Kelvin Blackbodies

Fira Vision are distributors of Kelvin Blackbodies. Their Blackbodies cover temperatures ranging from –20°C to 1200°C with various apertures and cavities sizes available

Model	JQ-100MYDD1B/JQ-100MYD1C
Temperature Range	.-20℃~60℃
Emissive Area	ϕ100mm
Temperature Resolution	0.1℃/0.01℃
Accuracy	± (0.3%FS+1.0) ℃/± (0.3%FS+0.5) ℃ (Ambient Temp 23℃ ± 5℃)
Stability	±(01~0.3) °C/10min/ ± (0.01~ 0.05) °C/10min
Emissivity	0.97±0.02
Power Supply	220VAC 50Hz 350W
Dimesnion/Weight	W235mmxH375mmxD295mm / 14kg
Operating Ambient Temp	0 ℃ ~ 40℃ (≤20℃ when the Blackbody is operating in cooling mode) /≤80%RH
Options	RS323 or RS485 communication interface / Plexglass cover

Model	JQ-50QYZ5B
Temperature Range	.-50 ℃~500℃
Aperture Diameter	ϕ50mm
Temperature Resolution	0.1℃
Accuracy	± (0.3%FS+1.0) ℃ (Ambient Temp 23℃ ± 5℃)
Stability	± (0.01~ 0.5) °C/10min
Emissivity	≥0.99
Power Supply	220VAC 50Hz 350W
Dimesnion/Weight	W235mmxH375mmxD295mm / 20.6kg
Operating Ambient Temp	0 ℃ ~ 40℃ /≤80%RH
Options	RS323 or RS485 communication interface / Plexglass cover

Model	JQ-50QYG2B
Temperature Range	.-500℃~990 ℃
Aperture Diameter	ϕ50mm
Temperature Resolution	0.1℃
Accuracy	± (0.3%FS+1.0) ℃ (Ambient Temp 23℃ ± 5℃)
Stability	± (0.01~ 0.5) °C/10min
Emissivity	≥0.99
Power Supply	220VAC 50Hz 350W
Dimesnion/Weight	W340mmxH650mmxD510mm / 40.2kg
Operating Ambient Temp	0℃ ~ 40℃ /≤80%RH
Options	RS323 or RS485 communication interface / Plexglass cover

Model	JQ-30QYG3A
Temperature Range	.-800℃~1200℃
Aperture Diameter	ϕ30mm
Temperature Resolution	1℃
Accuracy	± (0.4%*t) ℃ (Ambient Temp 23℃ ± 5℃)
Stability	± 1 ℃/10min
Emissivity	≥0.99
Power Supply	220VAC 50Hz 350W
Dimesnion/Weight	W280mmxH485mmxD415mm / 19.6kg
Operating Ambient Temp	0℃ ~ 40℃ /≤80%RH
Options	RS323 or RS485 communication interface / Plexglass cover

Blackbody Terminology

A Blackbody is defined as

An ideal body is now defined, called a *blackbody*. A *blackbody* allows *all* incident radiation to pass into it (no reflected energy) and internally absorbs *all* the incident radiation (no energy transmitted through the body). This is true for radiation of all wavelengths and for all angles of incidence. Hence the blackbody is *a perfect absorber for all incident radiation*

A black body in thermal equilibrium (that is, at a constant temperature) emits electromagnetic black-body radiation. The radiation is emitted according to Planck's law, meaning that it has a spectrum that is determined by the temperature alone (see figure at right), not by the body's shape or composition.

What is a Blackbody Source

Blackbody calibration sources are infrared radiators with fixed or adjustable temperatures which are used for the calibration or verification of the correct temperature. Blackbodies are typically used to calibrate infrared thermometers (pyrometers), thermal imaging systems, heat flux measurement systems, or spectrographic analysis systems.

Types of Blackbody Apertures & Cavities

Depending on the type of testing or calibration, Blackbody surfaces come in 3 main types. Conventional, Cavity and Extended/ Wide Area. Cavity Blackbodies are commonly used at higher temperatures.

Conventional Area Aperture

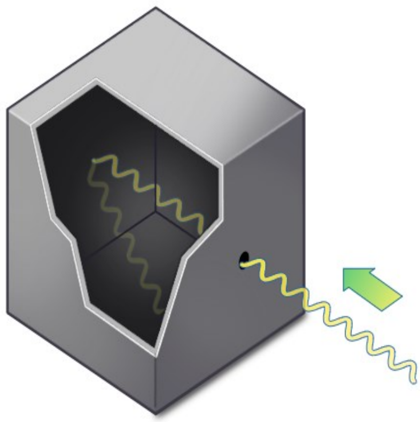
Cavity Aperture

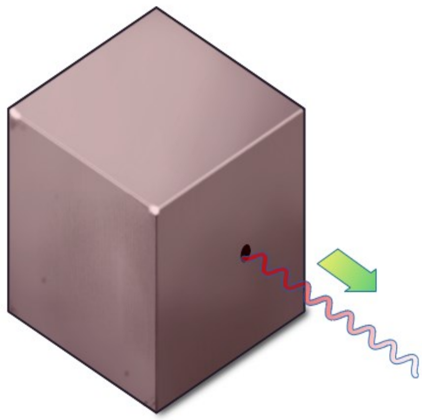
Extended/Wide Area Blackbody

Blackbody Terminology

Cavity Blackbody

A widely used model of a black surface is a small hole in a cavity with walls that are opaque to radiation. Radiation incident on the hole will pass into the cavity, and is very unlikely to be re-emitted if the cavity is large. The hole is not quite a perfect black surface—in particular, if the wavelength of the incident radiation is greater than the diameter of the hole, part will be reflected. Similarly, even in perfect thermal equilibrium, the radiation inside a finite-sized cavity will not have an ideal Planck spectrum for wavelengths comparable to or larger than the size of the cavity.





Suppose the cavity is held at a fixed temperature *T* and the radiation trapped inside the enclosure is at thermal equilibrium with the enclosure. The hole in the enclosure will allow some radiation to escape. If the hole is small, radiation passing in and out of the hole has negligible effect upon the equilibrium of the radiation inside the cavity. This escaping radiation will approximate black-body radiation that exhibits a distribution in energy characteristic of the temperature *T* and does not depend upon the properties of the cavity or the hole, at least for wavelengths smaller than the size of the hole. See the figure in the Introduction for the spectrum as a function of the frequency of the radiation, which is related to the energy of the radiation by the equation $E = hf$, with E = energy, h = Planck's constant, f = frequency.

At any given time the radiation in the cavity may not be in thermal equilibrium, but the second law of thermodynamics states that if left undisturbed it will eventually reach equilibrium, although the time it takes to do so may be very long. Typically, equilibrium is reached by continual absorption and emission of radiation by material in the cavity or its walls. Radiation entering the cavity will be "thermalized" by this mechanism: the energy will be redistributed until the ensemble of photons achieves a Planck distribution. The time taken for thermalization is much faster with condensed matter present than with rarefied matter such as a dilute gas. At temperatures below billions of Kelvin, direct photon–photon interactions are usually negligible compared to interactions with matter. Photons are an example of an interacting boson gas, and as described by the H-theorem, under very general conditions any interacting boson gas will approach thermal equilibrium.

Blackbody Terminology

Transmission, absorption, and reflection

A body's behaviour with regard to thermal radiation is characterized by its transmission τ, absorption α, and reflection ρ.

The boundary of a body forms an interface with its surroundings, and this interface may be rough or smooth. A non-reflecting interface separating regions with different refractive indices must be rough, because the laws of reflection and refraction governed by the Fresnel equations for a smooth interface require a reflected ray when the refractive indices of the material and its surroundings differ. A few idealized types of behaviour are given particular names:

An *opaque body* is one that transmits none of the radiation that reaches it, although some may be reflected. That is, $\tau = 0$ and $\alpha + \rho = 1$.

A *transparent body* is one that transmits all the radiation that reaches it. That is, $\tau = 1$ and $\alpha = \rho = 0$.

A *grey body* is one where α, ρ and τ are constant for all wavelengths; this term also is used to mean a body for which α is temperature- and wavelength-independent.

A *white body* is one for which all incident radiation is reflected uniformly in all directions: $\tau = 0$, $\alpha = 0$, and $\rho = 1$.

For a black body, $\tau = 0$, $\alpha = 1$, and $\rho = 0$. Planck offers a theoretical model for perfectly black bodies, which he noted do not exist in nature: besides their opaque interior, they have interfaces that are perfectly transmitting and non-reflective.

Conclusion

Fira Vision and Kelvin offer engineers high quality blackbody reference sources for testing and calibration of IR sensors and Thermal cameras. Our blackbodies have high speed temperature heating and cooling. As the calibration source for all your operational temperature instruments, keeping your blackbody calibration source in spec is vital to ensuring optimal performance, maintaining product quality, and avoiding costly shutdowns. To ensure you Blackbody works to its optimal level we recommend that the Blackbody is serviced and calibrated periodically