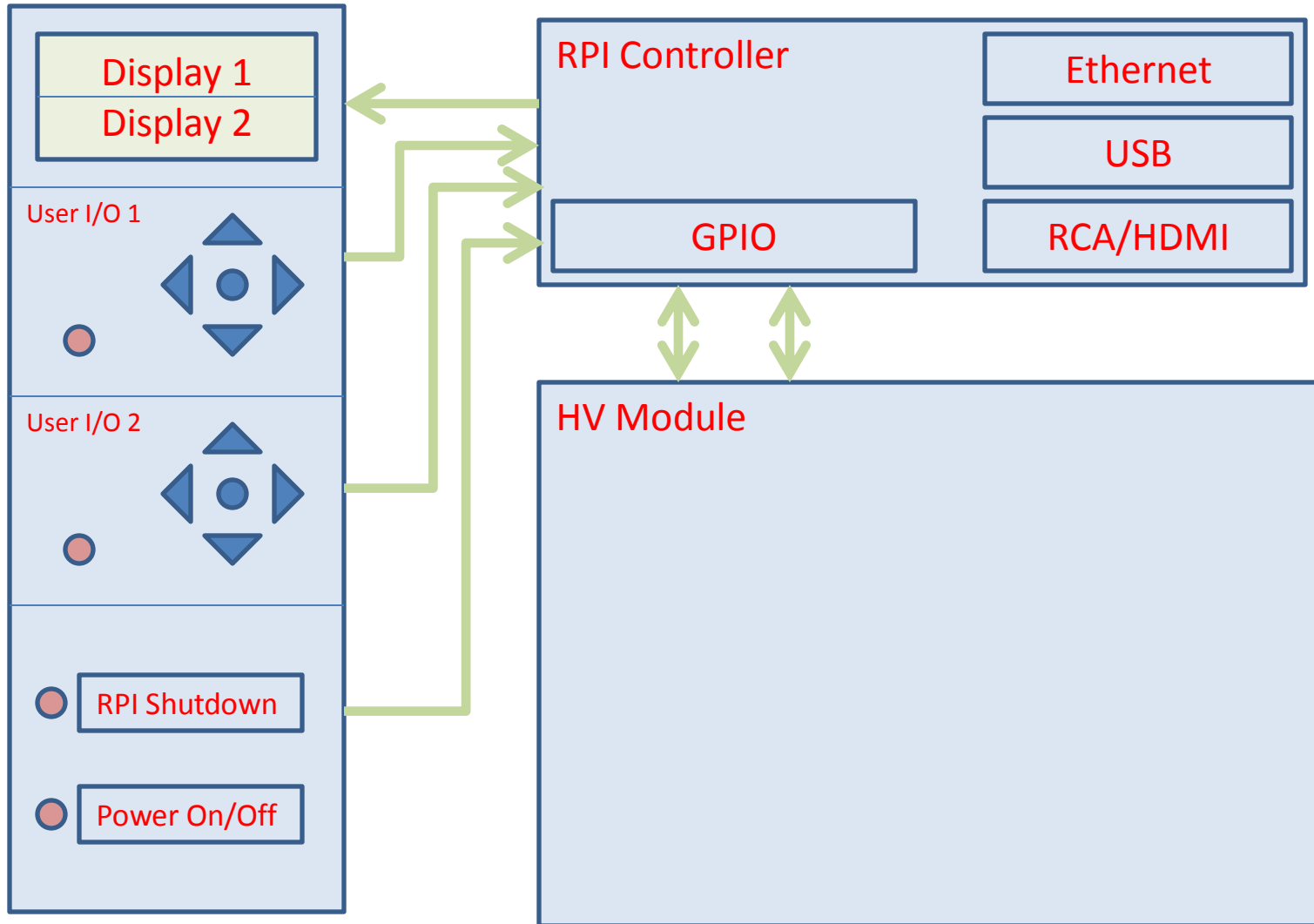


# HV Module Interface



# RPI Programming

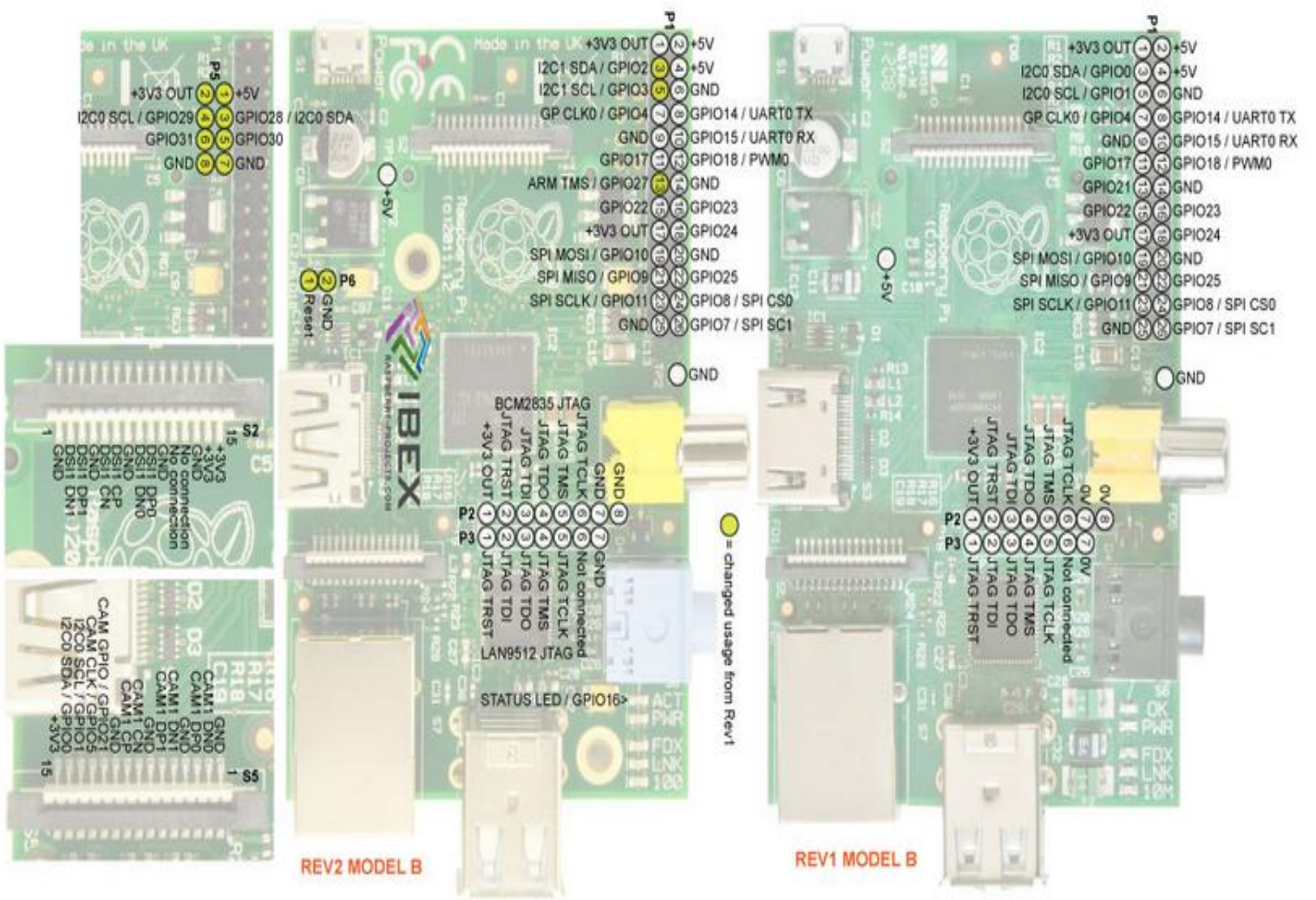
- Programming
  - Any Choice (Typically Python or C)
- Interface
  - Ethernet for internet control
  - USB and Video output for direct control

# RPI Controller

- Controlling
  - Ethernet
  - USB
  - User I/O buttons
- Hardware
  - GPIO Pins (SPI and I2C compatible)

# RPI Pins

3.3V Output

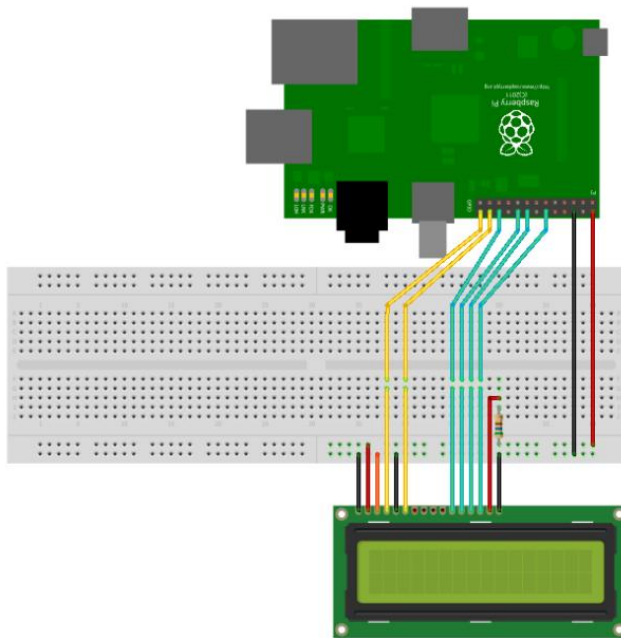


# Power

- MAIN Power
  - This will switch off the device (including the internal devices)
- RPI Shutdown
  - This will shutdown the RPI.
  - This needs to be done before pulling the plug.

# Display (16x2 or 20x4)

- LCD (SPI or I2C Preferred)
  - SPI or I2C control of the LCD will allow for less pins/wires



RPI direct LCD control (8 wires)

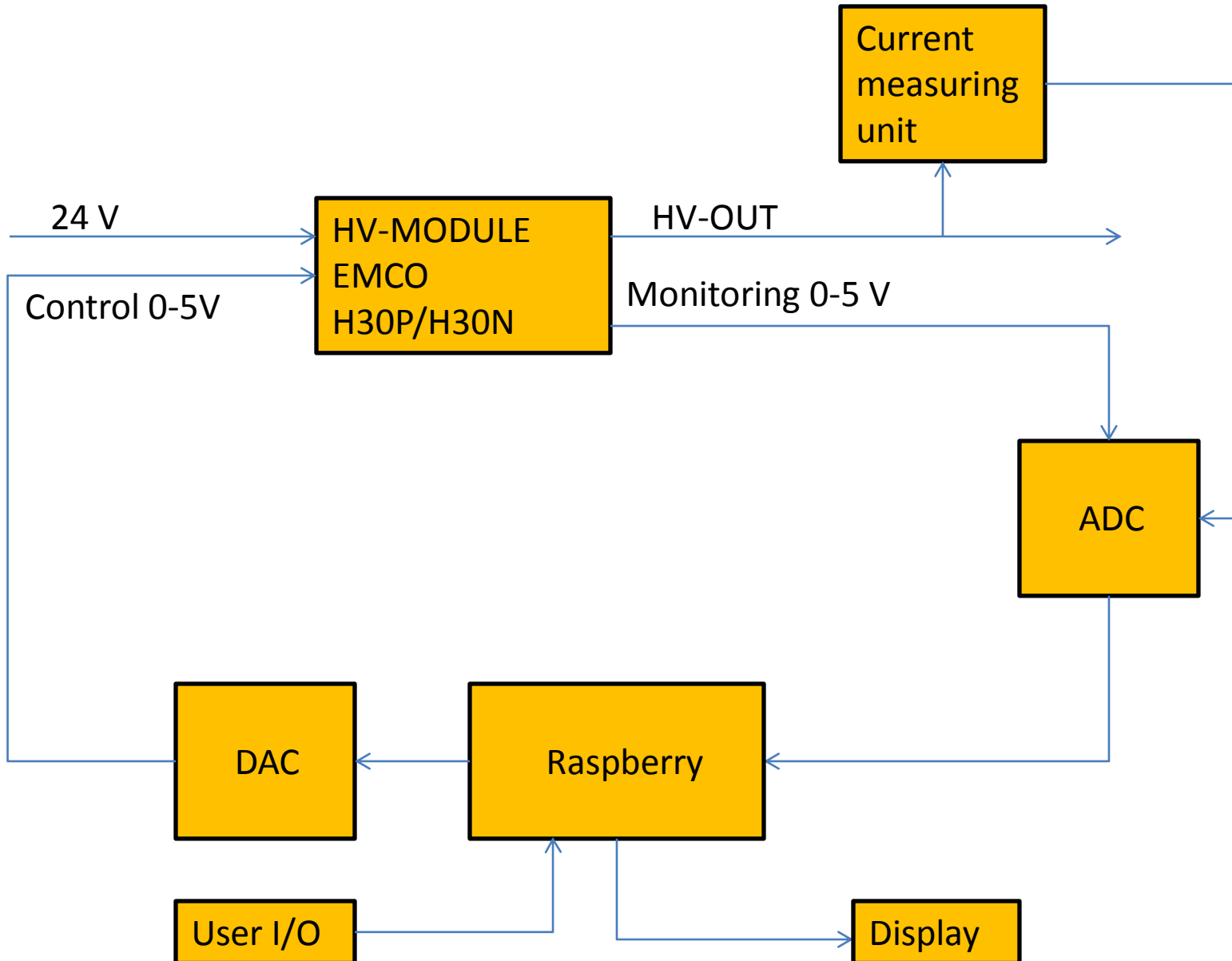


RPI I2C LCD Control(2 wires)

# User I/O

- Button Interface
  - 5 Buttons:
    - UP, DOWN, LEFT, RIGHT, and SELECT
  - UP and DOWN
    - Choose Channels
    - Increment Voltage
  - LEFT and RIGHT
    - Choose Voltage Level
  - SELECT
    - Set changes

# HV- Block Diagram



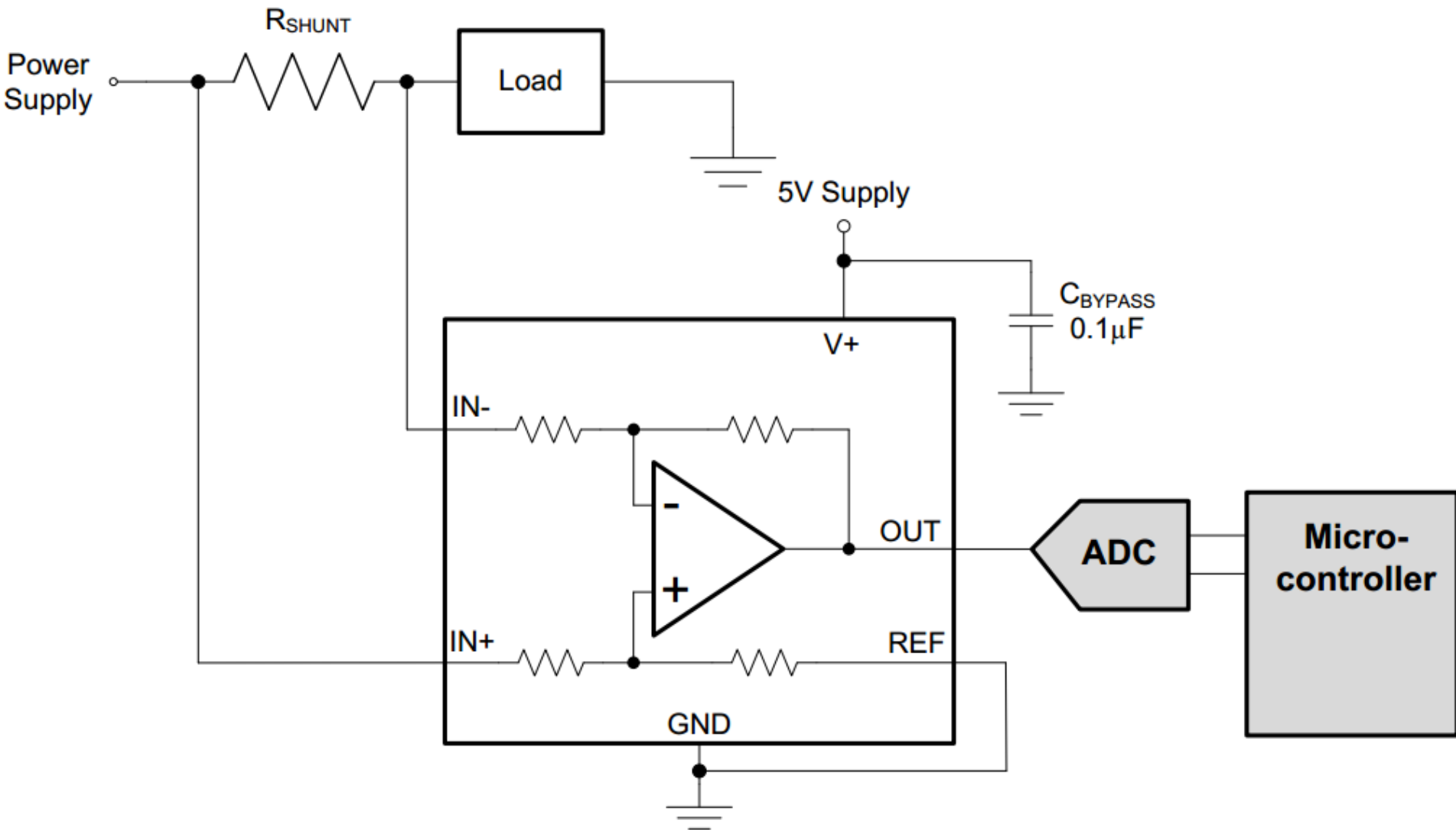


# ADC/Monitoring

- HV modules have voltage monitoring output
  - 0-5V
- AD7923 - ADC
  - Has 4 channels
  - Needs external clock (SCLK)
  - Can be controlled via SPI
- 4 inputs needed in total
  - 1 for Voltage/ HV Channel
  - 1 for Current/ HV Channel
- Do we have these in stock? (Price: 6,47\$)

# Current monitoring from HV line

- Texas instruments INA110 (Instrumentation amplifier) (Price: \$13,86 )
  - <http://www.ti.com/lit/ds/symlink/ina110.pdf>
- AD8207(Difference amplifier) (Price: \$5,67)
  - [http://www.analog.com/static/imported-files/data\\_sheets/AD8207.pdf](http://www.analog.com/static/imported-files/data_sheets/AD8207.pdf)TI ISO 121
- TI ISO 121 (isolation amplifier) (Price: \$135,86)
  - <http://www.ti.com/lit/ds/symlink/iso121.pdf>



**Figure 23. Typical Application**

# iCoupler

– [http://www.analog.com/static/imported-files/data\\_sheets/ADuM2280\\_2281\\_2285\\_2286.pdf](http://www.analog.com/static/imported-files/data_sheets/ADuM2280_2281_2285_2286.pdf)

-Price: \$3,43 (ADuM2280)

# DAC

- LTC2657
  - Controlled via I2C
- 2 Channels for HV controlling
- Do we have these in stock?
- Price 35,28\$

# HV-Module

- Power range?
  - EMCO has max 15W
- Ultravolt has modules with voltage and current monitoring
  - [http://www.ultravolt.com/uv\\_docs/FSeriesDS.pdf](http://www.ultravolt.com/uv_docs/FSeriesDS.pdf)

# Cost analysis

- RPI
  - \$ 39.95 (Adafruit)
- Display
  - (16x2) SPI/I2C LCD \$ 19.95 (Adafruit)
  - (16x2) LCD \$9.95 (Adafruit)
  - (20x4) LCD \$17.95 (Adafruit)
- ADC
  - AD7923 \$ 6,47\$
- DAC
  - LTC2657 \$35,28
- Icoupler
  - ADuM2280 \$3,43
- OPAMP
  - INA110 \$13,86
  - AD8207 \$5,67
- HV-Modules
  - EMCO H30P/H30N \$??? Probably ~\$200 each
- Estimation in total: \$120+ 400 + Other components = ~\$600