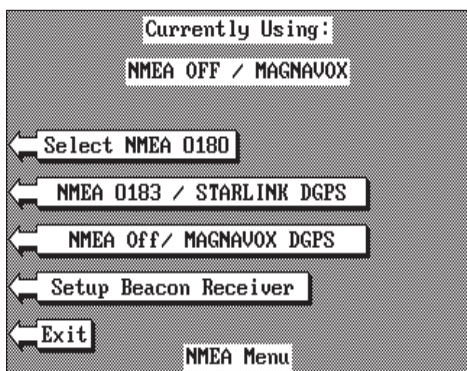
The data format currently in use shows at the top of the screen. To change it, press the key next to the desired data output. Now press the CLEAR key. The Accura will return to the last used GPS screen and send NMEA data out the white wire on the power cable.

DGPS (Differential GPS) BEACON RECEIVER SETUP

You'll have to tell the LMS-350A which beacon receiver's data to expect and set up the parameters for that data. To do this, first press the MENU key, then press the key next to the "Change GPS Settings" label. Now press the key next to the "Select NMEA/DGPS" label. The screen on the previous page appears. Press the key next to the desired beacon receiver. The beacon receiver is selected, now you'll need to set it up for the frequency and bit rate of the station you'll be using in your area.

Now press the key next to the "Setup Beacon Receiver" label. The screen shown below appears.

The station frequency and bit rate are shown on the right side of the screen. Press the key adjacent to the "INC FREQ" to increase the station frequency or the "DEC FREQ" to decrease it. Do the same for the bit rate. (Note: If you set the frequency to zero, the Starlink MRB-2A will automatically change frequencies and bit rates for new

stations as you travel. Otherwise, you will have to manually change the frequency and bit rate when you move out of range of the current station.) When the station frequency and bit rate are adjusted to their proper settings, press the key next to the "EXIT" label. The LMS-350A returns to the last used GPS screen. The letters "DGPS" appear next to the "POSITION" on all screens that show your present position, showing that the beacon receiver is working.
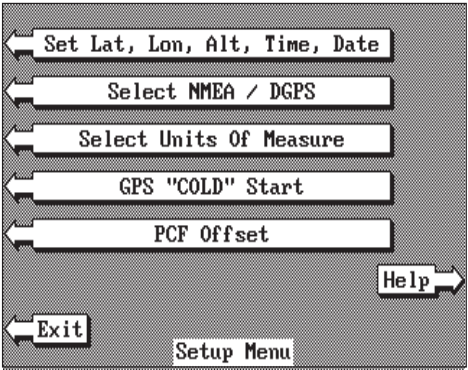
To view the status of the beacon signal, press the MENU key until the fourth menu page appears. Now press the key adjacent to the "Differential GPS Status" label. If the beacon receiver is receiving data from the transmitter and is connected properly to the LMS-350A, a screen similar to the one shown at right appears.
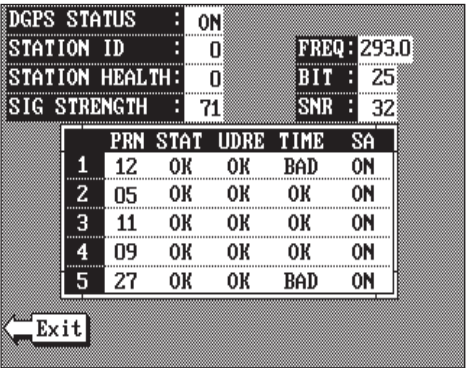
This page shows the station ID number, its frequency and bit rate, the "health" of the station (0 = best, 5 = worst), signal strength (the higher the number, the better), and the signal-to-noise ratio (SNR). The higher the SNR number, the better. The lower half of the screen shows statistics for each of the receiver's five channels. This includes the satellite number

DGPS STATUS	: ON		
STATION ID	: 0	FREQ:	293.0
STATION HEALTH:	0	BIT :	25
SIG STRENGTH	: 71	SNR :	32

	PRN	STAT	UDRE	TIME	SA
1	12	OK	OK	BAD	ON
2	05	OK	OK	OK	ON
3	11	OK	OK	OK	ON
4	09	OK	OK	OK	ON
5	27	OK	OK	BAD	ON

⬅ Exit

(PRN), its status (STAT), the User Differential Range Error (UDRE), Time status (TIME), and if SA (Selective Availablity) is on or off. The UDRE is the range error from your position to the satellite. If there is an "OK" in this field, then the range error to that satellite is 8 meters or less 68 percent of the time.

For more information, read your beacon receiver's manual.

TRUE and MAGNETIC POSITION
True and magnetic north are not the same. True north is the top of the world. It's where all lines of longitude converge. Magnetic north is the location our compasses point. It lies several hundred miles to the south of true north, at a location in Canada.

Charts are usually laid out according to a Mercator projection that uses true north. If you plot a course on a chart using the Mercator projection, you'll either have to convert magnetic to true or use true readings.

The LMS-350A can display navigation information in magnetic or true. When it's turned on for the first time magnetic is used. To switch to true, press the MENU key while a GPS screen is displayed. Next, press the key next to the "Change GPS Settings" label. Now press the key next to the "Select Units of Measure" label. Now simply press the key next to the "Bearing" label. This moves the black box from "MAG" to "TRU." Press the key next to the "Exit" label when you're finished.

PRESET

The Preset feature returns all sonar and GPS units to their original factory settings. This resets the units of measure, speaker volume, display contrast, and more. This doesn't erase any waypoints or routes, however.

To preset the unit, press the MENU key until the "Preset Sonar and GPS" label appears. Press the key next to that label. The menu screen disappears and the LMS-350A returns to the GPS position screen. All units will be returned to their factory settings.

MAN OVERBOARD

One of boating's most terrifying events is having a friend or family member fall overboard. This situation can be deadly on any body of water, fresh or salt. It's particularly dangerous at night or if you're out of sight of land. Of course, the first thing to do is remain calm and try all standard safety measures to try and rescue the person. If you lose sight of the person, you can use the LMS-350A to help start a search pattern.

Once you're back at the helm after initial rescue efforts have failed, press the LMS-350's MAN OVERBOARD key. The screen shown below appears. Your position at the time you pressed the Man Overboard key is shown in the top left corner of the display. Beneath the position is the time that you pressed the Man Overboard key. At the bottom of the screen are the navigation data displays showing the Distance (DTG), Bearing (BRG), Course (COG), Speed Over Ground (SOG), and Time To Go (TTG) back to the postion at the top of the display. Using these displays along with the plotter in the lower right corner of the screen gives you the information you need to steer back to the man overboard position.
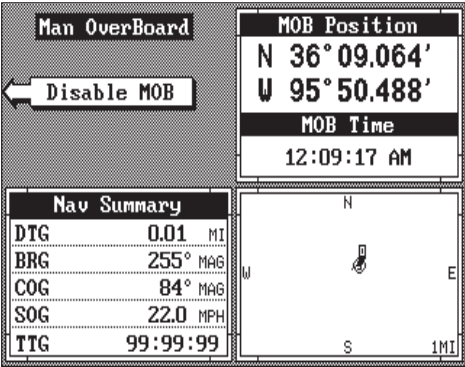
The LMS-350A doesn't save the Man Overboard position in the waypoint table. However, it does save the position on the Man Overboard screen.

The LMS-350A always shows navigation data to the position shown on the Man Overboard screen whenever the Man Overboard key is pressed. To stop the unit from navigating to the Man Overboard position, press the key next to the "DISABLE MOB" label. This resets the Man Overboard navigtion. For example, suppose you are viewing the Position screen, and you press the Man Overboard key, then press the GPS key. The LMS-350A first displays then stores your present position on the Man Overboard screen, then switches back to the Position screen. If you press the Man Overboard key again, it will still show navigation data to the position you were in when you first pressed the Man Overboard key - not your present position. Repeated pressing of the Man Overboard key does not repeatedly save your present position! The unit only saves the position the first time the Man Overboard key is pressed. To save a new Man Overboard postion, you must first clear the old position by pressing the key adjacent to the "DISABLE MOB" label.

You can navigate to a waypoint using the Waypoint Recall feature, however when you go back to the Man Overboard screen, the AccuNavII stops navigating to the recalled waypoint and show navigation data to the Man Overboard location.

Remember, saving the victim is the primary goal. Try all options to rescue the person immediately after the accident happens. Training and education are also good accident preventatives. The Coast Guard has excellentsafety courses. Instruct all members on board your boat on safety procedures before leaving the dock. Make certain all on board know what to do before any emergency occurs.

GPS MODULE SELF-TEST
This feature tests the GPS module and returns a special code. This code is of interest only to the service department. However, the LMS-350A interprets this code and displays a status message. This message is either "MODULE HAS PASSED" or "MODULE HAS FAILED" and shows at the bottom of the screen. The current software version number also appears

near the bottom of the screen. Contact the factory customer service department if the module fails the self test. Do not attempt to use this product if it fails the self test.

To use the self test feature, press the MENU key, then press the key next to the "More" label. Finally, press the key next to the "GPS Module Self Test" label. The screen shown at right appears.

To exit from this screen, press the key next to the "Exit" label.

GPS SIMULATOR
This feature places position and navigation data on all screens, including the plotter. The unit "navigates" a closed course. It shows bearing and distance to go, course over ground, and other information. A recurring message appears, alerting you that the simulator mode is en-

```
┌──────────────────────────────────┐
│       GPS Module Self Test       │
│ Bit Summary               0000   │
│ Low Order Ram             FFFF   │
│ High Order Ram            FFFF   │
│ Pre Process Test          0000   │
│ Pre Process Ram           FFFF   │
│ Multi Interface           0000   │
│ VCO Test                  0000   │
│ Signal INJ.               0000   │
│ Software Version          3.20   │
│      Module Has PASSED           │
│                                  │
│ ◄─Exit                           │
└──────────────────────────────────┘
```

abled. Don't navigate when the simulator is on!
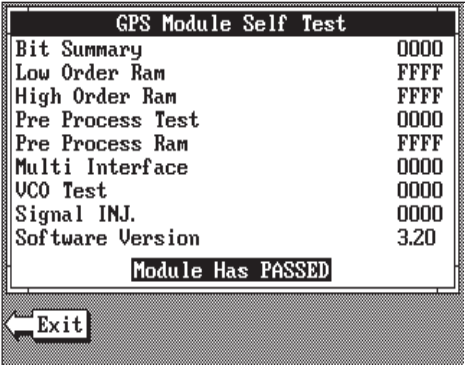
To turn the simulator on, press the MENU key, then press the key next to the "More" label. Finally, press the key next to the "GPS Simulator OFF ON" label. The simulator mode starts immediately. To turn the simulator off, either press and hold the OFF key or repeat the above steps.

PCF OFFSET

The GPS navigation system relies on complex mathematical calculations to determine your position based on satellite data and other factors. One factor is the Earth's shape. Since the Earth is not a true sphere, variations in the calculations have to be made to accommodate deviations. To make matters more complex, not everyone uses the same data to determine what the deviations are. The size and shape of the ellipsoids that are used to approximate the earth's surface are improved often. This can lead to errors if your navigation device uses one ellipsoid, while your chart uses a different one. The term used for these ellipsoids is "Datum."

To reduce the error factor between datum, this unit gives you the capability to move or "offset" the position shown on the display to match the one on the chart. The unit will add this offset to all position displays at all times.

For example, suppose you are anchored at a location that is accurately marked on a chart. Your unit shows a longitude position that is .010 degrees less than the one on the chart. Using the Position Correction Factor (PCF) Offset feature, you make the unit read the same as the chart. If you raise anchor and move, the unit will continuously add the change to all position displays. This makes it more closely match the datum used by the chart. For this reason, you should be careful when entering the PCF offset. This offset is saved in memory. It doesn't change when the unit is turned off. However, a Preset does erase the PCF factor.

To set the PCF factor, first press the MENU key, then press the key next to the "Change GPS Settings" label. Now press the key next to the "PCF Offset" label. The screen shown at right appears.
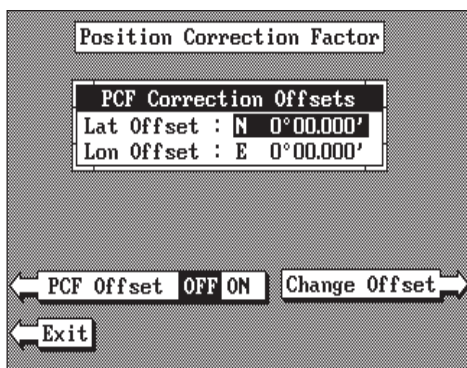
Now press the key adjacent to the "Change Offset" label to enter the correction factor for your location. The screen shown at the top of the next page appears. Remember, this is the difference between the location shown on the present position display and the position shown on the chart.

Use the arrow keys to move the black box to the number that you wish to change in the latitude, then enter the numbers. Press the key next to the "Latitude N S" to change the latitude from north to south, if necessary.

Press the key next to the "Accept Offset" label when you've entered the desired latitude offset. Repeat this procedure to change the longitude. In this example, we have entered 0 degrees, .012 minutes north lattitude and 0 degrees, .068 minutes east longitude as the PCF offset. That is the difference between the present position shown on the unit and our position shown by the chart.

```
┌──────────────────────────────┐
│  Position Correction Factor  │
│                              │
│   ┌──────────────────────┐   │
│   │ PCF Correction Offsets│  │
│   │ Lat Offset : N ■0°00.000' │
│   │ Lon Offset : E  0°00.000' │
│   └──────────────────────┘   │
│                              │
│  ◄─ Latitude  N  S           │
│                              │
│                Accept Offset ─►│
│  ◄─ Exit                      │
└──────────────────────────────┘
```

In other words, our position shown on the unit is 0.012 minutes north and 0.068 minutes east of the position shown on the chart.

After you've entered the desired offset, press the key next to the "PCF Offset OFF ON" label. This turns the PCF correction factor that you entered on. To leave this screen, press the key next to the "Exit" label. This also puts your changes into effect.

```
┌──────────────────────────────┐
│  Position Correction Factor  │
│                              │
│   ┌──────────────────────┐   │
│   │ PCF Correction Offsets│  │
│   │ Lat Offset : N  0°00.012' │
│   │ Lon Offset : W  0°00.068' │
│   └──────────────────────┘   │
│                              │
│                              │
│  ◄─ PCF Offset OFF ON   Change Offset ─►│
│  ◄─ Exit                      │
└──────────────────────────────┘
```

To turn these changes off, return to this screen and press the key next to the "PCF OFFSET OFF ON" label. Remember, Presetting the unit also erases any PCF offset, thereby turning it off.

LMS-350A GPS RECEIVER SPECIFICATIONS

GPS Module Dimensions .... 2.5"H x 4.1"W x 7" D
Channels .... Five Parallel
Four continuous for position
All satellites in view tracked
Update rate .... One second
Accuracy .... Maximum accuracy achievable with
Standard Positioning Service
Position: .... 25 meters CEP
Velocity: .... 0.25 meters/sec RMS
Without SA PDOP<6.0

NMEA 0183 SENTENCES

RMB .... Minimum Recommended Sentence, Part B
RMC .... Minimum Recommended Sentence, Part C
GLL .... Present Position - Latitude/Longitude
APB .... Autopilot Steering Data
DBT .... Water Depth
MTW .... Water Temperature (oC)
VHW .... Speed Through Water (KPH)
VLW .... Distance Travelled/LOG (NM)

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