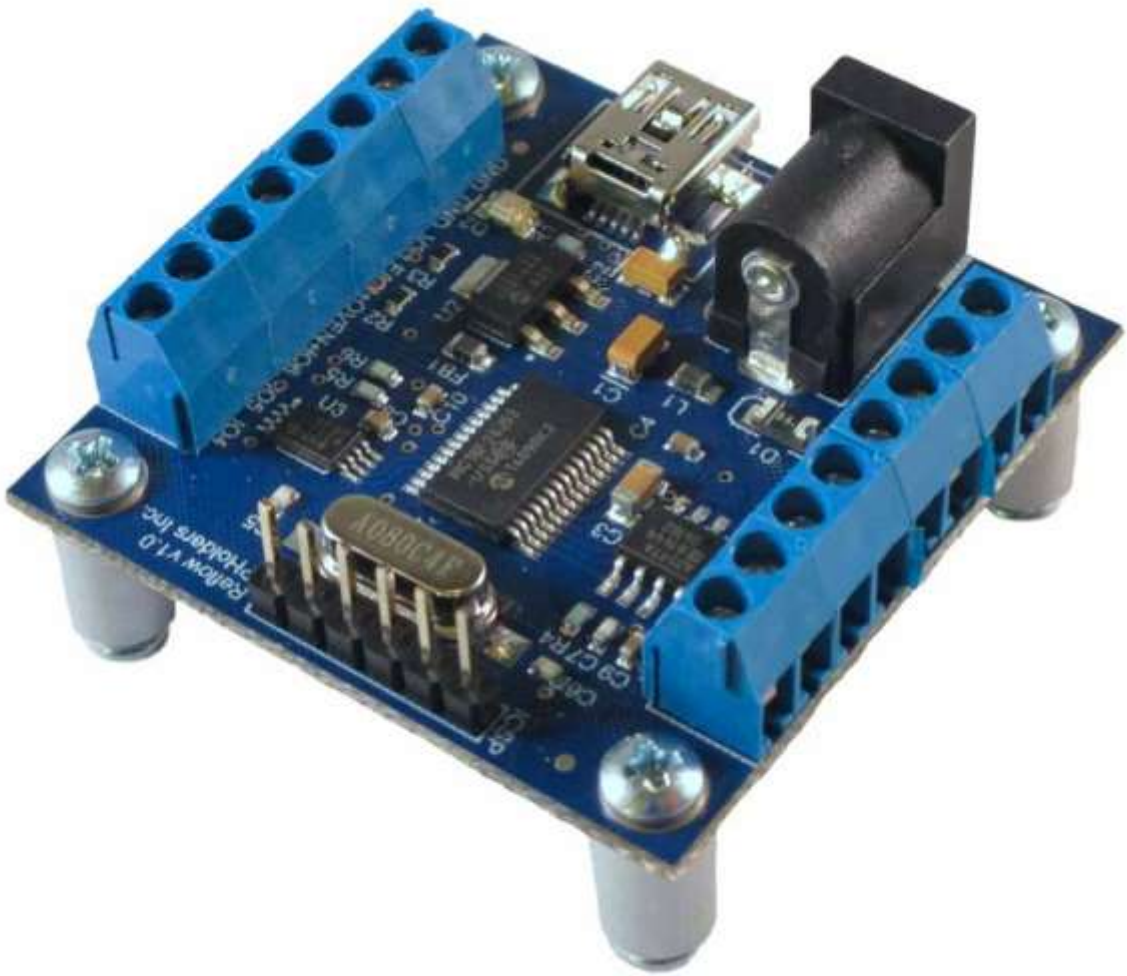
Reflow Controller 1.0

Hardware Manual

www.ReflowController.com



ipHolders inc.

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Features

•Small 1.75" x 1.75" size

•Microchip MCU

•USB 2.0

•12 bit ADC with 6 IO mapped to terminal blocks

•AD597 thermocouple amplifier

•Oven+ and Fan+ PID driven output

•Fast PID assembly routines

•ICSP programming header

•EEPROM for onboard profile / settings storage

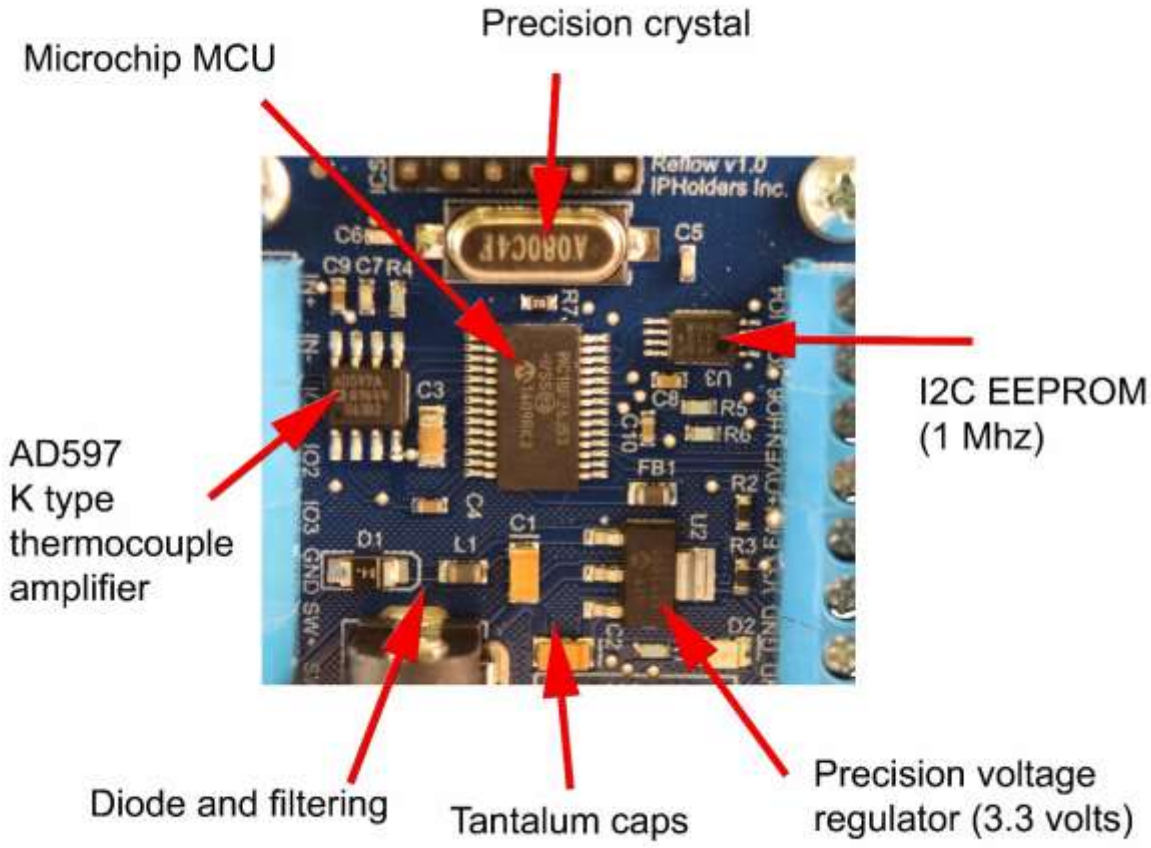
•Low noise 1% voltage regulator

The controller can read temperatures from 0 to 260 degrees Celsius using the K type thermocouple input and the 10 mV/C temperature sensor inputs.

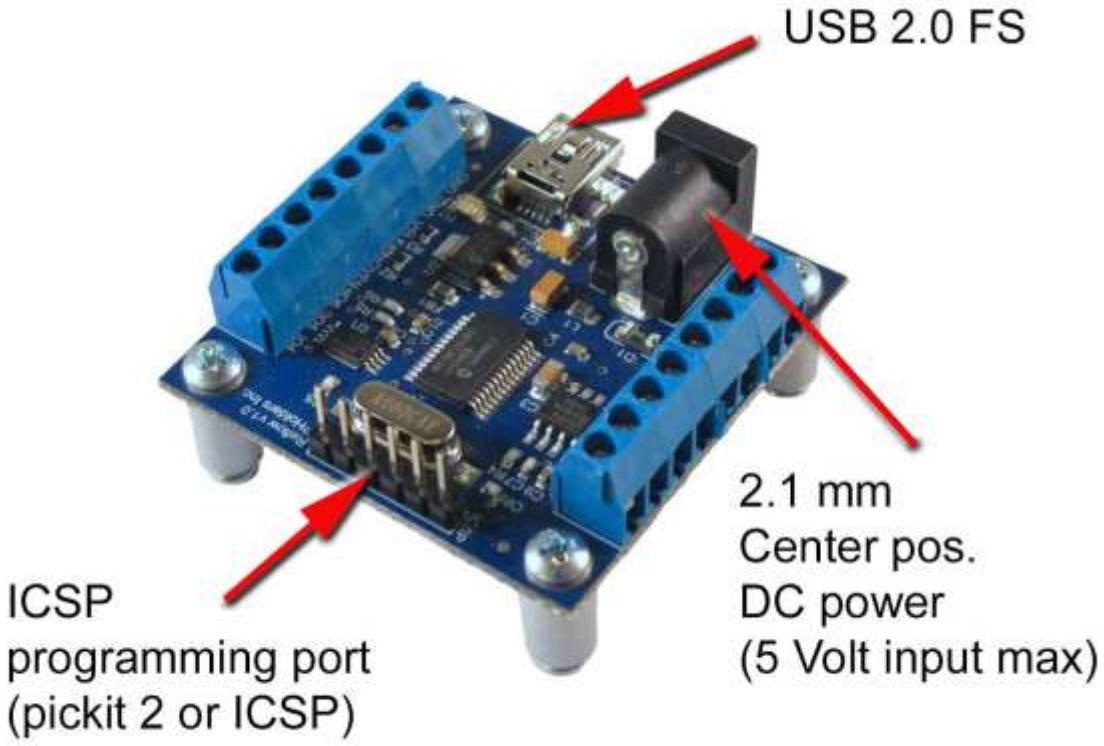
The controller uses a PID (proportional integral derivative) algorithm to drive the 2 outputs Oven+ and Fan+ to drive the system higher or lower.

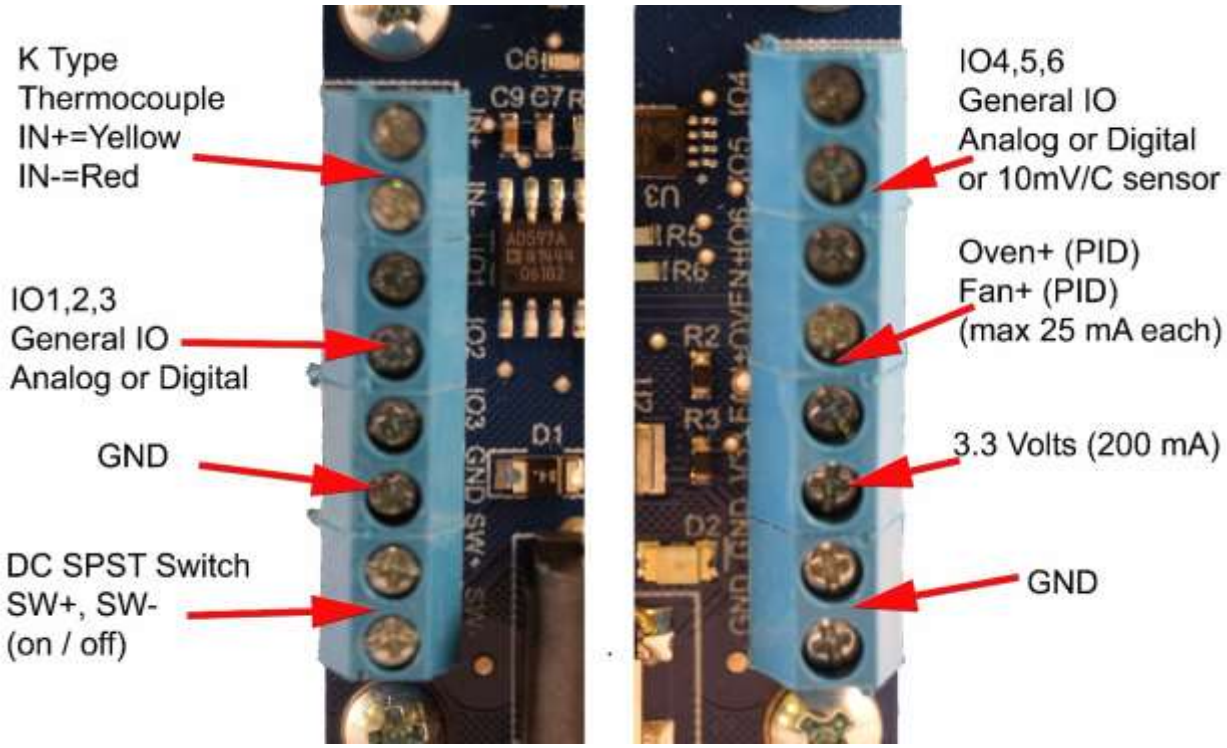
Additional IO are present for further programmability / expansion.

Hardware Layout



IO Ports and Connectors





IO Ports Descriptions

K Type Thermocouple:

This port takes a standard K type thermocouple and feeds it to the instrumentation amplifier.

The MCU can read temperatures from 0 deg Celsius to 260 deg Celsius.

ICSP Programming Port:

This port is used to reprogram the Microchip MCU. You can use a Pickit 3 or ICSP programmer from www.microchip.com.

DC Power Jack (2.1 mm Center Positive):

Ideal input voltage is 5 Volts DC, suggested to use a good switching power supply. Maximum input voltage is 6 Volts DC.

USB Port:

Standard USB 2.0 port, up to Full Speed transfer rates supported.

DC SPST Switch:

Intended to be used as a power on / off switch for the controller, the switch should be rated for 1 A max DC 6 Volts at a minimum.

GND and 3.3 Volt Ports:

The 3.3 Volt port can source a maximum of 200 mA of current total.

Oven+ and Fan+ Ports:

These outputs are PID driven, the Oven+ drives the system higher, and the Fan+ drives the system lower. Thus they have opposite functions, and when one is on, the other is off.

Both of these outputs should be used to drive a solid state relay at 3.3 Volts control voltage with a maximum sourcing current of 25 mA (3-15 mA is nominal for most SSR's).

IO 1 through 6 General Ports:

These ports can be input, output, analog input pins.

For analog input, a max of 3.3 Volts should be applied to the pin. The analog pins can read at 12 bit resolution.

For digital input, output, the pins are 3.3 Volts.

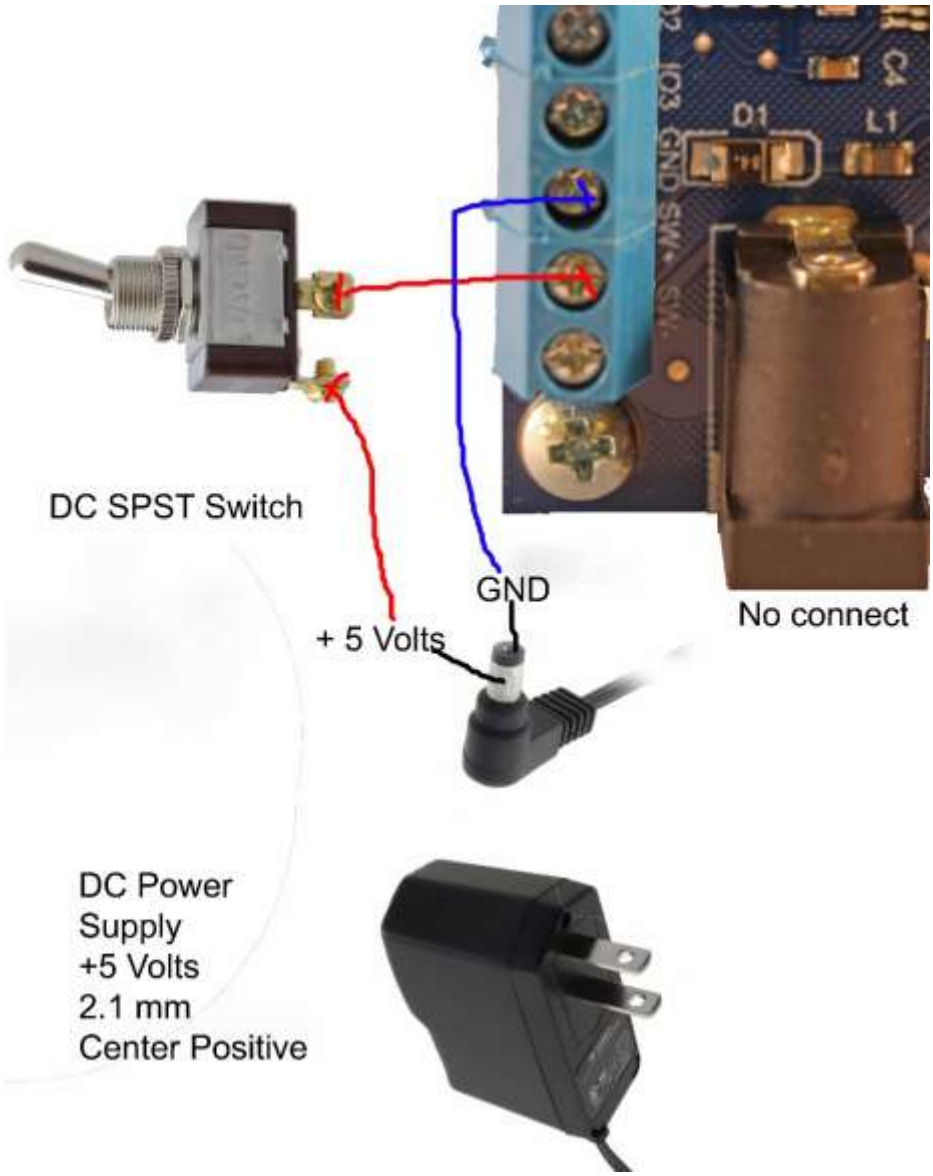
IO 4,5 are supported in Oven Tools and firmware 1.0 to be configurable as 10 mV/C analog sensor inputs without any code modification.

Powering the Controller

For safety, it is necessary to hook up a power switch to the controller. The switch being SPST it will simply break the DC input + through the switch.

There are two ways to supply power to the controller:

1) The DC jack is not needed, and power can be fed through the Switch + input only, and GND connected to the GND terminal screw.

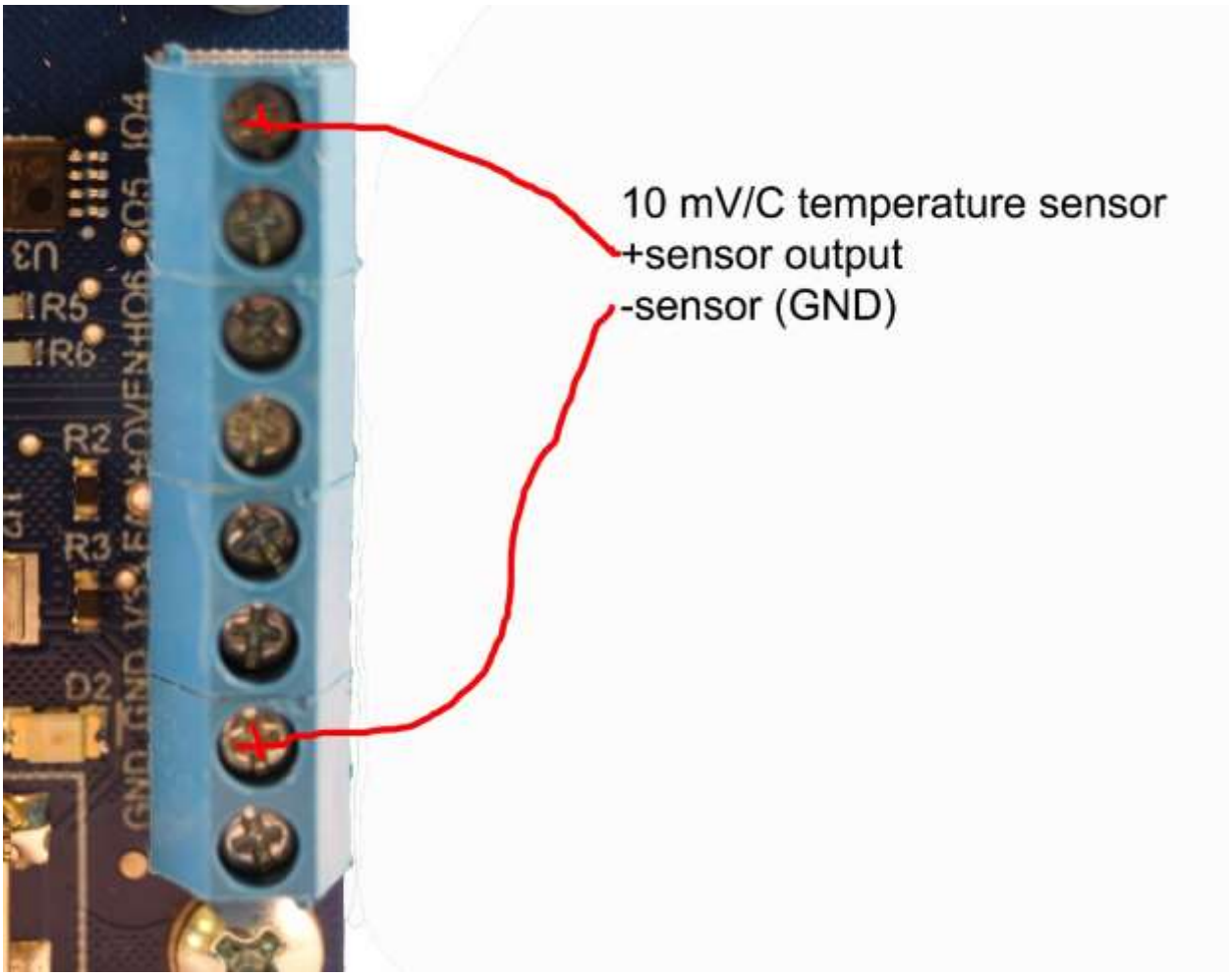


2) To use the DC jack, then hook up a 2.1 mm center positive DC power supply to the DC power jack and hook up the positive + path through the SPST switch.

Using IO 4, 5 for 10 mV/C temperature sensor

IO 4,5 can be used and selected in Oven Tools as a 10 mV/C temperature sensor (such as Omega Engineering's infrared thermocouples) by simply using the IO 4,5 ports as the positive (sensor) input and ground terminals as below:

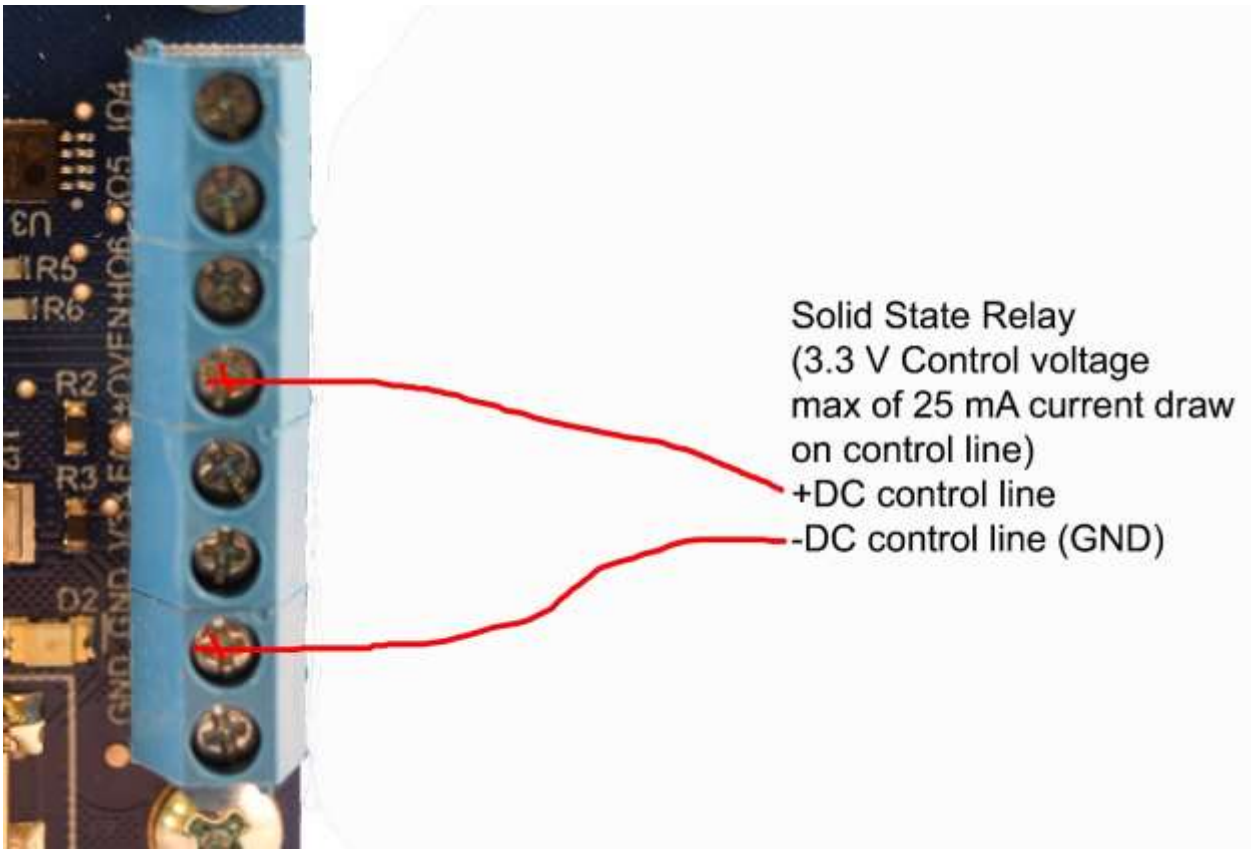
Generally these external type of sensors are self-powered and may need an external DC power supply as necessary. The grounds should be hooked together.



Using Oven+, Fan+ to Drive a Solid State Relay

Simply connect the Oven+ (PID driven to drive system higher) to the DC + control line of the SSR. Then connect the ground to the GND of the DC control line of the SSR.

The SSR control voltage should accept 3.3 Volts to turn it on, and should not draw more than 25 mA from the output pin of the controller.



Selecting a Solid State Relay (SSR)

The SSR should be rated higher than the current going through it by 40% for safety reasons.

To calculate the max current of the oven, get the wattage rating of the oven (ie: 1300 watts).

Then you know what voltage you are using in your country:

$$\boldsymbol{Max\ Current = \frac{Power}{Voltage}}$$

For example, a 120 volt house plug with a 1300 watt oven, that would give us about 11 amps max, then adding 40% more gives us 15 amp rating for our SSR.

Some additional features for selecting an SSR:

- Zero crossing
- Control line voltage of 3.3 volts turns it on
- Max current draw of 25 mA on the DC control line

Source code

The source code of the firmware is available in our web store.

The source code of Oven Tools is included in the package.

The free development tools are:

- Microsoft Visual Studio 2012
- Microchip MPLAB X IDE and XC8 1.33

For further information please email info@reflowcontroller.com or visit our website.

Device Characteristics

Maximum DC voltage input	6.0 V
Normal DC voltage input	5.0 V
Voltage regulation	1%
Maximum IO pin voltage	3.3 V
Maximum current per IO pin	25 mA
Normal current per IO pin	15 mA
Maximum current on external 3.3 V supply pins	200 mA
Temperature range on all sensors (10 mV/C)	0-330 Celsius (K type thermos 0-260 Celsius)
Temperature accuracy	(See AD597 Datasheet)
ADC resolution	12 bits
I2C maximum speed	1 MHz
Maximum MCU clock speed	48 MHz
MCU Program memory space	64 Kbytes
MCU SRAM memory space	3.8 Kbytes
Maximum USB 2.0 bus speed	FS