R-110B RECEIVER TECHNICAL MANUAL ADDENDUM -- PULSE STRETCH AND SLIDEBACK OPTIONS

1. INTRODUCTION

The R-110 and R-110B receivers support a pulse stretch and slideback option in which the receiver's AM video output is processed to extend short pulses and is also gated at a settable reference for signal strength measurements and noise removal. The option physically shares space on a cardcage plug-in module with the DVM option, and shares its cardcage bus interface.

The slideback option supplements the DVM option in that while the DVM option provides a continuous relative indication of signal strength, the slideback option can be used with an external signal generator to provide, with somewhat more effort, an accurate absolute indication of signal strength. Use of the DVM option with an external host computer containing calibration tables, such as is provided in the DSI-110 system, can provide the function of the slideback option in an automated and much more elaborate form.

2. INSTALLATION

Installation of the pulse stretch and slideback option is normally performed at the factory as part of the configuration of a new receiver. It may in some cases also be retrofitted by field service personnel at the costomer's site. Installations requiring a firmware upgrade are more complicated, since the front panel assembly of the receiver must be opened up and the processor assembly removed to gain access to the firmware EPROM.

Once installed, the receiver must be informed that the option is present via the standard configuration routine in firmware.

Retrofitting of a receiver by the factory or by authorized field service personnel is highly recommended.

3. USAGE

The pulse stretch and slideback functions are each provided with separate selection switches and adjustment controls on the front panel of the receiver. In addition, the slideback function is provided with a lightbar indicator in the tuning display. The video output of the circuit is taken to the front panel as the auxiliary output. In the R-110 receiver it replaces the X axis output.

The pulse stretch function acts to extend the decay of narrow pulses without affecting their peak amplitudes. The minimum pulse width that can be captured by the circuit is about 5 nanoseconds, while the stretch range is about 12 nanoseconds to 1.5 milliseconds. The enable switch contains an internal LED which illuminates when the function is enabled.

Typical usage of the pulse stretch function is to enable it and adjust the control so that narrow, wide-spaced pulses can be seen on an oscilloscope connected to the auxiliary video output, without extending them so much that they overlap.

The slideback function provides a settable DC level which is used as a thresold for the receiver's AM video signal. In effect the video output has this DC level subtracted from it, without ever going below zero. The enable switch contains an internal LED which illuminates when the function is enabled. The level is set with the front panel control. When the signal strength is greater than the set level, the "THRESH" lightbar in the front panel tuning display illuminates.

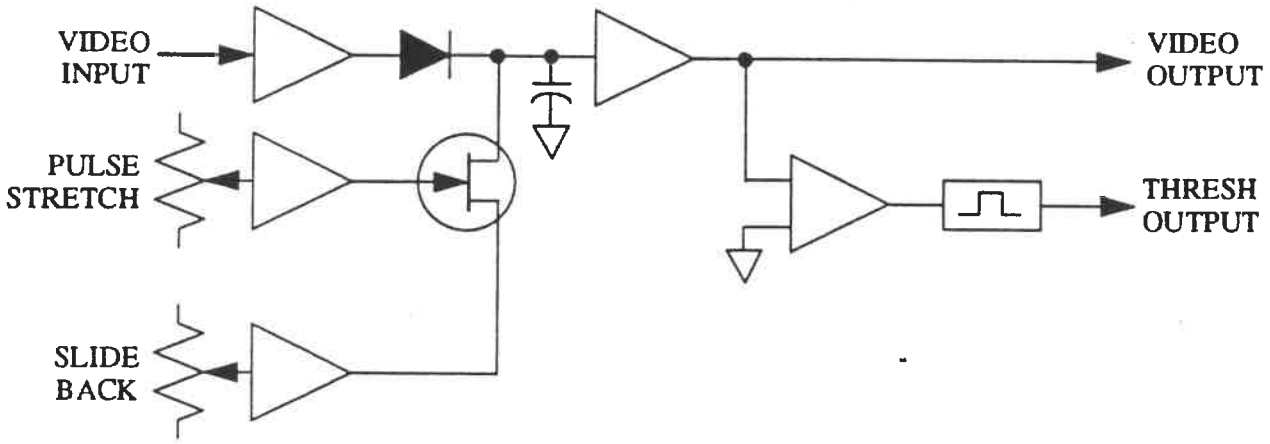
Typical usage of the slideback function for signal strength measurements consists of the following steps:

- Connect a signal of interest to the receiver's input #1
- Connect a signal generator to input #2

- Tune the receiver to the signal of interest and set the attenuation, gain, and bandwidth for optimum reception
- Enable slideback and adjust the slideback control so that the "THRESH" lightbar just barely illuminates
- Switch the receiver's input to the signal generator, set the signal generator's frequency to the tuned frequency of the receiver, and adjust the signal generator's output amplitude so that the "THRESH" lightbar again just barely illuminates
- Read the signal strength from the signal generators output meter or dial.

As mentioned previously, the DSI-110 automated receiving system automates this function using an A/D converter and a host computer with stored calibration tables.

Both pulse stretch and slideback are intended to be manual functions only. Both are disabled when the receiver is in remote (IEEE-488 control) mode.



4. THEORY OF OPERATION

The pulse stretch and slideback functions are combined in a single circuit block. In addition there is a supplementary video amplifier and a cardcage bus interface that is shared with the DVM option. The following description is based on schematic 493741, Rev X3.

The cardcage bus interface consists of a data bus buffer U17, address decoders U18 and U19, data latch U9, and status line driver U20A. Although all eight data bus lines are latched by U9, only bits 6 and 7 are used by the pulse stretch and slideback functions. Bit 6 enables pulse stretch and bit 7 enables slideback. The latch is cleared on powerup and reset so that the functions always initialize disabled. Then, when the processor initializes, it reads the initialization record in EEPROM and sets all of the hardware, including the pulse stretch and slideback enables if the initialization record indicates that they should be enabled.

The address decoders provide several address strobes to the module, but only one is used by the pulse stretch and slideback option, that being address 6D for the latch. Note that the other latch bits (bits 0 - 5) are used by the DVM option. The pulse stretch and slideback enables are inverted to the proper logic state by a pair of analog switches (U42C and U42D) that would have been spare otherwise.

The pulse stretch control is located on the front panel, and is connected to the module via coax cable, arriving on connector J8. The value of the front panel control and the feed resistor (R69) are carefully selected to provide a nonlinear output characteristic which acts to linearize the pulse stretch control FET (Q2). This voltage from the wiper is amplified, level-shifted, and buffered by amplifier U40B and connected to the rest of the circuit through enable switch U42B, which is an analog switch controlled by bit 6 of the control latch. The control voltage splits into two paths here. One path, through adjustment potentiometer R62 and an adjustable current source consisting of amplifier U41A and transistor Q4, controls the pulse stretch FET by generating a voltage across resistor R45. Since this node floats with changes in slideback level, a current source is required to control it. The other path, through diode string CR11 - CR14 and amplifier U40A, serves to reduce bias on diode CR8 for large amounts of stretching. The actual stretching is produced by the video signal, buffered by amplifier U34, charging capacitor C111 through diode CR8. The capacitor discharges through FET Q2, at a rate controlled by the aforementioned circuitry. It discharges into the slideback circuitry, which acts as a threshold gate. The greater the amount of pulse stretching, the less Q2 conducts, so that for lots of stretching Q2 is almost turned off, so that bias on diode CR8 must be reduced to keep the DC baseline from shifting, as mentioned above. The voltage on the capacitor is buffered by U35 and sent to the slideback indicator control circuit and also to the auxiliary video output on the front panel through connector J7. The signal path to the front panel is capable of passing the full 100 MHz bandwidth of the wideband option.

The slideback control on the front panel is log taper potentiometer, brought back to the module on coax through connector J9. Since only two wires are provided, a constant current source is provided by Q3 to generate the proper log characteristic output. Zener diode CR15 is provided to keep the output from rising to the positive supply rail when the front panel control is disconnected, as this would damage the output buffer. The voltage from the control is passed through enable switch U42A, which is an analog switch controlled by bit 7 of the control latch. The voltage is buffered by U41B and applied to the low side of pulse stretch FET U2. The result of this is that diode CR8 doesn't forward bias until it exceeds the slideback level, effectively subtracting all signal levels below this threshold from the output. The level can be adjusted from 0 to about 2.8 Volts to match a video range of 0 to 3 Volts.

The processed video signal is buffered by U35 and sent to the front panel auxiliary video connector, as mentioned above. Note that the slideback level appears as a DC offset on the output. The signal also feeds the indicator circuit. This consists of amplifier U38, followed by comparator U45, followed by pulse generator U20A. The signal is AC-coupled by capacitors C122 and C128, so that the comparator is set to always look for signal levels above zero Volts. The pulse generator produces a positive pulse with a minimum of several milliseconds duration every time the signal level exceeds the slideback level, to ensure that the condition will be visible on the front panel indicator. This is the "THRESH" indicator, located in the top right of the tuning display. Note that this indicator is the only one whose operation is totally independent of the control processor (except insofar as the control processor can disable the slideback function entirely).

The supplementary video amplifier, consisting of U30, U31, and related components, is provided to make up for the additional loading required by the option circuits. Gain of U30 is two so that U31 can drive a source resistance of 50 Ohms and have the output still come out unity. Note that this amplifier is compatible with the wideband option and can accept signals of up to 3 Volts and 100 MHz.

5. SERVICE AND ADJUSTMENTS

There are four adjustments in the pulse stretch, slideback, and supplementary video amplifier circuitry. None need to be readjusted frequently, but may perhaps need to be verified at intervals of several years. Making the adjustments requires the use of a signal generator, a pulse generator, a voltmeter, and an oscilloscope, plus familiarity with the procedure for removing the outer case from the receiver. The procedure for removing the case is given in the R-110 and R-110B technical manuals.

5.1. Maximum Pulse Stretch Adjustment

This adjustment is provided by trimpot R62. Connect a pulse generator to the input of the receiver and set it up so that it produces narrow pulses (1 usec or less) at a repetition rate of about 100 Hz. Then tune the receiver so that the pulses appear on the video output. Monitor the auxiliary video output with an oscilloscope, enable pulse stretch and rotate the front panel control fully clockwise, and adjust R62 so that the pulses are 1.5 milliseconds long at the point at which they decay to 10% of their peak value.

5.2. Maximum Slideback Adjustment

This adjustment is provided by trimpot R63. Connect a voltmeter to the auxiliary video output along with a 50 Ohm termination. With no signal applied to the input of the receiver, enable slideback, rotate the front panel control fully clockwise, and adjust R63 for a DC output of about 2.8 Volts.

5.3. Slideback Indicator Threshold Adjustment

This adjustment is provided by trimpot R61. Connect an impulse generator to the input of the receiver and apply a signal. Set the receiver for its widest bandwidth. Set the amplitude of the generator and the gain of the receiver to produce about 2.5 Volts at the video output. Now enable slideback and adjust the front panel control so that the indicator just barely illuminates. Now reduce the signal generator level to about 100 mV and repeat.

5.4. Supplementary Video Amplifier Offset Adjustment

This adjustment is provided by trimpot R38. With the coax cable unplugged from the module video input at J5 and J5 terminated in 50 Ohms, adjust R38 for about 1 milliVolt of positive offset into a 50 Ohm load at the video output at J6.

6. CARDCAGE INTERFACE SUMMARY

Address 6D: Control latch:

Bits 0 - 5: reserved for DVM option

Bit 6: pulse stretch enable (1 = enable)

Bit 7: slideback enable (1 = enable)