Human Body Temperature Measurement Camera Installation and Setup
Overview | Application scenarios

- This camera is ideal for installation as a pre-screening method to be placed in areas where personnel are on duty to conduct further screening of body temperature and to enact company protocols when individuals are found to have abnormal body temperatures. This solution is popular in places like passenger stations, railway stations, subway stations, airports, manufacturing facilities, hospitals and any other security check entrances. It is recommended to deploy our PT-BF5421-T camera and blackbody (real-time calibration tool) at each entrance of the facilities to ensure that all persons must pass through an inspection point. This camera has a built-in configurable audio and visible light to alert when persons are found above the expected temperature and can be connected directly to a laptop or computer for viewing through a web browser, or optionally connected through our MicroNVR or AVM NVR software for recording and additional alerting capabilities.

When properly installed and configured, this camera provides accuracy of ±0.3°C / ±0.54°F at normal body temperatures. This is the reason it is important to follow these directions for proper configuration and setup.

Airport  Station  Hospital  Enterprise

This product is not a medical device and is not intended for use in the diagnosis, cure, mitigation, treatment or prevention of any disease or other medical condition.
The PT-BF5421-T camera should be used as a pre-screening device as part of your building or business security plan.

This product is not a medical device and is not intended for use in the diagnosis, cure, mitigation, treatment or prevention of any disease or other medical condition.
**Overview | Topology**

**Solution 1:**
PT-BF5421-T Camera + Blackbody + Laptop/PC Local Access

**Solution 2:**
PT-BF-5421-T Camera + Blackbody + MicroNVR + TV/LCD + Laptop for Remote Access and Alerting

*Note:* Laptop, TV, Monitor, PoE Switch and Cabling shown for layout only. Not included with purchase.
### Thermal Network Bullet Camera
**PT-BF5421-T**

- Uncooled vanadium oxide infrared focal plane detector
- Detector resolution: 400*300
- Spectrum range: 8 μm ~ 14 μm
- Thermal imaging lens: 13mm
- Temperature measurement range: 30 °C ~ 45 °C
- Thermal sensitivity: ≤ 50mk @ f/ 1.0
- Visible light: 1 / 2.8 "CMOS
- Sound warning: Built in white warning light & audible alert
- Resolution: 1080p
- Temperature measurement accuracy:
  - ± 0.54°F (0.3 °C) with blackbody
  - ± 1.8°F (1.0 °C) without blackbody

### Body temperature measurement
**Blackbody**

- Working temperature: 40.0 °C
  (ring temperature + 5.0 °C ~ 50.0 °C adjustable)
- Temperature resolution: 0.1 °C
- Temperature measurement accuracy:
  - ± 0.2 °C (single point)
- Temperature stability:
  - ± (0.1 ~ 0.2) °C / 30min
- Effective emissivity: 0.97 ± 0.02
- Power supply: 220VAC 50Hz
- Ambient temperature and humidity: 0 ~ 40 °C / ≤ 80% RH

Optional adjustable tripod design with Special camera and blackbody mounting plates are ideal for fast-deployment and easy adjustment.

Please protect camera and blackbody From being bumped/knocked over To prevent damage and to ensure proper calibration of both devices.

### Adjustable Tripods (optional)

### Permanent Brackets (optional)

Optional junction boxes and pole mount brackets may be used to permanently affix the camera and blackbody to the building masonry or structure poles to keep them in position for permanent or semi-permanent use.

### AVM MicroNVR

The optional MicroNVR with Advanced Video Management software extends the features and functionality of the Thermal camera. It provides the ability to monitor the Thermal camera output from multiple PCs/Macs/Laptops and phones from anywhere in the world (when connected to the internet). The MicroNVR also provides the ability to configure email, pop up and text alerts to notify key personnel when individuals outside normal body temp range have entered the facility.
<table>
<thead>
<tr>
<th>Easy deployment</th>
<th>Safety</th>
<th>High-efficiency</th>
<th>High detection rate</th>
<th>Advanced Alerting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Body Temp. Thermal camera + Blackbody + ordinary PC constitutes a quickly deployed body temperature pre-screening station. Optional tripods make setup even easier.</td>
<td>Non-contact thermography to avoid the risk of cross infection during pre-screening process. This makes it a key component of a complete security solution for businesses and transportation.</td>
<td>Stop the long lines and difficult delays. By scanning quickly, this thermal camera allows people to move at normal speeds (detection times down to 1 sec)</td>
<td>The head detection temperature measurement can avoid the interference of other non-human targets, and the temperature measurement accuracy can reach ± 0.54 °F with blackbody</td>
<td>When combined with our AVM NVR software or MicroNVR recorder with AVM software, alerts can be not only heard and seen at the camera, but from anywhere with authorized users over the internet.</td>
</tr>
</tbody>
</table>
Preparation | Survey

- The installation area shall be **a relatively isolated and stable environment without wind or rapid changing ambient temperatures**. Avoid outdoor areas for best accuracy. It is not suitable for environments with strong air flow, rapid ambient temperature changes or strong electromagnetic interference or vibration.

- Position the camera so that the flow of traffic is towards the camera to ensure the camera can detect the temperature of people with their forehead and/or eyes.

- **Keep out of direct sunlight or high ambient temperatures.** Avoid interference of heat sources such as microwave ovens, electric heaters, hot water heaters, high-power lamps, radiators, etc. to avoid damage to the camera or blackbody.

- The visible light channel of the camera requires sufficient illumination with minimal backlighting to properly register faces.

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**Recommended Positioning**

It is recommended to use railings or other devices to guide personnel in the correct direction towards the camera for detection for best accuracy and stability.

**Avoid these scenarios**

- Too much backlighting
- Incorrect direction of traffic
- Insufficient illumination
When there is a large difference between indoor and outdoor temperatures, it is recommended to route people through a back and forth S shaped route to allow the temperature of a person’s forehead to stabilize (reducing impact of excessive heat from outside or excessive cooling of the skin).

It is recommended to keep thermal camera away from an exterior door where hot or cold air might rush in when it is opened.
## Preparation | Device & Tool List

Note: Tripod installation is used for this example for portable indoor installations. Optionally camera and blackbody can be mounted with brackets/junction boxes.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification type</th>
<th>Appearance</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal camera</td>
<td>PT-BF5421-T</td>
<td><img src="image" alt="Thermal Camera" /></td>
<td>Thermal camera 13mm lens, best monitoring distance ~10ft (3m)</td>
</tr>
<tr>
<td>Blackbody</td>
<td>JQ-D70Z</td>
<td><img src="image" alt="Blackbody" /></td>
<td>Blackbody provides continuous calibration for camera</td>
</tr>
<tr>
<td>Tripod and Connector</td>
<td></td>
<td><img src="image" alt="Tripod" /></td>
<td>Tripods (optional) for rapid deployment of camera and blackbody along with adapter plates for easy mounting.</td>
</tr>
<tr>
<td>Computer</td>
<td>Notebook / Desktop</td>
<td><img src="image" alt="Computer" /></td>
<td>(not included) for configuration and setup</td>
</tr>
<tr>
<td>MicroNVR (Optional)</td>
<td>NVR Recorder with AVM Software</td>
<td><img src="image" alt="MicroNVR" /></td>
<td>Optional MicroNVR recorder for recording and/or alerting. Includes our AVM recording software.</td>
</tr>
<tr>
<td>Software (Optional)</td>
<td>AVM software for Recording</td>
<td><img src="image" alt="Software" /></td>
<td>Optional AVM recording software to install on your own PC/Laptop</td>
</tr>
<tr>
<td>PoE Switch (Optional)</td>
<td>Standard PoE Switch</td>
<td><img src="image" alt="PoE Switch" /></td>
<td>An optional standard PoE network switch is recommended for powering the thermal camera and connecting to your computer or NVR recorder.</td>
</tr>
<tr>
<td>DC12V power adapter (Optional)</td>
<td>AC to DC Power Supply</td>
<td><img src="image" alt="Power Adapter" /></td>
<td>Optional AC to DC power supply to provide power to the Thermal Camera (only if PoE switch above is not used. Power-AC100V~240V-12V 2A</td>
</tr>
<tr>
<td>Tape Measure</td>
<td>20 feet or more</td>
<td><img src="image" alt="Tape Measure" /></td>
<td>Tape Measure for marking out distances and heights of camera and blackbody</td>
</tr>
</tbody>
</table>
### Preparation | Device & Tool List

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification type</th>
<th>Appearance</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network cables, Surge Protectors</td>
<td>several</td>
<td></td>
<td>Each setup may require different lengths of extension cords and network cables to permit connection. These are not included with the camera.</td>
</tr>
<tr>
<td>Traffic routing railings</td>
<td>several</td>
<td><img src="image" alt="Traffic railings" /></td>
<td>You may need additional railings in order to properly route people past your thermal camera to ensure that all people are scanned and in the correct direction. These are not included with this camera as every site will have different requirements.</td>
</tr>
<tr>
<td>Footprint stickers</td>
<td>several</td>
<td><img src="image" alt="Footprint stickers" /></td>
<td>Stickers or paint markings to show people the route of traffic into the facility for testing. These are <em>not</em> included with the thermal camera system.</td>
</tr>
<tr>
<td>Screwdrivers, Wire Clamp, Electrical tape, cable ties, RJ-45 plugs, etc</td>
<td>several</td>
<td></td>
<td>These are also <em>not</em> included</td>
</tr>
</tbody>
</table>
Installation | Installation Requirements and Precautions

- The blackbody should be installed just above and to the side of where persons will be walking past the camera. The blackbody heat radiation surface should face the camera. The black body can be to the left or right side where a person will be walking.

**Note:** The blackbody should not be installed too close to the edge of the thermal image. It is recommended to divide the image into 16 equal parts as shown. Mount so that the blackbody is near the intersection point on the upper left or upper right of the image.

Protect the blackbody and camera from damage, especially if opting to use the tripods!
The installation height of camera and blackbody and the distance from blackbody to camera are important for optimum accuracy as shown in the table below.

The distance between a person’s forehead and the camera should be the same as the distance between the blackbody and the camera.

<table>
<thead>
<tr>
<th>Camera mounting height</th>
<th>Camera angle</th>
<th>Blackbody Mounting Height</th>
<th>Distance between Blackbody and Camera</th>
<th>Distance between forehead and camera</th>
<th>Width at the best distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 ½ ft (~2m)</td>
<td>Downward angle of &lt; 30 °</td>
<td>6 ft (~1.8m)</td>
<td>10 ft (~3m)</td>
<td>(No blackbody 6.5ft (~2m))</td>
<td>5ft (~1.5m)</td>
</tr>
<tr>
<td>6 ft (~1.8m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 ft (~3m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10ft (~3m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **PT-BF5421-T (13mm) Installation Guide**
Announcements:

- Do not touch or spray the blackbody heating surface. Scratches, smudges and dirt will lead to the decrease of blackbody accuracy and/or failure. This will affect the accuracy of your calibration.

- The blackbody equipment uses AC120V power supply, make sure you use a grounded outlet/receptacle to prevent shock!
Installation | Installation Requirements and Precautions

This is an example setup of the thermal camera and blackbody. The height of the thermal camera from the ground is 6.5ft, and the height of the blackbody from the ground is 6ft. The best detection position of the human body is parallel to the blackbody (~10ft away from the camera), and the camera's pitch angle is less than 30 °, facing the forehead of the face and the radiation surface of the blackbody.

**Note:** During field installation, direct contact with the outside air should be avoided when possible, otherwise the temperature measurement may be inaccurate due to the influence of indoor and outdoor airflow convection.

Person standing at distance of ~10ft from camera at same distance as blackbody.
Installation | Ground Sticker & Notice Board

Note:
Install any guard rails, railings, fences or other stickers (not included with the thermal camera system) to ensure that people know the correct direction of flow for appropriate temperature scanning.
Installation | Thermal Camera & Blackbody

Camera connection:
Connect camera to a PoE switch or with optional DC power connection then connect network cables to PC and/or MicroNVR recorders to allow access to camera over local network.

Blackbody connection:
The black power supply is AC120V, with standard AC three-hole plug, the line length is 6ft (the socket must be grounded).
Configuring Camera & Blackbody

1. Log in to Camera’s IP address (default is 192.168.1.108), Select [Settings] > [Smart Channel] > [Smart Plan]

2. Click on the icon for [Body Temp Sensing] it will turn yellow once selected

3. Click Save.
1. Open the Power, the green light is on when the switch is turned on. (After power on, the blackbody equipment needs to be preheated for 20 minutes. The default working temperature of blackbody is 40 °C, which needs to be manually adjusted to 35 °C.)

2. Long press the “SEL” button to enter the set temperature, and the red light will be on. Then press increase / decrease key to adjust the value to 35 °C.
After mounting the camera and the blackbody in position, make sure that the blackbody is on the right or left side of the image and is not blocked by a person walking. Make sure the blackbody is not too close to the edge of the view of the thermal image sensor and that it will not be blocked by a person walking.
Configuring Camera & Blackbody

1. Select [Settings] > [Smart Thermal] > [Human Temperature Measurement] > [Blackbody Parameters] (1)
2. Enable (2) the Blackbody function (Note: if there is a blackbody scheme, it must be checked and enabled; if there is no blackbody scheme, it is not necessary to enable it)
3. The Blackbody temperature (3) is 35 °C (the default value). Confirm that the maximum temperature, the minimum temperature and the average temperature are all within 35 ± 0.2 °C.
4. Click “Draw Area”, then click and drag to just surround the bright portion of the blackbody (4). Click Save to apply.
5. **Temperature Correction**: Due to environmental differences, the temperature of the tester may have errors. If you have tested at least 5 people in the field and verified they are at the correct temperature measuring distance, and the measured temperature is generally too high or too low, compensation can be made through temperature correction (5). For example, if the temperature is 0.5 °c too low, fill in 0.5 °c with the temperature correction; if the temperature is 0.5 °c too high, fill in -0.5 °c.

6. Click **Save**
1. Select [Settings] > [Smart Thermal] > [Human Temperature Measurement] > [Human Temperature Measurement]

2. Enable (2) Human Body Temperature Measurement function
3. **Draw a regular frame:** Have a person stand 10ft from the camera, next to the blackbody facing the camera. Draw the frame around the person (small blue frame in picture above), making sure it includes the head and shoulders of the person clearly and **ensure the frame does NOT include the blackbody** (Note: the lower edge of the frame cannot be too low, otherwise it can give false alarms from persons as they move too close. Ideally a person will walk below the frame as they come closer than 9ft from the camera’s view.)
Configuring Camera & Blackbody

Set up Temperature ranges and Alerts

4. Enable “Temperature Report” and “High Temperature Abnormal Alarm” functions (4), “High temperature abnormal alarm” set to 37.3 °C by default, then the thermal camera can send the alarm and report to MicroNVR or AVM software (optional).

5. Temperature Lower Limit (5) : Increase the lower limit of temperature detection: for example, if it is set to 25 °C, the target below 25 °C will not be detected.

6. Enable “Audio Linkage” and “White light” (6) for alerts if desired.

7. Increase the size or scaling of the face identification frame as needed. This is the area where the camera will watch for faces to measure.

8. Click Save.
1. Select [Setting] > [Smart Thermal] > [Human Temperature Measurement] > [Smart Channel]

2. **Smart Channel**: Visible light and Thermal imaging are the Options. In most instances, visible light is used to detect faces. If there is too much backlight or not enough light, then you may wish to select thermal for face detection instead. **Snap Angle Filter**: The higher the value, the easier it is to capture a face from the side. For example, when the value is 1, it will only detect a face from the front.

3. Click **Save**.
Configuring Camera & Blackbody

Temperature Calibration

1. Select [Setting] > [Smart Thermal] > [Human temperature measurement] > [Compensation Settings]

2. **Temp. Compensation Mode**: 1) Mercury thermometer (default); 2) Forehead temperature compensation.
   
   This setting will adjust the displayed temperature. Since most of us compare body temp to the "normal" 98.6 °F, that is a normal body temperature when taken with a Mercury Thermometer (internal temp) so select Mercury Thermometer. This will adjust temperature readings up (surface temp of forehead) to match the temperatures you are used to reading with a thermometer.

3. Click “Save”.

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Configuring Camera & Blackbody

1. Select [Setting] > [Smart Thermal] > [Human temperature measurement] > [Others]

2. Please confirm if the “Adaptive ambient temperature” is consistent with the real ambient temperature on-site. If it is, no adjustment is needed. If it is not, please input the accurate ambient temperature (use a thermometer to measure or point to measure the temperature of the tripod under the blackbody as a reference, as shown in the figure below).

   This setting must be accurate, otherwise it will lead to inaccurate temperature.

3. Click “Save”.

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**Ambient Temperature Configuration**

![Image of ambient temperature configuration interface](image.png)
**Adjusting Video Target Overlay**

1. **Adjust the Video Target Overlay for Visible and Thermal Image Sensors** -
   1) When the **Visible light Smart channel** for face detection is selected, the visible light face frame will be correct, and the thermal imaging face frame should be adjusted to match.
   2) When the **Thermal imaging channel** for intelligent detection is selected, the visible light face frame should be adjusted according to match the thermal imaging frame.
   3) Adjust the up, down, left and right arrows (set step length 5) as stated above to make sure that both visible and thermal match. This must be accurate for proper detection.
Configuring Camera & Blackbody

Final Testing for Accuracy

Return to the preview interface, have personnel pass normally, and check the temperature measurement of multiple individuals with various face coverings (masks, hats, etc) to ensure proper calibration. If variance is found, test actual temperature with thermometer and adjust camera settings accordingly. Do not adjust temperature correction based on a single person, instead make adjustment only if an average of all people is high or low during an extended test.

Simulate an above average temperature trigger alarm by placing a heated object on the forehead of a person as they walk through. This will test the audible and visual alerts.
## Installation Checklist

<table>
<thead>
<tr>
<th>Factors</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The camera installed in an indoor area with a relatively stable ambient temperature and no major fluctuations?</td>
<td>Outdoor temperatures, wind, humidity and other environmental factors have a great impact on the accuracy of the thermal imaging, it is not recommended to be installed outdoors or in the area directly connected to the outdoor, but in a closed and relatively stable environment without wind.</td>
</tr>
<tr>
<td>The Camera height at 2m (6.5 ft)</td>
<td></td>
</tr>
<tr>
<td>The Blackbody Height is 1.8m (6 ft)</td>
<td></td>
</tr>
<tr>
<td>Distance between blackbody and camera is 3m (10ft)</td>
<td></td>
</tr>
<tr>
<td>Width of path is at maximum 5 ft (1.5m)</td>
<td>Ensures all persons will be scanned as they enter</td>
</tr>
<tr>
<td>The path of traffic is directing people to walk towards the camera</td>
<td></td>
</tr>
<tr>
<td>Make sure the calibration channel is correct for the blackbox heating surface</td>
<td>Improper calibration will make temp measurements inaccurate</td>
</tr>
<tr>
<td>Make sure the face detection zone is correct for persons entering and has face view at optimum distance (10ft)</td>
<td>Ensure faces appear in the drawn zone at the correct distance for optimal accuracy</td>
</tr>
<tr>
<td>Check all system configuration settings</td>
<td>Double check all system settings based on the configuration section of this manual.</td>
</tr>
<tr>
<td>Observe continuously for 3 minutes under normal human flow to see whether the detection temperature of human head is accurate (dual channel video recording). Double check any variations with thermometer and adjust temperature calibrations as needed.</td>
<td></td>
</tr>
</tbody>
</table>
FAQ | Precautions for use of Blackbody

Warning

To avoid personal injury and damage, please follow the following instructions:

• Make sure the ground and area around the blackbody and camera is free of oil, chemicals, inflammables and explosives!
• Operating Temp. is 0 ℃ ~ 40 ℃.
• **Only use grounded outlets to prevent accidental electric shock!**
• Ensure that the blackbody is protected from physical damage
• Blackbody cannot be used for applications other than temperature testing and calibration
• Do not change the blackbody range without permission to avoid damaging the blackbody or causing safety issues
• **Do not disassemble or refit blackbody. If the tamper proof label is torn or damaged, the product will not be warranted.**
• **Do not touch the blackbody heat element surface. Scratches and dirt will lead to the decrease of blackbody accuracy or render it non-functional.**
• **Indoor use only.** Use only in areas free from obvious air convection and strong light irradiation, strong electromagnetic interference and vibration.
• **Allow for heat dissipation around the blackbody,** and the distance between the blackbody and surrounding objects shall not be less than 10cm.
FAQ | Precautions for use of Blackbody

Calibration

- In order to ensure the accuracy of blackbody temperature measurement, it is recommended to send blackbody for paid calibration on a regular basis. The calibration cycle is usually one year.

Routine maintenance

- Blackbody shall be cleaned and maintained by designated personnel.
- **When in use, do not cover the blackbody with any object to block the heat dissipation and thus the temperature accuracy.**
- **When not in use, unplug the blackbody and allow to cool and place in a dust free area to protect from dirt or damage.**
  
  Ensure that the storage environment temperature and humidity are appropriate.

- It is recommended to use neutral detergent to clean the blackbody shell and soft brush to clean the dust on the radiation surface of blackbody. Only clean while the blackbody is cool.
1. **What is the blackbody? What is its function?**
   - Blackbody can be simply understood as a constant temperature reference source. When testing human body temperature, blackbody is generally set to 35 °C by default, which is used for temperature correction of thermal imaging acquisition, to meet the accuracy requirements of ± 0.3 °C (± 0.54°F).

2. **Can it be installed in outdoor or semi outdoor environment?**
   - Because the outdoor temperature, wind, humidity and other environmental factors have a great impact on the temperature measurement of the thermal imaging surface, it is not recommended to be installed outdoors or in the area directly connected to the outdoors, but in a closed and relatively stable environment without wind.

3. **Why is it recommended to measure the temperature of frontal forehead?**
   - A person’s forehead offers the best temperature reading except for an internal body temperature (thermometer)
   - A person’s temperature reading comparing the forehead to the side of their face of the same person / same position will have a slight difference due to blood-flow and other factors. Even with masks, the high temperature points are mainly in the forehead, ears and neck, and the temperature is different among different people. Therefore, it is required to face the camera and test the frontal temperature uniformly to reduce the impact of temperature difference between different parts of the face.
4. **The best distance for temperature measurement?**
   - The best temperature measurement distance is the same as the distance between blackbody and equipment. Detection distance is 3m (10ft), and the path width of 1.5m (5ft)
   - **Objects closer to the camera will read as higher temperatures.**
   - **Objects farther from the camera will read as lower temperatures.**
   - That is why proper setup of face detection field is very important, as is the camera distance and angle.

5. **How many people can be tested at one time?**
   - There is no limit to the number of people in the detection area, but not many people will fit side by side in a 5ft wide path. This is the reason that you generally want to have traffic flow to move towards the camera so that 1-2 people are scanned at a time.

6. **Why does the image of thermal imaging channel seem to freeze at times? Is it normal?**
   - This is normal. From time to time, the thermal imager will reset itself to recalibrate and ensure proper accuracy. The process is fast so it should not affect normal operation.

7. **Why thermal camera does not measure temperature after the first configuration**
   - System time is not synchronized, refer to time synchronization setting in system debugging.

8. **Why is the head detection inaccurate?**
   - Double check the camera angle adjustment, frame placement and camera and blackbody height. See the camera configuration settings in this manual to determine if any adjustments are necessary.