R-110B TECHNICAL MANUAL ADDENDUM: DVM DISPLAY OPTION

1. INTRODUCTION

The R-110B DVM display option works in conjunction with the basic DVM option to allow front panel control of the DVM options, and also to provide a front panel display of measured signal levels. While the basic DVM option is available for both the R-110 and R-110B receivers, the DVM display option is available for the R-110B only. Without the display option the basic DVM option operates in conjunction with the IEEE-488 interface only.

This document is an addendum to the R-110B technical manual covering the DVM display option only. A separate addendum is provided with the basic DVM option, covering its installation, usage with the IEEE-488 interface, and theory of operation.

2. INSTALLATION

The hardware for the DVM display option consists of a front panel pushbutton and display assembly that replaces the one normally supplied with the receiver. Note that this is the third different display assembly, since the display assembly in the non-optioned R-110B is also different from the one in the original R-110.

It is recommended that installation of the the DVM display option display assembly be done as part of the original assembly of the receiver, or that it be retrofitted only by factory field service personnel. Although the installation of this assembly is in no way different from the installation of the normal display assembly, the procedure for opening and closing the front panel assembly is somewhat complex, and it is easy for wires to become pinched in several places during re-assembly.

Once the new assembly has been installed the standard firmware configuration routine must be run to ensure that the firmware is aware of the new assembly. It is possible to autodetect the presence of the assembly, and the firmware does this on powerup, but the configuration store should be updated nevertheless.

3. USAGE

The R-110B front panel provides support for the DVM display option, whether or not the option is actually present, in the form of the "DVM" alternate keypad function. This is the alternate function of the "M" key, selected by pressing the black "Alt" key followed by pressing the "M" key. If the DVM display option is not present then the tuning display will read "Unavailable!". If it is present then a number of parameters may be set using the tuning display select pushbuttons (the three pushbuttons located directly below the tuning display).

If AM mode is selected then the DVM menu selections, obtained by means of the left and right select pushbuttons, are DVM off, DVM peak video, peak-and-hold input coupling, and peak-and-hold sample time. If FM mode is selected then there is only DVM off and FM deviation. Switching the FM demodulators in and out using the appropriate front panel pushbutton will result in both DVM hardware settings and display menu selections changing as well.

3.1. Peak-and-Hold Input Coupling

The peak-detect-and-hold circuit receives its input from the video output of the receiver. It captures peak amplitudes of that signal, including impulses as short as 5 nanoseconds, and holds the value for subsequent A/D conversion. Both the input coupling and the accumulation time of this circuit may be set. DC input coupling allows the circuit to sample both the carrier and any AM modulation present, while AC coupling will eliminate the carrier component, which is represented as a DC voltage, leaving only the modulation. With the AC/DC coupling message showing on the tuning display, the selection may be toggled by means of the center select pushbutton. Readings may take a second or two to stabilize after toggling the selection.

3.2. Peak-and-Hold Sample Time

The accumulation time in the peak-detect-and-hold circuit can be set to values between about 10 usec and 10 sec. The timebase that does this consists of a counter based on a 1.2288 MHz clock, so the accumulation time is set as a number of counts at about 814 nsec each. The firmware accepts time settings in microseconds, milliseconds, and seconds, and automatically determines the best timebase count to provide the desired setting.

With the sample time shown on the tuning display, a new value may be entered using the numeric keypad. The new value is entered in decimal, followed by the "H" key to indicate microseconds, the "K" key to indicate milliseconds, and the "M" key to indicate seconds. Any value from 10 usec to 10 sec is acceptable. The "C" key may be used during the entry to recover the old setting.

3.3. The Display

All of the foregoing selections and settings have used the tuning display. The DVM display itself, which is what is provided by the DVM display option, consists of an extra row of displays above the attenuation, gain, and bandwidth displays. Slightly smaller displays were used in this window (relative to the standard displays) in order to accommodate the new function.

Although provisions have been made for a full row of up to 16 characters, at present only the middle two sockets (8 characters) are filled, and not all of the characters are driven by the firmware. The displays for the existing functions (attenuation, gain, and bandwidth) operate normally.

3.4. Initialization and Storage of Settings

DVM settings are stored as part of the overall setting records used in initialization, temporary, and permanent storage. This means that, firstly, the DVM and display options will be initialized on powerup and reset to the settings held in the initialization store. This store may be modified by the user. Likewise, when using the temporary and permanent stores, DVM settings are stored and recalled along with many other receiver parameters.

3.5. Usage in AM

When AM demodulation is selected (the default in the absence of FM), the peak-detect-and-hold circuit is in use and both of its settings become significant. To set up the DVM display in this mode first press the black "Alt" key so that its LED is illuminated, and then press the keypad "M" key to bring the DVM setup indications to the tuning display. The parameter to be displayed is selected by pressing the left or right select pushbutton repeatedly until the desired message appears.

With "DVM Off" displayed, the DVM display may be enabled by pressing any of the three select pushbuttons. The center button is in fact a "default select" button for most menu selections. Here the default is "enabled".

With "Peak Video" displayed, normal DVM AM operation is in progress.

With "AC coupling" or "DC coupling" displayed, the selection may be toggled by pressing the center select pushbutton. This is an exception to the normal "select default" function of the center button.

With the sample time displayed, the sample time may be changed by entering it on the keypad in decimal, followed by the "H" key to indicate microseconds, the "K" key to indicate milliseconds, or the "M" key to indicate seconds. If the entry is out of range then the nearest legal value will be substituted.

AM video is 0 - 4 Volts in a standard receiver and 0 - 3 Volts in a receiver equipped with the wideband option. This is conditioned by the peak-detect-and-hold circuit to the 0 - 5 Volt range of the A/D converter itself. The firmware then displays the A/D count as a decimal range of 0 - 9.99

3.6. Usage in FM

When the FM option is present and the FM demodulator is selected the function of the DVM display changes from an indication of video amplitude to an indication of FM deviation. The FM option hardware contains a special circuit to generate this signal. The A/D converter accepts its 0 - 5 Volt range and converts it, whereupon the firmware displays the results as a signed decimal number from -9.99 to +9.99. An indication of 0 represents perfect tuning to the received signal, while a negative indication represents tuning too low and a positive indication represents tuning too high.

When FM demodulation is selected the DVM selections on the tuning display are limited to two: on and off. Any of the three select pushbuttons can be used to enable the DVM display, while either the left or right pushbuttion may be used to disable it.

3.7. Usage in Remote

In remote mode the DVM display continues to indicate AM video or FM deviation, except that instead of controlling sampling and conversion automatically, in remote mode the receiver will sample and convert only when commanded to do so by the IEEE-488 interface, and will therefore not display new data until the receiver is commanded to take it. A free-run command is available over the IEEE-488 interface as well.

4. THEORY OF OPERATION

The new pushbutton and display assembly that comprises the DVM display option hardware is very similar to the assembly used in the standard R-110B. The only major difference is that the three four-character displays used by the standard R-110B assembly are replaced by sockets for up to seven smaller four-character displays. The new displays have a different interface characteristic than the old displays, which allows them to be identified automatically by the firmware on powerup. Basically, the older displays are more elaborate, featuring a read/write interface allowing the characters loaded into them to be read back for verification. The new displays are write-only. This means that if an attempt to read back a character from an address allocated to an older display fails, then the new displays must be present. This characteristic is used for autodetection on powerup.

Another difference between the displays is that the older displays have internal blinking and brightness controls. Four levels of brightness are supported. The new displays require that brightness control be provided externally, via an enable pin that requires pulse-width modulation. Added circuitry has been provided in the form of an oscillator and a monostable multivibrator with a controllable pulse width. A control latch is used to set the oscillator on and off and set the pulse width to 25%, 50%, or 100%. None of the seven new displays are required to blink in the current revision of firmware, so a blinking control is not provided.

Note that more addresses are needed for the seven new displays versus the three old ones, even though the old displays required eight addresses apiece whereas the new ones only require four. Extra decoded chip selects are brought onto the new assembly from the front panel interface assembly to support the new displays.

Although sockets have been provided for seven four-character displays, only five are currently in use. The sockets in the upper corners are left vacant.

5. SERVICE INFORMATION

Removal and replacement of the DVM display assembly uses the same procedure as that for the standard display assembly, as described in the R-110B technical manual. As stated above, it is recommended that only the factory or factory field service personnel perform this operation.

There are no adjustments on the DVM display assembly.

6. INTERFACE SUMMARY

The interface to the front panel display assembly containing the DVM display is the same as for the normal display assembly except for the attenuation, bandwidth, and gain displays, the DVM display itself, and the brightness control latch. Pushbuttons, lightbars, the tuning display, the shaft encoders, and the panel beeper are all identical for both assemblies (in fact, all except the tuning displays have their data bus interfaces on the interface assembly, anyway). Only the new addressing will be given here. A complete list of the old addressing may be found in the R-110B technical manual.

Address D8:	Attenuation display	character 0 (righthand)
Address D9:		character 1
Address DA:		character 2
Address DB:		character 3 (lefthand)
Address E0:	Gain display	character 0 (righthand)
Address E1:		character 1
Address E2:		character 2
Address E3:		character 3 (lefthand)
Address E8:	Bandwidth display	character 0 (righthand)
Address E9:		character 1
Address EA:		character 2
Address EB:		character 3 (lefthand)

Address F0:	DVM display	character 0 (vacant) (righthand)
Address F1:		character 1 (vacant)
Address F2:		character 2 (vacant)
Address F3:		character 3 (vacant)
Address F8:		character 4
Address F9:		character 5
Address FA:		character 6
Address FB:		character 7
Address A0:		character 8
Address A1:		character 9
Address A2:		character 10
Address A3:		character 11
Address A8:		character 12 (vacant)
Address A9:		character 13 (vacant)
Address AA:		character 14 (vacant)
Address AB:		character 15 (vacant) (leftmost)

Address BE: Brightness latch:

Bits 0 - 2 = Brightness code:

000 = off

001 = off

010 = full

011 = 25%

100 = off

101 = off

110 = full

111 = 50%

Bits 3 - 7 = (unused)