Modulation Kit

The modulation kit consists of three sections: **a signal source, a modulator, and a demodulator**. The front panel controls to each of these sections are shown in Figures 1-3. The following sections explain the pertinent features of the modulation kit:

Synchronised Signals on Signal Source Board

The signal source allows the generation of both sinusoidal and digital signals. These signals with the exception of a 10 KHz signal are all synchronised with a 1 MHz clock. Such synchronisation allows the various signals generated in the modulator to be clearly displayed on an oscilloscope. The digital signals are unipolar (0 to 5 V) and can be converted to polar signals (-2.5 to 2.5 V) via the circuitry labelled "unipolar to polar".

PRN Generator

The PRN (pseudo random noise) generator generates a pseudo random binary sequence of 0-5V NRZ unipolar pulses. The sequence length is 2^{15} -1 pulses.

Frequency Feedback on FM Modulator

The frequency feedback network in the modulator board requires explanation. This network provides feedback to the input of the VCO so that its unmodulated frequency (100 kHz) is synchronised with the 1 MHz clock and hence the modulating signals available on the signal source board. This allows FM and FSK signals to be clearly displayed on an oscilloscope. The feedback network is lowpass with a bandwidth of less than 1 Hz and is such that it does not affect the generation of FM or FSK signals provided the frequency of the modulating signals is greater than around 100 Hz. A LED indicates when the frequency feedback network has synchronised the unmodulated output frequency of the VCO with the 1 MHz clock. If the VCO is modulated with a unipolar signal the frequency feedback network will not achieve lock.

Modulator Board

The modulator can generate, in addition to AM, DSB, SSB, QAM, and FM signals, binary ASK (amplitude shift keyed), FSK (frequency shift keyed), and PSK (phase shift keyed) signals.

Demodulator Board

The demodulator is based on extracting a synchronised signal via a Phase Locked Loop (PLL) (either a standard PLL or a COSTAS PLL) and synchronous detection.

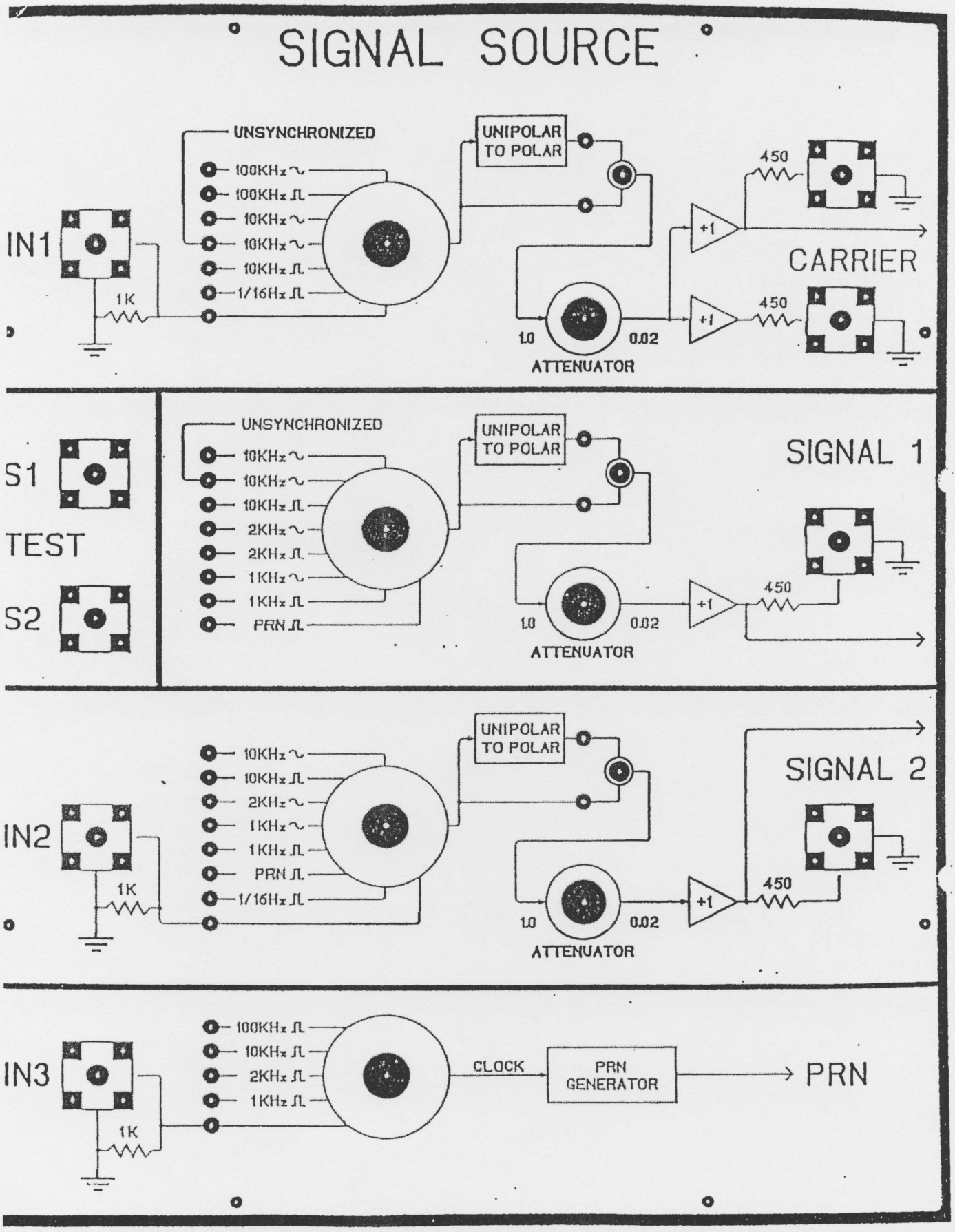
SIGNAL SOURCE
UNSYNCHRONIZED
100KHz ∿
100KHz ⎍
10KHz ∿
10KHz ∿
10KHz ⎍
1/16Hz ⎍
IN1
1K
UNIPOLAR TO POLAR
1.0
0.02
ATTENUATOR
+1
450
CARRIER
S1
TEST
S2
SIGNAL 1
10KHz ∿
10KHz ∿
10KHz ⎍
2KHz ∿
2KHz ⎍
1KHz ∿
1KHz ⎍
PRN ⎍
IN2
1/16Hz ⎍
SIGNAL 2
IN3
CLOCK
PRN GENERATOR
PRN

Figure 1

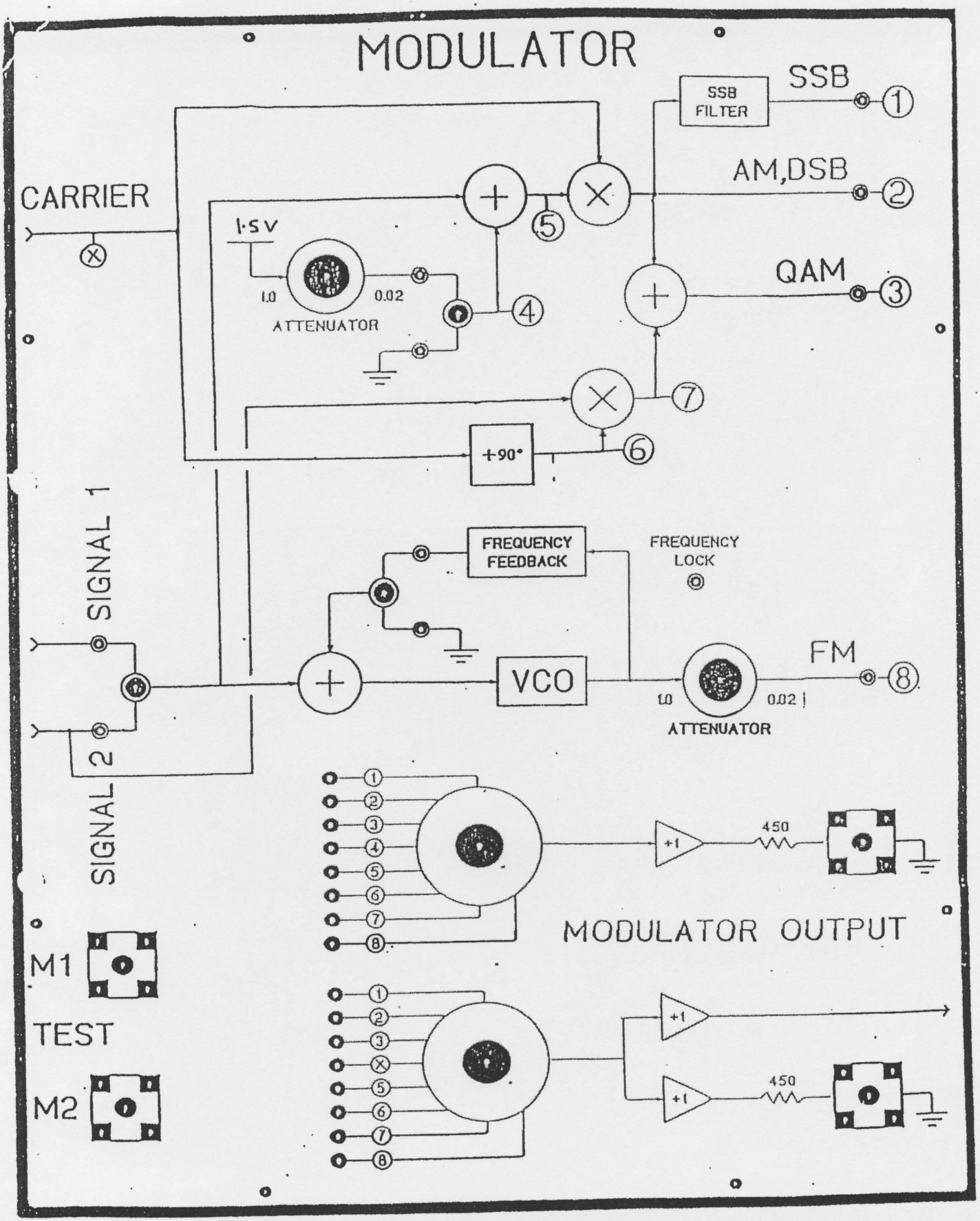
MODULATOR
SSB
SSB FILTER
AM,DSB
CARRIER
1·5V
1.0
0.02
ATTENUATOR
QAM
+90°
FREQUENCY FEEDBACK
FREQUENCY LOCK
SIGNAL 1
SIGNAL 2
VCO
FM
1.0
0.02
ATTENUATOR
450
MODULATOR OUTPUT
M1
TEST
M2
450

Figure 2

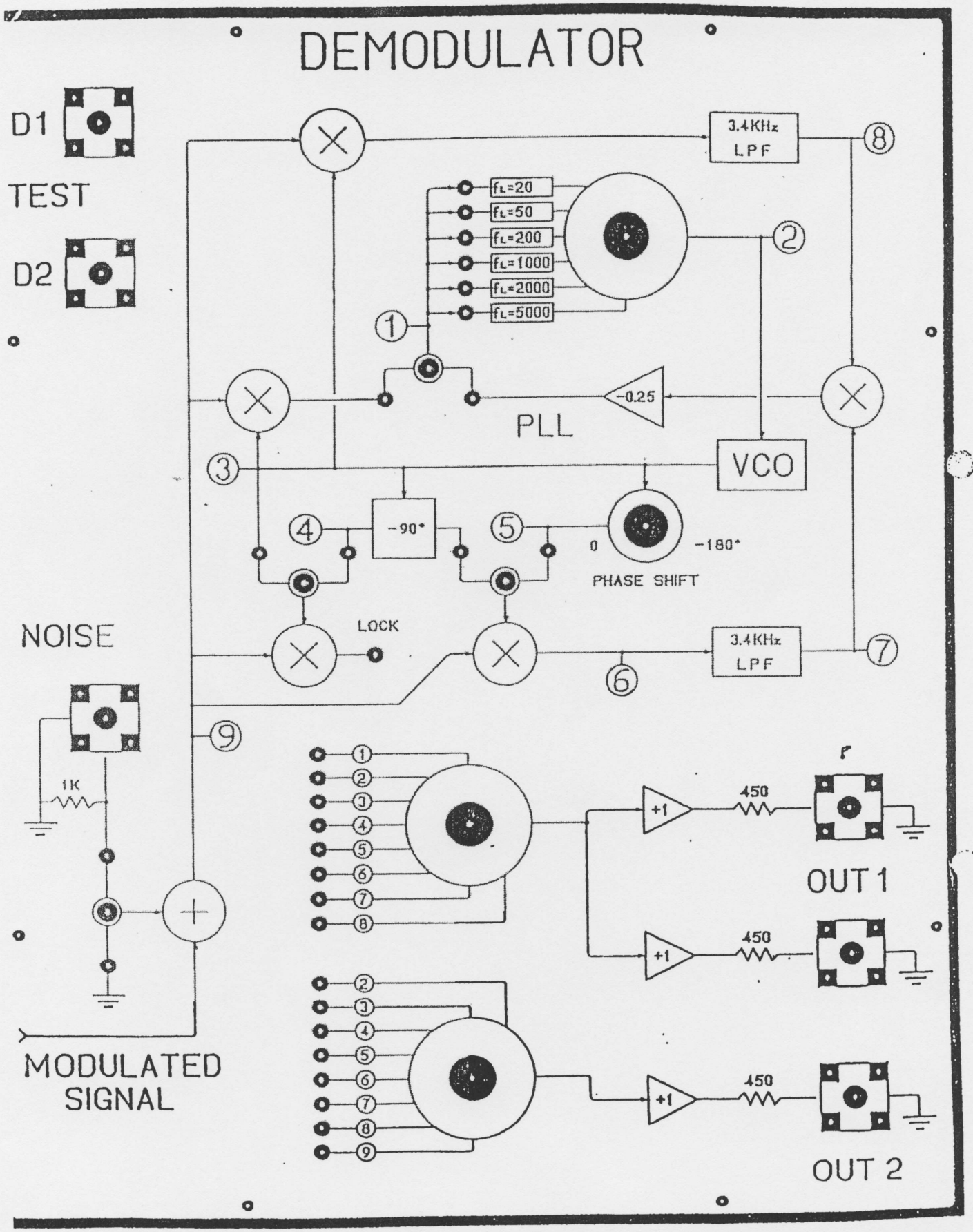
DEMODULATOR
D1
TEST
D2
3.4KHz LPF
8
fL=20
fL=50
fL=200
fL=1000
fL=2000
fL=5000
2
1
-0.25
PLL
VCO
3
4
-90°
5
0
-180°
PHASE SHIFT
LOCK
NOISE
3.4KHz LPF
7
6
9
1K
MODULATED SIGNAL
1
2
3
4
5
6
7
8
+1
450
OUT 1
+1
450
2
3
4
5
6
7
8
9
+1
450
OUT 2

Figure 3