



# MULTIESPECTRAL VISION SYSTEM



Disclaimer: Product concept intended for potential customer evaluation and definition, specifications may be changed without any prior notice

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# MODULAR CONFIGURATION

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The use of human vision, even when enhanced by optical devices, is not enough for a complete situational awareness in battle sites. Technologies as long range camera, infrared thermal sensors and lasers are being widely used in most diverse situation and environments.

In order to provide a full system that allows the vital situational awareness, Opto Space and Defense developed a complete line of multispectral vision system modules. Through a modular architecture, that may be equipped and configured quickly and easily, being always ready for any operational scenario.

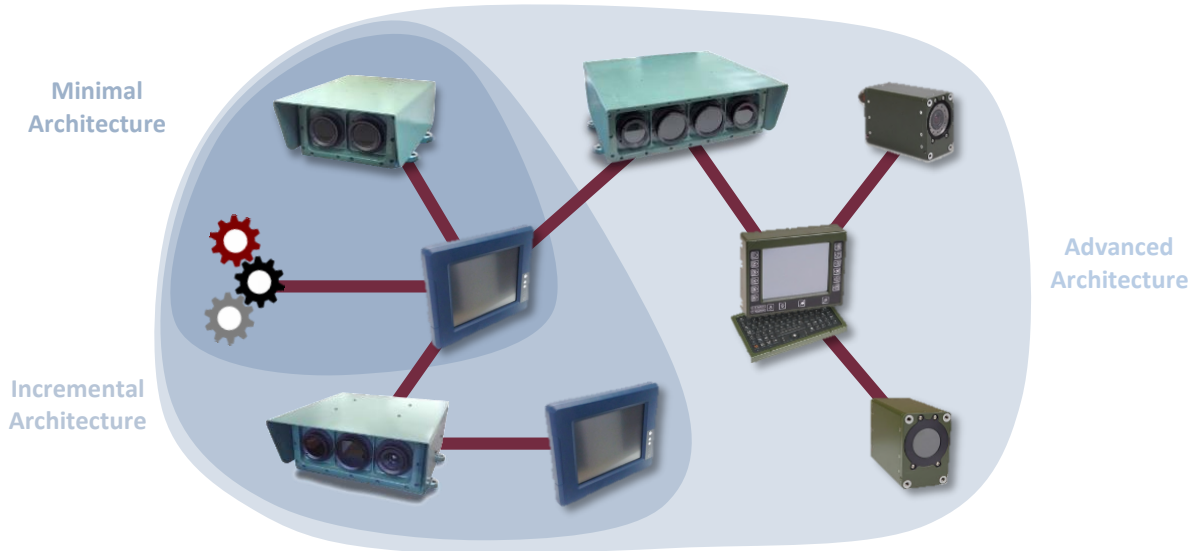
The multispectral sensor boxes have several options of hermetic metallic frames that allow the accommodation on the most diverse types of scenarios. Each computer display may include up to four optronic module as high-resolution visible cameras, thermal and SWIR cameras and laser range finders. Apart from the optronic module, a range of electronic sensors may also be integrated in the system, enhancing its performance.

Using a standardized electronic interface Opto's vision system allows total integration with communication network and, through the aid of optional modules, the connection with legacy items such as analog cameras and other sensors. The use of intermediate connection bridges shields the network blocking any data pack that is not related to the vision system interface and control.

Due to the applied technology, all operators are able to view and share all the available information each with their own display. Opto's multispectral vision system provides full situational awareness in any environment.

# ARQUITECTURE

Opto's Multispectral Vision System features a modular architecture that allows a singular configuration for each campaign. A single scenario may be equipped with several modular boxes and displays all connected by a unified communication protocol and cabling.



Due to its modularity, the architecture has the capability to remain operational even with a damaged sensor box.

# TECHNICAL SPECIFICATIONS

<b>Weight</b>	Ranging from 3 to 120 kg
<b>Number of optronic modules</b>	Ranging from 1 to 4
<b>Visible Camera</b>	
Resolution	Up to 1280 x 960 px
Horizontal field of view	Up to 60°
<b>Thermal Camera</b>	
Spectrum	8 – 14 $\mu\text{m}$
Resolution	Up to 640 x 480 px
Horizontal field of view	Up to 44°
<b>SWIR Camera</b>	
Spectrum	1 – 1.6 $\mu\text{m}$
Resolution	640 x 512 px
Horizontal field of view	Up to 40°
<b>Laser range finder</b>	
Spectrum	1550 nm
Range	Ranging from 1 to 20 km
Accuracy	< 3 m
<b>Power Supply</b>	
Supply voltage	Ranging from 18 to 75 V
<b>Communication interfaces</b>	
Communication protocol	Controller Area Network 1.2
Digital Video	Gigabit Ethernet
Analog video input	NTSC/PAL
Analog video output	NTSC/PAL
<b>Video Latency</b>	
Gigabit Ethernet GigE	< 100ms
Direct Video	< 20ms

# MODULAR BOXES

All the optronic modules are allocated in mechanically robust housings. The mechanical frame is scalable from 1 to 4 possible module slots. Each slot accommodates only one optronic module. Each frame size has its own specification but all share the same electronic connection allowing a change of housing without changing the cabling. The first step when building the system is to decide how many slots are required and then choosing the desired optronic and sensors.

## SINGLE MODULE

This frame is ideal for a visible or infrared rear camera.



Dimension	12 x 20 x 09 cm
Number of slots	1
Ordering code	FVT1

## DUAL MODULE

Dual module box increases the number of modules without significantly increasing the size and weight. This frame is ideal for a dual view with thermal and visible cameras.



Dimension	30 x 53 x 19 cm
Number of slots	2
Ordering code	FVT2

## TRIPLE MODULE

Triple module box allows a broad range of building options. This frame is ideal to give a complete multispectral view of the surroundings with visible, SWIR and thermal cameras. Another option is to add a laser range finder for small weaponry systems.



Dimension	47 x 53 x 19 cm
Number of slots	3
Ordering code	FVT3

## QUADRUPLE MODULE

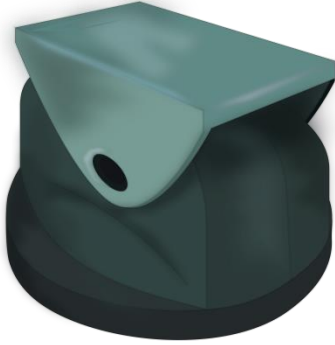
The quadruple module box was designed to give a complete situational awareness view. With its four slots any optronic may be accommodated.



Dimension	65 x 69 x 24 cm
Number of slots	4
Ordering code	FVT4

## PLATFORM MODULE

The platform module can accommodate any of the previously shown modules adding dynamic movement to the system. The platform is equipped with two orthogonal rotating axes, enabling a wide 90x360 degrees movement range. With angular speed adjustable up to 2rad/s, this platform can fill all possible target tracking requirements.



Dimension	45 x 45 x 40 cm
Stabilized platform	Two-axis
Azimuth stabilization	1mrad
Elevation stabilization	1mrad
Azimuth range	-180° to +180°
Elevation range	-20 to +70°
Azimuth angular speed	Up to 2 rad/s
Elevation angular speed	Up to 2 rad/s
Weight	120kg
Supply voltage	110 – 220V
Power	Up to 2kVA
Ordering code	FVTP

# OPTRONICS

A sensor box may many optronic modules according to the required capability and functionalities. Each module can be integrated as many times as needs in a box or in a vehicle.

## VISIBLE

The visible camera enables high-resolution viewing of images, allowing recognition of the environment and possible targets over distances ranging from a few meters to kilometers. The magnification factor can be adapted according to the needs of the mission, by the selection of specially designed lenses. The uses of high-sensitivity sensors allow operation at low levels of natural light.

Ordering code	Resolution	Color	Field of view	Digital Zoom
CVM064009	640 x 480	Monochrome	9°	16x
CVM064040	640 x 480	Monochrome	40°	16x
CVM128009	1280 x 960	Monochrome	9°	16x
CVM128040	1280 x 960	Monochrome	40°	16x
CVC064009	640 x 480	Color	9°	16x
CVC064040	640 x 480	Color	40°	16x
CVC128002	1280 x 960	Color	2°	16x
CVC128009	1280 x 960	Color	9°	16x
CVC128040	1280 x 960	Color	40°	16x
CVC128060	1280 x 960	Color	60°	16x



## THERMAL

The uncooled LWIR (8-14µm) infrared camera enables the visualization of thermal images at high resolution allowing the recognition of possible targets close to the vehicle regardless of external illumination. Typically used to aid the driver's vision and for target engagements up to 3km. Cooled MWIR (3-5µm) or LWIR infrared camera allows recognition of possible targets kilometers away from the vehicle regardless of external illumination. Typically used as a pointing camera for the cannon gunner or missile launcher.

Uncooled Thermal Cameras

Ordering code	Resolution	Field of view	Focus
CTN032009A	320 x 240	9°	Athermal
CTN032009F	320 x 240	9°	Fixed
CTN032024A	320 x 240	24°	Athermal
CTN032027F	320 x 240	27°	Fixed
CTN032042A	320 x 240	42°	Athermal
CTN064009A	640 x 480	9°	Athermal
CTN064024A	640 x 480	24°	Athermal
CTN064044A	640 x 480	44°	Athermal

Cooled Thermal Cameras

Ordering code	Resolution	Field of view	Focus
CTR064004A	640 x 512	4,6°	Athermal
CTR064009A	640 x 512	9°	Athermal
CTR064002A	640 x 512	2°	Athermal





## SWIR

The SWIR (Short Wave Infrared, 0.9 - 1.7 $\mu$ m) camera enables images to be viewed under adverse environmental conditions such as fog, smoke and fog. The technology of these cameras allows eliminating the influence of inclement weather, ensuring a wide recognition of the environment. It also allows night use, where its high sensitivity allows the visualization of the nocturnal environment without the use of residual light intensifiers.

Ordering code	Resolution	Field of view
CS064009	640 x 512	9°
CS064040	640 x 512	40°



## CAMERA SET

A camera set is defined when two or more similar cameras with different fields of view are used in the same mechanical housing. This unique combination allows the system processor to digitally create a seamless continuous magnification effect without the necessity of having moving parts in the optical system.

In the following image, three different fields of view, one wide, an intermediate, and one narrow, are used together to create a hybrid mechanical/digital continuous zoom. According to the user input, an automatic weighting algorithm sort and merge the correct image, creating any level of magnification.

To facilitate the understanding, the ordering code for camera sets is created based on a combination of the chosen cameras as follows:

Ordering code	1 <sup>st</sup> Camera	2 <sup>nd</sup> Camera	3 <sup>rd</sup> Camera
SVTC600902	CVC128060	CVC128009	CVC128002
SVTC400902	CVC128040	CVC128009	CVC128002
SVDC0902	CVC128009	CVC128002	-
SVDM4009	CVM128040	CVM128009	-
STD0902	CTR064009A	CTR064002A	-
SWD4009	CS064040	CS064009	-

# ELECTRICAL CONNECTION

All modular boxes share the same electrical connection pinout allowing interchangeable cables to be installed in the vehicle. Panel connector: D38999/20FC35SN

Pin	Description	Pin	Description
1	Ground	12	Analog Video out
2	Ethernet BI_DA+	13	Video out Shield
3	Ethernet BI_DA-	14	Restrict
4	Ethernet BI_DB+	15	Restrict
5	Ethernet BI_DB-	16	VCC+
6	Ethernet BI_DC+	17	VCC_GND
7	Ethernet BI_DC-	18	CAN_H
8	Ethernet BI_DD+	19	CAN_L
9	Ethernet BI_DD-	20	Restrict
10	Analog Video in	21	Restrict
11	Video in shield	22	Restrict

# ORDERING CODE

For configuration control all systems have a unique codification sequence. The code is always composed by the modular box code followed by any numbers of optronic or laser system code that are used in each slot.

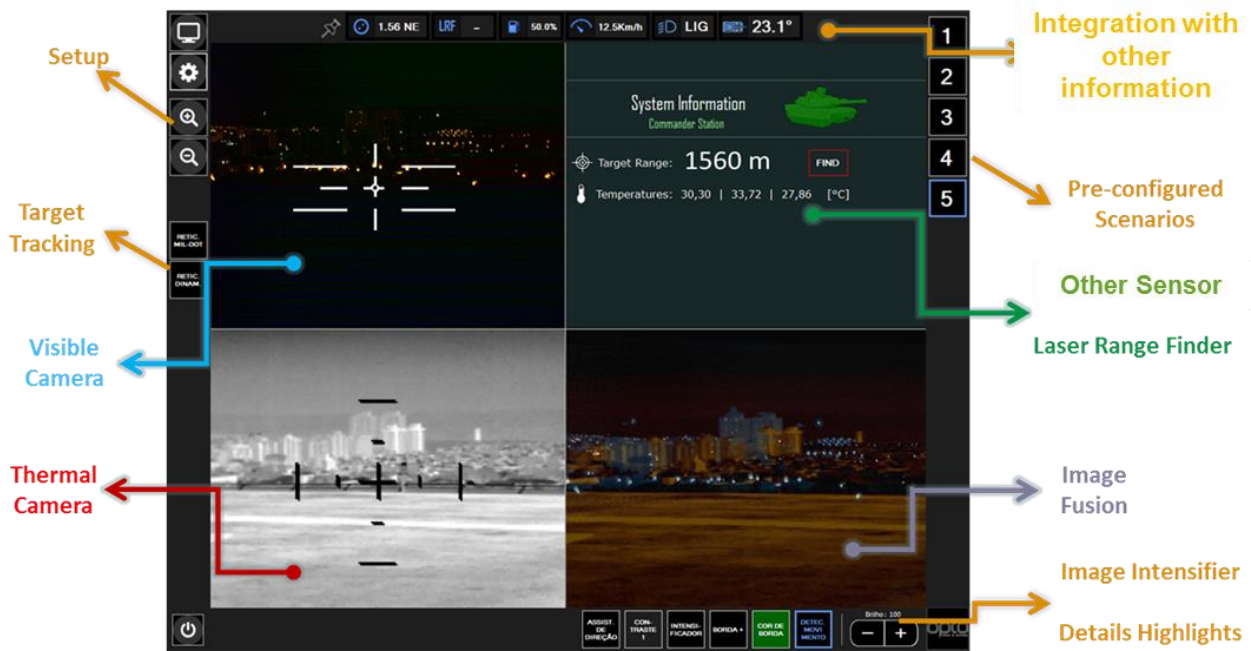


If a slot is desired to be empty use the letter “x” as the referring code.

# SOFTWARE

The embedded firmware of the Multispectral Vision System can be accessed with standard communication protocols. A robust middleware access all system functionalities and can be integrated within different vehicle systems. A variety of powerful algorithms can be used enhancing situational awareness like image fusion, zooming, data display, virtual crosshair and others.

In the first picture can be seen an example of images exhibiting the city through visible and thermal sensors. A third video is generated from the fusion between visible and thermal data, facilitating image interpretation and enhancing details with the heat of the objects.



Different crosshair, colors and highlights can be chosen. Other data can be read and processed with the obtained target distance. Algorithms like edge highlighting and motion detection are used to improve capacity.



# ABOUT OPTO SPACE & DEFENSE

**OPTO SPACE & DEFENSE**, Opto S&D is an international design and manufacturing company specialized in delivering Aerospace, Defense and Industrial solutions. Established in 1985 at São Carlos, SP, Brazil, as a division of OPTO Eletronica S/A, since 2017 Opto S&D is a company fully owned by Akaer Group. OPTO S&D has been a market leader in developing leading edge products for over 30 years. In Brazil and throughout South and Central America, the Opto S&D brand is well known for its excellence in the design and manufacture of precision optical system and components, high reliability electronic systems, fine mechanics and system engineering.



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After a careful evaluation by the Ministry of Defense, **OPTO SPACE & DEFENSE** received the seal of a strategic defense company, being one of the only Brazilian companies capable of supplying high technology products to the armed forces.

**AKAER** is an integrated technological solution provider company based in São José dos Campos, SP and specialized on the development of aero-structures and management of turnkey projects for the aerospace and defense markets. Akaer was founded in 1992, and since then has participated in important aerospace programs worldwide. Fully committed to customer's demands, Akaer develops its activities according to the most demanding quality standards and since 2001, the AKAER Quality Management System is ISO9001:2015 and AS9100 rev. D. Akaer is also accredited as a Strategic Defense Company since 2013 and since 2016 authorized by the Brazilian Ministry of Defense for the treatment, control and storage of classified information up to secret level. With a high qualified team of engineers and designers with large experience in the aerospace field, Akaer pursues excellence and the most cost effective solution for the customer and shows an outstanding record of deliverables. Akaer applies simultaneous engineering to integrate all the technologies with emphasis on DFM – Design for Manufacturing and DFA – Design for Assembling. Turnkey contracts management includes planning and control, system engineering, system installation design, technical support to manufacturing and assembling (subcontractors) and support to certification.



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