Mode Switch/Calibrator
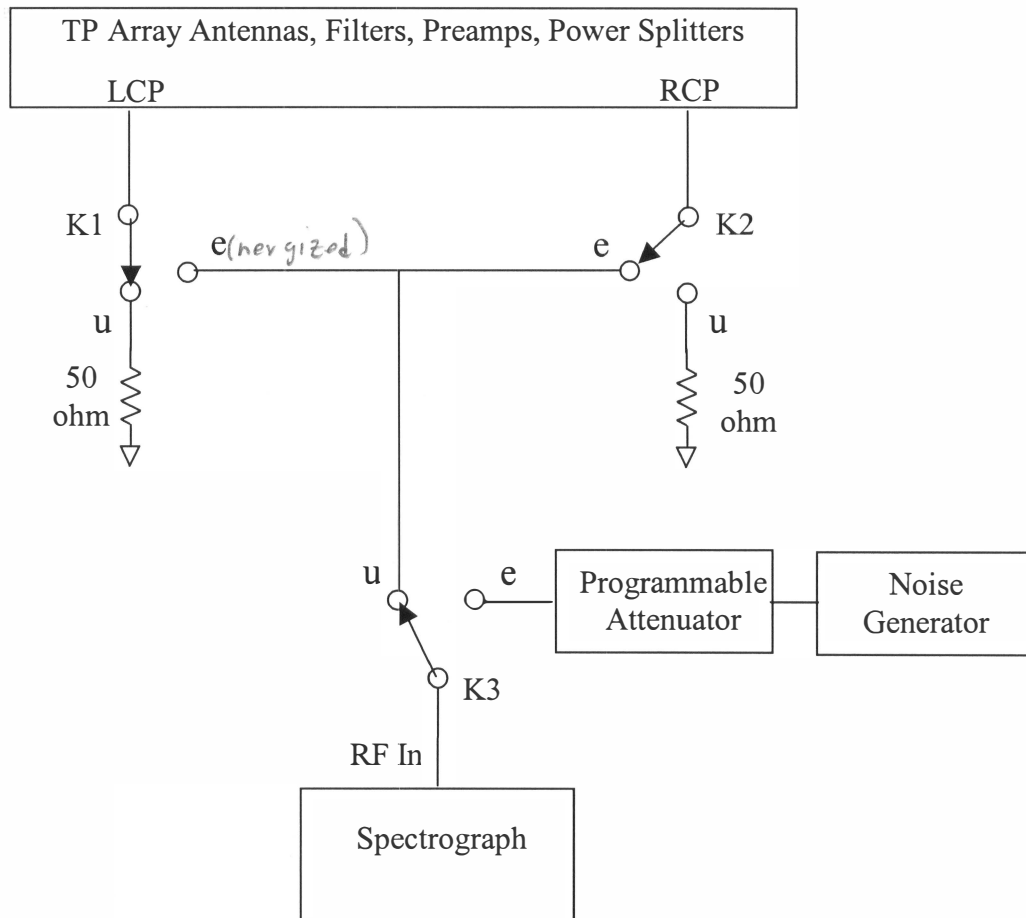
A mode switch (M16) with 3 coaxial relays (K1, K2, and K3) selects the RF source for the spectrograph (for the Florida installation this is either RCP, LCP or a calibrator).

The calibrator comprises a high temperature RF noise source followed by a commercial programmable attenuator.

K1 is LCP select relay (energize to select LCP)
K2 is RCP select relay (energize to select RCP)
K3 is CAL/OPR relay (energize for CAL)

During CAL both K1 and K2 are un-energized, terminating both antenna ports in 50 ohms

Both the mode switch and the step attenuator are controlled by a microcontroller (PIC), which communicates with the a300y computer via an RS232 serial link.

The mode switch/calibrator components are mounted on a 5.25" by 19"wide rack panel.

M15 – A **PIC microcontroller and driver circuit** generate command signals to control a commercial step attenuator and the mode switch. Three control lines operate the LCP, RCP, Cal/Opr Mode switch and seven control lines drive the individual 1, 2, 4, 8, 16, 32, and 64 dB cells of the step attenuator. The PIC communicates with the a300y computer via an RS232 line.

The physical layout of the modules and their interconnecting signal cables is seen below.
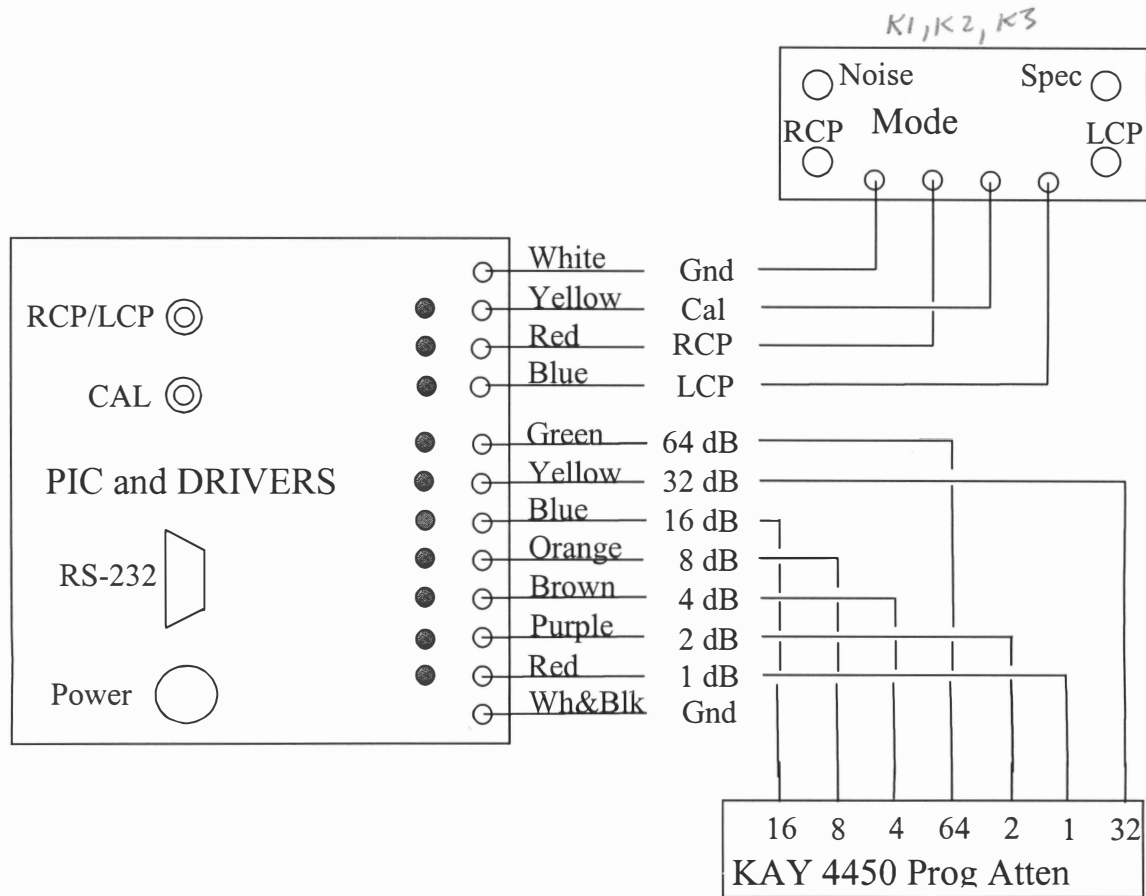
The PIC controller module is connected to the Elenco Power Supply by a 3-wire cable supplying +5, and +12 volts.

Pushbuttons on M15 can be used to test the RCP/LCP polarization select relays as well as the calibrate function. One push of the CAL button initiates the CAL sequence while pushing the RCP/LCP button toggles the spectrograph input between the RCP and LCP antennas.
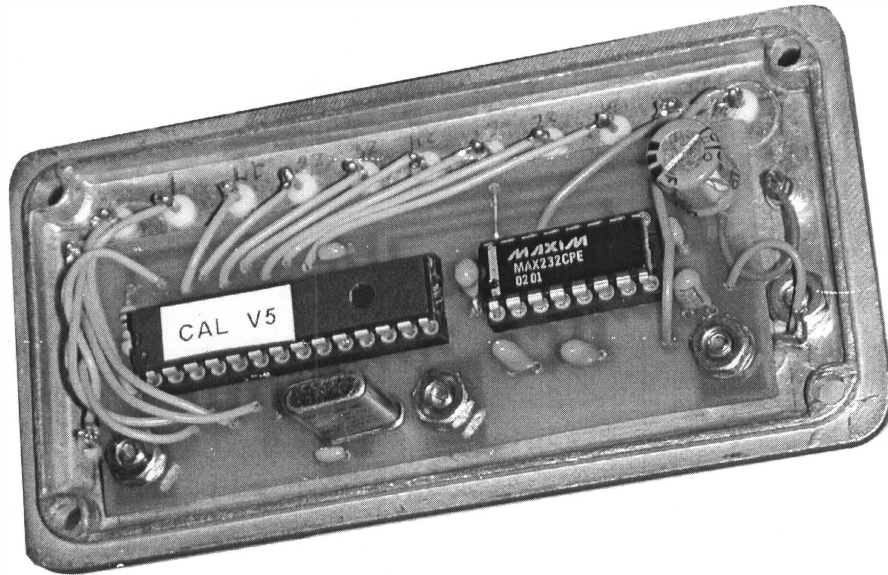
CAL PC BUARD

OUTS ←

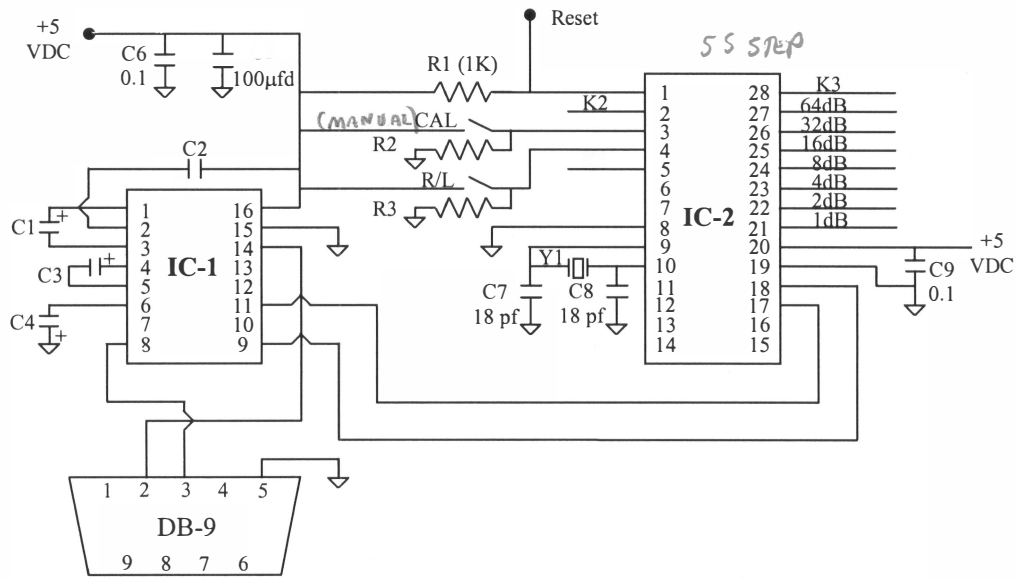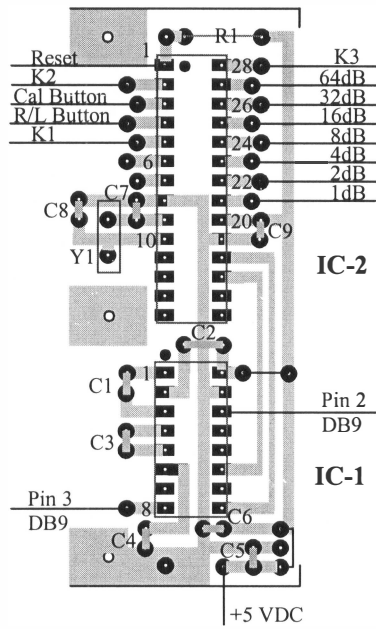Columns labeled: 2N3906'S, 2N3904'S, DIODES

3 3/4" PIC

2 3/4"
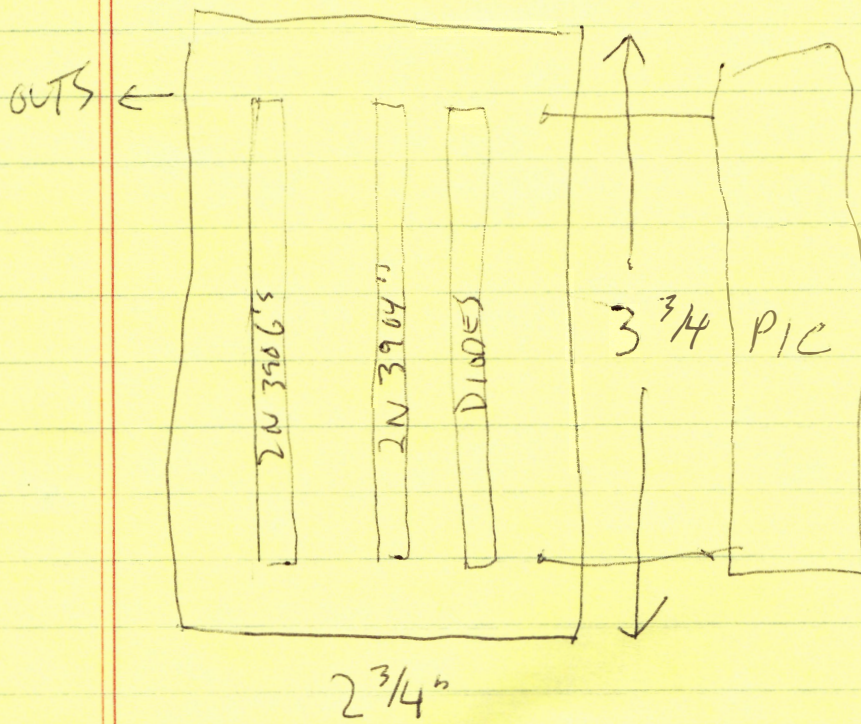
12/30/07 Replaced 2N3904 & 2N3906
on "4" cal bit.
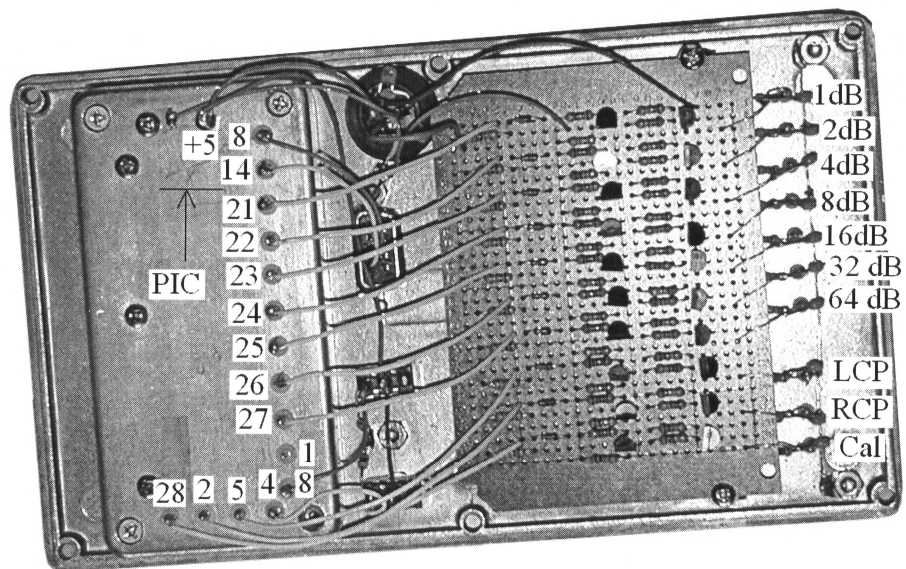
PIC Microcontroller and Driver Module (M15)
Numbers on PIC controller box indicate PIC and MAX-232 pin numbers.

The PIC16F873 microcontroller communicates with the main a300y computer via a MAX232 RS-232 chip. Serial communications rate is 56 K bits, which is derived from an 18.432 MHz crystal. The 16F873 contains the custom control code for the mode switch and the calibrator programmable attenuator. The PIC and MAX232 are mounted on a PC board inside of a small diecast box. Connections to the driver board and RS232 9 pin D-connector are via Teflon insulated feedthroughs. The PIC box is mounted inside a larger diecast box, which also contains the relay driver board.

Top diagram (PCB layout) labels:

Reset
K2
Cal Button
R/L Button
K1
R1
1
28 K3
26 64dB / 32dB / 16dB / 8dB / 4dB / 2dB / 1dB
24
22
20
C8 C7 C9
6
10
Y1
IC-2
C2
C1 1
C3
Pin 2
DB9
IC-1
Pin 3
DB9
8
C6
C4 C5
+5 VDC

Bottom schematic:

+5 VDC
C6 0.1   100µfd
Reset
R1 (1K)
5 S STEP
(MANUAL) CAL
K2
R2
R/L
R3
C2
C1
IC-1
C3
C4
Y1
C7 18 pf   C8 18 pf
IC-2
1 28 K3
2 27 64dB
3 26 32dB
4 25 16dB
5 24 8dB
6 23 4dB
7 22 2dB
8 21 1dB
9 20
10 19
11 18
12 17
13 16
14 15
+5 VDC
C9 0.1
IC-1
1 16
2 15
3 14
4 13
5 12
6 11
7 10
8 9
DB-9
1 2 3 4 5
9 8 7 6

Calibrator PIC Controller

Note: C1, C2, C3, C4 are 1 µfd
        IC1 = MAX-232, IC2 = 16F-873, Y1 = 18.432 MHz
        Ground RESET line to reset PIC

Driver circuits.

Two different driver circuits are used – one to control the 5 volt OMRON RF relays in the mode switch (M16) and the other, a 12 volt circuit used to drive the solenoids in the Kay programmable step attenuator. Each relay solenoid requires a dedicated driver circuit. The drivers turn on their solenoid when a +5v signal is applied by the PIC.
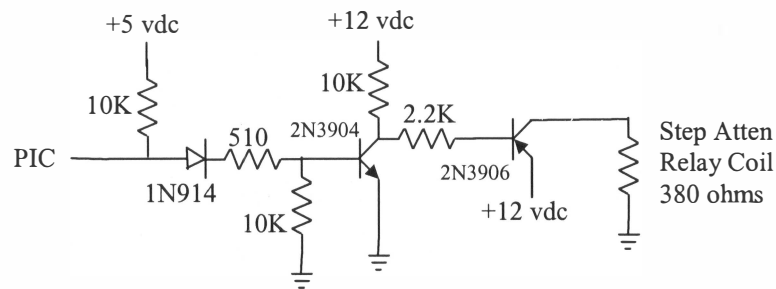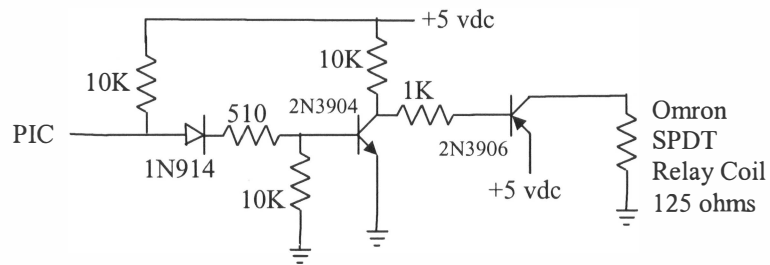
M16
Mode Switch

The mode switch contains three, 5 volt, SPDT Omron RF relays. These relays allow selection of either RCP or LCP signals and also control selection between calibrate and operate modes. The relays are controlled by signals generated by the PIC and amplified in the driver circuits located in module M15.