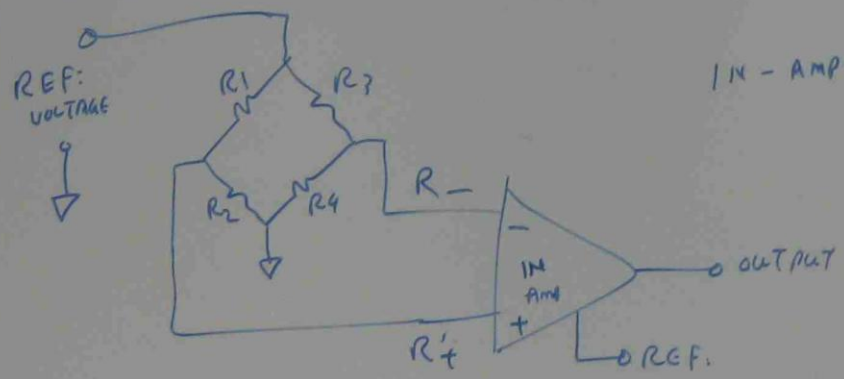
INSTRUMENTATION AMPLIFIER

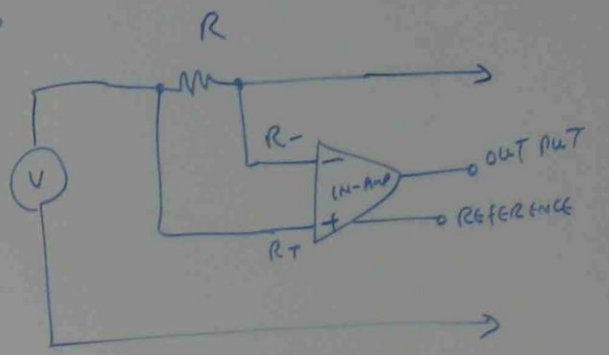


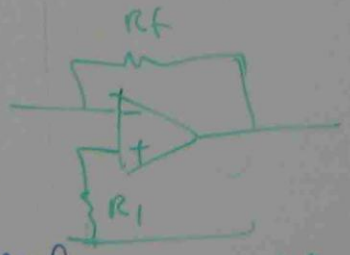
IN-AMP = INSTRUMENTATION AMPLIFIER

AN INSTRUMENTATION AMPLIFIER IS A CLOSED LOOP GAIN BLOCK THAT HAS A DIFFERENTIAL INPUT THAT IS SINGLE ENDED WITH RESPECT TO REFERENCE TERMINAL.

UNLIKE AN OP-AMP WHICH HAS IT'S CLOSED LOOP GAIN DETERMINED BY EXTERNAL RESISTORS, AN IN-AMP EMPLOYS AN INTERNAL FEEDBACK RESISTOR NETWORK THAT IS ISOLATED FROM SIGNAL INPUT TERMINAL.

IN LINE CURRENT MEASUREMENT





$$\text{GAIN} = \frac{Rf}{R_1}$$

PROPERTIES of INSTRUMENTATION AMPLIFIER

- HIGH AC AND DC COMMON MODE REJECTION RATIO
- Low OFF SET VOLTAGE AND OFF SET VOLTAGE DRIFT $1\mu V/^{\circ}C \longrightarrow 10\mu V/^{\circ}C$
- A MATCHED HIGH INPUT IMPEDANCE $10^{9}\,\Omega \longrightarrow 10^{12}\,\Omega$
- Low INPUT BIAS AND OFFSET CURRENT ERRORS
  - BIPOLAR $1nA \longrightarrow 50nA$
  - FET $1pA \longrightarrow 50pA$
- Low NOISE — $10nV/\sqrt{Hz}$ @ $1kHz$
- Low NON LINEARITY
- SIMPLE GAIN SELECTION
- ADEQUATE BAND WIDTH $500\,kHz \longrightarrow 4\,MHz$

APPLICATION

MEDICAL INSTRUMENTATION

MONITOR AND CONTROL ELECTRONICS

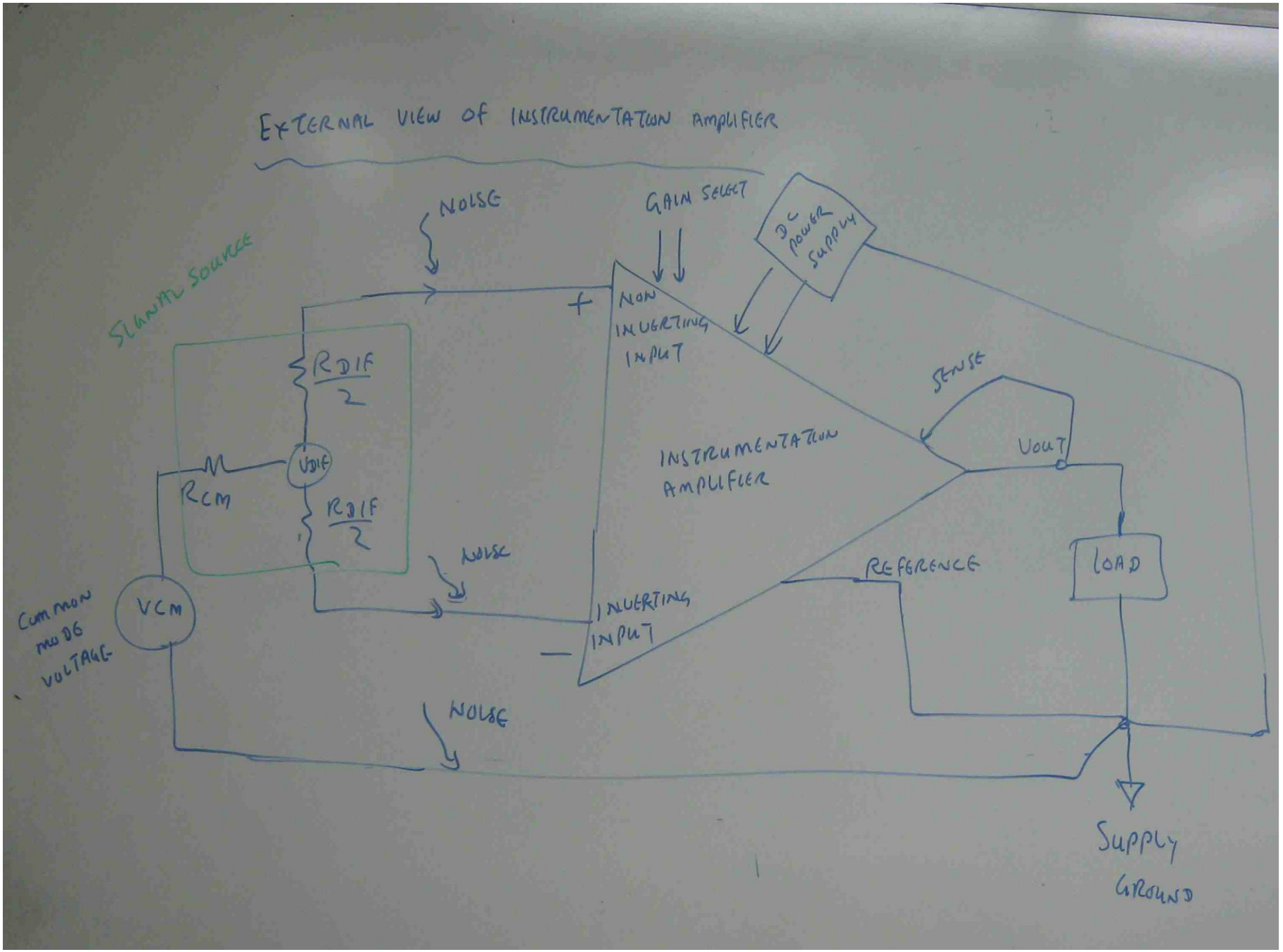
SOFTWARE PROGRAMMABLE APPLICATIONS

AUDIO APPLICATIONS.

HIGH SPEED SIGNAL CONDITIONING

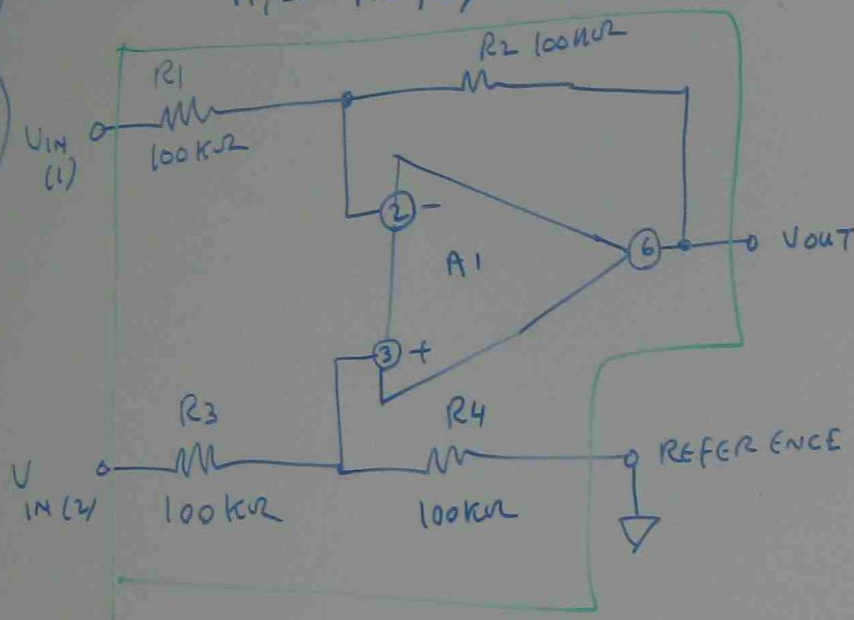
VIDEO APPLICATIONS

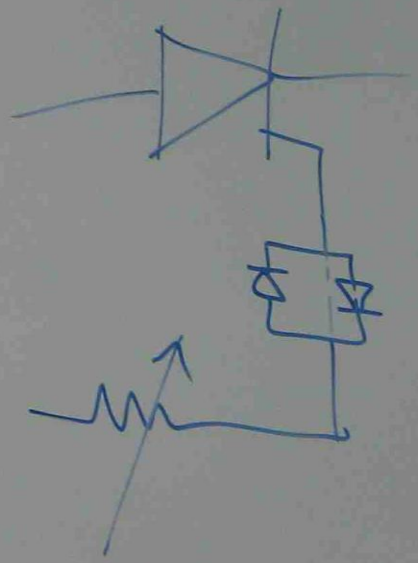
POWER CONTROL APPLICATIONS.

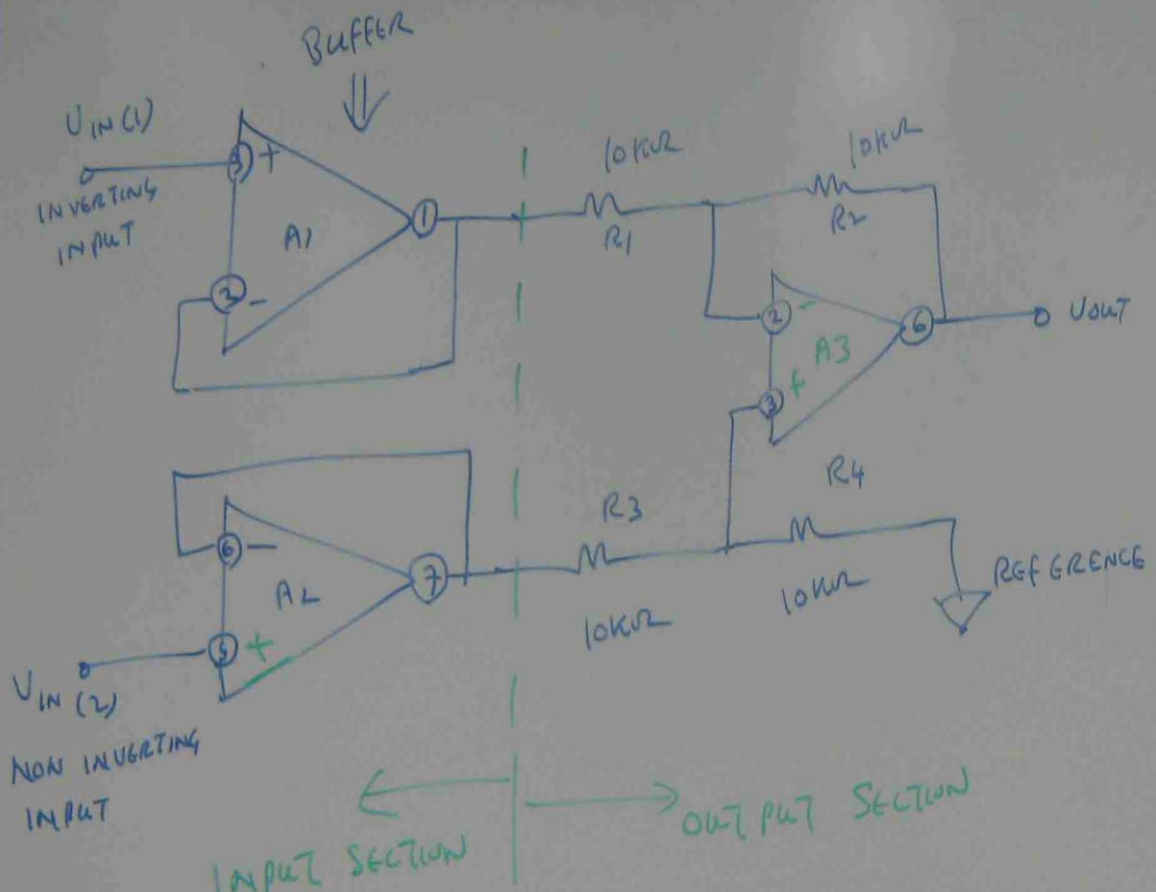

EXTERNAL VIEW OF INSTRUMENTATION AMPLIFIER
SIGNAL SOURCE
NOISE
GAIN SELECT
DC POWER SUPPLY
NON INVERTING INPUT
+
RDIF/2
VDIF
RCM
RDIF/2
SENSE
VOUT
INSTRUMENTATION AMPLIFIER
NOISE
REFERENCE
LOAD
COMMON MODE VOLTAGE
VCM
INVERTING INPUT
−
NOISE
SUPPLY GROUND

INSIDE VIEW OF INSTRUMENTATION AMPLIFIER

A_1 = AD705, OP97







SUBSTRACTOR CIRCUIT WITH INPUT BUFFERING

$$V_{OUT} = \left(V_{IN(1)} - V_{IN(2)}\right)\frac{R_2}{R_1}$$

for $R_1 = R_3$

$R_2 = R_4$

A_1 & A_2 → AD706, OP 247

A_3 → AD704, OP 97

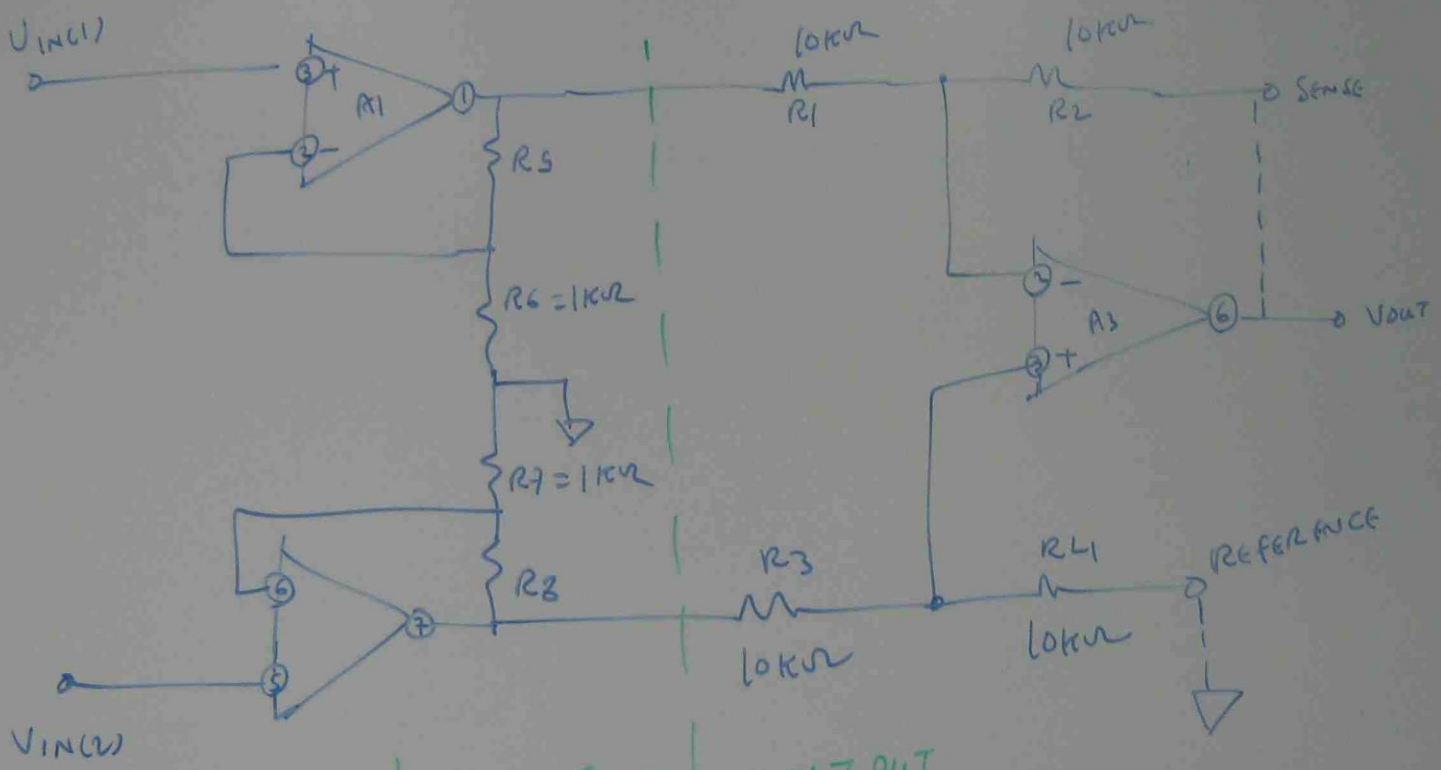
$V_1 - V_2$

$V_1 - 10V_2$

$10V_1 - V_2$

$10V_3 - 5V_2$

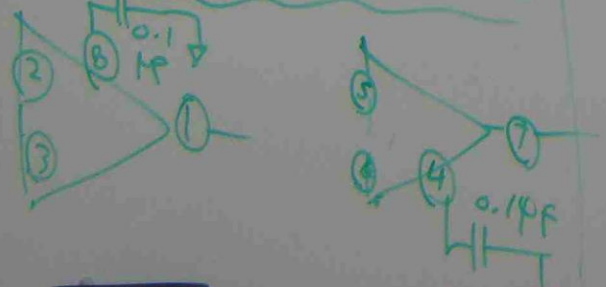
A BUFFERED SUBTRACTOR WITH BUFFER AMPLIFIERS OPERATING WITH GAIN



INPUT SECTION ← → OUTPUT SECTION

REDUCED CMV

COMMON MODE VOLTAGE



$$V_{OUT} = (V_{IN(2)} - V_{IN(1)})\left(1 + \frac{2R_2}{R_6}\right)\left(\frac{R_2}{R_1}\right)$$

FOR $R_1 = R_3$, $R_2 = R_4$, $R_5 = R_6$