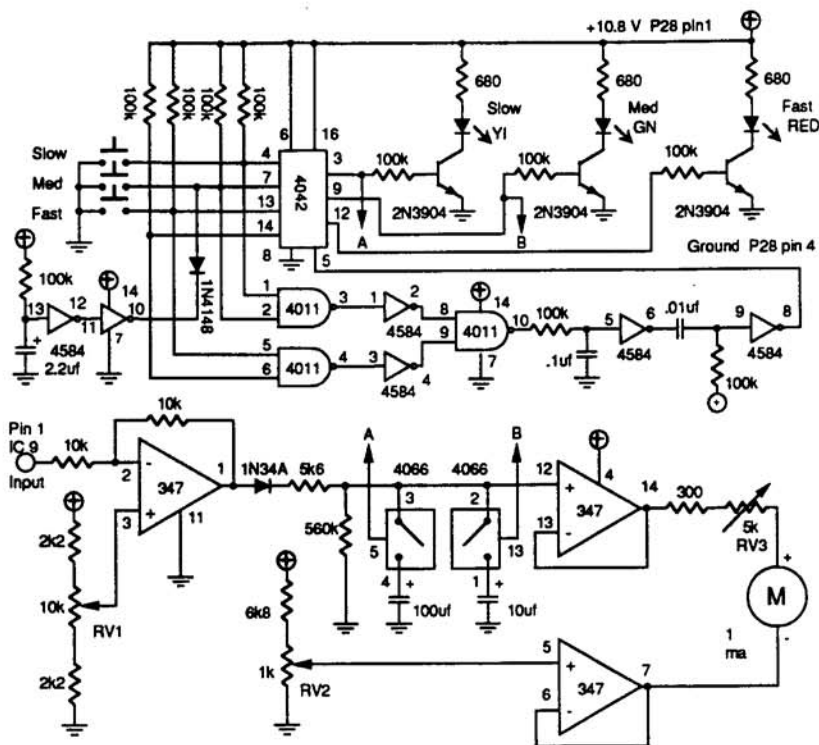
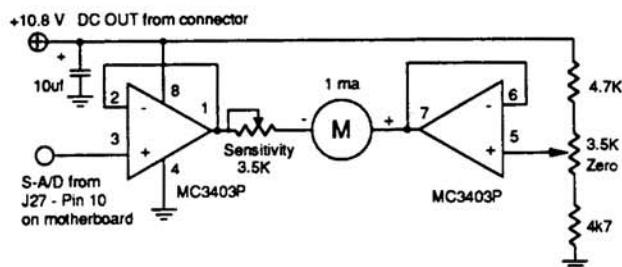


**A ONE CHIP S-METER:** This circuit is courtesy of Paul Lannuier of JRC-New York, via Chuck Bolland. Paul states it was designed by a member of the JRC 1st Engineering Department.

The single integrated circuit (a quad op-amp) may be one of the following ICs: Fairchild U3403PC, Motorola MC3403P, National Semiconductor LM3403N, Texas Instruments MC3403N or NJM3404.

The attachment point which provides the AGC signal is pin 10 of J27 on the motherboard. This is at the base where the CAE-182 circuit slots are located. For the 10.6 volts DC power, the DC OUT jack on the rear panel of the NRD-525 can be used, or tap circuit points such as pin 1, J32 or pin 1, J34 on the motherboard. Calibration for sensitivity and meter zeroing is done with the 3.5K  $\Omega$  potentiometers. If the needle goes off-scale for medium strength signals, add resistance to the line from the circuitry to the meter.



**A VERSATILE S-METER FOR THE NRD-525:** Craig Siegenthaler of Kiwa Electronics is the author of this flexible circuit. I have used his design for over two years and can attest to its excellent performance. Its usefulness is greatly enhanced by the selection of a large, easy-to-read meter movement and calibration to industry standard S-units.

This circuit can provide three levels of dampening to drive the analog meter. It is designed around a quad bi-fet op-amp such as a LF347 or TLO-74. Only three sections are used; the unused section should have its input pins grounded. The upper half of the schematic is the control logic to drive the CMOS FET switches which add or subtract capacitance to dampen the metering signal.

The meter used should have a 1 milliamp full-scale display. DC power is provided by the receiver with V+ connected to P28, pin #1 and ground to P28, pin #4 on the CAE-182 IF/AF Amp Board. The input to the S-meter circuit connects to IC9, pin #1 on the CAE-182 board.

To calibrate the meter, first set the RV controls to midpoint. Disconnect the antenna, and set the receiver's RF gain control to maximum. Adjust RV2 until the meter movement just begins to deflect upwards. At this point RV1 and RV3 should not require much adjustment past their midpoint settings. Adjust RV1 until it, too, just starts to deflect the meter's needle upward. Connect the antenna and tune to a strong MW station. Adjust RV3 for a similar upscale reading. Readjustment of RV1 and RV2 will be required to tune the meter so it will respond to low and high level signals.

A more accurate calibration can be performed with a RF signal generator having a precision attenuator and 50  $\Omega$  output. Terminate the generator with 50  $\Omega$ , set the frequency to mid band (example: 8 MHz), and connect it to the receiver's antenna input. The meter can now be calibrated according to the following standard signal levels adopted by the IARU (International Amateur Radio Union):

<b>S-meter</b>	<b>Vrms at 50 <math>\Omega</math> (0-30 MHz only)</b>	<b>S-meter</b>	<b>Vrms at 50 <math>\Omega</math> (0-30 MHz only)</b>
S9 + 40db .....	5 mV	S6 .....	6.3 mV
S9 + 30db .....	1.6 mV	S5 .....	3.2 $\mu$ V
S9 + 20db .....	500 $\mu$ V	S4 .....	1.6 $\mu$ V
S9 + 10db .....	160 $\mu$ V	S3 .....	0.8 $\mu$ V
S9 .....	50 $\mu$ V	S2 .....	0.4 $\mu$ V
S8 .....	25 $\mu$ V	S1 .....	0.21 $\mu$ V
S7 .....	12.5 $\mu$ V		

Most receiver manufacturers except Japan Radio Company have adopted these signal levels as the S-meter standard. The two NRD-525 radios Craig tested show 100  $\mu$ V as the S9 signal level. Also, neither receiver developed AGC voltage below S2 to S3 levels. This means it is impossible to calibrate the S-meter accurately below that point (the stock bargraph meter cannot be properly calibrated for low level signals, either).

My external S-meter, built to Craig's design, uses a surplus Hewlett-Packard meter 4-1/2" in width. After the S-meter was calibrated I created a new faceplate for it with rub-down lettering on thin white cardboard. Slipped behind the meter's needle, the faceplate markings accurately show signal levels to the industry standard.

The three selectable dampening settings of this circuit are very helpful. "Fast" gives an good indication of polar flutter conditions, or the true extent and rate of signal fading. "Medium" is the normal setting that approximates most receivers' S-meter characteristics. The "slow" setting smooths out level variations—even drastic changes—to give an average reading.