INSTRUCTION MANUAL

ANEMOMETER MODULAR RACK SYSTEM

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PREAMBLE

The Constant Temperature Anemometer units are ideal for the measurement of turbulence statistics in general and small scale turbulence statistics in particular. The units require no cable compensation adjustments due to a unique current feedback bridge circuit. The signal to noise ratio is good and there is provision for slow probe heating on startup.

The Constant Current Anemometer has been optimised for stable, low noise performance. A discrete component preamplifier and zero feedback current source yield a low noise floor approaching the level of noise generated in the resistance of a typical constant current probe. Balance indication Light Emitting Diodes (LED's) provide easy setting of the bridge balancing potentiometer.

The Filter Amplifier Unit provides a range of gains, calibrated offset control and filter ranges to condition turbulence signals prior to digitisation.

The Anemometer Rack Unit will accommodate a maximum of eight 5 cm wide modules. Any combination of constant temperature, constant current anemometers and filter amplifier modules can be used. Star point earthing has been used to minimise earth loop noise when the rack is connected to external equipment.

The output from each module position is internally interconnected to suit the input of a Filter Amplifier Module placed to the right hand side of the module to be conditioned. Filter Amplifier Modules can be joined together in this manner to obtain different gain combinations or higher filter cut-off slopes.

CONSTANT TEMPERATURE ANEMOMETER

FRONT PANEL CONTROLS

SQUARE WAVE LEVEL ADJUST

Adjust to obtain small square wave disturbance (0.2V pk - pk) on velocity signal (C.W. to increase)

BIAS LEVEL ADJUST

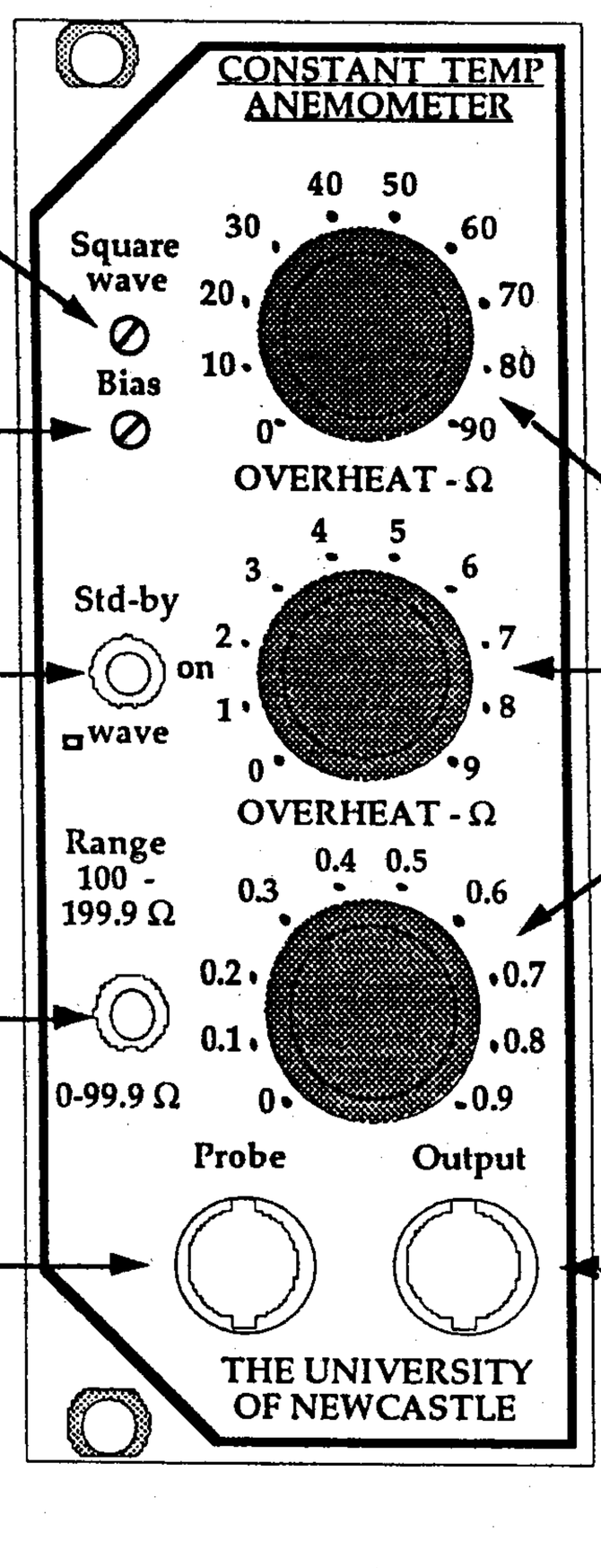
Adjust to optimise transient square wave response of anemometer.
NOTE : Insufficient bias will prevent automatic slow startup heating of probe in operate mode (C.W. to increase)

MODE SWITCH

Std-by - Probe excitation inhibited
On - Constant temp operation
▫wave - select for amplifier response optimisation

OVERHEAT RESISTANCE RANGE SWITCH

PROBE INPUT BNC



OVERHEAT RESISTANCE SWITCHES

OUTPUT BNC

INTERNAL ADJUSTMENTS

AMPLIFIER STABILITY TRIM CAPACITOR - Adjust to apply high frequency roll off, above 1MHz to ensure amplifier stability (plates in mesh lowers roll off frequency)

CONSTANT TEMPERATURE ANEMOMETER (CTA) OPERATING INSTRUCTIONS

- Apply power to the anemometer module and put the CTA in standby mode.

- Connect the coaxial cable (50Ω, at least 2 metres long) to the probe's lead connector and measure the total resistance using an ohm meter. It is recommended that a miniature 50Ω cable be used for the probe lead connector. This would help to avoid the cable discontinuity between the probe lead connector and the coaxial cable.

- Set the required overheat resistance using the switches (see the figure for the front panel controls of the CTA). With the low noise performance of the anemometer, an overhead ratio of 1.6 would maximise the life of the hot wire.

- Set the BIAS TRIM potentiometer to its minimum, i.e. turn the Bias Level Adjust screw anticlockwise until a small click sound is heard.

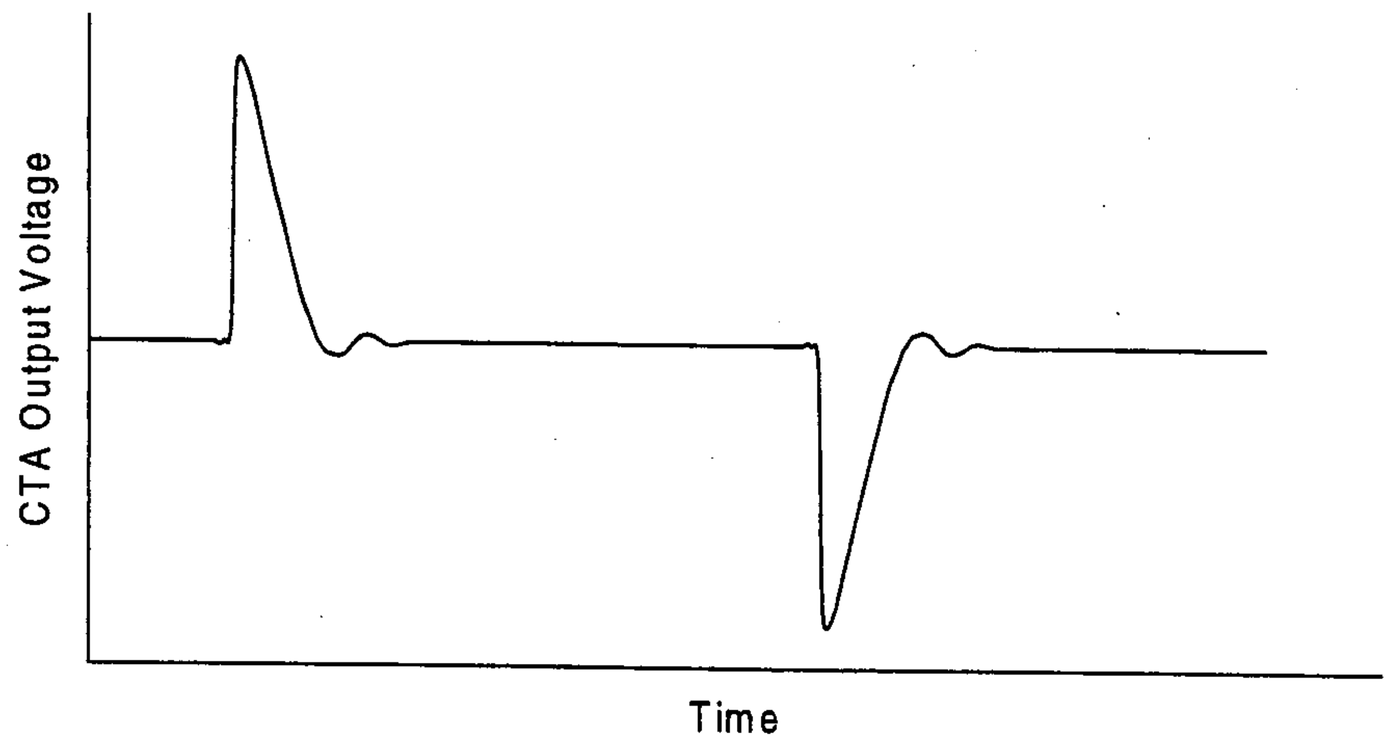
- Connect the probe to the CTA unit (Probe Input BNC) and set the mode switch to ON. The output should be close to 0 volts DC.

- Start increasing the bias level, by turning the Bias Level Adjust Screw clockwise, until the output level jumps to a steady 1 to 4 volts indicating that the circuit is now in operation. If high frequency oscillations appear on the output, increase the stability trimming capacitor (C10, an internal adjustment of the CTA unit) until the oscillations disappear. **CAUTION** : An excessive amount of bias level will effectively increase the overheat resistance and cause the burn out of small diameter wires.

contd.

CTA Operating Instructions Contd.

- Check the square wave response of the circuit by setting the mode switch to WAVE and view the output signal on an oscilloscope. Turn the Square Wave Level Adjust clockwise to achieve 0.1 to 0.2 volts peak to peak level of the output signal. The square wave response could be checked either in still air or in a constant velocity. Ideally, the response should be similar to that in the sketch below.



A couple of cycles of damped ringing in the transient recovery may be expected as a trade off for the low noise performance of this circuit. With a 5 μm diameter wire, the bias level may have to be increased to obtain the ideal response. But usually, there is no need to increase the bias beyond that required for the initial start up. When a stable operation is not achieved, the cause is usually a faulty wire, probe, cable connection or the probe support transmitting mechanical noise.

Bridge Driving
Current Source
Transistors

T1 & T2 Mounted On
A Common Heatsink

T1
327

T2
BD140

R1
470R

R2
100R

Range
Switch

100-199.9
Ohms

0-99.9

S2
SW7101

R3
470R

1 PIN

0' Heat
Resis
-tors

2 PIN

3 PIN

Probe
BNC

4 PIN

Soft Start Circuit

T3
MPF106

D1
1N4732

R5
220k

T4
337

R6
100k

R7
1M

C1
4u7F

C2
10uF

C10
2-10pF

Bridge Amp

R4
2k2

C3
10uF

U1
OP-27

Operating
Mode Switch

S1
SW7203

Square Wave
On
Standby

R25
4k7

4.3 Gain Amp

U2
LM318

C5
0.1uF

R21
47R

R20
33k

C9
6p8F

C6
0.1uF

R19
10k

OUT

PIN 5
Output
PIN BNC

PIN 6

Square Wave
Generator

U3
LM555

C4
10uF

R22
39k

R23
6k8

R24
22k

C7
0.01uF

C8
0.033uF

R18
10k

R8
47k

R9
47k

T5
337

T6
337

R13
470k

R14
470k

P2
10k

Bias
Level
Adjust

R12
2k2

R15
22k

R17
100k

R16
22k

R11
5k6

R18
100k

P1
10k

Square Wave
Level Adjust

Offset Balancing Circuit

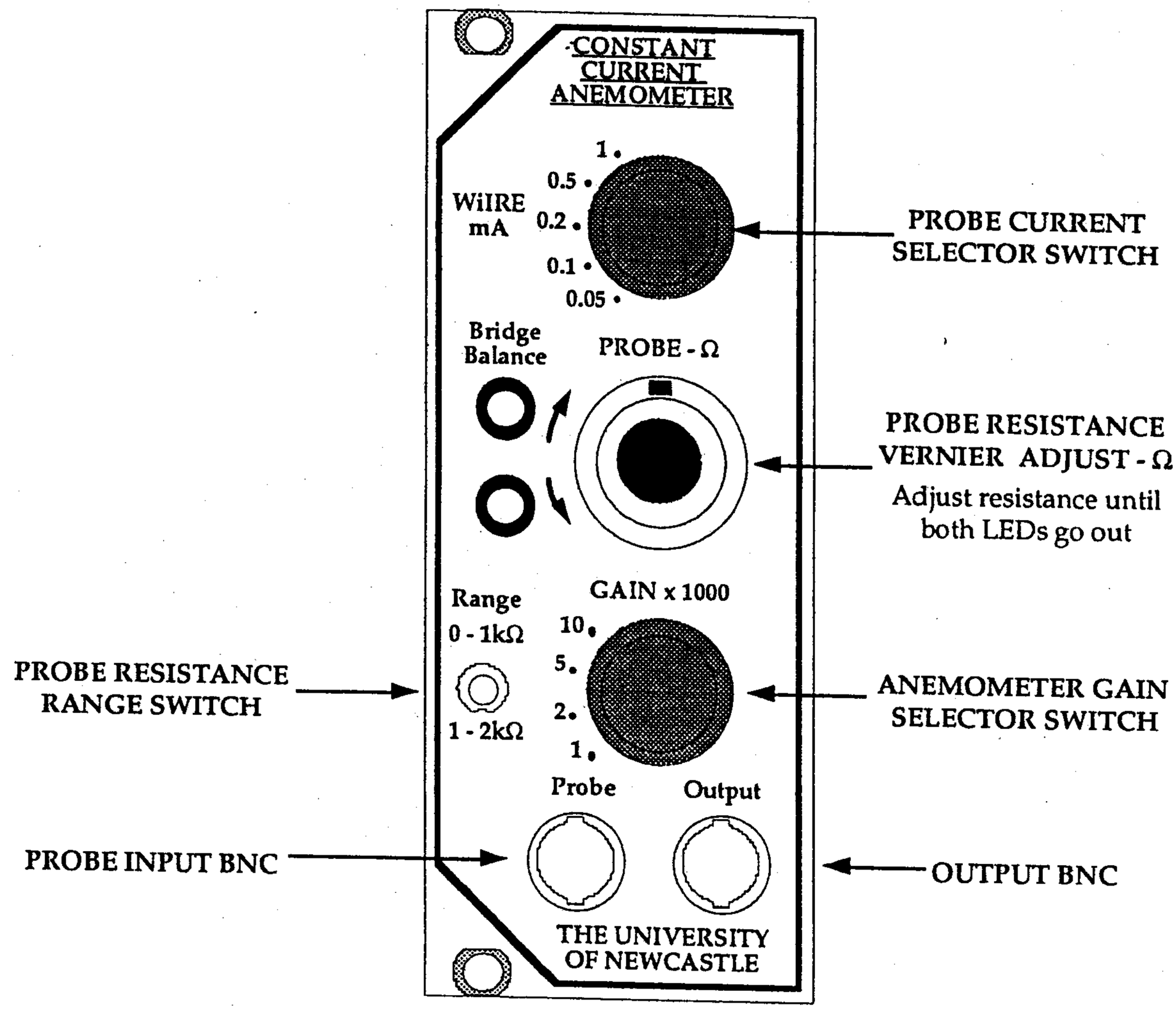
Edge Connector

J1
DIN32RA

Title: CONSTANT TEMPERATURE ANEMOMETER		
Size: A4	Number: CTA.S01	Revision:
Date: 9-MAR 1995		Sheet 1 of 1
File: CTA/1		Drawn By: I.Mills

CONSTANT CURRENT ANEMOMETER

FRONT PANEL CONTROLS



INTERNAL ADJUSTMENTS (Preset)

AMPLIFIER INPUT OFFSET TRIM - Connect a 470Ω 1% resistor across the probe input BNC . Set the probe resistance vernier adjustment to 470 and adjust trimmer to obtain 0 V at the output BNC

PROBE CURRENT TRIM - Connect A digital multimete, set to mA, across the probe input BNC and set the selected currents for a close match to the indicated current.

GAIN SET - Feed 50¨µV A.C. @1kHz via a 10µF capacitor onto a 470Ω dummy probe connected to the input.
5000 GAIN TRIM - Set LM 394 pre-amp gain to obtain 2.5 V AC output.
1000, 2000, and 10000 GAIN TRIM - Adjust apripriate trimmer to obtain the correct output at these gains

CONSTANT CURRENT ANEMOMETER (CCA) OPERATING INSTRUCTIONS

- Apply power to the anemometer module.

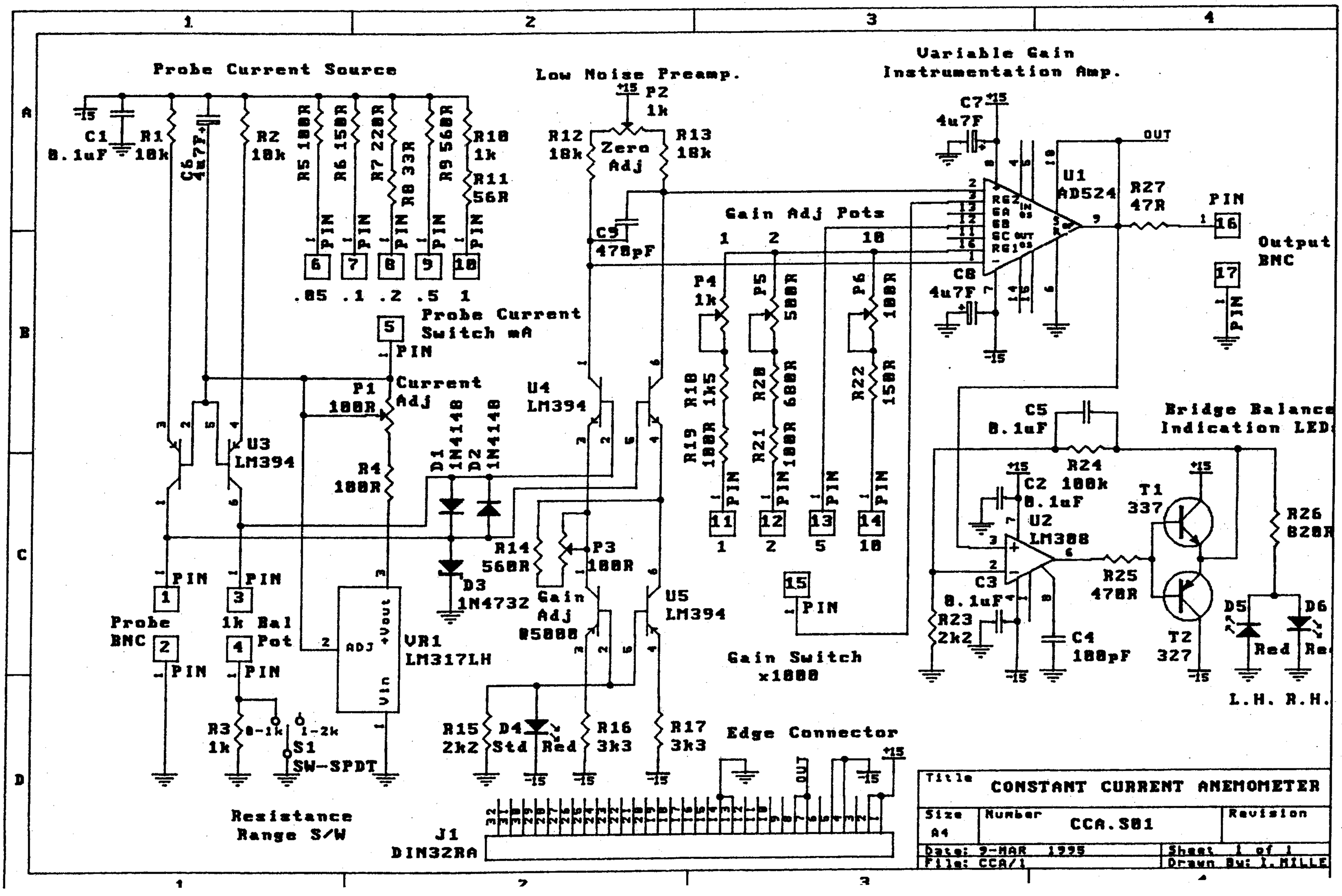
- Choose an appropriate resistance range using the Probe Resistance Range Switch and set the resistance using the Probe Resistance Vernier Adjust. This resistance should be slightly smaller than the probe resistance initially.

- Select a current value using the probe Current Selector Switch and a value for gain using the Anemometer Gain Selector switch.

- Connect the coaxial cable (50Ω, at least 2 metres long) to the probe's lead connector. It is recommended that a miniature 50Ω cable be used for the probe lead connector. This would help to avoid the cable discontinuity between the probe lead connector and the coaxial cable.

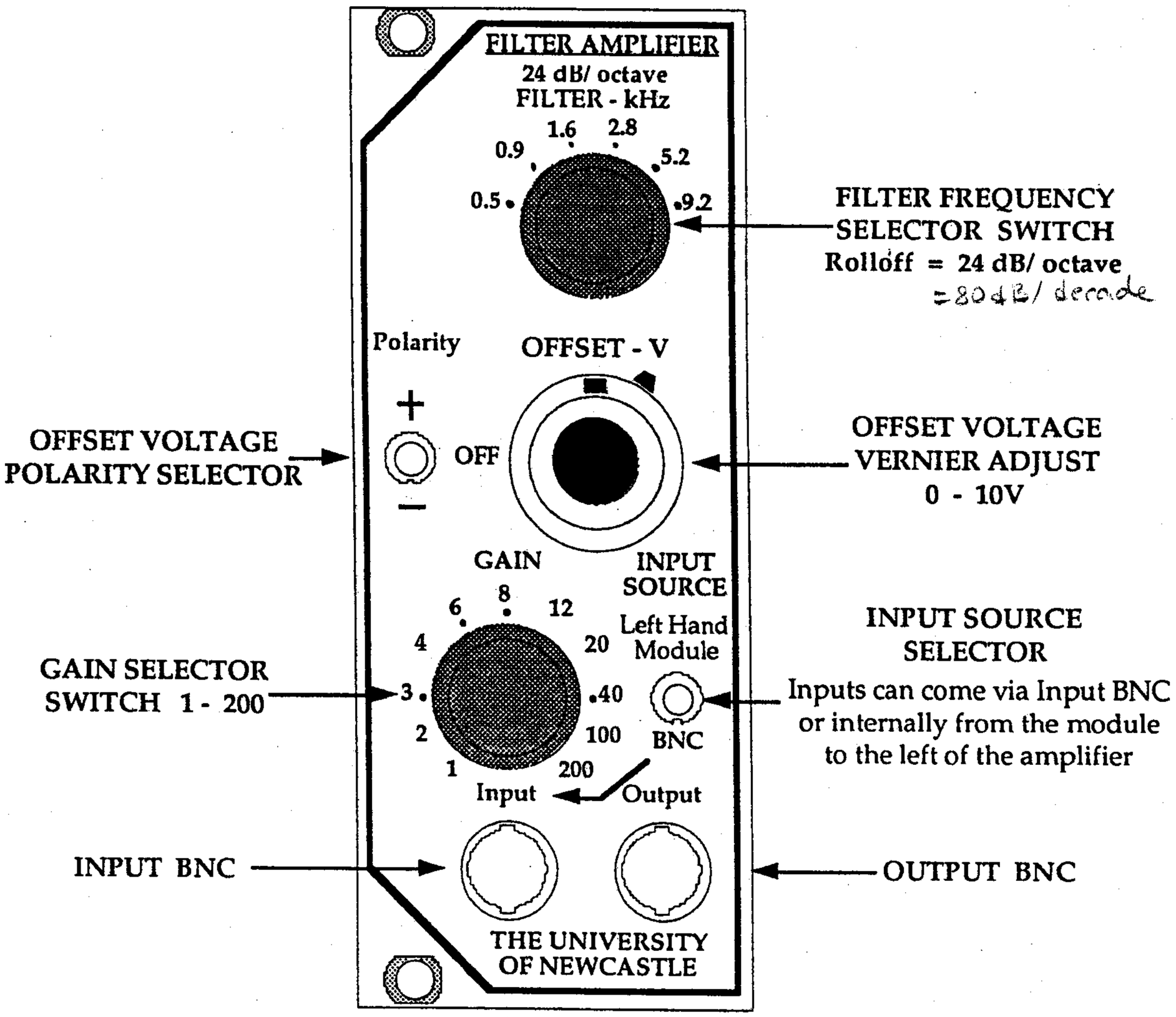
- Connect the coaxial cable to the Probe Input BNC.

- Increase the resistance very slowly using the Probe Resistance Vernier Adjust until both LED's go out or a signal is seen from an oscilloscope. It is recommended that this adjustment should be done very carefully since the signal could disappear when the resistance is slightly changed. Once the signal is tuned out, the gain and offset (using the Offset Voltage Vernier Adjust in the amplifier) will probably need to be varied to achieve good resolution.


Probe Current Source
Low Noise Preamp.
Variable Gain
Instrumentation Amp.
C1
8.1uF
R1
18k
C6
4u7F
R2
18k
R5 180R
R6 150R
R7 220R
R8 33R
R9 560R
R10
1k
R11
56R
PIN
6
7
8
9
10
.85
.1
.2
.5
1
5
Probe Current
Switch mA
P1
100R
Current
Adj
U3
LM394
R4
100R
D1 1N4148
D2 1N4148
U4
LM394
P2
1k
R12
18k
Zero
Adj
R13
18k
C9
470pF
Gain Adj Pots
P4
1k
P5
500R
P6
100R
R19 100R 1k5
R21 100R 680R
R22
150R
11
12
13
14
1
2
5
10
C7
4u7F
U1
AD524
OUT
R27
47R
16
17
Output
BNC
C8
4u7F
C5
0.1uF
Bridge Balance
Indication LED
R24
100k
C2
0.1uF
U2
LM308
T1
337
T2
327
R25
470R
R26
820R
C3
0.1uF
R23
2k2
C4
100pF
D5
D6
Red
L.H.
R.H.
R14
560R
P3
100R
D3
1N4732
Gain
Adj
R5000
U5
LM394
15
Gain Switch
x1000
Probe
BNC
2
1k Bal
Pot
4
1
3
VR1
LM317LH
ADJ
+Vout
Vin
R3
1k
0-1k
1-2k
S1
SW-SPDT
Resistance
Range S/W
R15
2k2
D4
Std
Red
R16
3k3
R17
3k3
Edge Connector
J1
DIN32RA
Title
CONSTANT CURRENT ANEMOMETER
Size
A4
Number
CCA.S01
Revision
Date: 9-MAR 1995
Sheet 1 of 1
File: CCA/1
Drawn By: I.MILLE

FILTER - AMPLIFIER

FRONT PANEL CONTROLS

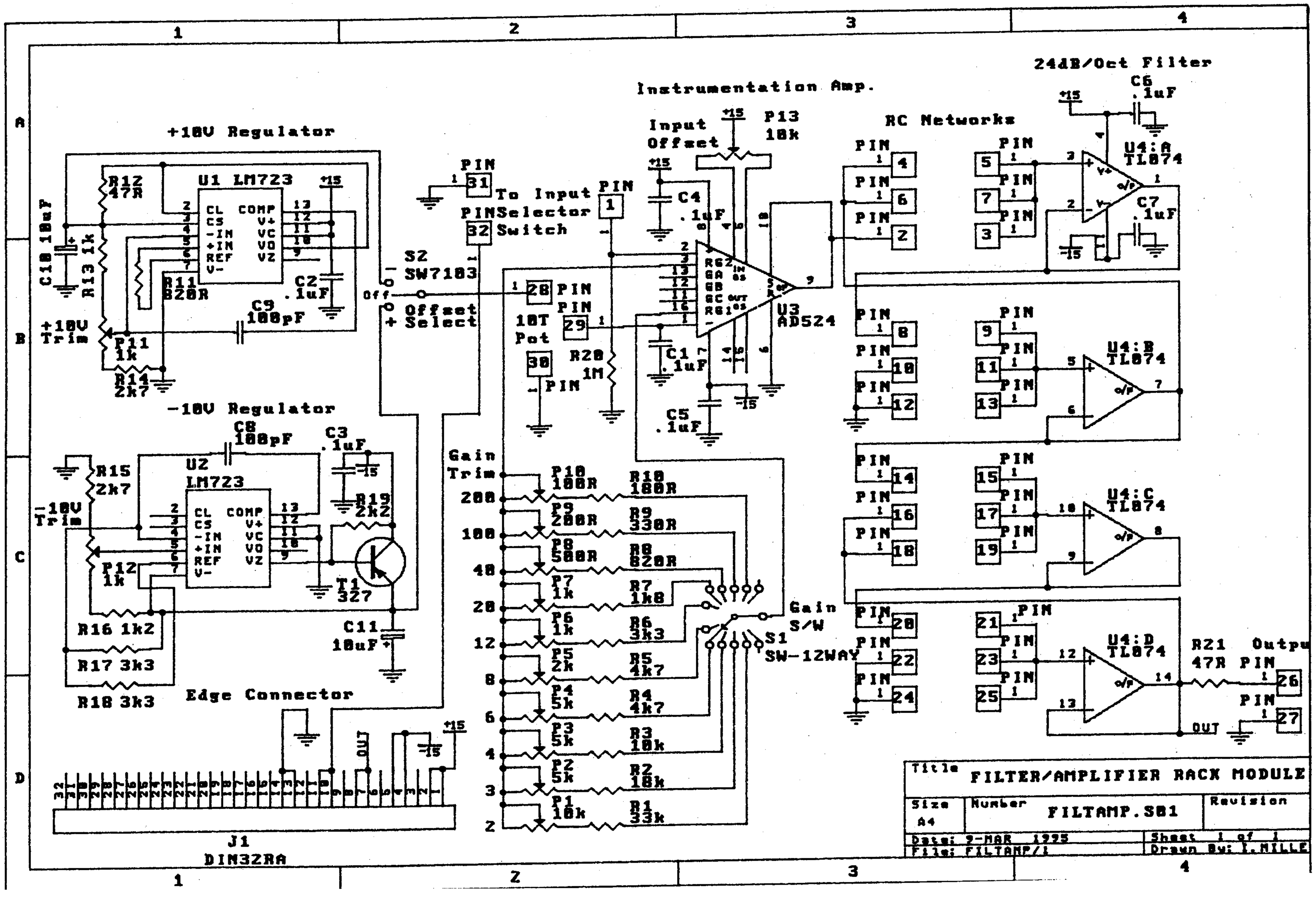


INTERNAL ADJUSTMENTS (Preset)

AMPLIFIER GAIN ADJUSTMENTS - Set for gains 1 to 200

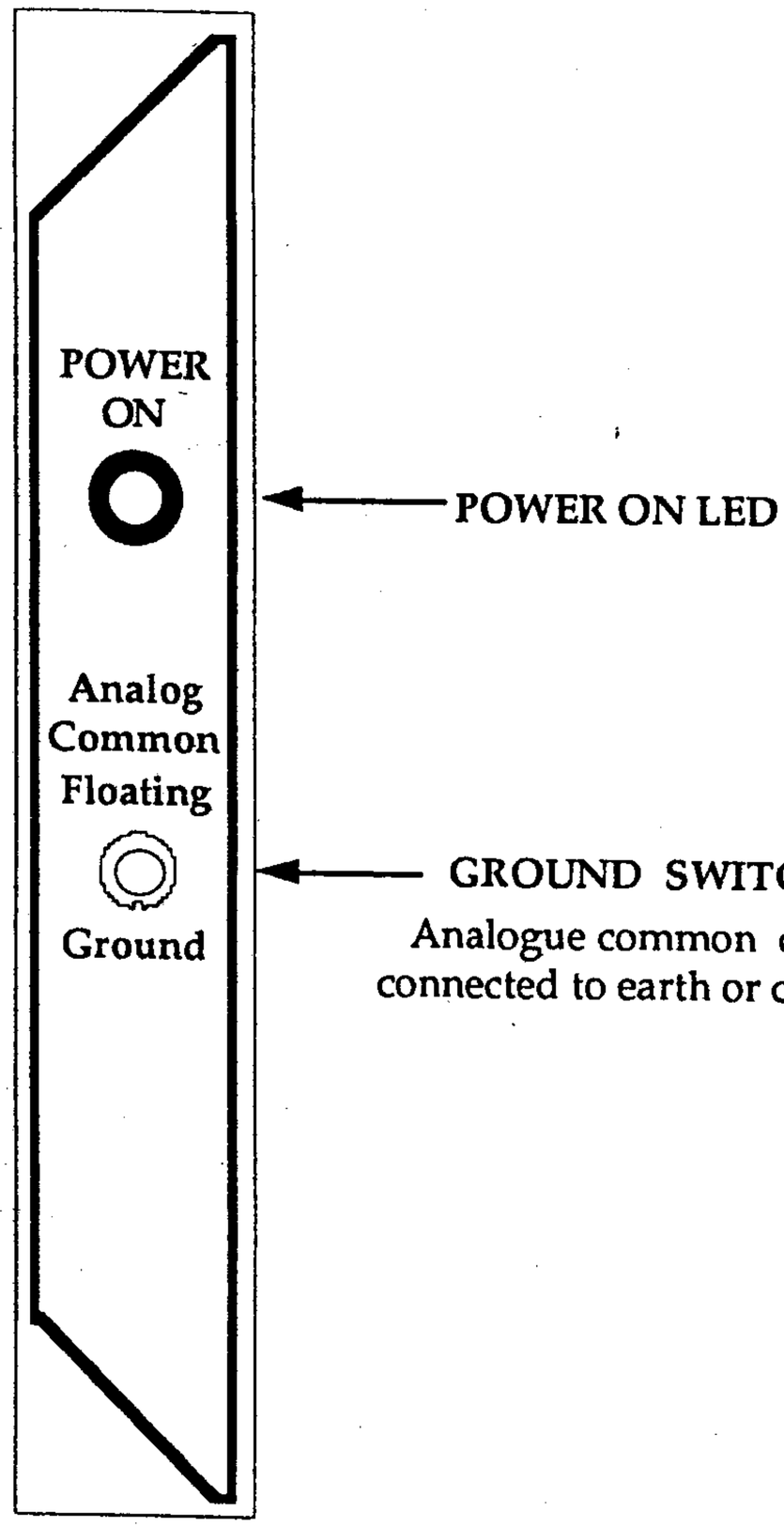
AMPLIFIER INPUT OFFSET - Adjust to zero with AD524 inputs shorted

OFFSET VOLTAGE REFERENCE ADJUST - Set to +10.000V and -10.000V


1
2
3
4
A
B
C
D
+18V Regulator
U1 LM723
R12 47R
C10 10uF
R13 1k
R11 820R
P11 1k
+18V Trim
R14 2k7
C2 .1uF
C9 100pF
+15
-18V Regulator
C8 100pF
C3 .1uF
U2 LM723
R15 2k7
-18V Trim
P12 1k
R16 1k2
R17 3k3
R18 3k3
R19 2k2
T1 327
C11 10uF
Edge Connector
J1
DIN3ZRA
PIN 31
To Input PIN Selector
32 Switch
S2 SW7183
Off
Offset + Select
PIN 28
10T Pot
PIN 29
30 PIN
R20 1M
Instrumentation Amp.
Input Offset
P13 10k
C4 .1uF
C1 .1uF
C5 .1uF
U3 AD524
Gain Trim
P10 100R
R10 100R
P9 200R
R9 330R
P8 500R
R8 820R
P7 1k
R7 1k8
P6 1k
R6 3k3
P5 2k
R5 4k7
P4 5k
R4 4k7
P3 5k
R3 10k
P2 5k
R2 10k
P1 10k
R1 33k
Gain S/W
S1 SW-12WAY
RC Networks
PIN 4
PIN 6
PIN 2
PIN 8
PIN 10
PIN 12
PIN 14
PIN 16
PIN 18
PIN 20
PIN 22
PIN 24
24dB/Oct Filter
C6 .1uF
U4:A TL074
C7 .1uF
U4:B TL074
U4:C TL074
U4:D TL074
R21 47R
Outpu
PIN 26
PIN 27
OUT
Title
FILTER/AMPLIFIER RACK MODULE
Size A4
Number FILTAMP.SB1
Revision
Date: 9-MAR 1995
File: FILTAMP/1
Sheet 1 of 1
Drawn By: I.MILLE

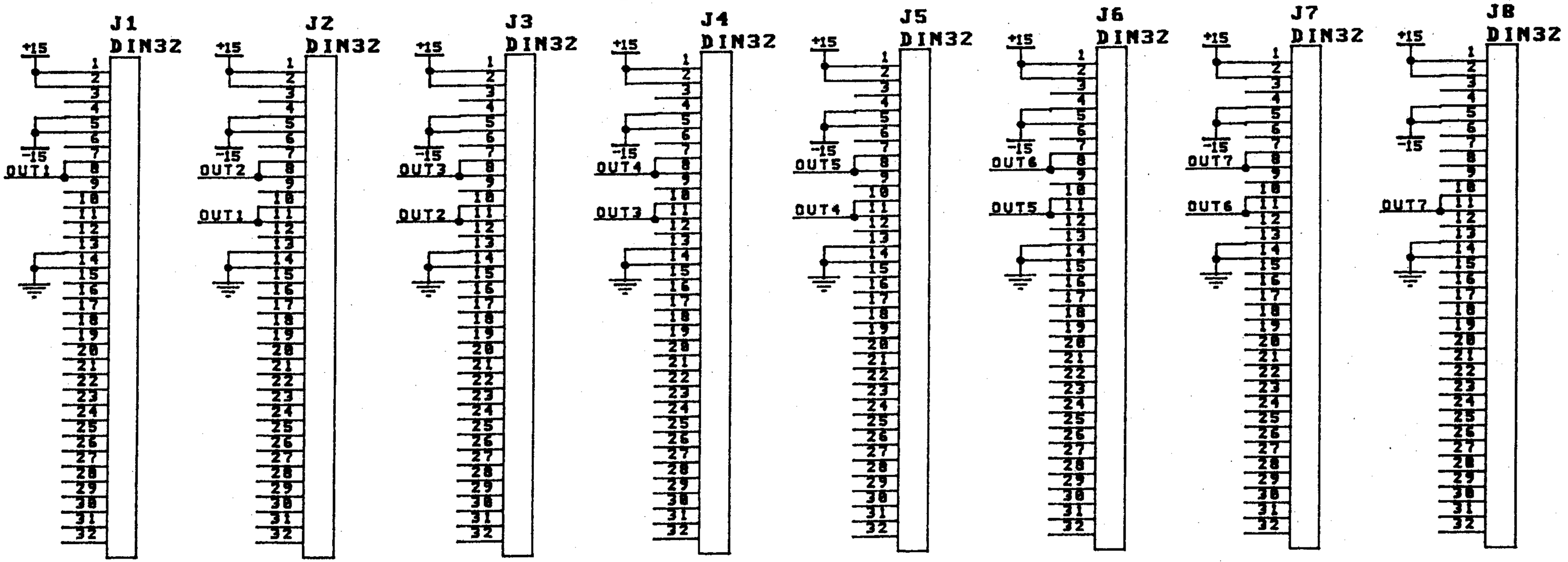
POWER SUPPLY

FRONT PANEL CONTROL

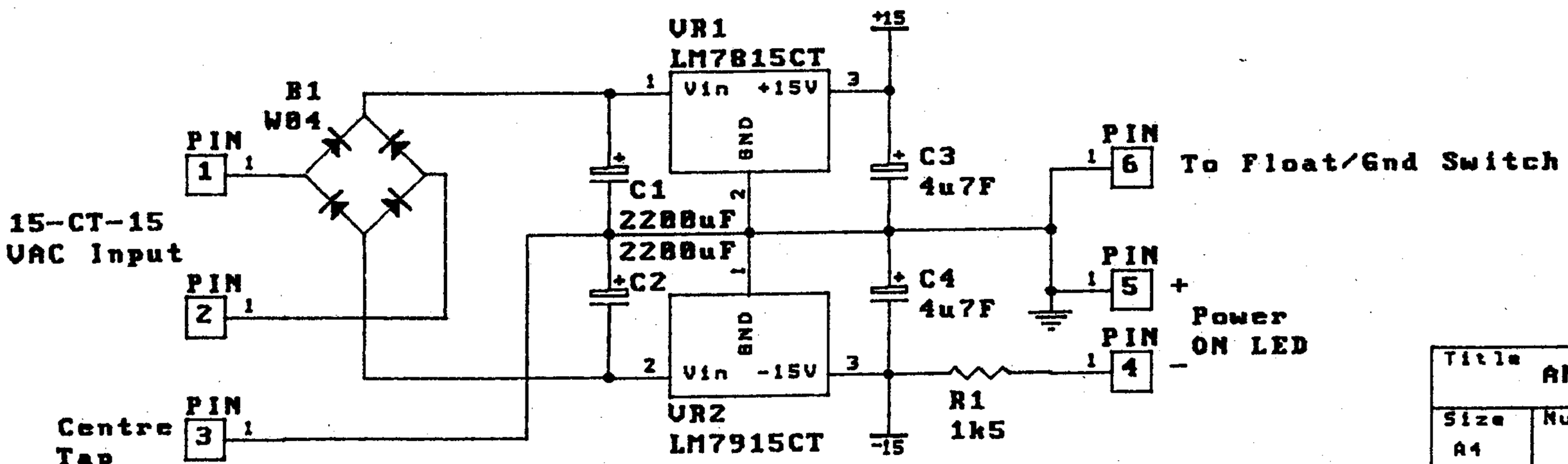


POWER SUPPLY IS LOCATED ON THE RACK BACK PLANE

Plug In Board Edge Connectors



+15/-15 Volt Power Supply



Title: ANEMOMETER RACK POWER SUPPLY		
Size: A4	Number: RACKPWR.S01	Revision:
Date: 18-FEB 1995		Sheet 1 of 1
File: RACKPWR/1		Drawn By: I.MILLER

ELECTRICAL SPECIFICATIONS

CONSTANT TEMPERATURE ANEMOMETER

Probe Wire Sizes Supported:	1 → 5 µm
Maximum Probe Current:	100 mA
~~Maximum~~ Probe Resistance:	4Ω optimised for 7-40 Ω
Noise Output 9.6Ω wire at 1.6 overheat ratio:	1.3 µV/√Hz RMS
Output Voltage Swing:	0 → +12 Volts
Output Impedance:	50Ω

CONSTANT CURRENT ANEMOMETER

Amplifier Noise with shorted input at 2000 gain:	2.8 nV/√Hz RMS referred to input
Total Noise with 500Ω Probe at 0.2 mA current:	4.2 nV/√Hz RMS referred to input
Frequency Response:	Flat to 3.5 kHz (bandwidth restricted)
Output Voltage Swing:	±12 Volts
Output Impedance:	50Ω

FILTER AMPLIFIER

Input Impedance:	1 MΩ Resistive
Frequency Response at all Gains:	Flat, restricted by filter rolloff
Filter Response:	3 dB down at selected frequency
	24 dB/Octaved Butterworth response
Noise with Input Shorted:	9 nV/√Hz RMS referred to input

Output Voltage Swing:	±12 Volts
Output Impedance:	50Ω

RACK POWER SUPPLY

Power Input:	240 Volt A.C. 50 Hz nominal
Power Output:	±15 Volt nominal at 500 mA
Module Driving Capacity:	Any combination of modules but with a maximum of 4 Constant Temperature Anemometers running