# User's Guide for the 12-Channel Over-Temperature Monitor OTM-12 Model 349

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# 1.0 Description

The 12-Channel Over-Temperature Monitor (OTM12) is a multi-point temperature monitoring device. The OTM12 provides secondary temperature monitoring and reporting independent of any primary temperature control system. The OTM12 monitors for excessive temperatures independent of any potential failures in the primary control system and provides visible and electronic alarm outputs and can shut off power to the system being monitored.

The OTM12 also monitors for open circuits in the thermocouples being used and reports any such failures. The OTM12 latches any alarm status until the temperature(s) drops below the set level and an operator resets the alarm.

Up to 12 temperature zones may be simultaneously monitored. Up to six different types of thermocouples may be used simultaneously with the OTM12, with any type being used on any input channel. Cold junction compensation is performed on a channel-by-channel basis. Over-temperature set points and thermocouple types for each channel are stored in non-volatile memory.

# 2.0 Specifications

## 2.1 Number of Input Channels

There are 12 input channels. Each channel is driven by a thermocouple. A selector switch on the OTM12 is used to designate the thermocouple type for each channel.

**2.1.1** Switch coding for thermocouple types:

| Switch Code | Thermocouple Type | Max. Temperature (Degrees C) |
|---|---|---|
| 0 | R | 1760 |
| 1 | S | 1760 |
| 2 | B | 1820 |
| 3 | J | 760 |
| 4 | K | 1370 |
| 5 | E | 1000 |
| 6 | C | 2310 |

## 2.2 Accuracy

Errors in columns three and four are the error contribution as a percentage of the change in the cold junction temperature. The errors given in column five are the worst-case errors in degrees C for the full-scale temperature plus a 30 degree C shift in the cold junction.

| Thermocouple Type | Worst Case Error (full scale & 30 degree C change in CJ) |
|---|---|
| R | 2.1 degree C |
| S | 2.4 degree C |
| B | 2.2 degree C |
| J | 0.8 degree C |
| K | 1.1 degree C |
| E | 0.7 degree C |
| C | 2.6 degree C |

### 2.3 Repeatability

The trip point for any channel will repeat within 1 degree C if the cold junction is held at a constant temperature.

### 2.4 Input filter

All input channels are sampled once per second.

### 2.5 Common Mode Range

The common mode range for all input channels is –8.0 to +3.4 volts.

## 2.6 Digital Interfaces

### 2.6.1 Alarm outputs

There are 12 alarm outputs, each one corresponding to a particular input channel. These are open collector outputs. Each will sink up to 100 milliamps to ground to indicate an alarm condition. These outputs are latched. The alarm will not reset until both the temperature for that channel falls below the alarm set point and the alarm status is cleared. See Section 3.3.5

### 2.6.2 Ethernet Port

There is a 10/100 Base-T Ethernet connection which provides setup, calibration, monitoring, and clearing of alarms.

### 2.6.3 Relay Contacts

Relay contacts are available for disabling power to the primary temperature control system. The contacts are rated at 10 amps at 240 VAC. The Normally-open (NO) and Common (COM) should be wired in series with the power to the primary temperature control system.

These contacts form a short when there is no temperature alarm and open until the temperature alarm status is cleared. This output is latched until the temperature of all channels is below the set points and the RESET button is pressed.

### 2.6.4 LED outputs

12 LED's are visible through openings in the cover of the OTM12. Each LED will turn on when an alarm condition exists on its corresponding channel. All LED's are briefly turned on when power is first applied to the OTM12 so that the user may verify that each LED functions.

## 2.7 Power Requirements

Power supplied to the OTM12 is 24 VDC nominal at 60-80 ma . The OTM12 will function normally if the input voltage is between 15 and 35 VDC.

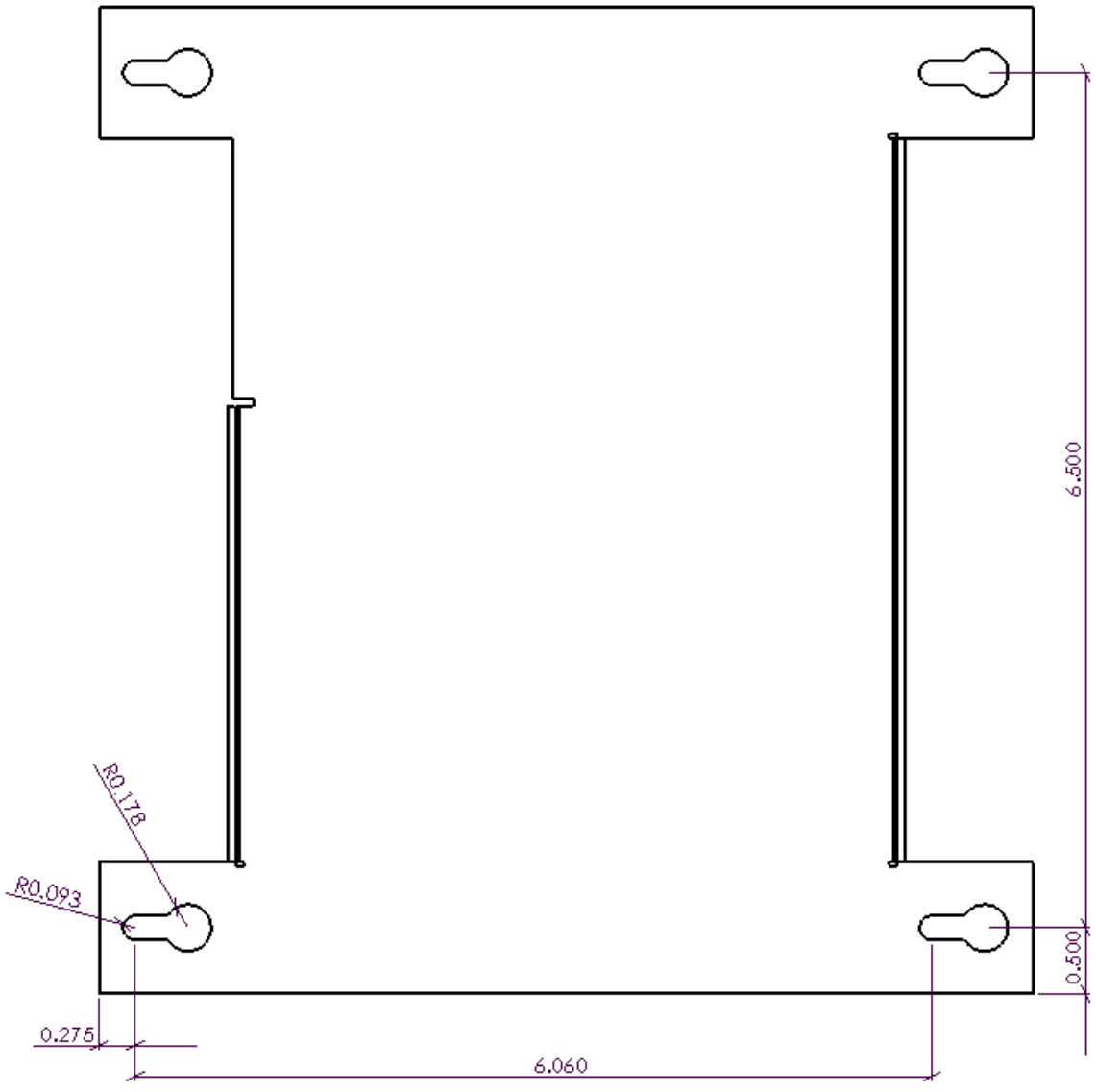
## 2.8 Environmental Requirements

| | |
|---|---|
| Operating temperature: | 0 to 60 degrees C. |
| Storage temperature: | -20 to 100 degrees C. |
| Relative humidity: | 0 to 95 percent, non-condensing |

# 3.0 Installation

## 3.1 Mounting

OTM12 mounts directly to a grounded panel.



### 3.2 Grounding

It is important to ensure that the OTM12 is well grounded. The screw mounting should be connected directly to ground.

## 3.3 Wiring Recommendations

Mating connectors to the Phoenix headers should be Phoenix GmbH, MSTB Series, Rated 15A, 600 VAC, using 30-14 AWG wire, and using a screw torque of 5-7 in/lbs.

### 3.3.1 24 Volt Input Power Connections

Connect a 24-volt supply to J8 Pin 1 (+24V) and J8 Pin 2(GND)

### 3.3.2 Thermocouple Connections

Connect a thermocouple to each pair of channel input connections (CH1+, CH1-; CH2+, etc.) observing correct polarity for the thermocouple. If the thermocouple has a shield it may be connected to the GND adjacent to the channel input pins.

**Any unused input channel pins must be shorted to ground.**

### 3.3.3 Alarm Output Connections

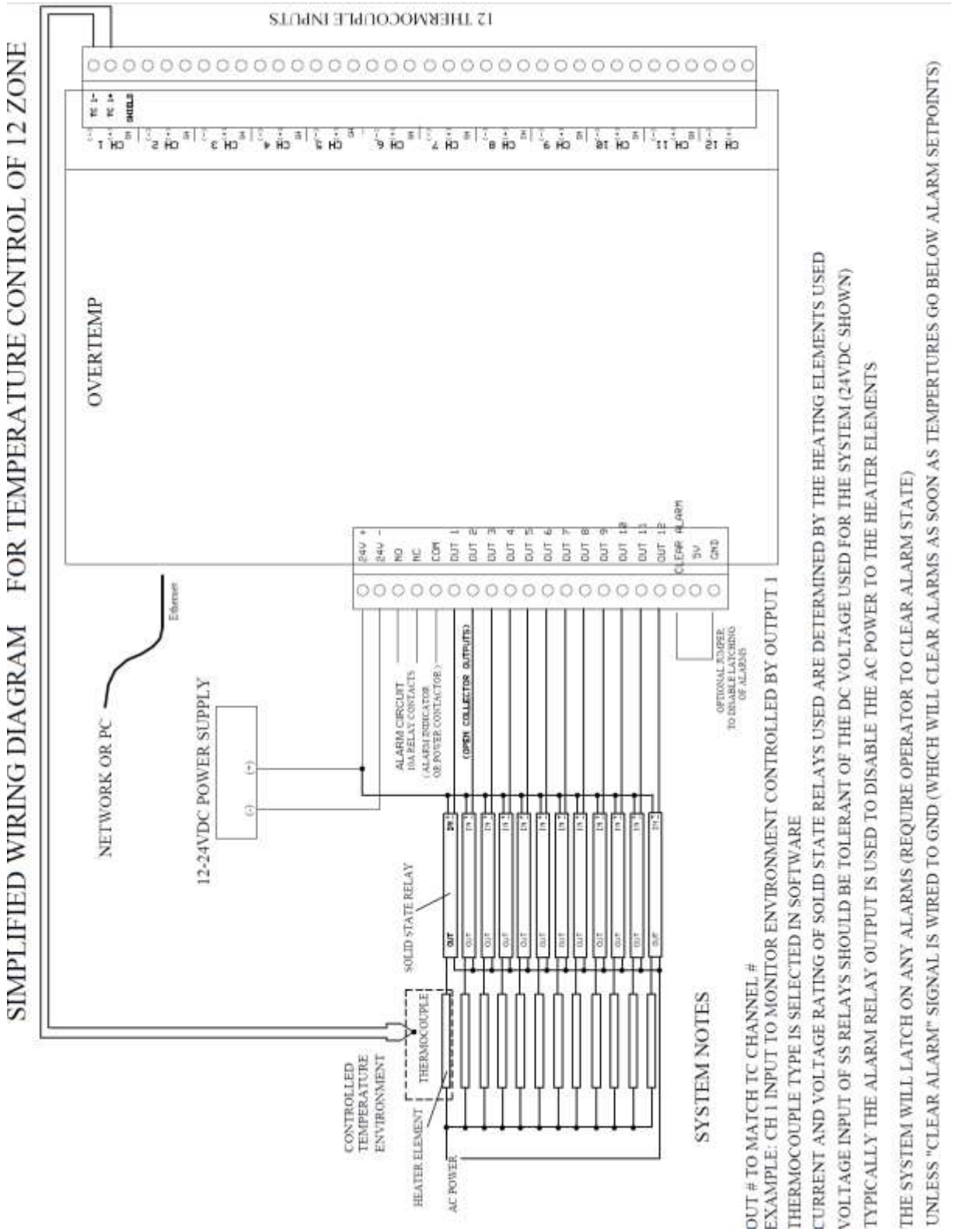
Output alarms are available for each channel (see picture above). These provide an open collector path to GND when an alarm is present. These may be wired together or separately to the user's monitoring circuit. Each output alarm is capable of sinking 100 milliamps and will withstand +30 volts DC.

The relay output will open whenever any of the channels are in an alarm condition.

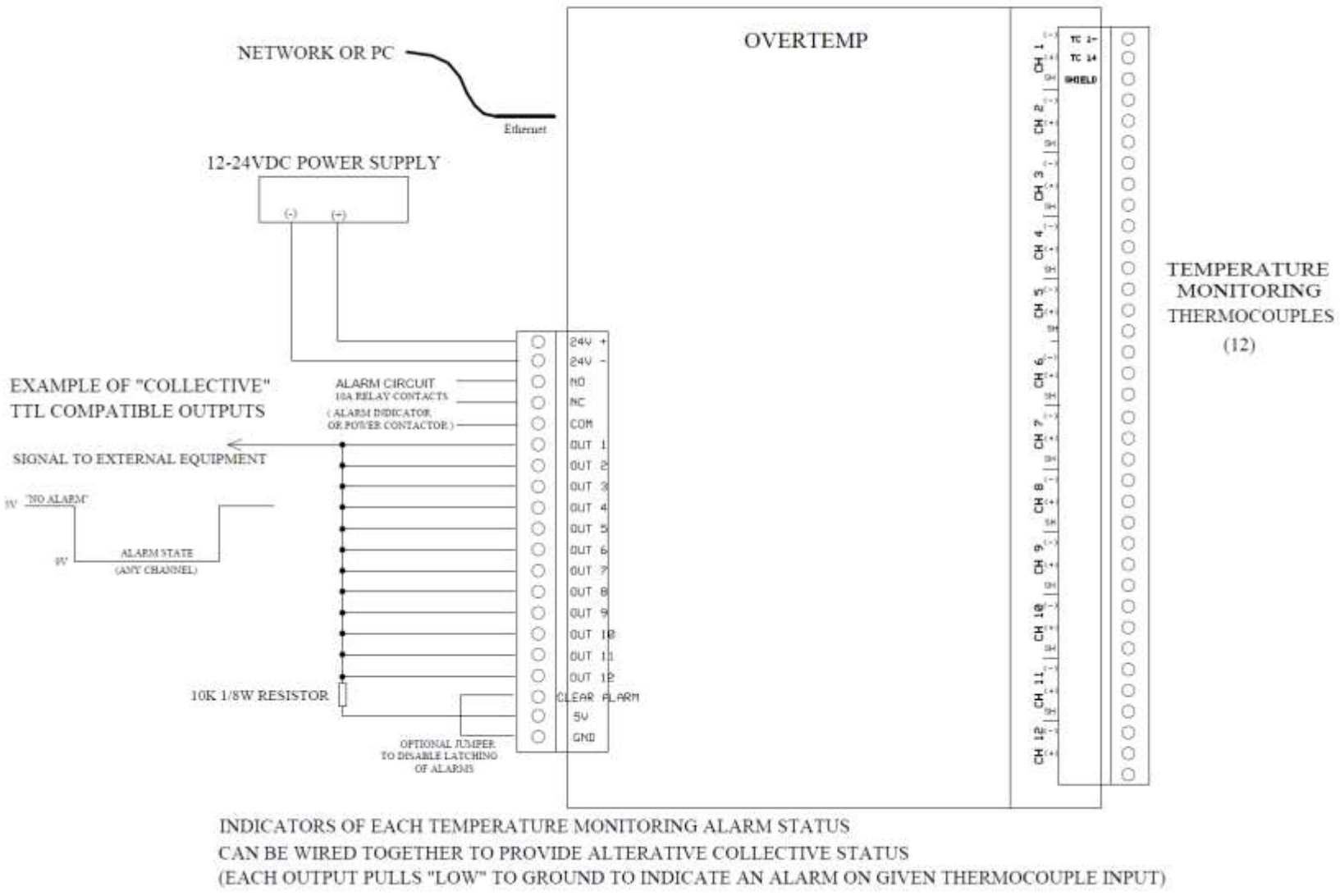
### 3.3.4 External Reset

Alarms may be cleared either by pressing the RESET button, by pulling the RESET pin on the connector to GND through a resistance of less than 200 ohms, or by pressing the Clear Alarms button on the Status page of the web interface.

## 3.3.5 Wiring Examples



# EXAMPLE FAILSAFE WIRING DIAGRAM




INDICATORS OF EACH TEMPERATURE MONITORING ALARM STATUS
CAN BE WIRED TOGETHER TO PROVIDE ALTERATIVE COLLECTIVE STATUS
(EACH OUTPUT PULLS "LOW" TO GROUND TO INDICATE AN ALARM ON GIVEN THERMOCOUPLE INPUT)

# 4.0 Furnace Application (Legacy Mode)

## 4.1 Setting Trip Points

In order to calibrate any channel of the OTM12 connected to a furnace, perform the following steps.

**Tools required**
Calibrated Millivolt source
Input Connector

Remove trip point access cover.
**Do not remove the OTM chassis cover.**

1. Determine the Thermocouple type used on each channel.
Set the HEX switch to the corresponding position:

| Switch Code | Thermocouple Type |
|---|---|
| 0 | R |
| 1 | S |
| 2 | B |
| 3 | J |
| 4 | K |
| 5 | E |
| 6 | C |

2. Apply simulated temperature with the milli volt power supply equal to the maximum operating temperature of the furnace plus 10 deg. C.

*Example:*
*If the furnace has type K thermocouples and the maximum temperature rated temperature is 350 degrees, set the selector switch to position 4 and the mV source for 360 degrees.*

3. Press the button of the channel being calibrated until the LED indicator flashes once (about one second).

**This is the trip point.**

4. Verify the channel by setting the mV source for 10 degrees below the trip point.
5. Press the reset button.
6. Verify the LED is off.
7. Increase the simulated temperature to 10 degrees above the trip point.
8. Verify the channel trips.
9. Repeat steps 1-8 for each used channel.

Note:
If all channels will be using the same type of thermocouple, step 1 need be performed only once.

**Important:**
**Make sure the thermocouple wire is the correct polarity from the monitored zone including all connectors to the OTM. Reverse wires will not allow the OTM to detect an overtemp condition.**

### 4.1.1 Avoiding Nuisance Alarms

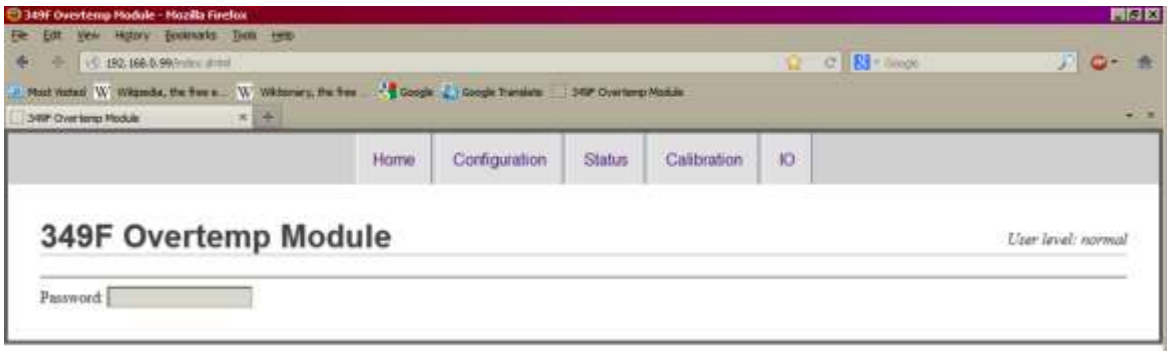
In order to avoid nuisance alarms from unused channels set the trip point to 100 degrees C or higher. Make sure the unused channels are shorted to ground when wired to the furnace.

# 5.0 Furnace Application (Web Interface Mode)

## 5.1 Connecting to the web interface.

To use the Web Interface of the OTM12 requires a computer with an Ethernet interface connected to the same physical network as the OTM12 and with an IP address on the same subnet.

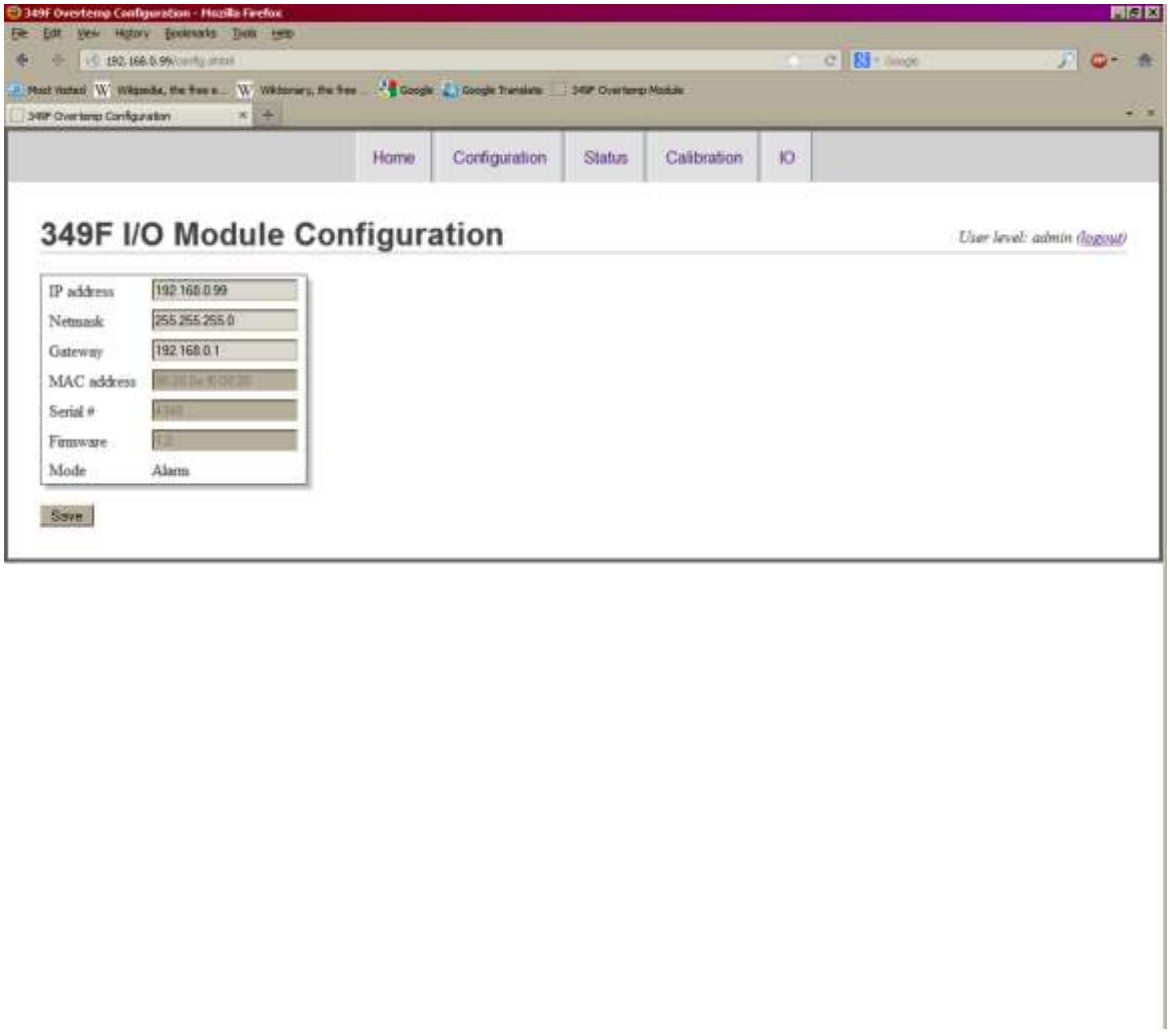
From a web browser, enter the IP address of the OTM12 in the browsers location bar. The default IP address is **10.10.10.20**.




From here, you may select from the Configuration, Status, Calibration, and IO links. The calibration and settings fields will be disabled unless logged in with administrator priveleges, so enter the administrator

password here if changes are intended. The administrator password is available upon request by contacting BLS.

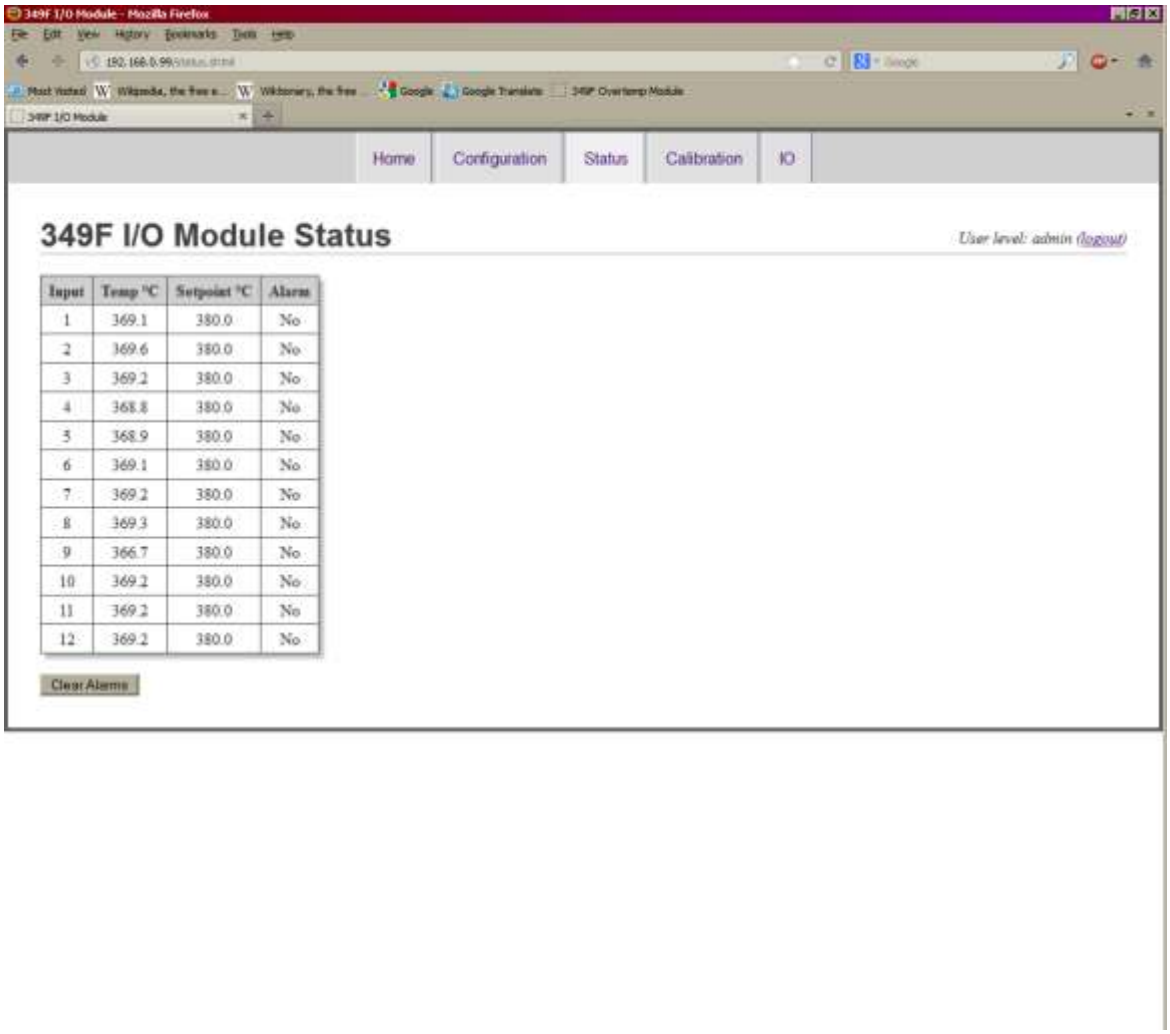
### 5.2.1 Configuration




The Configuration page allows the IP address, Netmask, and Gateway setting of the OTM12s network interface to be configered. **Take special note that when changing the IP address you must not lose track of what it has been changed to. If the IP address is lost it may be reset to the facory default 10.10.10.20 by holding the 'Clear' button for >10 seconds.**

On some versions of the OTM12, a PID mode is available. The mode can be switched between Alarm and PID using the corresponding radio buttons.

### 5.2.2 Status

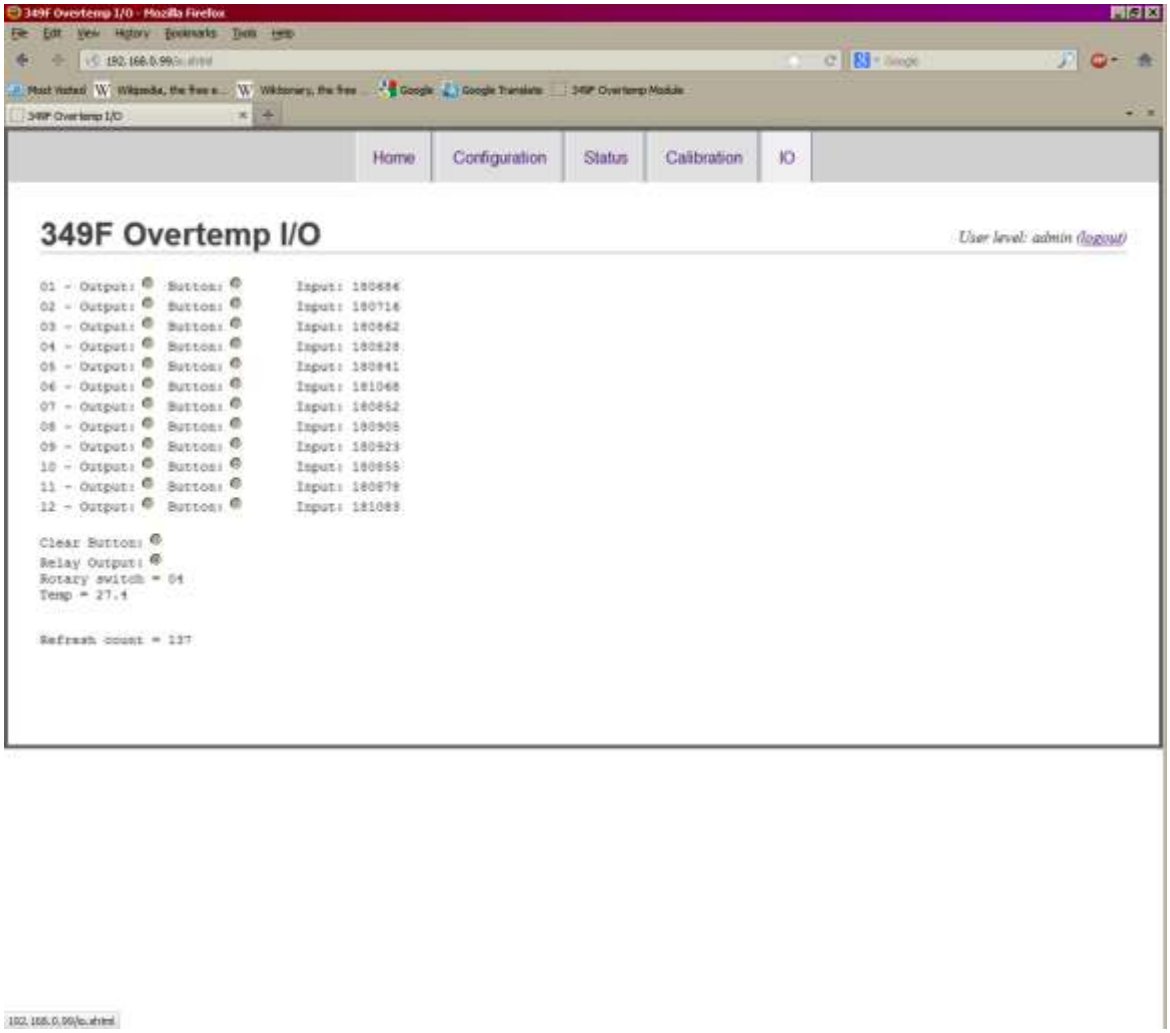



| Input | Temp °C | Setpoint °C | Alarm |
|---|---|---|---|
| 1 | 369.1 | 380.0 | No |
| 2 | 369.6 | 380.0 | No |
| 3 | 369.2 | 380.0 | No |
| 4 | 368.8 | 380.0 | No |
| 5 | 368.9 | 380.0 | No |
| 6 | 369.1 | 380.0 | No |
| 7 | 369.2 | 380.0 | No |
| 8 | 369.3 | 380.0 | No |
| 9 | 366.7 | 380.0 | No |
| 10 | 369.2 | 380.0 | No |
| 11 | 369.2 | 380.0 | No |
| 12 | 369.2 | 380.0 | No |

The Status page allows you to monitor the temperature being measured on each of the OTM12s 12 channels, the alarm setpoints of each channel, and whether an alarm condition exists on each channel.

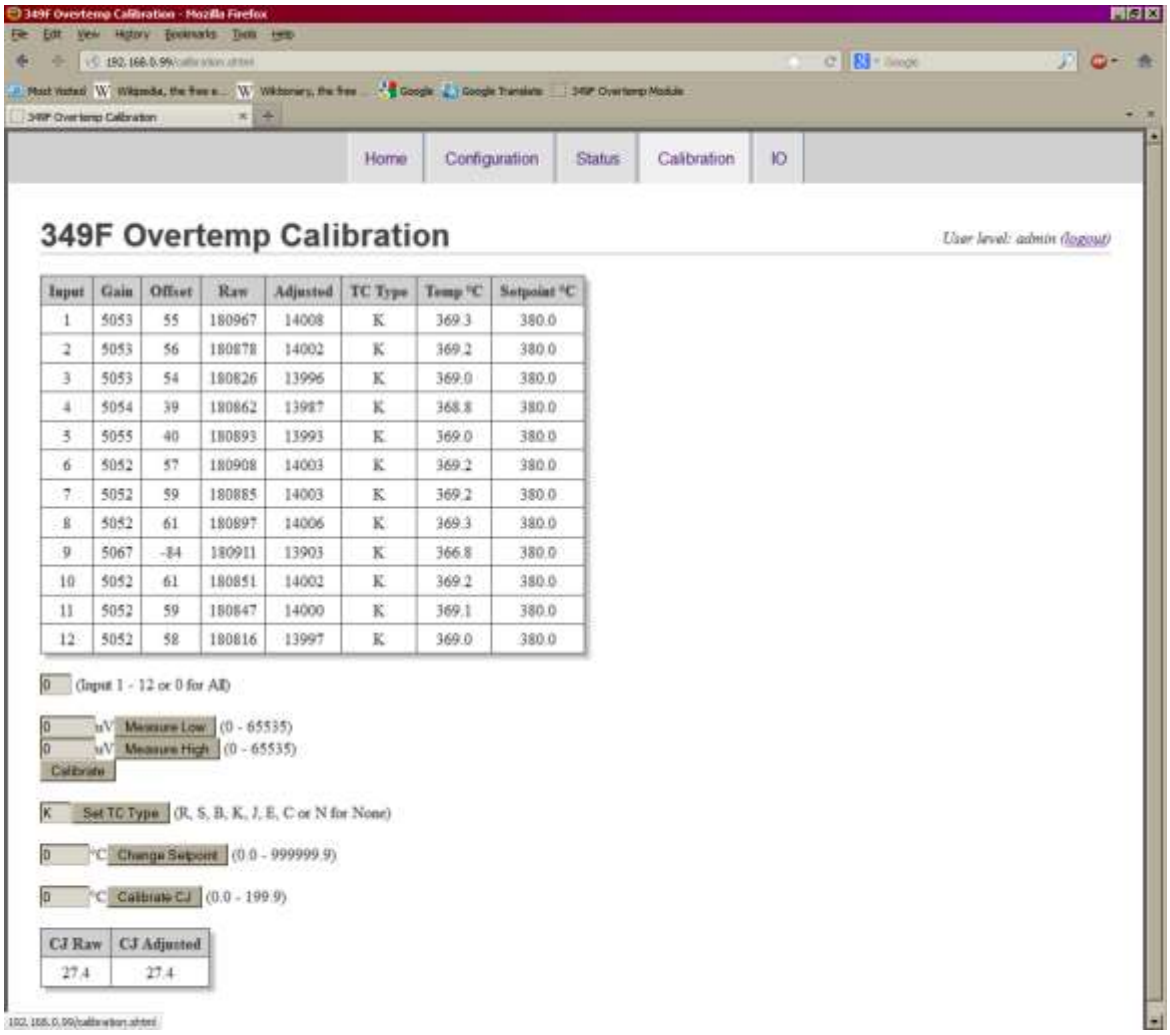
The Clear Alarms button will clear the alarm condition for any channels which are no longer measuring temperatures above their alarm setpoint.

### 5.2.3 IO




The IO page provides the status of all of the OTM12s physical buttons, digital alarm outputs, the raw microvolt readings of the thermocouple inputs, the position of the rotary thermocouple type selector switch, and the reading of the cold juction temperature sensor.

### 5.2.4 Calibration




| Input | Gain | Offset | Raw | Adjusted | TC Type | Temp °C | Setpoint °C |
|---|---|---|---|---|---|---|---|
| 1 | 5053 | 55 | 180967 | 14008 | K | 369.3 | 380.0 |
| 2 | 5053 | 56 | 180878 | 14002 | K | 369.2 | 380.0 |
| 3 | 5053 | 54 | 180826 | 13996 | K | 369.0 | 380.0 |
| 4 | 5054 | 39 | 180862 | 13987 | K | 368.8 | 380.0 |
| 5 | 5055 | 40 | 180893 | 13993 | K | 369.0 | 380.0 |
| 6 | 5052 | 57 | 180908 | 14003 | K | 369.2 | 380.0 |
| 7 | 5052 | 59 | 180885 | 14003 | K | 369.2 | 380.0 |
| 8 | 5052 | 61 | 180897 | 14006 | K | 369.3 | 380.0 |
| 9 | 5067 | -84 | 180911 | 13903 | K | 366.8 | 380.0 |
| 10 | 5052 | 61 | 180851 | 14002 | K | 369.2 | 380.0 |
| 11 | 5052 | 59 | 180847 | 14000 | K | 369.1 | 380.0 |
| 12 | 5052 | 58 | 180816 | 13997 | K | 369.0 | 380.0 |

| CJ Raw | CJ Adjusted |
|---|---|
| 27.4 | 27.4 |

The Calibration page provides the ability to calibrate any one or all of the OTM12s thermocouple inputs, as well as setting their thermocouple types, and alarm setpoints.

To calibrate the inputs requires a microvolt source capable of producing known stable voltages of aproximately 5000 microvolts and 50,000 microvolts.

The calibration process is as follows:

1. Apply the low microvolt source (~5,000uV) to the channel(s) being calibrated.
2. Enter the input number of the channel being calibrated in the text box labled "(Input 1 - 12 or 0 for All)". If all the channels are being calibrated, enter 0.

3. In the next text box enter the exact value of the microvolt source, and click the button labeled "Measure Low".
4. Apply the high microvolt source (~50,000uV) to the channel(s) being calibrated.
5. Again enter the input number of the channel being calibrated in the text box labled "(Input 1 - 12 or 0 for All)". If all the channels are being calibrated, enter 0.
6. In the third text box enter the exact value of the microvolt source, and click the button labeled "Measure High".
7. Click the button labled "Calibrate".

After the "Calibrate" button is clicked, the OTM12 will calculate the gain and offset values necessary to convert raw readings into accurate microvolt values.

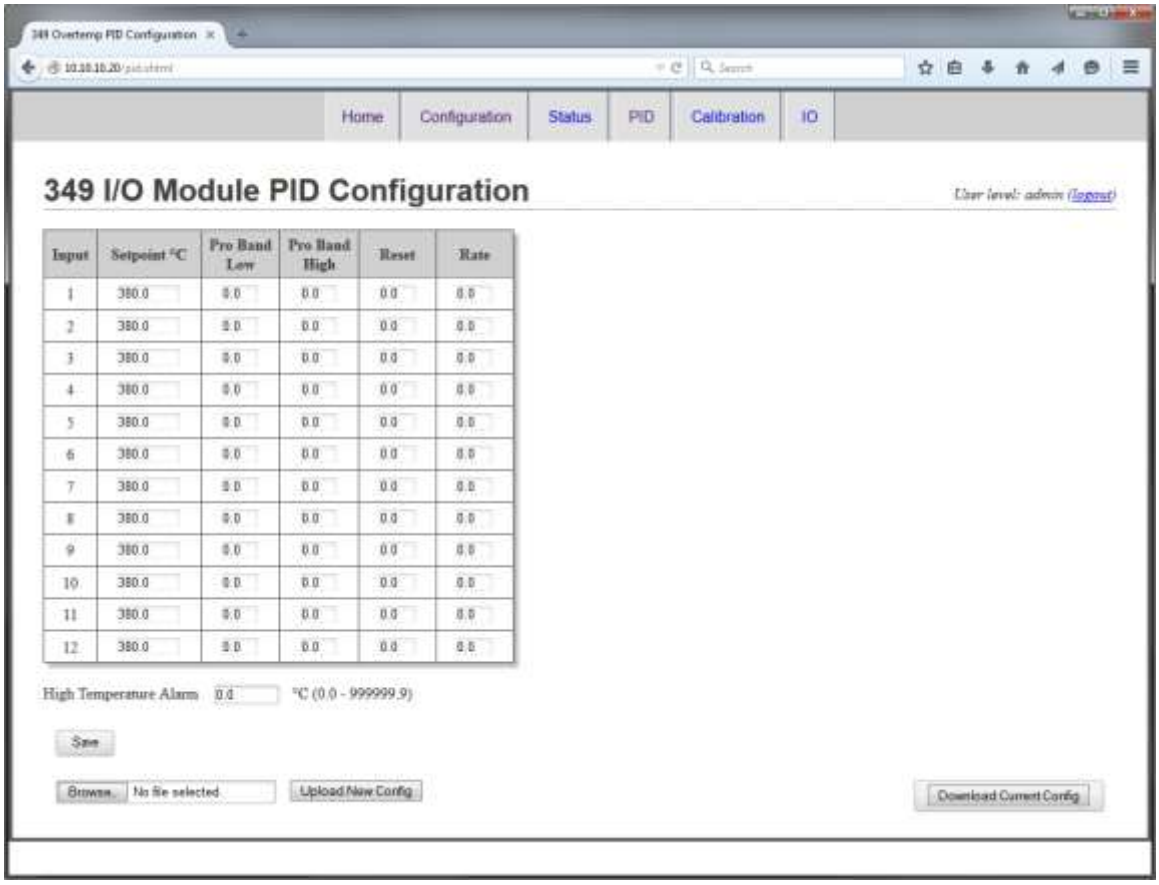
To set the thermocouple type for any one or all of the channels:

1. Enter the input number of the channel being set in the text box labled "(Input 1 - 12 or 0 for All)". If all the channels are being set, enter 0.
2. Enter the desired thermocouple type in fourth text input box. Be sure to use capital letters.
3. Click the button labeled "Set TC Type".

To set the alarm setpoint for any one or all of the channels:

1. Enter the input number of the channel being set in the text box labled "(Input 1 - 12 or 0 for All)". If all the channels are being set, enter 0.
2. Enter the desired setpoint in degrees Celcius in the fifthe text box.
3. Click the button labeled "Change Setpoint".

### 5.2.5 PID Configuration




The PID page becomes active when PID mode is enabled on the Configuration page.

This mode allows the OTM12 to serve as a temperature controller over 12 separate temperature zones, with each output producing a pulse width modulated control signal based on the corresponding thermocouple input.

Each zone is configurable for setpoint, proportional band, rate, and reset.

Information on PID tuning can be found at:
http://en.wikipedia.org/wiki/PID_controller#Loop_tuning

A High Temperature Alarm can be set. The relay on the OTM12 will open when the alarm temperature is exceeded on any of the inputs and will remain open until the temperature falls below the alarm setpoint and the alarm is cleared by pushing the physical clear button

on the OTM12 or the clear function on the Status page of the web interface.

Additionally, configurations may be saved to or uploaded from the device running the web browser.

### 5.2.5 JSON Data for Custom Applications

Complete status information for the OTM12 is available via the web interface at http://*UnitIPAddress*/json.shtml

Data is presented in JSON format for ease of importation into Javascript applications or other programming languages.

Here is an example of the data as it's presented:

{"Output1": 0, "Output2": 0, "Output3": 0, "Output4": 1, "Output5": 1, "Output6": 0, "Output7": 1, "Output8": 1, "Output9": 1, "Output10": 0, "Output11": 0, "Output12": 1, "Button1": 0, "Button2": 0, "Button3": 0, "Button4": 0, "Button5": 0, "Button6": 0, "Button7": 0, "Button8": 0, "Button9": 0, "Button10": 0, "Button11": 0, "Button12": 0, "Input1": 140.0, "Input2": 141.4, "Input3": 140.0, "Input4": 140.0, "Input5": 138.4, "Input6": 140.0, "Input7": 139.2, "Input8": 140.0, "Input9": 139.2, "Input10": 139.2, "Input11": 139.2, "Input12": 139.2, "Setpoint1": 145.0, "Setpoint2": 145.1, "Setpoint3": 145.2, "Setpoint4": 145.3, "Setpoint5": 145.4, "Setpoint6": 145.5, "Setpoint7": 145.6, "Setpoint8": 145.7, "Setpoint9": 145.8, "Setpoint10": 145.9, "Setpoint11": 146.0, "Setpoint12": 146.1, "Alarm1": 0, "Alarm2": 0, "Alarm3": 0, "Alarm4": 1, "Alarm5": 1, "Alarm6": 0, "Alarm7": 1, "Alarm8": 1, "Alarm9": 1, "Alarm10": 0, "Alarm11": 0, "Alarm12": 1, "Clear": 0, "Relay": 1, "Rotary": 04, "CJTemp": 26.0, "Count": 1}

As you can see; the status of the 12 open collector outputs, the 12 legacy mode buttons, the values read by the 12 therocouple inputs, the alarm setpoints of all 12 channels, the alarm status of all 12 channels, the status of the "clear" button, the condition of the relay, the position of the rotary switch for setting CJ types in legacy mode, the temperature measured by the cold junction sensor, and the number of times the JSON data has been polled are all available in an easily parsed format.

The JSON data may be polled as often as network capacity allows, however the thermocouple input data will only update at

approximately once per second.

## 6.0 Maintenance

No regular maintenance is required.