

Guide to thermal imaging cores

European leader in advanced technology solutions



About Acal BFi

Acal BFi are Europe's leading provider of advanced technology solutions, operating in 12 countries throughout Europe, China and South Korea.

We offer products across 12 specialist technology areas, each with a dedicated pan-European sales team. Customers use our design-led expertise and expert consultation services to find the best technology solutions for their design, prototype and production needs.

About FLIR

FLIR Systems Inc. design, develop and manufacture technologies that enhance perception and awareness. They bring innovative sensing solutions into daily life through their thermal-imaging systems, visible-light-imaging systems, locator systems, measurement and diagnostic systems, and advanced-threat-detection systems.

Acal BFi's Imaging Competence Centre

Our Imaging Competence Centre (ICC) is a dedicated resource available to our customers. It is at the core of our thermal-imaging offer and has enabled customers to design and develop their thermal-infrared solutions. Home to trained technical specialists in the field of thermal imaging, we can support all thermal core requirements, from uncooled LWIR and cooled MWIR thermal cores to complete thermal-imaging systems, such as EOIR PTZ surveillance systems.

For more information on the ICC, turn to page 7 of this guide.

Products and support

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Magnetic components

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A guide to thermal-imaging cores from FLIR

Acal BFi have more than four decades of experience supplying and designing world-class, thermal-imaging solutions for OEM manufacturers and system design and integrator providers across Europe. We are uniquely positioned to offer class-leading technology and support customers with their individual applications.

This guide has been created by our team of technical experts to help you identify and select the right components and products for your application from one of the world's leading thermal-imaging system designer and manufacturer, FLIR Systems Inc.

As the pan-European distributor for some of FLIR's most popular products and with specialist product and application expertise, we are ready to support you with your specific application or project. Talk to us today or contact your local Acal BFi office via the details on the back of this guide.

Thermal-imaging cores overview

When choosing a thermal-imaging core there are a number of key elements you should consider. Below are details for each aspect of the popular FLIR Tau®2 640 core. Using this guide, you can quickly compare and prioritise the qualities required to ensure the core's performance for your application.



Acal BFi work directly with leading partner suppliers to locate and supply the right components and products for your application. Best-in-class components and products can be enhanced and customised to suit your specific application and, with our technical expertise and ICC, we are uniquely placed to support you with the design, testing and manufacture of your products and services.

FLIR lens options

FLIR's thermal-imaging cores can be combined with a selection of lenses to best suit your application. There are three steps to configuring your product – lens, sensitivity and radiometry selection.

These two pages contain details of the three lens options available from FLIR. Details of the three grades of sensitivity and two grades of radiometry are available on page 6.

Lens selection

There are three options when choosing a lens for your application.

Option 1 – Standard FLIR lenses

There are multiple standard lenses available, all with single focal. These lenses are hard coated with a sealed front element optic and feature athermal optics, and are suited to FLIR's suite of products, including the Tau2 640 uncooled LWIR thermal core.

Focal length (mm)	Aperture	FOV (h x v)	iFOV (mrads)	Minimum focus distance	Length (mm)	Diameter (mm)	Weight of camera and lens (g)	Detection, recognition, identification (Man size target) Typical / best conditions (metres)		
7.5	f/1.4	90° x 69°	2.267	2.5 cm	19	29	< 71	D = 210/235	R = 52/60	I = 26/30
9	f/1.4	69° x 56°	1.889	3 cm	19	29	72	D = 250/285	R = 63/71	I = 31/36
13	f/1.25	45° x 37°	1.308	8 cm	19	29	< 70	D = 390/340	R = 95/112	I = 47/56
19	f/1.25	32° x 26°	0.895	16 cm	19	29	< 70	D = 570/640	R = 144/160	I = 72/80
25	f/1.1	25° x 20°	0.680	30 cm	30	42	112	D = 820/930	R = 210/230	I = 104/116
35	f/1.2	18° x 14°	0.486	60 cm	39	42	150	D = 1140/1280	R = 280/320	I = 142/160
50	f/1.2	12.4° x 9.9°	0.340	1.5 m	62	58	280	D = 1500/1700	R = 380/430	I = 190/215
60	f/1.25	10.4° x 8.3°	0.283	2.3 m	62	61	200	D = 1750/2000	R = 450/510	I = 225/255
100	f/1.6	6.2° x 5.0°	0.170	7 m	110	82	479	D = 2450/2950	R = 650/750	I = 330/380

Option 2 – Using your own lens

Thermal cores from FLIR, such as the Tau2, are unique for their multiple lens options. Our ICC can support you when installing and calibrating customer lenses on the Tau2 core by:

- **Recalibration** – all FLIR Tau2 cameras are factory calibrated, either with a lens or with a special aperture. When a different lens is installed, the original factory calibration is no longer valid. Cameras will still operate without recalibration; however, image performance may be degraded. We can recalibrate cameras to restore full operation.
- **Custom lens mount** – third-party lenses may require a different FLIR or custom mount as well as knowledge of the back working distance (bwd2) to ensure the lens focus system operates correctly. Lens mounts are critical to the cores operation, and we can offer this level of support.
- **Advanced settings** – for qualified customers, advanced settings can be made available by FLIR through the camera control GUI. Advanced settings include the capability to perform lens calibrations on Tau2 cameras. We can support you with field calibration which requires the use of at least one blackbody source (a uniform, controllable temperature reference).

Option 3 – Acal BFi thermal zoom cores

Finally, you can opt for the FLIR Tau2 640 uncooled LWIR thermal cores fitted with a selection of high performance continuous zoom lenses from Acal BFi. All zoom lenses have athermal optics, hard coating and a sealed IP67 front element optic.

ICC Model Tau2 640 and zoom lens	100CZ	105CZ	105HZ	150LZ	150CZ	225CZ
Continuous zoom range	6.6X	3X	3X	3X	6X	9X
Focal length (min)	15 mm	35 mm	35 mm	50 mm	25 mm	25 mm
Focal length (max)	100 mm	105 mm	105 mm	150 mm	150 mm	225 mm
Aperture	f/1.4	f/1.6	f/1.0	f/1.6	f/1.4	f/1.5
Wide FOV (h x v)	30° x 22°	18° x 13.5°	18° x 13.5°	12.5° x 9.4°	25° x 19°	24.5° x 18.3°
Narrow FOV (h x v)	4.7° x 3.3°	6° x 4.5°	6° x 4.5°	4.1° x 3.1°	4.1° x 3.1°	2.8° x 2.1°
Length	168 mm	162 mm	190 mm	195 mm	164 mm	270 mm
Diameter	94 mm	82 mm	120 mm	125 mm	141 mm	178 mm
Weight of camera and lens	1.2 kg	600 g	2 kg	1.25 kg	2 kg	4.4 kg
Detection, recognition, identification – in NFOV (Man size target)	D = 2450/2950 R = 650/750	D = 2500/3000 R = 670/770	D = 2600/3100 R = 700/800	D = 3650/4000 R = 950/1000	D = 3700/4200 R = 1000/1200	D = 5000/6000 R = 1400/1600
Typical / best conditions (metres)	I = 330/380	I = 340/390	I = 350/400	I = 490/540	I = 500/600	I = 700/800

Using the TA640-150LZ, configured by our ICC, the core is able to detect a man working in an unlit garage (zoom 3x), providing a clear image, even when zoomed and in poor/mixed lighting conditions



For more information on our ICC, see page 7 of this guide.

Sensitivity selection

There are three options when choosing the right sensitivity for your application.

Option 1 – Commercial grade (Grade C)

NETD < 60mK with f/1.0 lens @ 25°C operation temperature

The entry grade offered by FLIR on the Tau2 640 core, Grade C is ideal for short range surveillance applications, such as for intra-urban perimeter surveillance.

The Grade C Tau2 640 has an operating temperature range from -20°C (-4°F) to 55°C (131°F), and can detect and measure targets with a strong thermal contrast to the background or those with a good signal in the LWIR spectrum.

Option 2 – Performance grade (Grade P)

NETD < 50mK with f/1.0 lens @ 25°C operation temperature

Grade P is the standard grade offered by FLIR on the Tau2 640. It is the most popular choice by customers in terms of flexibility and range. Compared with Grade C, Grade P offers a greater operating temperature range from -40°C (-40°F) to 80°C (176°F), and is well suited to hot climates and in situations where heat dissipation is an issue, such as when integrating into a compact housing.

Option 3 – Industrial grade (Grade I)

NETD < 30mK with f/1.0 lens @ 25°C operation temperature

Grade I is the highest sensitivity grade offered by FLIR. With the same operating temperature range as Grade P (-40°C to 80°C), it offers superior detection and identification, is able to detect objects at long range in bad weather, and has the benefits of radiometry such as displaying isotherm.

If you are using a zoom lens with a slow aperture, such as large or long-range perimeter surveillance with a good detection range required constantly, you will require a Tau2 640 Grade I thermal-imaging core.

When using a zoom lens, the actual NETD of the combined thermal core and thermal lens is reduced by the square root of the lens aperture. A Tau2 640 Grade I core fitted with an Ophir 25- 225mm F/1.4 zoom lens will therefore have a combined NETD of <60mK.

Acal BFi only use the Tau2 640 Grade I core with ICC-TA640 thermal zoom cores

NETD (Noise Equivalent Temperature Difference)

The NETD is a key differentiator to qualify infrared cameras. The signal-to-noise figure represents the temperature difference which would produce a signal equal to the camera's temporal noise.

It represents the approximate minimum temperature difference which the camera can report. The NETD value is a function of the camera's f/number and the temperature at which the measurement is made.

Radiometry selection

FLIR offer two levels of radiometry with the Tau2 640 cores supplied with a FLIR lens (option 1). With radiometry, users can measure the temperature of an object to +/-5% accuracy and display isotherms, which can be used to enhance security (detect intruders) and fire detection (hot spots). Radiometry options are available on Grades P and I cores.

Basic radiometry

Basic radiometry allows users to measure the temperature of a central area and display isotherms. It is standard on all Tau2 Grade P cores.

Advanced radiometry

With advanced radiometry, users can measure the individual single temperature, as well as the high/low gain, of every pixel within the image. It comes complete with radiometric software and is standard on all Tau2 Grade I cores. It is also available as an option on Grade P cores.



Acal BFi's Imaging Competence Centre

The ICC is our central technical laboratory in Europe. Based in Groebenzell (near Munich, Germany), it employs trained technical specialists in the field of thermal imaging.

With a dedicated resource available to our customers, the specialist team integrate, calibrate and service all types of thermal-imaging equipment. With the latest equipment and training they can support uncooled LWIR and cooled MWIR thermal cores to complete thermal-imaging systems, such as EOIR PTZ surveillance systems.

The ICC is at the core of our thermal-imaging offer and has enabled customers to design and develop their thermal infrared solutions. It provides customers with:

- **Thermal zoom lens calibration (NUC)**
The NUC process is done using blackbody
- **Backfocal distance adjustment / infinity focus**
The infinity focus is done using blackbody with collimator
- **NETD / MRTD measurement**
The NETD / MRTD measurements are done using thermal targets in front of a Blackbody that are projected to the camera with collimator
- **Cooler replacement**
Acal BFi have a US government-authorised Technical Assistance Agreement in place with General Dynamics to replace cooled engines in their long-range cooled InSb Thermal Zoom MWIR cameras





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