

# ISSI

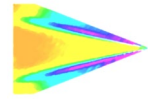
INNOVATIVE SCIENTIFIC SOLUTIONS, INC

## Calibration System (CAL-04, CTC-04)

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Installation and Operation Instructions (Version 3.4)





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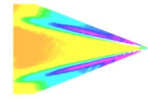
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## **Overview**

CAL-04 is a multi-function system designed for controlling the mass-flow of two gases and temperature within a cell. This new evolution of ISSI's pressure and temperature sensitive paint calibration system utilizes a gas flow design whereby the nitrogen to oxygen mass flow ratio is controlled to simulate pressure. The advantage of this technique is the ability to simulate pressures from approximately 0 to 4.0 bar without the noise and complexity of the diaphragm pump. Nitrogen and oxygen from gas bottles flow into the gas inlet fittings on the calibration box via appropriate dual stage regulators (ISSI does **NOT** supply bottled gas or regulators). The mixed gas exits the calibration control box via the output rear fitting and then into the calibration cell where the gas flows over the sample. The temperature control has been upgraded to provide faster temperature control and improved stability.

Operation of the system can be completely manual via the front panel interface for custom calibration purposes or in an automatic mode via software where the customer collects calibration data over a chosen set of conditions in an automated fashion

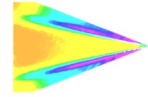
The system sends a TTL level trigger to the camera to acquire an image once it is on condition via a trigger output BNC connection. The camera returns a TTL level pulse to the trigger input BNC connection once it frames, signaling the calibration system that an image has been acquired and to move to the next condition.

The calibration cell requires a low steady flow of water for cooling purposes. A quiet, low maintenance water circulator with fan cooling is packaged with the system. Another advantage of the system is the Ethernet interface which simplifies communication with a computer, especially over long distances. The calibration system can be installed in a convenient location and communicated with over an existing network. Firmware updates and support by ISSI personnel are possible from our offices to where the system is installed. The system is set up for universal power so can be powered by 110 VAC, 60 Hz or 220 VAC 50 Hz. The system can also be used to control mass flow ratios of other gases within the cell. The system is capable of handling many other gases. The cell is for gases only, no liquids.

**For the setup video of calibration system, please visit or scan this link:**

<https://youtu.be/oviahhn7yms>





## **Specifications**

<b>Pressure Range</b>	0.0-4.0 bar
<b>Temperature Range</b>	0-70°C
<b>Pressure Accuracy</b>	0.5% of full scale
<b>Temperature Accuracy</b>	0.1 °C
<b>Interface</b>	10/100 Mbps Ethernet
<b>Power</b>	100-240 VAC, 50/60 Hz
<b>Software</b>	Windows GUI
<b>Warranty</b>	1 year
<b>ECCN</b>	EAR99

## **Requirements**

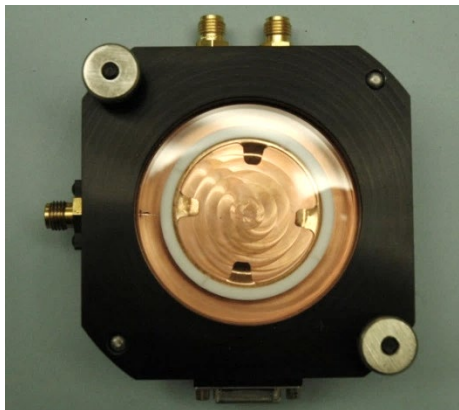
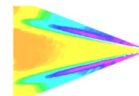
- Windows XP/Vista/7/8/10, 32- and 64-bit OS.
- Minimum 100 Mbps NIC (Network Interface Card)

## **Unpacking**

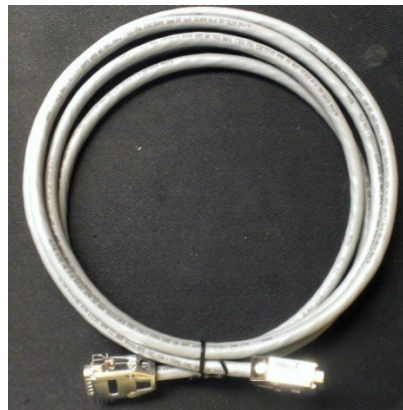
The calibration system contains several components and connections. Take careful stock of your components before assembling the system.

### **Component List**

1. Calibration Cell (1)
2. RTD cable for temperature control (1)
3. Ethernet patch cable (1)
4. BNC cable for camera trigger (2)
5. BNC Barrel connectors for camera to cable (2)
6. ¼" tubing for supply and output to cell with gas fittings (3)
7. Thermal compound (1)
8. Power Cable (2)
9. *PT Control* software for control of system (1)
10. *OMS Calibrate* software license (1)
11. Koolance cooling unit (1)
12. Power supply and adapter for Koolance cooling unit (1)
13. Fittings and hose for cooling water (2)
14. Coupons for paint calibration (5)
15. Mounting screws for cell to mount (3)
16. Cell Mount (1)
17. Calibration Control Box (1)



**1. Calibration Cell (CTC-04)**



**2. RTD Cable**



**3. Ethernet Cable**



**4. BNC Cables**

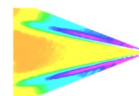


**4. BNC Barrel Connectors**



**6. 1/4" Tubing For Gas**





**7. Thermal Compound**



**8. Power cable**



**9-10. Software (In envelope)**



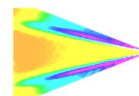
**11. Cooling Unit**



**12. Power Supply and Power Adapter for Cooling Unit**



**13. Water Hoses and Fittings**



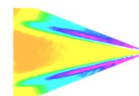
**14-15. Calibration Coupons, Calibration Cell Mounting Screws**



**16. Cell Mount**



**17. Calibration Control Box (CAL-04)**



## Hardware Setup

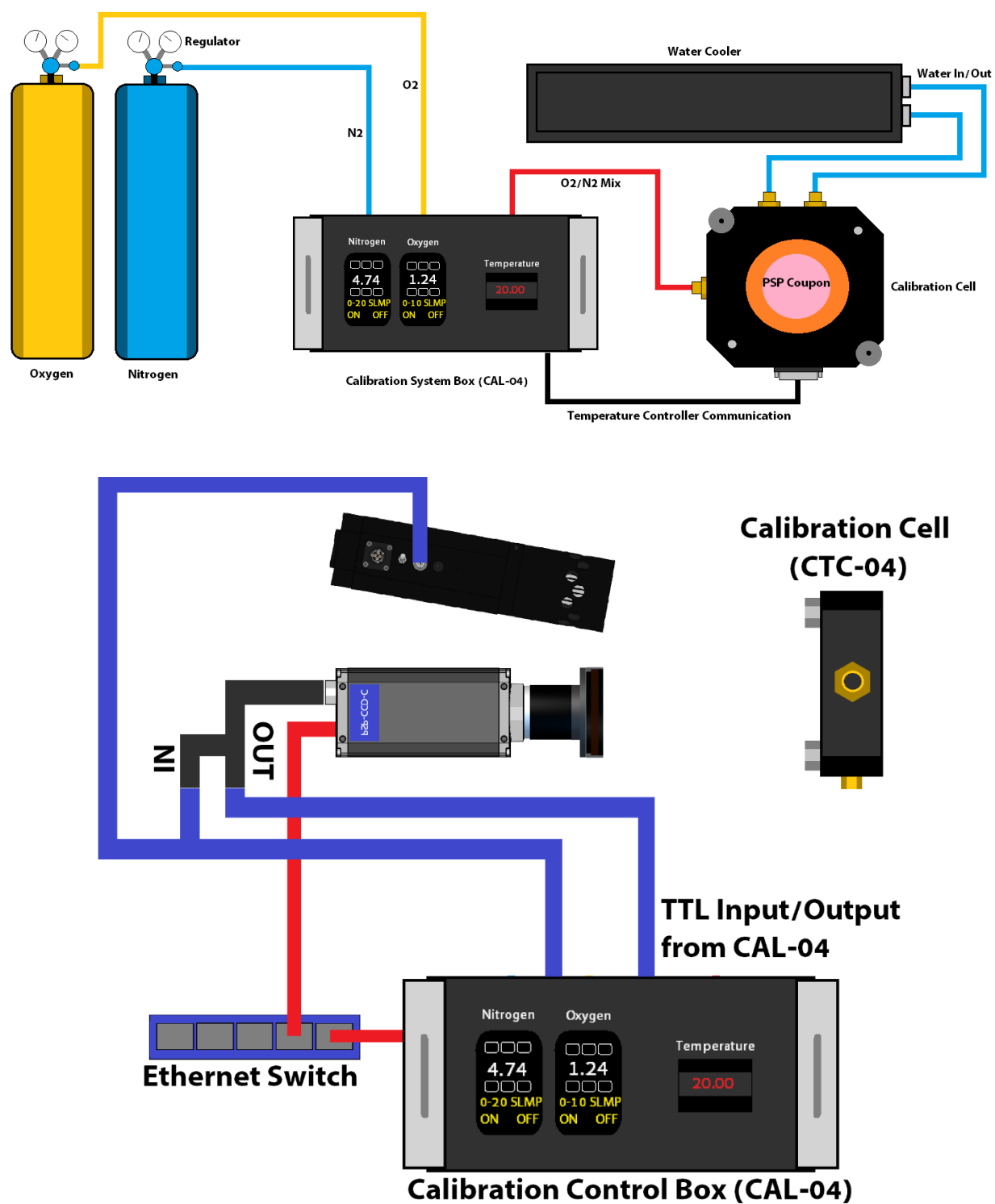
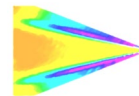


Figure 1: Schematic of CAL-04 Setup and Network and Trigger Setup



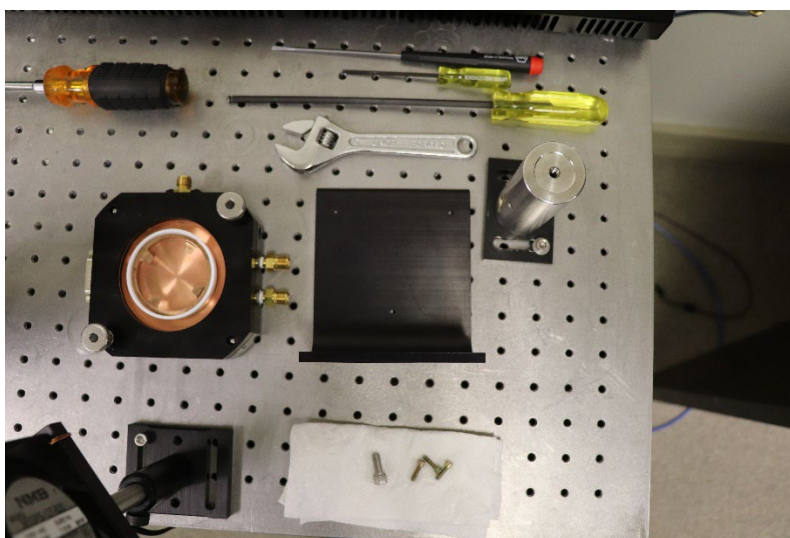


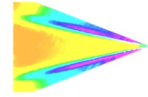
The calibration system is **NOT** sold with bottled gas or regulators, as it is up to the end user to supply both of these. Only clean  $N_2$  and  $O_2$  bottled gas should be used with the system. Regulators for the gas supply should be dual-stage regulators only and designed for use with each gas being run through them. Regulators used with oxygen should be cleaned for oxygen. Failure to do so could result in damage to the system or fire. Contaminants in a line which encounter pure oxygen could be a fuel source which means proper regulators must be used. Pictured below is an example of the dual-stage regulators used at ISSI for our calibration system.



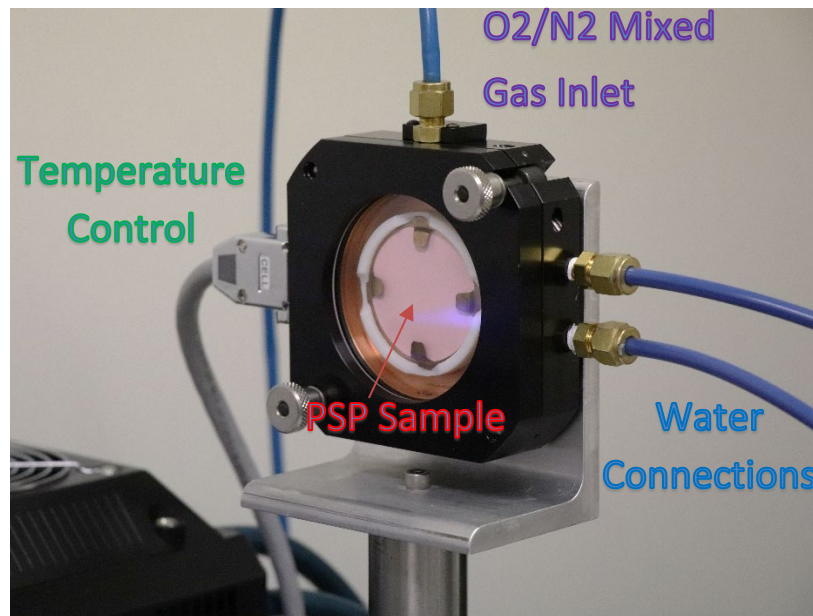
**Figure 3: Dual Stage regulator**

Begin by mounting the calibration cell to the provided mount, securing to a post so that it remains in a fixed position. Next, use the provided bolts to attach the cell body to the mount.

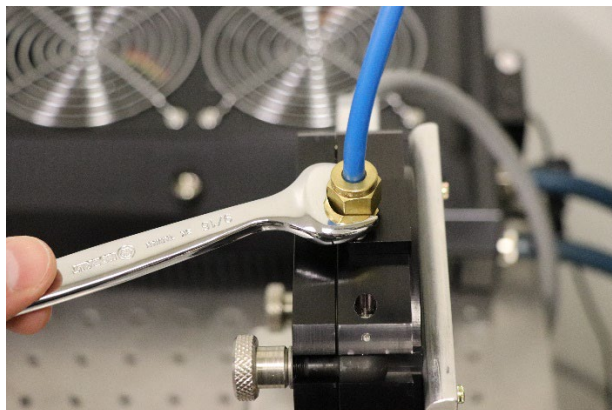




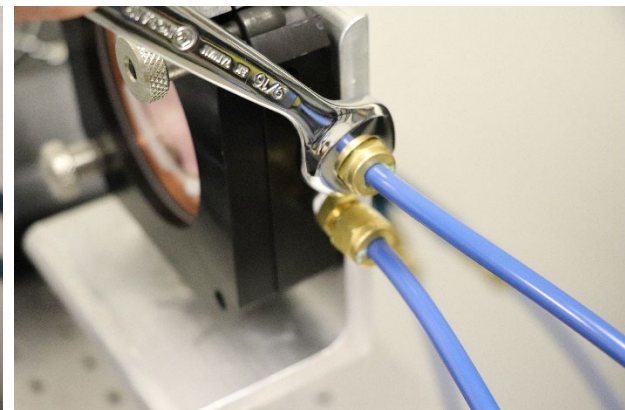
1/4" tubing is supplied to connect the calibration control box to the regulators. The two pieces of tubing with connectors on only one end are to be connected to the regulators. **DO NOT** set the regulator output above 20 psig [138 kPa]. The internal components inside the calibration box can be damaged if the input pressure exceeds 50 psig and no more than 20 psig is needed for operation. In the dual-stage regulator pictured in Figure 1, the gage on the right displays the pressure in the bottle and the left displays the output pressure which is going into the calibration control box.



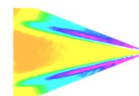
Connect the  $O_2/N_2$  mixture output labeled '**OUT TO CALIBRATION CELL**' to the single input connection to the cell. The water connections should be made to the two fittings adjacent to one another. The water fittings do not need to be to a specific connection, either water fittings can be connected to each water input. Lastly, the gray serial cable should be attached to the serial connector on the cell for temperature control.



**O<sub>2</sub>/N<sub>2</sub> Mixture Connection**



**Water Connections**



The gas and water connections are the same size. Use a 9/16" wrench or adjustable to tighten but do not over-tighten. Simply turn the fittings with the wrench until tight and then stop. Over-tightening can damage fittings.

The water-cooling unit comes from ISSI with the water fitting installed. Connect the provided blue water-cooling rubber hoses directly to the water-cooling unit. Attached the power adapter to cooling unit using the thumbscrews, then fill with distilled water and run. Check for leaks in the connections between the cooling unit and the calibration cell.

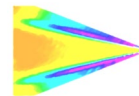


The back of the calibration control box (CAL-04), shown in Figure 3 is where the connections need to be made to set the system up. Pictured in Figure 2 is the schematic of the connections that need to be made on the calibration control box. Bottled gases are connected to the calibration control box via the 1/4" tubing. The serial connection on the calibration cell head is connected via the gray RTD cable to **'CONTROL TO CALIBRATION CELL.'** The output mixed gases are connected to the calibration cell from the **'OUT TO CALIBRATION CELL'** fitting. Cooling water is connected from the water-cooling unit (Push-on fittings, Image 15) to the calibration cell head (in any order) using the rubber hoses supplied. The system is connected to the PC via an Ethernet cable. Use **ONLY** distilled water in the cooling unit. **DO NOT** use tap water or de-ionized water. Let the cooling unit run until air bubbles have purged and top off the water once air has been purged.



**Figure 4: Rear Panel Connections on Calibration Control Box**

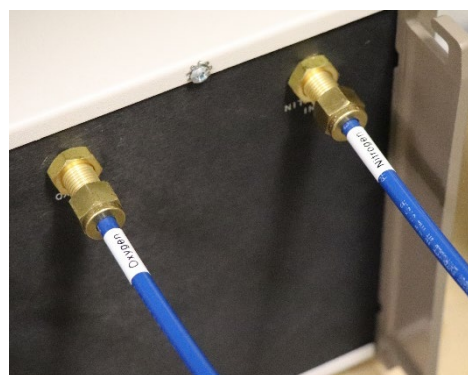


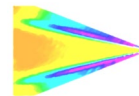


All connections are clearly marked on the back of the calibration control box. Take care in connecting the Swagelok fittings for the gas tubing as to avoid stripping the connectors. Tighten by hand before using a wrench to avoid damage to the connectors. It is very important that the oxygen be connected to the **'OXYGEN IN'** connection and nitrogen to the **'NITROGEN IN'** connection. The internal components are designed and conditioned to work with those respective gases and could be damaged if improperly used.



**'CAMERA TRIGGER IN'** should be connected to the camera strobe and **'CAMERA TRIGGER OUT'** should be connected to the trigger of the camera using the provided coaxial cable. **'CAMERA TRIGGER IN'** receives a TTL trigger from the strobe (which mirrors the frame) of the camera. During auto-mode, this alerts the calibration control box that the camera has acquired an image and it is time to move to the next condition. **'CAMERA TRIGGER OUT'** sends a TTL trigger to the camera's trigger input to trigger the camera to acquire an image or series of images once the system is at the next condition (pressure and temperature). Acquisition by the system can be automatic, stepping through prescribed pressures and temperatures or manually done by a user. This will be covered in detail in **'Software Operation.'**

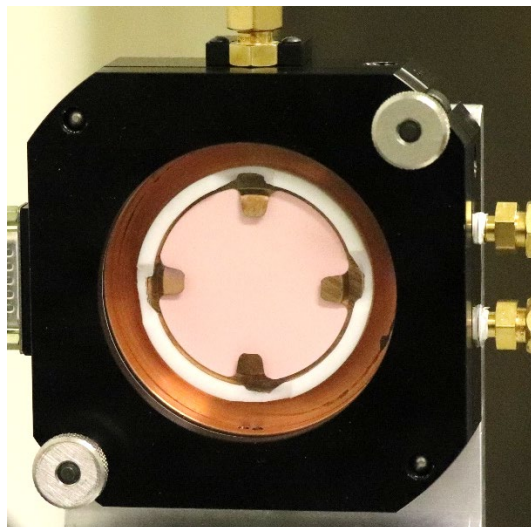




## **Calibration Sample**

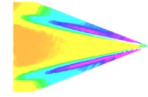
Prior to setting up the calibration system, paint the sample coupon with the paint that will be used during the pressure sensitive or temperature sensitive paint testing in your facility. Follow the painting and curing instructions for the paint that are provided with it. Once painted and cured, the sample can be used in the calibration process. It is good practice to store the painted calibration samples in a plastic sleeve or sealable bag to prevent damage. Store these in a dark place (box or cabinet) so they do not photodegrade when not in use.

Once the calibration system is set up and operating, remove the sample from its storage location and apply a small amount of the thermal compound to the back side of the sample. Distribute evenly across the back surface with a cotton swab or finger. Remove the copper retaining clip and plastic retaining ring mount from the cell and apply the same amount of thermal compound on the raised copper portion of the cell where the sample is placed.



Place the sample on the cell and place the copper retaining clip and plastic retaining ring back over the sample to hold it in place. Place the front window back on the cell and secure by hand using the two swing bolts.





## Network Setup

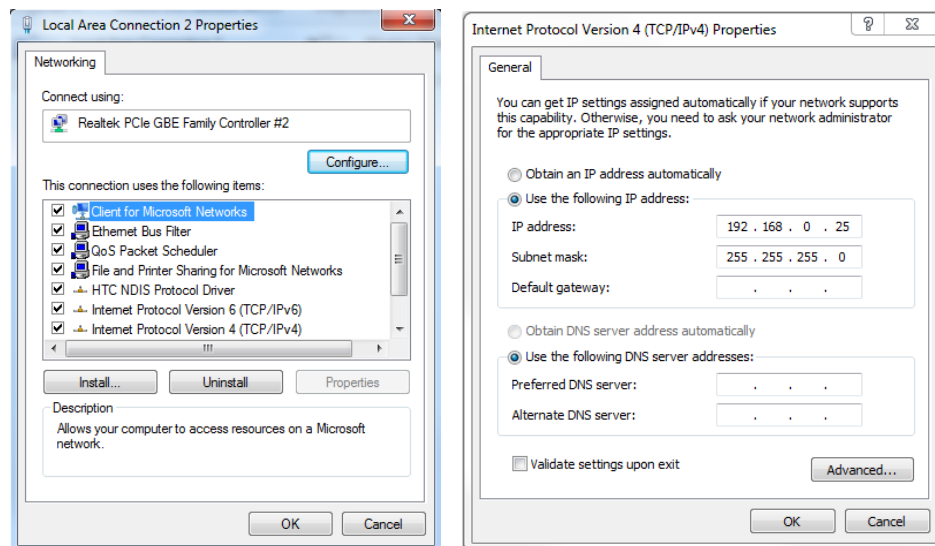
Refer to Figure 2 to install the network and trigger connections for the system. The network on the PC NIC (network interface card) needs to be properly configured for communication over the network. To do this, navigate to the *'Network Connections'* page on the control panel where the local networks of the computer is displayed. Right-click on the network where the calibration system is connected and select *'Properties.'*

From the *'Local Area Connection X Properties'* window, click on *'Internet Protocol Version 4 (TCP/IPv4)'* and then press the *'Properties'* button, now useable. This will open the *'Internet Protocol Version 4 (TCP/IPv4) Properties'* window. This is where the IP addresses are entered so that calibration system can be reached over the local network. The settings needed for communication are **IP Address** and **Subnet mask**.

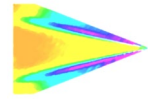
The IP address of the NIC should use the following conventions:

IP Format: **Network.Network.Subnet.Host**

- CAL-04 IP: 192.168.1.251
- NIC IP: 192.168.1.XXX

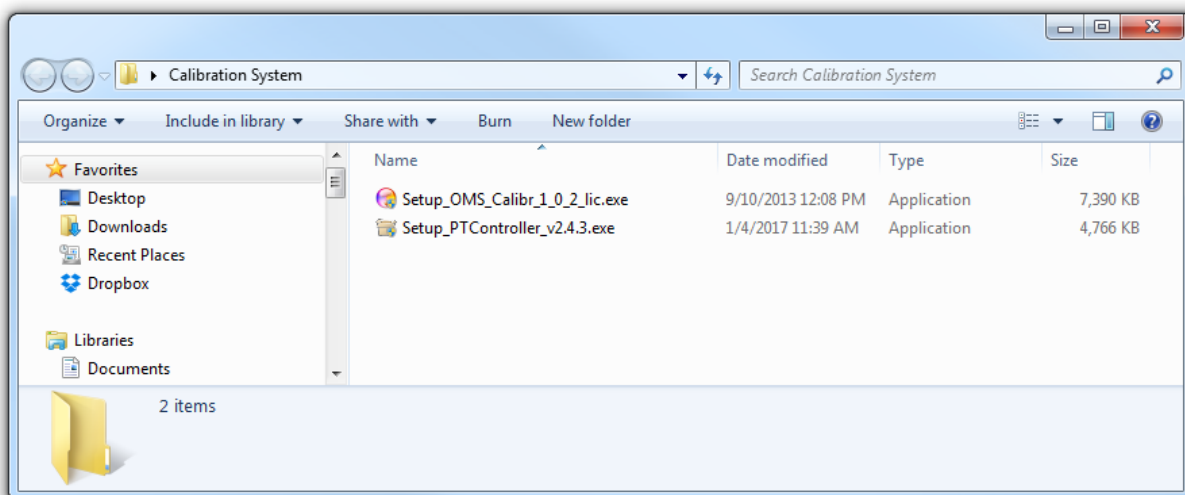
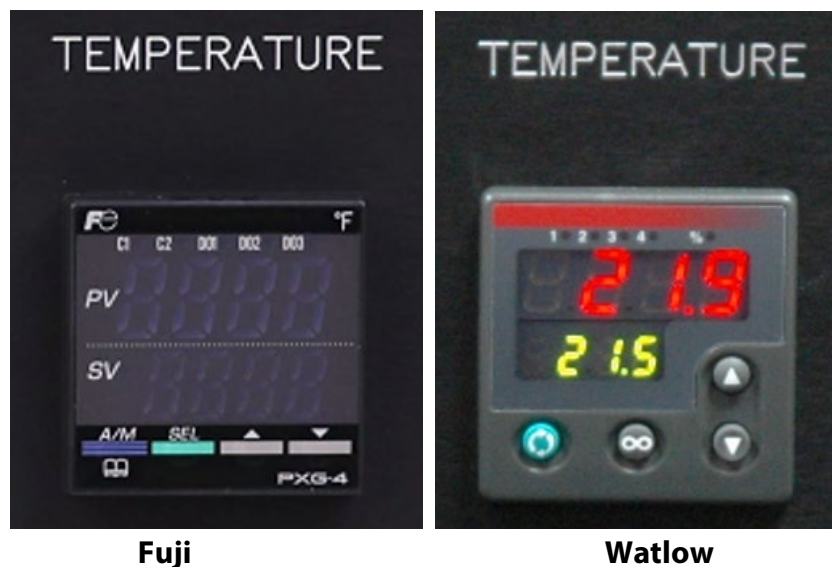


The NIC IP address should have the same network and subnet addresses but a unique host, the last line of the IP address. The host can be any value 1-254 but different from the host address of the calibration system. The subnet mask should be set to match that of the calibration system which, by default is 255.255.255.0. The **Default Gateway** and all other fields can be left blank.

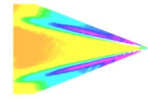


## Software Installation

Software is provided on a USB drive. There are two software packages on the drive. **Setup\_PTController.exe** is the control software for the calibration control box. **Setup\_OMS\_Calibr\_1\_0\_2\_lic.exe** is the calibration processing software used to convert the raw images and list file to a calibration file used in pressure and temperature sensitive paint post-processing conversion to pressure. Check our website (<https://innssi.com/calibration/>) to verify you are using the latest revision of the software. There are two version of the software, based on the temperature controller version (Fuji or Watlow). The correct version will be supplied with the system.



**Figure 5: Associated Software Installers for the Calibration System**



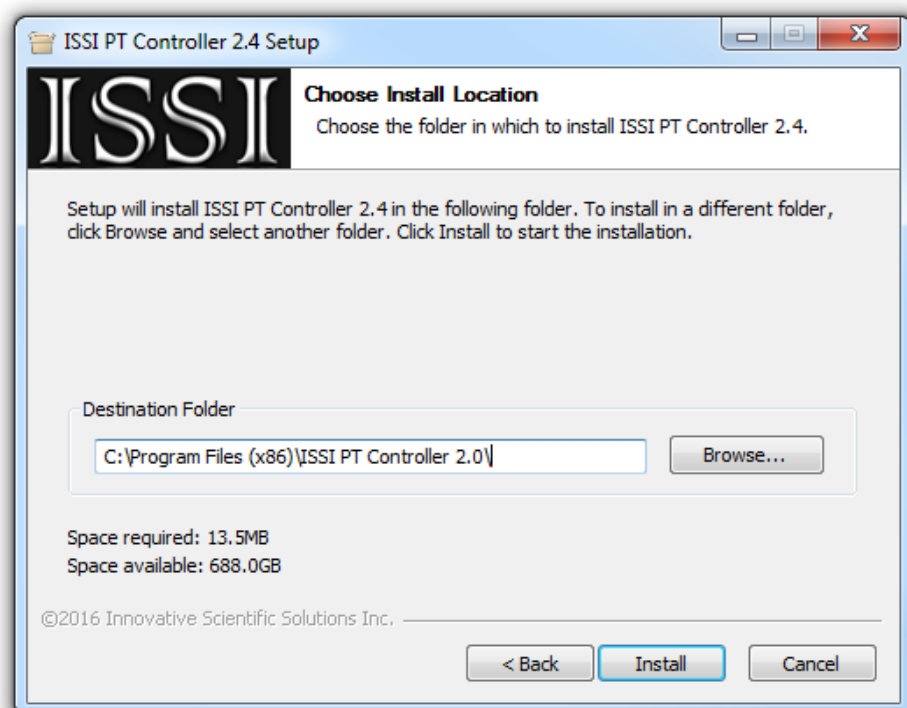
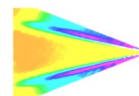
Open **Setup\_PTController.exe** to begin installing the calibration control software. *PT Controller* is a 32-bit program which will also work on 64-bit operating systems. Follow the steps that are shown next to install the software.



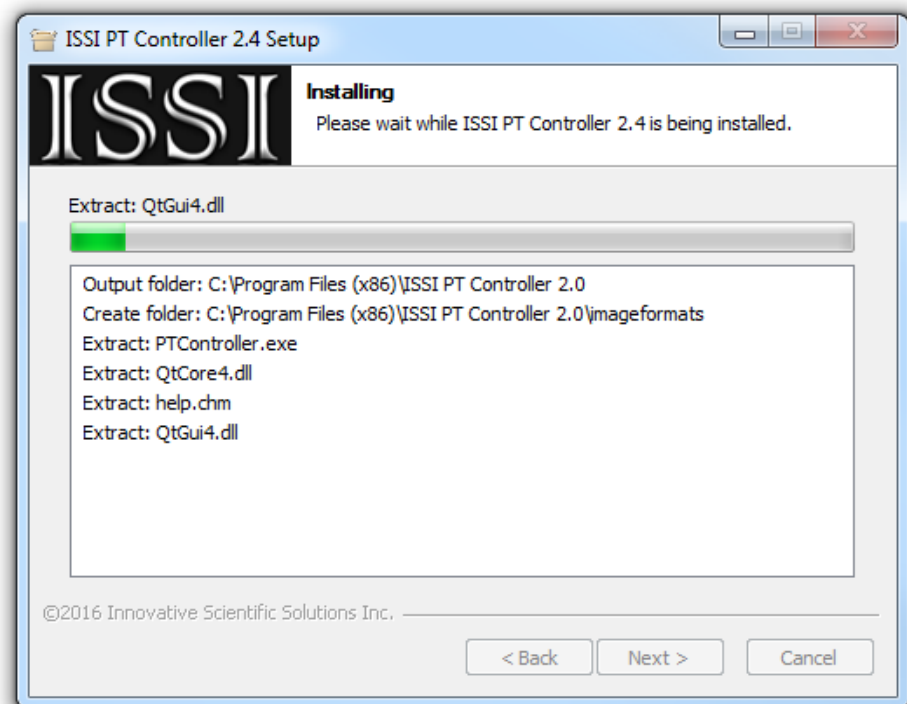
**Figure 6: PT Controller Software Setup**



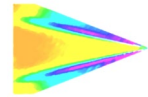
**Figure 7: License Agreement**



**Figure 8: Installation Location**



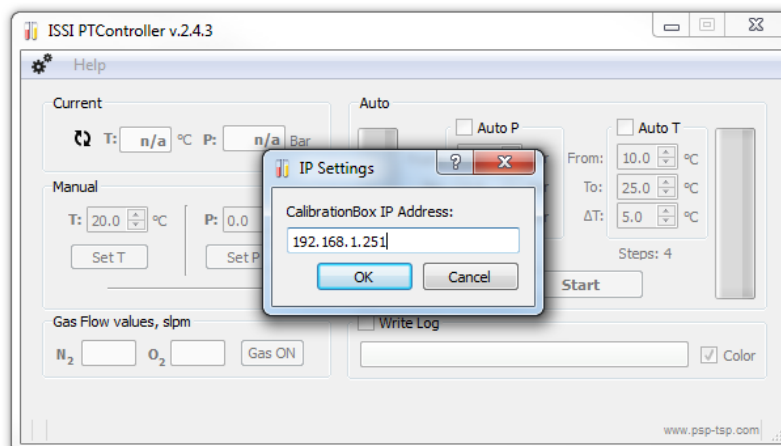
**Figure 9: Installation Progress**



**Figure 10: Setup Complete**

## **Software Operation**

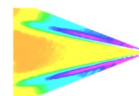
*PT Control* is graphical user interface which allows for full control of the calibration system. From here, the pressure and temperature in the system can be controlled and monitored. Control can be set up to be automatic or manual depending on the requirements of the user.



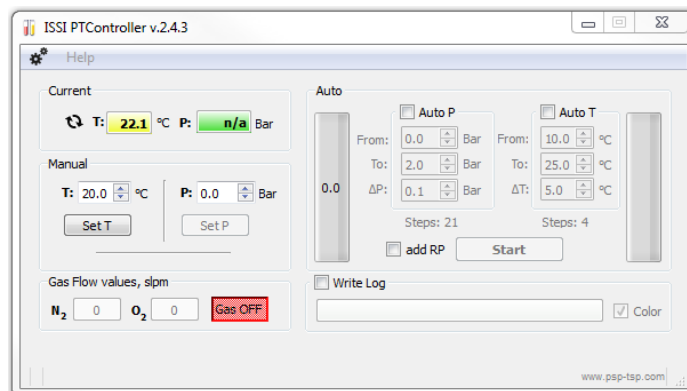
**Figure 11: Select IP Address of CAL-04 to Connect**

The program will ask for the IP address of the calibration control box (Figure 10) to connect. The default IP address is 192.168.1.251. The subnet mask default is 255.255.255.0 and the



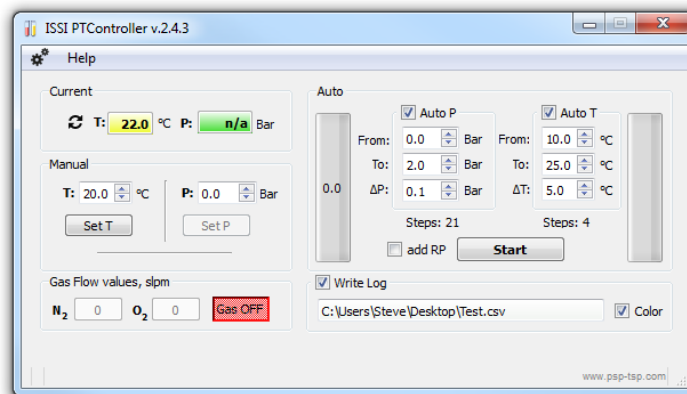


default gateway is 192.168.1.1. Click **OK** to connect. Once connected, the interface will display default values for pressure and temperature as well as the current pressure and temperature of the cell. **'Current'** will display current values inside the cell. **'Manual'** is where a user can manually input a temperature and/or pressure. Clicking **'Set T'** or **'Set P'** will set the temperature and pressure to what was entered by the user. The temperature range is 0-70 °C and the pressure range is 0.0-450 kPa (0-4.5 Bar). Units can be displayed and stored in a log file in either Bar, psi or Pa.



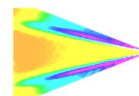
**Figure 12: PT Controller GUI Connected**

**'Gas Flow Values, slpm'** displays the current flow rates for each of the gases in standard liters per minute (slpm). In auto-mode, the SLPM will be recorded in the log file. **'Gas On'** gives manual control of the valves to turn the gas flow on or off. When stepping through conditions manually and waiting for temperature to adjust or setting the camera up, it may be desired to turn the gas off as to avoid waste. In auto-mode, the valves will close while the temperature is being adjusted.



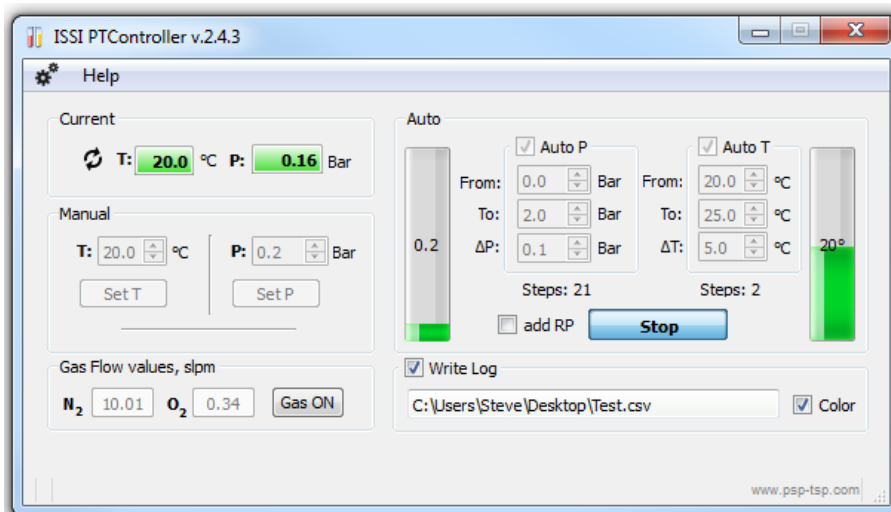
**Figure 13: PT Controller System Auto Mode Active**

Using **'Auto'** mode, shown in Figure 12, allows for automatic operation of the system at user prescribed set points. By entering the range and the step size of pressure and temperature,



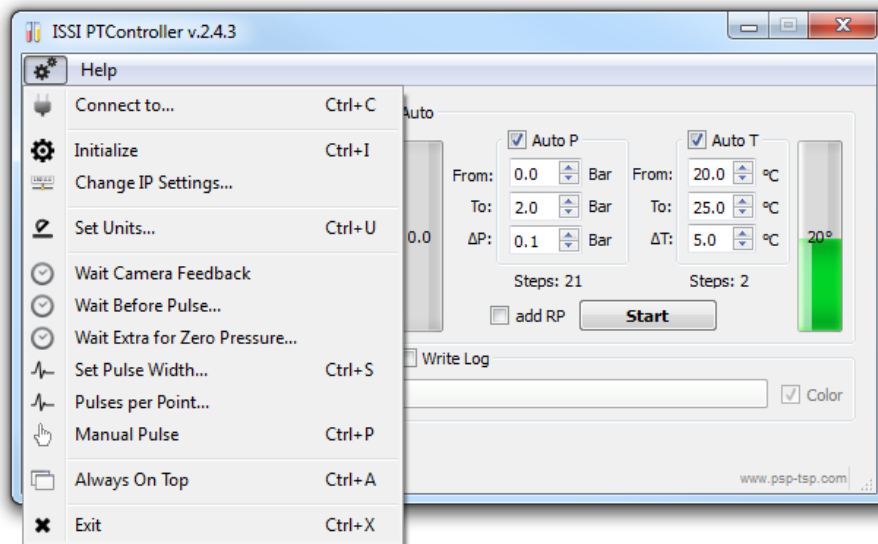
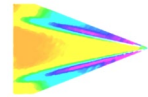
the system will step through the associated pressures and temperatures once initialized and output a log file to be used in processing of the calibration file. See the **'OMS Calibrate'** section for more detail on post processing.

To set up auto mode, check the box next to **'Auto P'** and/or **'Auto T'** as shown below and the section will allow the user to input values. Create a log file for calibration post-processing by checking the box next to **'Write Log'** and select a file path, file name and file type, as in Figure 13. Output log files can be saved as **.cls** or **.csv**, which are compatible with *OMS Calibrate*.



**Figure 14: Auto P, Auto T**

Once calibration parameters have been entered, press **'Start'** to begin automatic running of the system. The system will automatically step through pressure and temperatures sequentially until finished. The log file will be updated as the system moves through conditions. Once the calibration is finished, the system will return to the initial condition. To save bottled gas supply, the system will automatically close the valves during temperature adjustment.



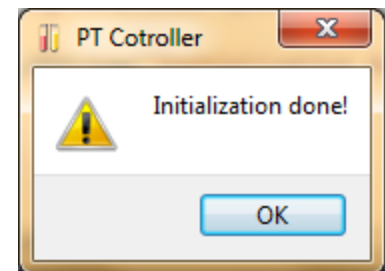
**Figure 15: Settings**

The gear symbol in the top left of the interface opens the settings tab. Most commands have a keyboard shortcut listed.

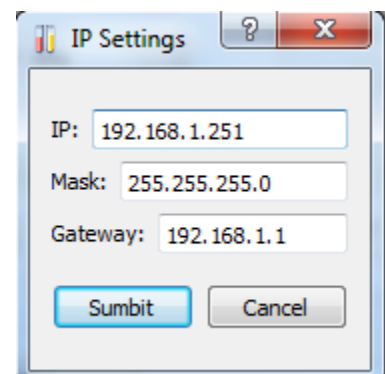
**'Connect to...'** will open the IP Settings tab. This allows the user to select which calibration system they wish to connect to by entering the IP address. The default IP address will be displayed on the initial operation of a new calibration system as shown at right. →

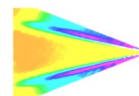


**'Initialize'** will program the temperature controller and flow controllers to the appropriate settings for operation within the calibration system. This is done at ISSI before each unit is shipped, however, if modifications are found to be needed, this can be done at ISSI and re-initialized by the user with a software upgrade. →

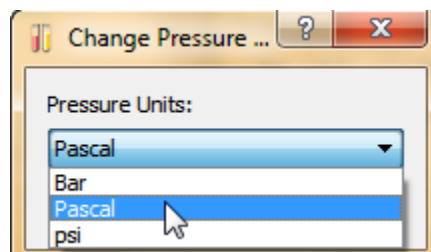


**'Change IP Settings'** opens the IP settings tab, allowing for changes to the IP address, Subnet Mask and Gateway. If operating the calibration system over a network, it may be necessary to modify these to match network parameters. Make sure that the updated settings match with those of the computer NIC. →



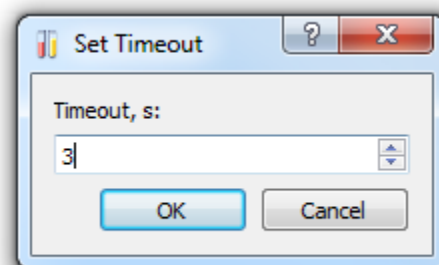


**'Set Units'** allows the user to choose between Bar, psi and kPa for pressure units displayed on the GUI. →

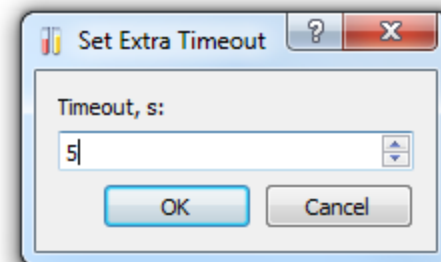


**'Wait Camera Feedback'** should be selected when the calibration system is operating with a camera. If selected, the system will not move to the next condition without a strobe pulse TTL input (mirroring the camera frame) into the **'CAMERA TRIGGER IN'** connection. This assures that the system is acquiring one image per condition and the images correspond to the correct file name in the log file generated.

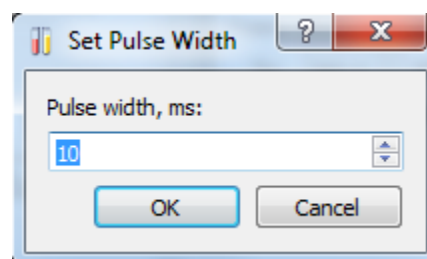
**'Wait Before Pulse'** sets a delay time before each trigger from the calibration box to the camera. This allows the mixing ratio in the cell to settle or reach equilibrium before the image is acquired. →



**'Wait Extra for Zero Pressure'** sets an extra time delay for images acquired at 0.0 bar/Pa/psi or vacuum. This condition takes longer to reach equilibrium so the system can be set to add in extra wait time before an image is acquired. It will only add this in for points acquired at 0.0 bar/Pa/psi. 5 seconds is recommended if using a vacuum point like this. →



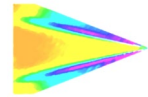
**'Set Pulse Width'** sets the pulse width of the output TTL signal from the **'CAMERA TRIGGER OUT'** connection. This is the pulse width the camera will receive as its input trigger. If using external pulse control for the camera trigger, this will be the camera exposure. Some cameras may require different pulse widths to trigger properly. Values are in milliseconds from 1 to 999 ms. →



To set the camera exposure to match this pulse width, select both **Trigger** and **Exposure Trig. Width**. This means the camera exposure time will be equal to the pulse width set in PT Control. The LED can also be controlled via this pulse width if connected to the same output TTL signal from the calibration system.

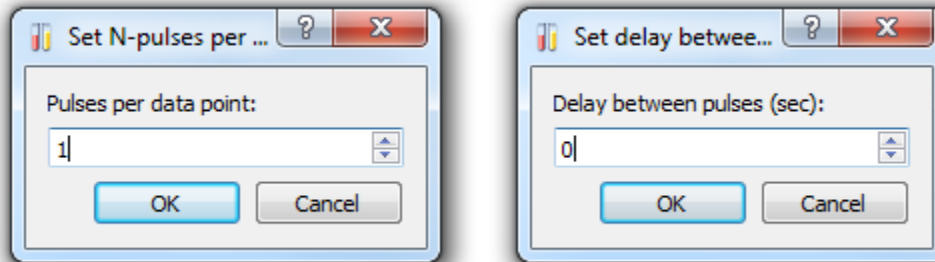


**Add RP** adds a 'reference point' at a selected pressure and temperature. This is selected based off of the local barometric pressure and temperature at the time of the calibration. This

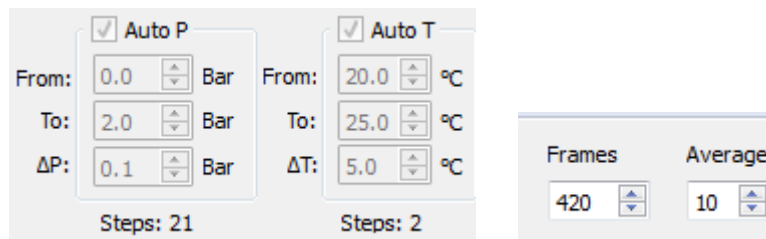


is optional as one point in the calibration matrix usually corresponds to the local barometric pressure and temperature. Check the box to enable and set a reference point.

**'Pulses Per Point'** sets the number of camera frames to acquire per data point. For better accuracy, averaging data is sometimes done. The calibration system will send X pulses to the camera per data point based on the number entered. A delay can be set between these pulses if desired.



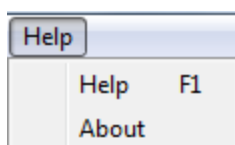
If setting 10 pulses per point in PT control, the number of acquired frames by the camera needs to be multiplied by 10. For example:



In the above case,  $21 \times 2 = 42$  frames will be acquired for the calibration parameters entered. If doing 10 pulses per point, the number of camera frames to acquire is  $42 \times 10 = 420$ . The above example shows this using ProAcquire and acquiring 420 total frames, averaging 10. This means that 42 total images will be saved, each an average of 10.

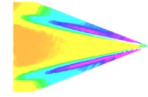
**'Manual Pulse'** will send a TTL pulse via **'CAMERA TRIGGER OUT'** to the connected camera and/or LED each time it is pressed (Ctrl+P). This can be used if a manual calibration is being conducted to acquire an image once the system is at condition.

**'Always on Top'** will place the PT Controller GUI on the top layer on the desktop so it always displays at the front even when other windows/programs are open.



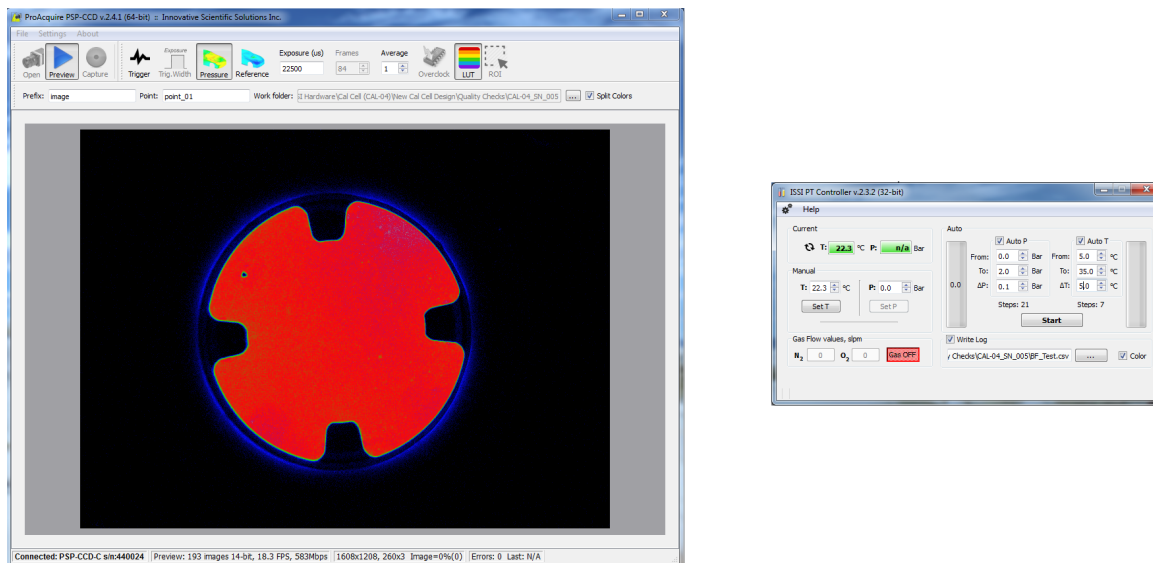
The Help tab displays the help file, detailing the features of PT Control and information about the version of PT Control installed.





## Camera Acquisition Setup

The camera used for the calibration (which should be the same model camera and filter used during the PSP testing) can be triggered from the calibration control box once the system reaches each condition. Any camera can be used with the system but if auto-mode is desired, the camera needs to be capable of being externally triggered and output a strobe to trigger the system to move to the next condition. The camera should be set up to begin acquisition from an external trigger so that it runs synchronously with the calibration control box.

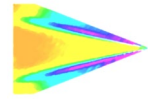


**Figure 16: Camera Synchronization with CAL-04**

The camera needs to be set up in external trigger mode with '**CAMERA TRIGGER OUT**' on the calibration control box connected to the camera trigger input. '**CAMERA TRIGGER IN**' needs to be connected to the camera strobe or external trigger output of the camera. This will send a TTL signal from the camera to the calibration control box when the camera acquires an image. Once the calibration control box receives this signal, it will wait two seconds and then move onto the next condition.

BinaryFIB.csv	11/30/2016 4:13 PM	Microsoft Excel C...	8 KB
BinaryFIB_SLP.csv	11/30/2016 3:41 PM	Microsoft Excel C...	5 KB
calib.settings	11/30/2016 3:07 PM	SETTINGS File	1 KB
calib_000000_p.tif	11/30/2016 4:37 PM	TIF File	949 KB
calib_000000_r.tif	11/30/2016 4:37 PM	TIF File	949 KB

**Figure 17: Saved Images from Camera**



In Figure 16, the camera acquisition software ProAcquire for the PSP-CCD-C/M is shown in use with the PT Controller software. The camera was set up to acquire 147 images, the total number needed for the auto-calibration shown at the right (P step (21) x T step (7) = 147). The camera needs to be set to acquire the same number (or greater) of images as conditions the calibration system will step through. As stated on page 18, if averaging images by using multiple pulses per point, the number of camera frames needs to be multiplied by the number of averages.

Filename convention for saving images needs to match with that of the PT Controller software so that the log file matches the file names acquired by the camera. The PT Control software will name each parameter in the log file in the following format: **calib\_000001\_1.tif**. This is also shown in Figure 17 in the list of files saved for the calibration example shown. Each file has an extension (\_p, \_r), each of which correspond to a different channel on the color camera. For monochrome cameras, there is no extension. The file naming convention for color chips (this is true for the PSP-CCD-C and pco.1600C however, other color cameras may differ) is detailed below:

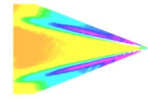
- **calib\_000001\_p.tif** – Red (pressure sensitive)
- **calib\_000001\_r.tif** – Green (reference)

#	N2[slpm]	O2[slpm]	T[C]	Pair[bar]	O2[%]
1	9.99	0	10	0	0
2	10	0.22	10	0.1	2.2
3	10	0.44	10	0.2	4.2
4	9.99	0.66	10	0.3	6.2
5	10	0.9	10	0.4	8.3
6	9.99	1.15	10	0.5	10.3
7	10	1.39	10	0.6	12.2
8	10	1.69	10	0.7	14.5
9	9.99	1.98	10	0.8	16.5
10	9.99	2.27	10	0.9	18.5
11	10	2.61	10	1	20.7
12	10.01	2.95	10	1.1	22.8
13	10	3.3	10	1.2	24.8
14	9.99	3.68	10	1.3	26.9

When setting up filename and saving parameters in the camera acquisition software, use the same folder as the PT Controller log file. For OMS Calibrate to use the log file, it needs to find the associated files in the same folder location. '**Calib**' should be the filename used by the camera acquisition software. PT Controller will save a log file listing filenames **calib\_XXXXXX\_X.tif** for each data point. The PSP-CCD cameras will always save files in the format **filename\_XXXXXX\_X.tif**. Other

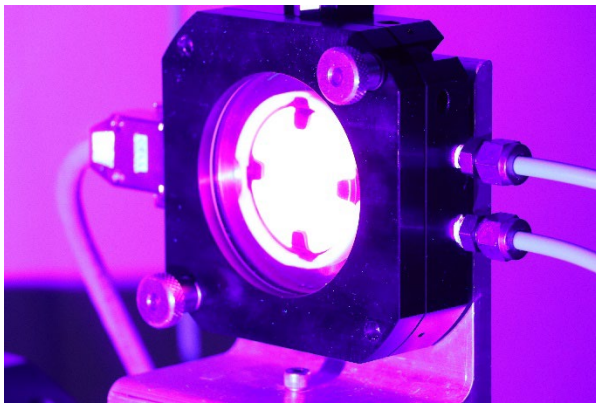
cameras may have a different number of digits following the filename. If that is the case, the log file needs to be edited to match file names to images saved so that the names match each condition.

The camera software (if using ProAcquire from ISSI) will allow for splitting of color channels ( ☐ Split Colors ). For color cameras, this should be selected. For monochrome cameras, this option is not available.

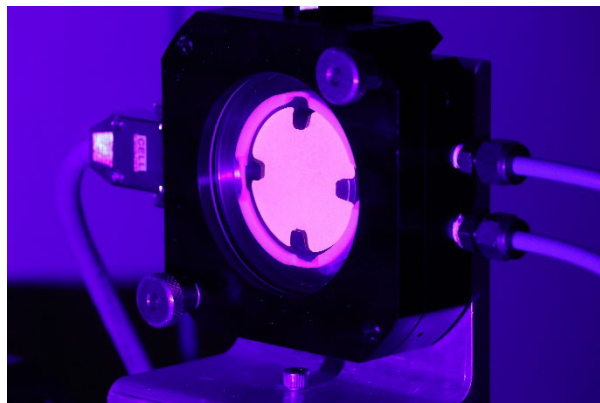


Also saved with the log file is an additional log file showing the SLPM of oxygen and nitrogen at each condition as well as the oxygen concentration (%). This file has the same name as the log file but with the \_SLMP extension.

The camera and PT control software should be set up with an appropriate exposure time for the pressure and temperature range to test. When exposed to very low oxygen partial pressure, PSP will be very bright. When exposed to very high oxygen partial pressure, the PSP signal will be much dimmer. The camera exposure time and lens aperture setting should be set such that when the paint is at its brightest emission level (lowest pressure setting), the intensity on the preview image is around 80-90% of dynamic range of the sensor.

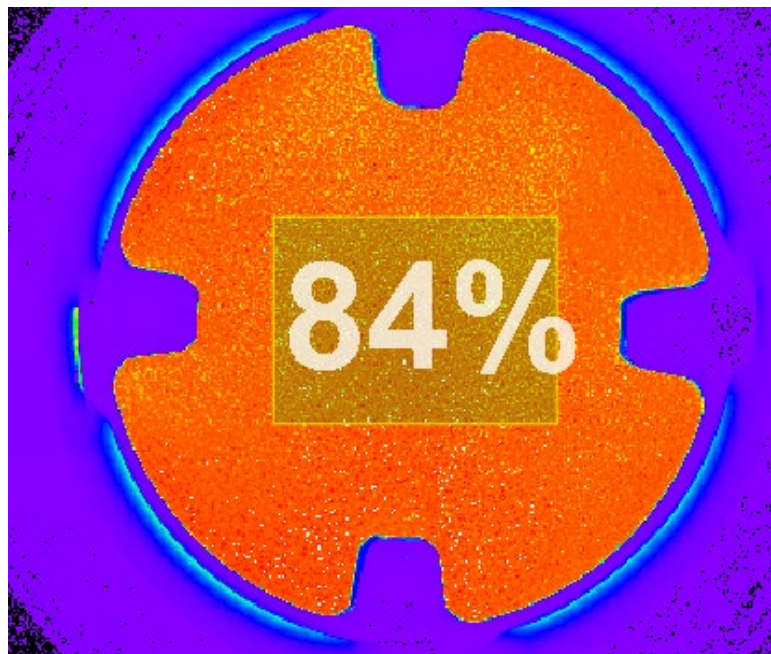


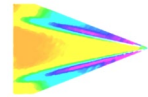
**0.0 Bar Setting**



**2.0 Bar Setting**

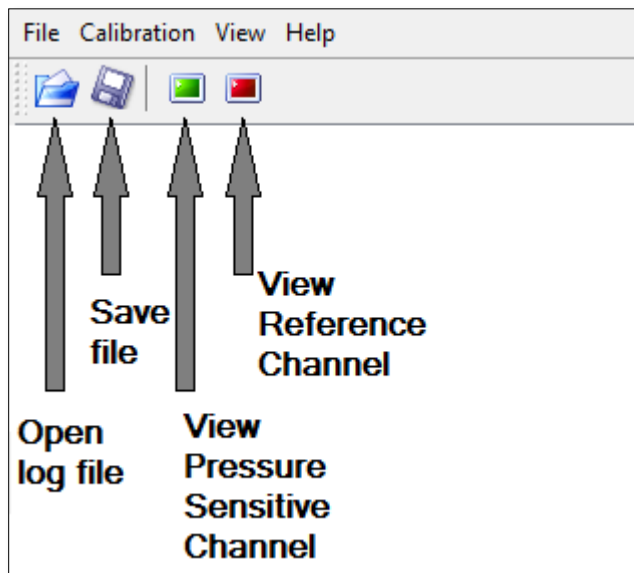
Proper signal level for ideal lens aperture and exposure time as shown in ProAcquire.



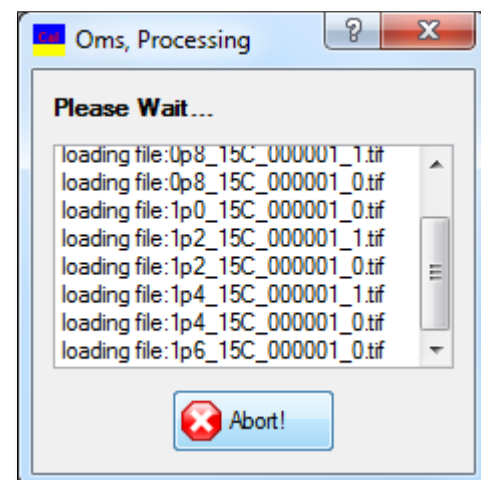


## **OMS Calibrate**

*OMS Calibrate* is a post-processing calibration software that converts the raw images from a calibration along with the list file listing the conditions (pressure and temperature) of each image to a calibration (**.clb**) file used to convert intensity ratio to pressure or temperature fields in PSP/TSP post-processing. The software uses log files (**.cls** or **.csv** format) to read from a list of raw images used in creation of the calibration file. Once the software has opened, open the log file for the calibration performed and it will load each associated image.



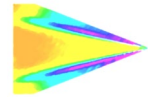
**Figure 18: Loading Images from Log File**



**Figure 19: OMS Calibrate Controls**

Once loaded, the image files will display as in Figure 20. It will display the Pressure (in bar, Pa, or psi), Temperature (C), Pressure-sensitive image (I Sens), scaling factor for the pressure-sensitive image (L Sens), the reference image (I Ref) and the scaling factor for the reference image (L Ref). Figure 20 shows a calibration with a color camera. A monochrome camera log file will only display the first four columns.

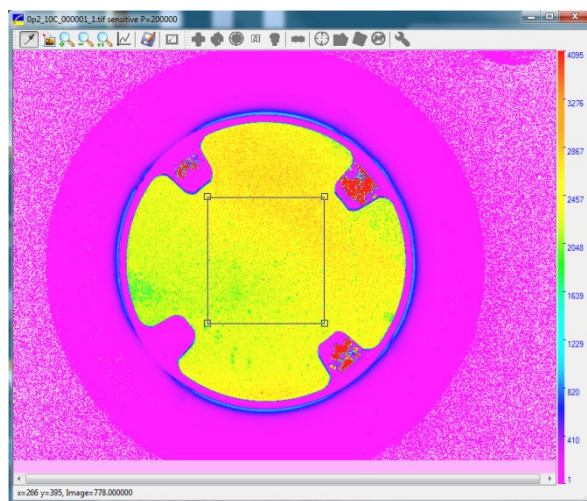




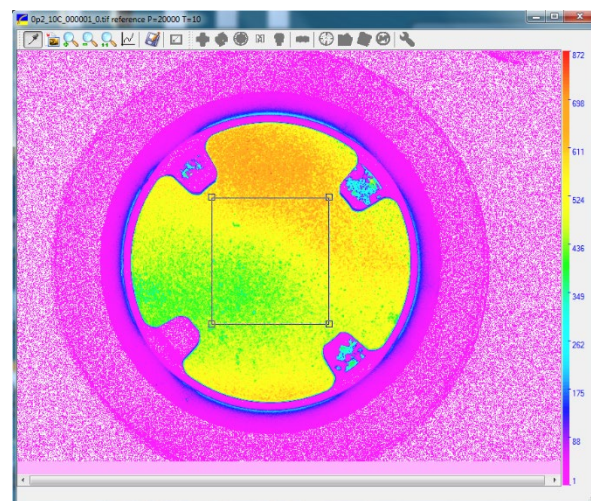
File Calibration View Help						
P	T	I Sens	L Sens	I Ref	L Ref	
160000	45	1p6_45C_000001_1.tif	1	1p6_45C_000001_0.tif	1	
140000	45	1p4_45C_000001_1.tif	1	1p4_45C_000001_0.tif	1	
120000	45	1p2_45C_000001_1.tif	1	1p2_45C_000001_0.tif	1	
100000	45	1p0_45C_000001_1.tif	1	1p0_45C_000001_0.tif	1	
80000	45	0p8_45C_000001_1.tif	1	0p8_45C_000001_0.tif	1	
60000	45	0p6_45C_000001_1.tif	1	0p6_45C_000001_0.tif	1	

**Figure 20: Log File Loaded in OMS Calibrate**

Before performing a calculation, select a region of interest (ROI) for the software to interrogate upon. The pressure-sensitive channel can be displayed by pressing the green button and the reference channel by pressing the red as shown in Figure 18. This will open each color channel as in Figures 21-22.



**Figure 21: Pressure-Sensitive Channel ROI Select**

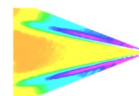


**Figure 22: Reference Channel ROI Select**

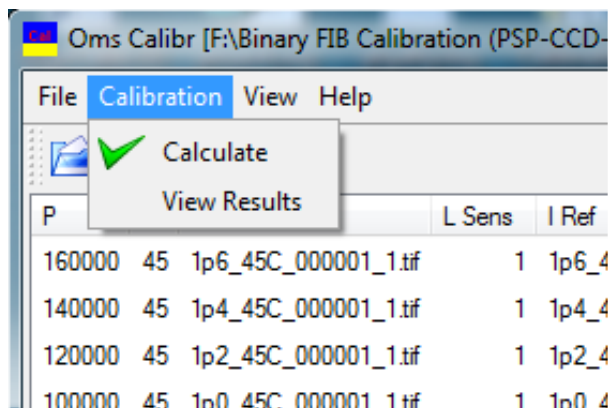
Select a region of interest where there is paint over the entire surface. If a non-painted surface is selected, it will adversely affect the calibration results.

To calculate the new calibration file, select the **'Calibration'** tab and **'Calculate.'** This will display the **'Calibration Settings'** window, Figure 24. Here, normalizing pressure (P norm) and temperature (T norm) can be entered as well as the order of the approximation. A **.csv** spreadsheet can also be saved from this window under **'Export CSV file.'** **'ROI'** is the currently selected ROI which was selected on the previous page.

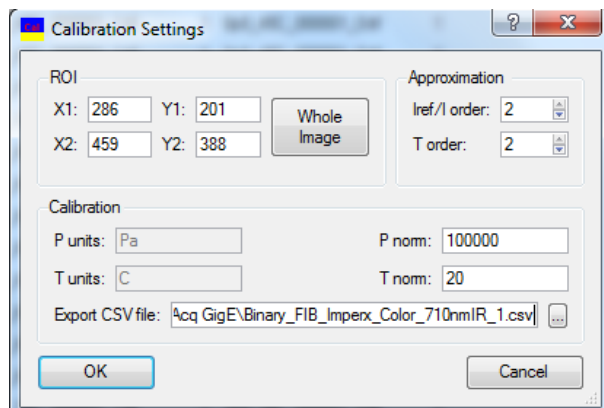




Once the calibration coefficients have been calculated for the calibration file, the **'Paint Features'** window will open, showing the coefficients which the file will use to convert to pressure or temperature.



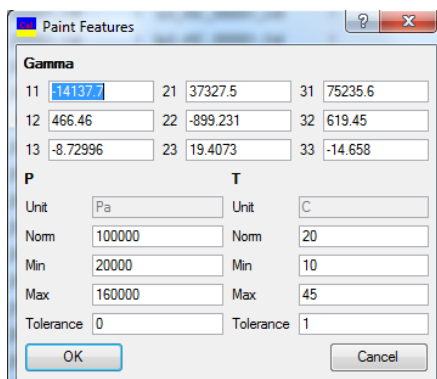
**Figure 23: Calculate Results**



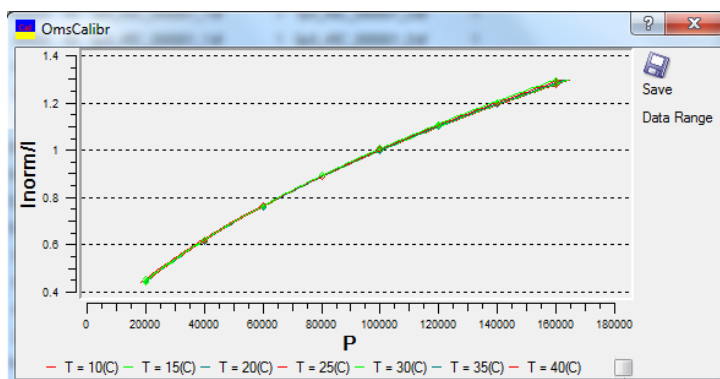
**Figure 24: Calibration Settings**

Gamma displays the coefficients of the Stern-Vollmer Equation and the pressure and temperature ranges are shown at the bottom as in Figure 25.

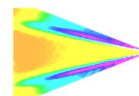
Once finished, *OMS Calibrate* will display the plot of the calibration (Figure 26), displaying each isotherm and its normalized response to pressure. This can be saved for plotting if desired. The output file, **.clb** can be loaded into *OMS Prolmage* or *OMS-Lite* for post-processing of pressure and temperature sensitive paint datasets to convert intensity ratio (wind-off/wind-on) to pressure or temperature. Further detail on that can be found in the instruction manuals for those respective software packages.



**Figure 25: Resultant File Coefficients**

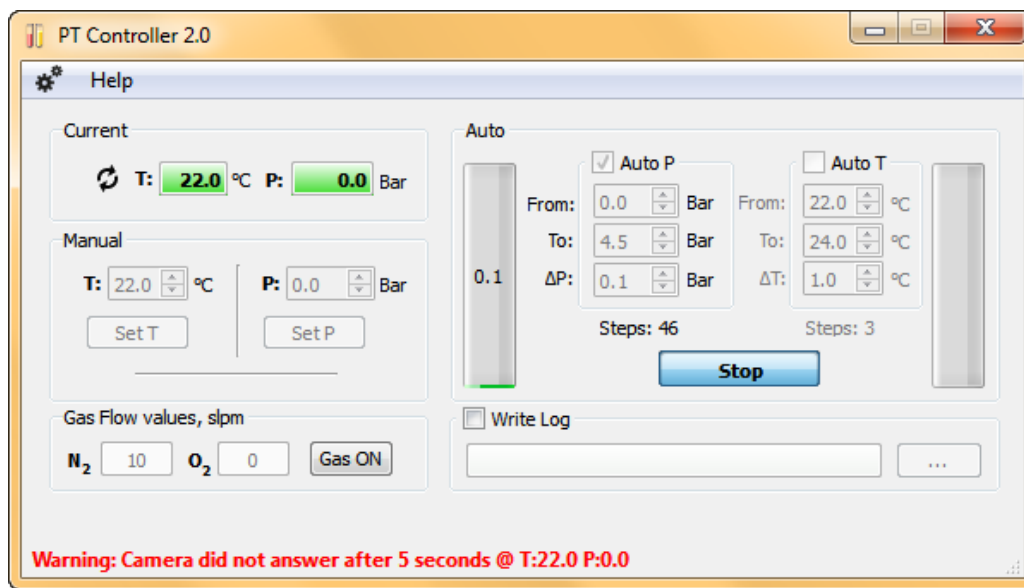


**Figure 26: Calibration Plot of Isotherms**



## Troubleshooting

If the connected camera does not return a TTL signal to the calibration control box after five seconds, the system will alert the user that it has not received a trigger signal to move to the next condition.



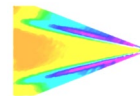
**Figure 27: Camera Not Responding Error**

If this error occurs, make sure the output of the camera can be seen on a scope and is TTL level (3.5-5V). Check all connections and cabling between the camera output pulse and **'CAMERA TRIGGER IN'** on the calibration control box.

## Maintenance

The flow controllers inside the system need to be calibrated every three years to ensure consistent performance of the system. Calibration of the flow controllers require the system to be returned to ISSI at the time of calibration. Please contact ISSI for pricing for the recalibration and recertification process at [issi-sales@innssi.com](mailto:issi-sales@innssi.com).

Any systems returned to ISSI must have a certificate stating the gases which were run through the system. Use of unspecified gases in the system will void the warranty of the system and can have potentially harmful effects for technicians who work on them. ISSI will not accept any unit returned without such certification. The product warranty is one year, so costs associated with calibration are not covered under the warranty. Opening the calibration control box voids the warranty. Only the calibration control box needs to be returned for calibration.



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