BLK	0
BRN	1
RED	2
ORG	3
YEL	4
GRN	5
BLU	6
VLT	7
GRY	8
WHT	9

V^- pin 7 connects to −Sense

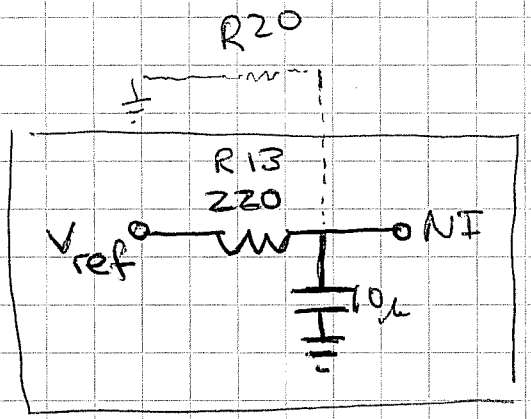
V^+ pin 12 connects to V_C pin 11 and then goes to ??

CL (pin 2) goes to ??

CS (pin 3) goes to + output

INV INP (pin 4) goes to R14 R4R = 2.4K resistor goes to − Sense 2.4K to ground.

NI INP (pin 5) to RRBrn (220Ω) to pin 6 also goes to capacitor 10μf to Vref & to − Sense



Vref (pin 6) goes to 220Ω to NI

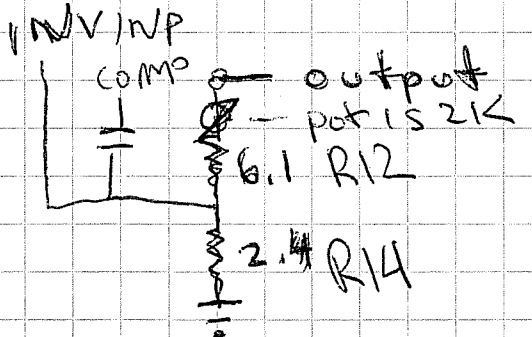
pin 8, 9, 10 all connected = V_{out}, V_Z, Nc goes to power-things

pin 11, 12 connected, goes to ?? (see above)

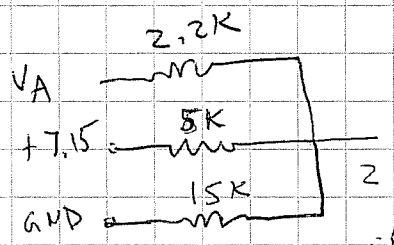
pin 13, 14 = Freq comp, goes to cer. disk, then to pin 4 = INV inp

INV INP also goes to ADJ POT via some other resistors

BLU BRN Red = 6.1K to pot to + sense



if V_A is not connected, then the output will go too high.



if NC, 5.4 V
if 0, 2 V

$$\frac{0-2}{R} + \frac{7.15-2}{5} + \frac{0-2}{15} = 0$$

$$-\frac{2}{R} + 1.03 - .13 = 0$$

$$\frac{2}{R} = 0.9$$

$$R = 2.2K$$

$V = IR$
$I = \frac{V}{R}$

at + 5V,

$$\frac{5-x}{2.2} + \frac{7-x}{5} + \frac{0-x}{15} = 0$$

$$2.27 - \frac{x}{2.2} + 1.4 - \frac{x}{5} - \frac{x}{15} = 0$$

$$-.45x \quad -.2x \quad -.07x$$

$$3.67 = .72x$$

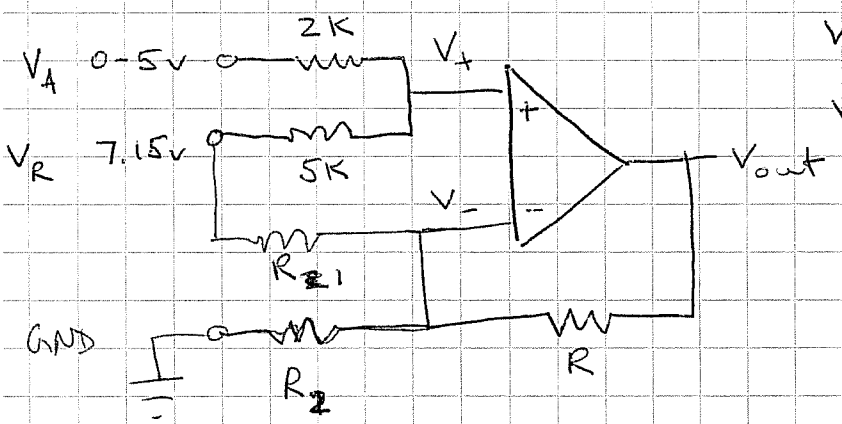
$$5.1\text{ V} = x$$ well, that's closer.

control voltage divider:

$V_A = 0 \rightarrow 5v$

$V_+ = 2.04 \rightarrow 5.61v$

$V_{out} = 0 \rightarrow 12v$



feedback voltage divider:

$$\frac{7.15-2.04}{R_1} + \frac{0-2.04}{R_2} + 0-2.04 = 0$$

$$\frac{5.11}{R_1} - \frac{2.04}{R_2} = 2.04$$

$$\frac{1}{R_1} = 0.40 + \frac{0.40}{R_2}$$

$$\frac{7.15-5.61}{R_1} + \frac{0-5.61}{R_2} + 12-5.61 = 0$$

$$\frac{1.54}{R_1} - \frac{5.61}{R_2} = -6.39$$

$$\frac{1}{R_1} = \frac{3.64}{R_2} - 4.15 = 0.40 + \frac{0.40}{R_2}$$

$$\frac{3.24}{R_2} = 4.55$$

$R_2 = 0.71$

$R_1 = 1.04$

$R = 10K$
$R_1 = 10.4K$
$R_2 = 7.1K$

for 0 - 24v

$$\frac{1}{R_1} = 0.40 + \frac{0.40}{R}$$

$$\frac{7.15-2}{R_1} + \frac{0-2}{R_2} + \frac{0-2}{1} = 0$$

$$\frac{5.15}{R_1} - \frac{2}{R_2} = 2$$

$$\frac{1}{R_1} = 0.39 + \frac{0.39}{R_2}$$

$$\frac{7.15-5}{R_1} + \frac{0-5}{R_2} + \frac{24-5}{1} = 0$$

$$\frac{2.15}{R_1} - \frac{5}{R_2} + 19 = 0$$

$$\frac{1}{R_1} = \frac{2.33}{R_2} - 8.84 = 0.39 + \frac{0.39}{R_2}$$

$$\frac{1.94}{R_2} = 9.23$$

$$R_2 = 0.21$$

$$R_1 = 0.45$$

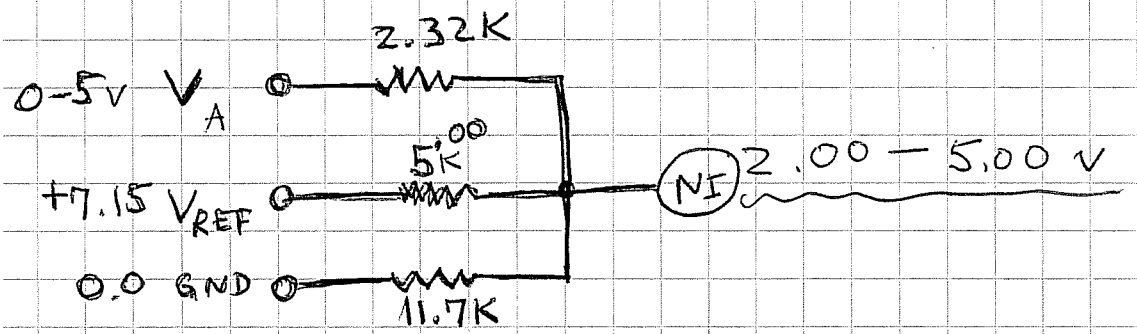
if $R_2 = 2.4\,K$ (too V_{Ref})
then need $R_1 = 5.1K$
and $R = 11.4K$
so enter value of pot + resistor = $11.4K$

$$\frac{19}{1} + \frac{2.15}{.45} - \frac{5}{.24} =$$

$19 + 4.77 - 23.80 = -.03$ ✓

$$-2 + \frac{5.15}{.45} - \frac{2}{.21} =$$

$-2 + 11.44 - 9.52 = -.08$ ✓

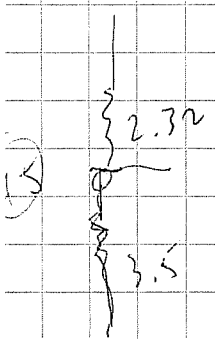


$$\frac{0-2}{R} + \frac{7.15-2}{5} + \frac{0-2}{11.7} = 0$$

$$-\frac{2}{R} + 1.03 - 0.17 = 0$$

$$\frac{2}{R} = .86$$

$$R = 2.32K$$



$$\frac{5-x}{2.32} + \frac{7.15-x}{5.00} + \frac{0.0-x}{11.7} = 0$$

$$2.16 - 0.43x + 1.43 - .2x - .09x = 0$$

$$.72x = 3.59$$

$$x = 4.99 \text{ perfect.}$$

1. to test suggest use bench power supply to provide 0 to 5v control.

2. connect +S to + out and -S to -out on Power-one.

3. connect - out to ground at bench supply. (for both power supplies!)

4. Replace 220Ω R13 with 5.0K resistor

5. Add 11.7K resistor at R20

6. Attach 0-5v control voltage through a 2.3K resistor, at R13 or R20, at end which is next to "R13" or "R20" label.

7. Replace 6.1K R12 with 10.4K

8. Attach 5.1K resistor between other end of R13 (away from "R13" label) and R14, (at the end next to the R14 label).

That's it!

need: 2.3K
5.0K
5.1K (5.0 ok)
11.7K
10.4K

For 0-12v

$$\frac{7.15-5}{R_1} + \frac{0-5}{R_2} + \frac{12-5}{1} = 0$$

$$\frac{2.15}{R_1} - \frac{5}{R_2} + 7 = 0$$

$$\frac{1}{R_1} = \frac{2.33}{R_2} - 3.26 = 0.39 + \frac{0.39}{R_2}$$

$$\frac{1.94}{R_2} = 3.65$$

$$R_2 = 0.53$$

$$R_1 = 0.89$$

R14 is Yellow - Purple (?) - Red

= 4.7 K

R12 is Red - Red - Red = 2.2K pot is 2K

Same instructions except

$R_2 = 4.7\,K$

$R_1 = 7.89K$

$R = 8.87\,K = \underline{7.9K + 1K}$

V = IR

7. Replace 2.2K R12 with 7.9K

8. Attach 7.9K resistor between (etc.)

heat tape
5a @ 12v
2.4Ω
two 4.8Ω
5a @ 24v

24V SUPPLY

R13: 218.5Ω ORIGINALLY

R12: 5.05kΩ ORIGINALLY

12V SUPPLY

R13: 218Ω

R12: 2.18kΩ

After Adjusting Pot:

Control V off: 24V supply $V_{OUT} = 23.99$

Control V ON:

V_{CNTL}	V_{OUT}
5.00	24.00
4.50	

VAC	TIME
8×10^{-3}	8:30 AM 20 JULY
52.5×10^{-3}	9:30 AM 21 JULY
91.0×10^{-3}	9:30 AM 22 JULY
135×10^{-3}	1:30 PM 23 JULY

~8:30 AM 20 JULY
8×10^{-3} mbar

9:30 21 July 52.5×10^{-3} mbar

Initial to pump
Time ~ 10-60 sec?

Run pump at lowish Voltage
Set Heat tape V using:

$P_{TAPE} = (T_{set} - T_{WATER\ FINE}) \cdot 200\ W/°C$

Heat tape $R_T = \frac{12V}{5A} = 2.4\Omega$

$V_{TAPE} = \sqrt{P_{TAPE} \cdot R_{TAPE}}$