

Owner's Manual

LRX⁺ Nav Repeater

K|V|H

Congratulations!

You have purchased the finest remote loran/GPS repeater on the market. The KVH LRX+ Nav Repeater is a waterproof remote readout that is easy to read... and understand! The microprocessor-controlled system accepts NMEA 0183 output from your loran or GPS and displays the navigational data you need most while steering your boat: *cross track error, distance to the waypoint, and bearing to the waypoint.*

Any questions, comments or suggestions, contact:

KVH LRX+ Nav Repeater
KVH Industries, Inc.
110 Enterprise Center
Middletown, RI 02840 U.S.A.
(401) 847-3327
telex: 382051
fax: (401) 849-0045

Before You Begin...

As you start unpacking your box containing your new KVH LRX+ Nav Repeater, most often thoughts run as follows, "out of the box and into the boat.....as quickly as possible," but before you jump into your installation, please read this manual carefully. The correct installation of the LRX+ is of utmost importance. The system is so easy to use and to install that after this one reading, we hope you will never have to refer to this manual again. So give it a glance...you won't regret it.

I. Introduction

The KVH LRX+ consists of:

- one remote repeater with 15' cable
- one connector box with 15' cable
- one repeater weather cover

Mounting hardware consists of:

Remote Repeater

- 4 1-3/4" 10-32 studs with hex nuts
- 4 #10 washers

Connector Box

- 4 3/4" #6 self-thread panhead screws

Tools needed for installation:

- slotted screwdriver
- drill with 9/16", 1/4" and 7/64" bits
- Pencil
- center punch
- electrical tape
- tape
- silicone type sealant
- wire stripper (optional)
- 24 gauge (or greater) wire (optional)

The LRX+ has been designed for easy installation, but please read through the installation instructions before attempting to install your LRX+.

Serious damage, inaccuracies, or voiding of warranty can result from incorrect installation.

II. Installation

1. Choosing a Location

The first step necessary for each component is choosing a good location. Below are guidelines for finding a good location for each. This is necessary before mounting any one component to ensure that the provided cable for the repeater (15') is long enough for your installation.

Connector Box

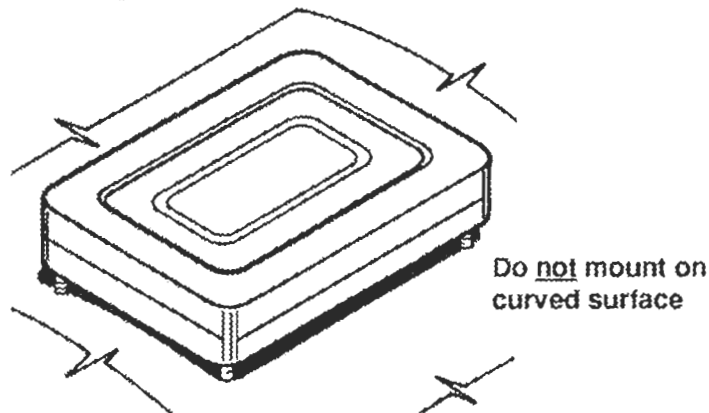
Although the connector box is weatherproof and water resistant, it is intended to be mounted in the boat cabin or a weather protected area. When picking a handy location, make sure that the connector box's 12 volt power leads are able to reach the 12 volt battery or the electrical panel that your loran or GPS is connected to. If the cable does not reach, use a similar or larger gauge wire to extend it (24 gauge or greater). Also make sure that the other 4 leads in the cable are long enough to reach your electrical panel, your loran, GPS or other navigational equipment. (see page 11 and 16 for wire color codes) If they are not, you may also extend these with 24 gauge (or larger) wire.

Remote Repeater

The remote repeater is completely waterproof so you can put it wherever is most convenient and visible. The repeater will not affect other instruments. Furthermore, the cable is shielded, so R.F interference should be minimal. For sailboats,

KVH offers single and dual repeater mast brackets which attach to the mast at the sail slot so that no holes need to be drilled into the mast. *Contact your local KVH dealer for information on these brackets.*

When determining the right spot for the repeater on your boat, keep in mind that **the repeater needs a flat mounting surface to avoid unnecessary stress on the watertight seal.**



If the repeater is installed on a surface that is not flat, you can break its seal causing it to leak, as the flat repeater will bend to conform to the curved surface. If your spot is not perfectly flat, use a small block of wood to make a flat mounting plate. If using a mast bracket, this is not a concern as the brackets are designed specifically for the repeater.

At this stage, should you find that the cable provided with your repeater is not sufficient for your needs, there are two options:

1. Move the repeater to a new location that can be reached by the provided cable.
2. Purchase an extension cable by contacting your local KVH Dealer. Extension cables are available in 15' and 25' lengths and may be connected one to the other for greater length.

Never try to extend a cable or cut a cable from the repeater. This will result in the voiding of the warranty.

2. Mounting the Components

Now that you are certain of each component's location, you can begin to mount each one.

Remote Repeater

After you have carefully chosen a **flat** surface, follow these instructions carefully:

1. Tape the template located at the back of this manual in the place where you want to mount the repeater. Use a center punch on the crosshairs indicated on the template.
2. Drill four 1/4" holes for the enclosed 10-32 studs. Then drill a 9/16" hole for the cable and connector. **Never try to remove the connector from the cable. The hole must be large enough so that the connector can pass through.**

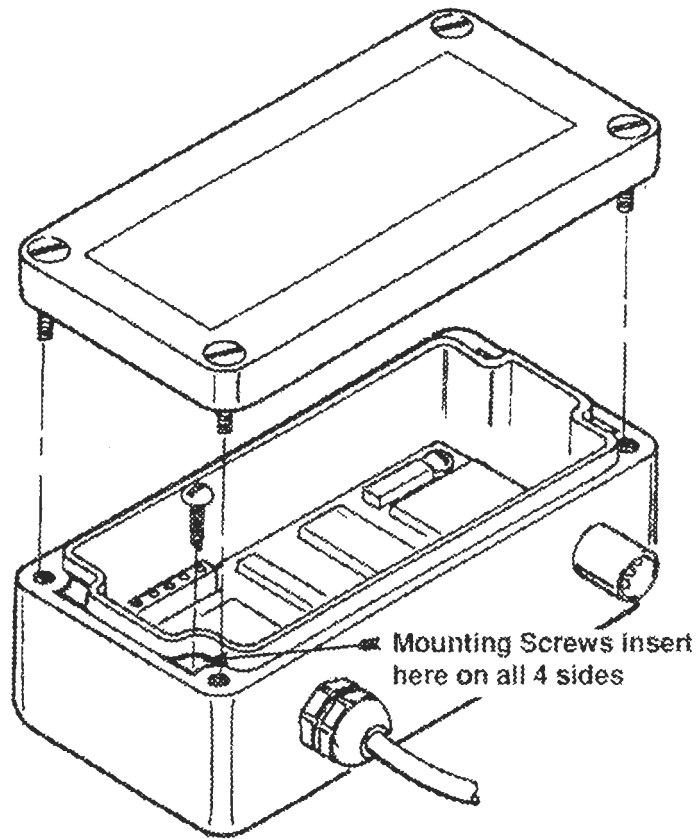
3. Screw the four 10-32 studs into the back of the repeater. Check if the repeater slides easily into the four holes. Correct the hole positions if necessary. **Do not force the repeater if the holes don't line up!**
4. Remove the repeater, apply some silicone-type sealant around each hole and push the cable and display all the way in.
5. Use the provided #10 washers and nuts to secure the display. **Hand Tighten Only! Overtightening the screws will damage the display.** A dab of silicone on the threads will keep the nuts from loosening up.

Connector Box

Use the four #6 mounting screws to mount the connector box. The screw holes are only accessible from the inside of the connector box.

To install:

1. Unscrew the four screws on the top of the connector box and carefully remove the cover. **Be careful not to touch anything within the box and do not leave the cover off for long periods of time.**
2. Mark the location of the inner screw holes of the connector box bottom on the mounting surface. Drill 7/64" holes (3/32"



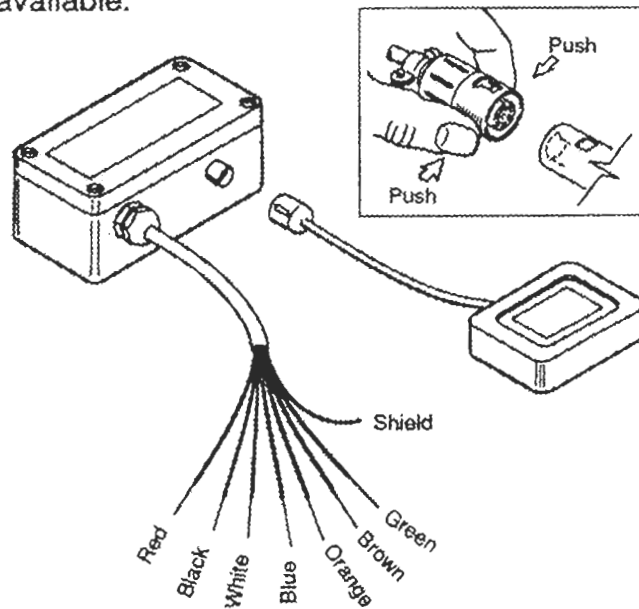
to 1/8" will work depending on the material being drilled) at each location and insert the four self-tapping screws. Tighten down securely.

3. Replace the cover and tighten the cover screws securely. The box's waterproof seal is reinstated by tightening the cover screws (The mounting screws lie outside of the inner rubber gasket.)

3. Making the Connections

Now that you have each component in place, you are ready to connect the components together. Follow the instructions below for making the connections:

1. Connect the repeater cable to the repeater port on the connector box. (see illustration) Snap the connector into the port as indicated in the insert illustration. If a second remote repeater is desired at a later date, "Y" connectors are available.



2. Connect the LRX cable coming from the connector box (with seven colored wires and one unjacketed wire coming out of the end) to the following:

Power	Red Black White	+12VDC Ground +12VDC (light switch)
Input from GPS/ Loran	Blue Orange Shield	NMEA In(+) Data Wire NMEA In(-) Signal Gnd. Ground
Output to Auxiliary (optional)	Brown Green	NMEA Out(+) NMEA Out(-)

To power your LRX+:

1. Connect the **black wire** and the **cable shield** (unjacketed wire) to the **negative terminal** of the **same** switched 12 Volt DC power source that your loran or GPS is connected to. This would correspond to the DC power ground terminal of the switch or power panel on the boat.
2. Connect the **red wire** to the **same +12 Volt DC power source** that your loran or GPS is connected to. Make sure that this power source is fused (1 amp) or has a circuit breaker, as the LRX+ has no internal fuse to protect it from overloading.

To connect the LRX+ to your loran or GPS:

The configuration of the signal wiring will

vary depending on the brand of loran or GPS that you have and what parts come with it.

There are three variations:

- A. The loran or GPS may have a **connector wired to a cable** with a pigtail of colored wires. In this case, consult your loran or GPS owner's manual for the wire color code.
- B. The loran or GPS may supply **only a connector** without a pigtail of wires. The NMEA data would then be accessed through the pins on this loran or GPS output connector. Consult your loran or GPS manual or contact the loran or GPS manufacturer directly to obtain the color code and connector pinout.
- C. The loran or GPS may provide **nothing at all**. In this case, you must consult your dealer or loran/GPS manufacturer to obtain a plug and the required information.

After you have determined the configuration of your loran or GPS' signal wiring:

1. Connect the **blue wire (NMEA In(+))** to the Loran's or GPS' **NMEA Data Wire (signal side)**.

2. Connect the orange wire (NMEA In(-)) to the Signal Ground point on the loran or GPS unit.

To output NMEA 0183 from your LRX+ for other equipment (optional):

The LRX+ gives an opto-isolated NMEA output for driving other equipment (such as an autopilot) so that the LRX+ does not tie up your loran's or GPS' only output port.

The brown wire is the NMEA Out(+) and the green wire is the NMEA Out(-). If these wires are not used they should be tied back and wrapped with electrical tape.

To connect the LRX+ repeater's backlight:

Connect the white wire (lamp control terminal) to a switched +12 Volt D.C. power source. This will probably be found on the boat's electrical panel (such as the circuit for instrument lights or compass light). It will turn the repeater's backlight on and off.

III. Functions

Now that you have connected your LRX+ to your loran or GPS, you may now see the various kinds of information it gives you.

As long as you have connected your LRX+ to the same power source as your loran or GPS, the LRX+ will turn on everytime your loran or GPS is on. The LRX+ gives steering information only, so if your loran or GPS is giving position information, you will not get any steering information on your LRX+ repeater. In this case, the LRX+ will display "- -" to remind you that you have not entered waypoints into your loran or GPS. Also, if for any reason your loran or GPS gets switched off at its box, the LRX+ will revert to "- -" to warn you that it is not receiving any information from the loran or GPS.



When you instruct your loran or GPS to steer you to a waypoint, the LRX+ display will be activated. Every 2 seconds the repeater will alternate between displaying "Bearing to Waypoint" and "Distance to Waypoint" as shown on the next page. The LRX+ will display your loran's or GPS' most critical data on its easy to read display.



Miles to Go

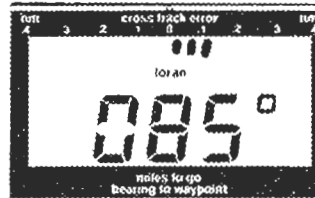


Bearing to Waypoint

As you progress, if you get any cross track error, the upper color part of the LRX+ display will also show you cross track error to port or starboard with segments in increments of .05 nautical miles. When there are no green or red segments on the display, this means that you are on the rhumb line to your waypoint.



Miles to Go with .15 nm cross track error to starboard



Bearing to Waypoint with .15 nm cross track error to starboard



Miles to Go with .15 nm cross track error to port



Bearing to Waypoint with .15 nm cross track error to port



Miles to Go with no cross track error (on rhumb line to waypoint)



Bearing to Waypoint with no cross track error (on rhumb line to waypoint)

IV. Technical Appendix

1. Technical Specifications

Input	NMEA 0183
Output	NMEA 0183
Voltage	11-18V DC
Current Consump.	100 mA
Temp. Range	-10°F to +150°F (-23°C to +65°C)
Cable Length	15 feet (4.57 meters)
Warranty	1 Year Limited Warranty/ 3 Year Buyer Protection Plan

2. LRX+ Connector Box Wiring Data

<u>Wire Color</u>	<u>Function</u>
Black	Ground
Unjacketed	Ground (Shield)
Red	Power (+12V DC)
Blue	NMEA In(+) (Data Wire)
Orange	NMEA In(-) (Signal Gnd.)
Brown	NMEA Out(+)
Green	NMEA Out(-)
White	switched +12V DC (light switch)

3. KVH LRX+ NMEA 0183 Sentences (Input/Output)

A. Composite Sentences

APA: cross track error

Number 1 2 3 4 5 6 7 8 9 10
Format \$LCAPA,A,A,X.XX,L,N,A,A,XXX.,M,CCCC

1. OR'ed Blink and SNR; 2. Cycle Lock; 3. - 4. - 5. Cross Track, Sense L or R, N. Mi. Units; 6.- 7. Arrival circle, Arrival Perpendicular (crossing of the line which is perpendicular to the course line and which passes through the Dest. WPT.); ; 8.- 9. Bearing Dest. Wpt. from Origin Wpt., Magnetic; 10. Dest. Wpt. Identifier. For Blink, SNR and Cycle Lock, A=Valid, V=Invalid. For Cross Track Sense, L=Steer Left, R=Steer Right.

BWC: bearing to destination and great circle distance to waypoint from the current point

Number 1 2 3 4
Format \$LCBWC,XXXXXX,XXXX.XX,N,XXXXX.XX,

Number 5 6 7 8 9 10 11 12
Format W, XXX.,T,XXX.,M,XXX.X,N,CCCC

1. UTC of Bearing; 2.- 3. Lat,N or S of Wpt; 4.- 5. Long. E or W of Wpt; 6.- 7. Brng., True; 8.- 9. Brng.,Mag.; 10.- 11. Dist., N.Mi; 12. Wpt.Ident.

B. Primitive Sentences

XTE: cross track error

Number 1 2 3 4 5
Format \$LCXTE,A,A,X.XX,L,N

1. Or'd value Blink and SNR (A=Valid, V=Invalid);
2. Cycle Lock, (A=Valid, V=Invalid); 3.- 4.- 5.
Cross Track Error; 4. Steer Left or Right (L=Left,
R= Right); 5. Units (N.Mi.)

The following sentences used only if BWC
is not used:

BOD: bearing to destination from the original point

Number 1 2 3 4 5 6
Format \$LCBOD,XXX.,T,XXX.,M,CCCC,CCCC

- 1.- 2. Brng. True; 3.- 4. Brng. Mag; 5. Dest. Wpt.
Identifier; 6. Origin Wpt. Identifier

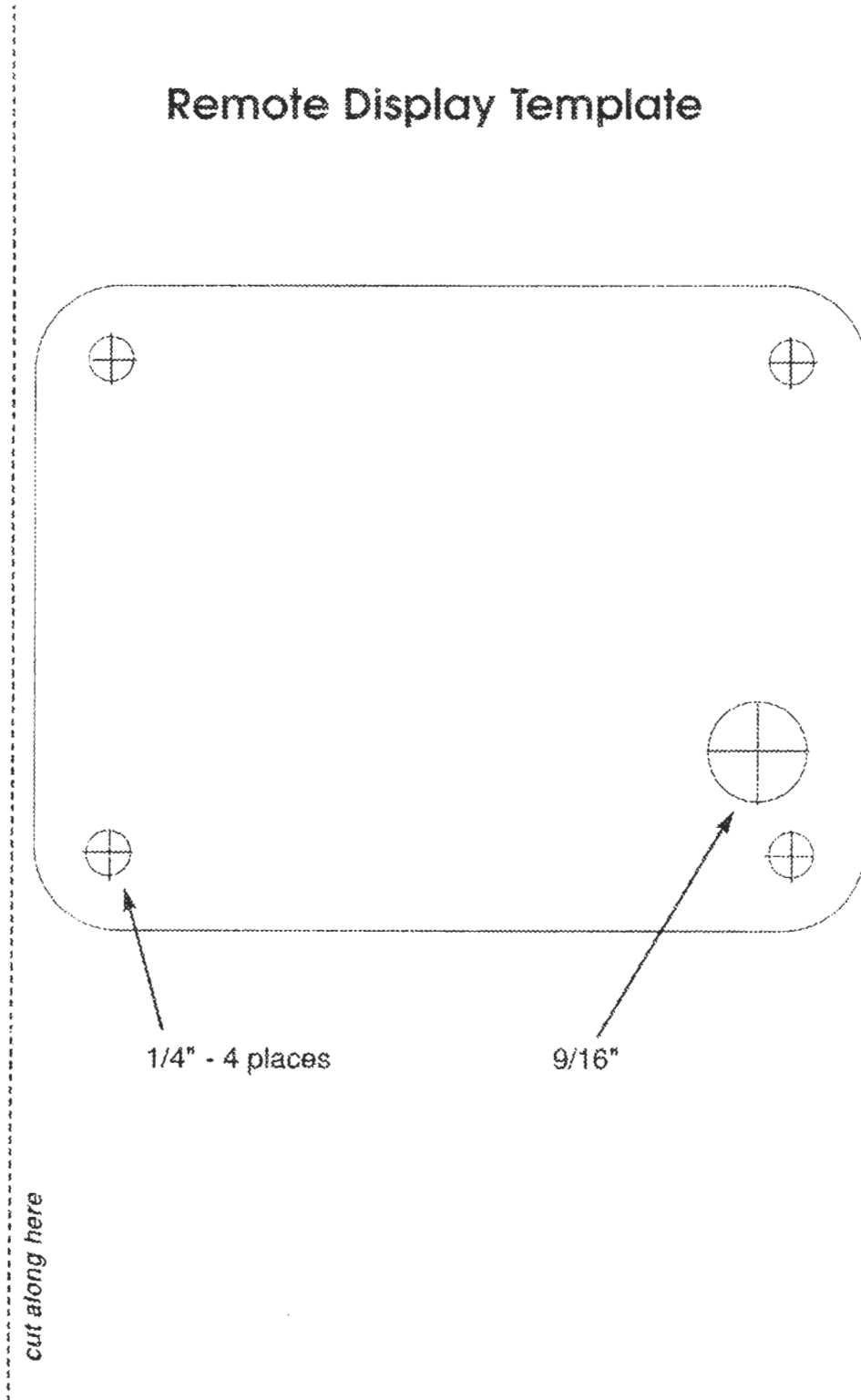
WDC: great circle distance to waypoint from the original point

Number 1 2 3
Format \$LCWDC,XXX.X,N,CCCC

- 1.- 2. Dist., N.Mi.; 3. Wpt. Ident.

rev.3/91

Remote Display Template



Special Functions

1. "snr" message



"snr" stands for "signal to noise ratio". If the "snr" bit is set in the loran's or GPS' "APA" or "XTE" NMEA 0183 sentences, the LRX+ display will indicate this by displaying "snr" as shown above. "Miles to Go" and "Bearing to Waypoint" will not be displayed until this bit is cleared.

2. "oor" message



"oor" stands for "out of range". The LRX+ will display "oor" if the loran's or GPS' distance field in the "BWC" or the "WDC" NMEA 0183 sentence is a null field or is greater than 999.9. "Miles to Go" will not be displayed until the distance field is less than 1000. The LRX+ display will alternate between "Bearing to Waypoint" and the "oor" message.



KVH Industries, Inc.
110 Enterprise Center
Middletown, RI 02840

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