

## **AHD-VCS** **Video Control System**



- **CCTV System for up to 16 cameras**
- **Simple integration into Böning Ship Alarm Systems via CAN-Bus**
- **Control of all camera functions with touch screen or separate operation unit**

The closed circuit television (CCTV) has been established as a standard to increase the safety and comfort onboard of vessels, e.g. by surveillance of public and private spaces, unmanned machinery spaces, gangways, entrances and visual support at berthing maneuvers etc.

The video control system AHD-VCS is designed for individual operation of up to 16 video cameras including control of pan, tilt and zoom functionality. The system components can easily be integrated into a Böning Ship Alarm System, while the same displays can be used here. Also data communication is performed on the same CAN-bus. Therefore, no additional console space for separate monitors is required.

The presentation and control of real time video signals can be performed anywhere on board either on touch screen displays with integrated operation facilities or alternatively monitors resp. television sets with separate video control panels AHD-VCP. The quantity of connected control panels is not limited.

Controllable camera functions:

- Pan
- Tilt
- Control of moving speed
- Zoom
- Storing and recall of fixed camera positions (Pre-sets)

## System components

The main components of the system are: Video Distribution Control Unit AHD-VDCU, Video Control Panel AHD-VCP and Touchscreen Colour Displays AHD 1215 (15"), AHD 1219 (19") or AHD 880 TC (8.8") as well as separate operating units (optional).

The Video Distribution Control Unit AHD-VDCU processes the control signals for the cameras and distributes their video signals to connected displays. The AHD-VDCU is available in three configuration versions:

- 4 Cameras (Video inputs)/4 Video outputs
- 8 Cameras (Video inputs)/8 Video outputs
- 16 Cameras (Video inputs)/16 Video outputs

## Cameras

Various models for standard and special applications are available. The robust cameras are specified to fulfill the maritime environment requirements, and have anti-vandalism protection. In general, they are controlled and powered by AHD-VDCU unit. In case of higher current consumption or non-standard supply voltages, the power supply is connected separately. (For further details see technical data).

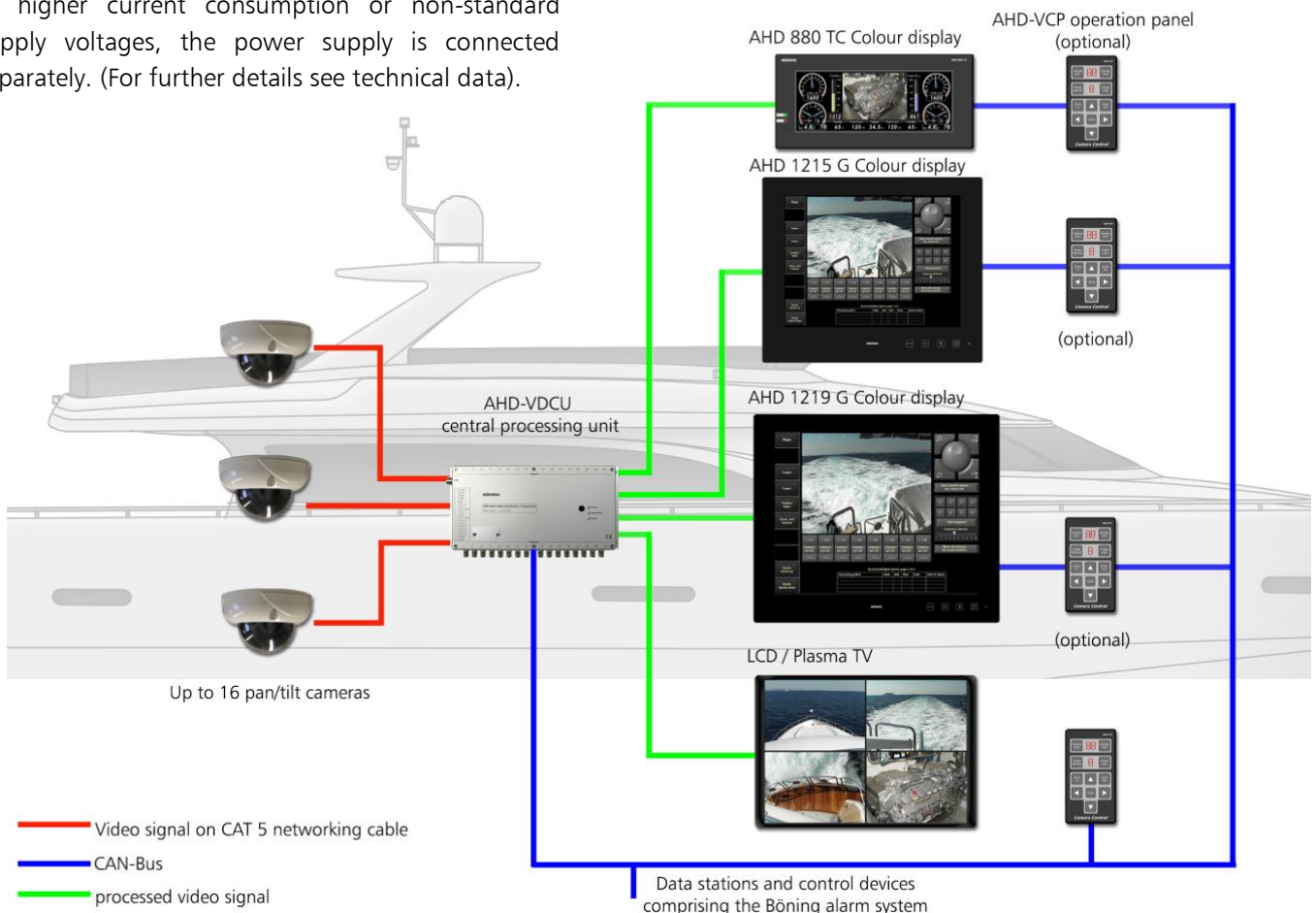
Optionally, the video control system can be extended with a video quad processor AHD-VCS Q 4-1, which allows quad display of four selected cameras on one screen.

As a further option, a digital video data recorder AHD-VC VR8 is available with various further functions.

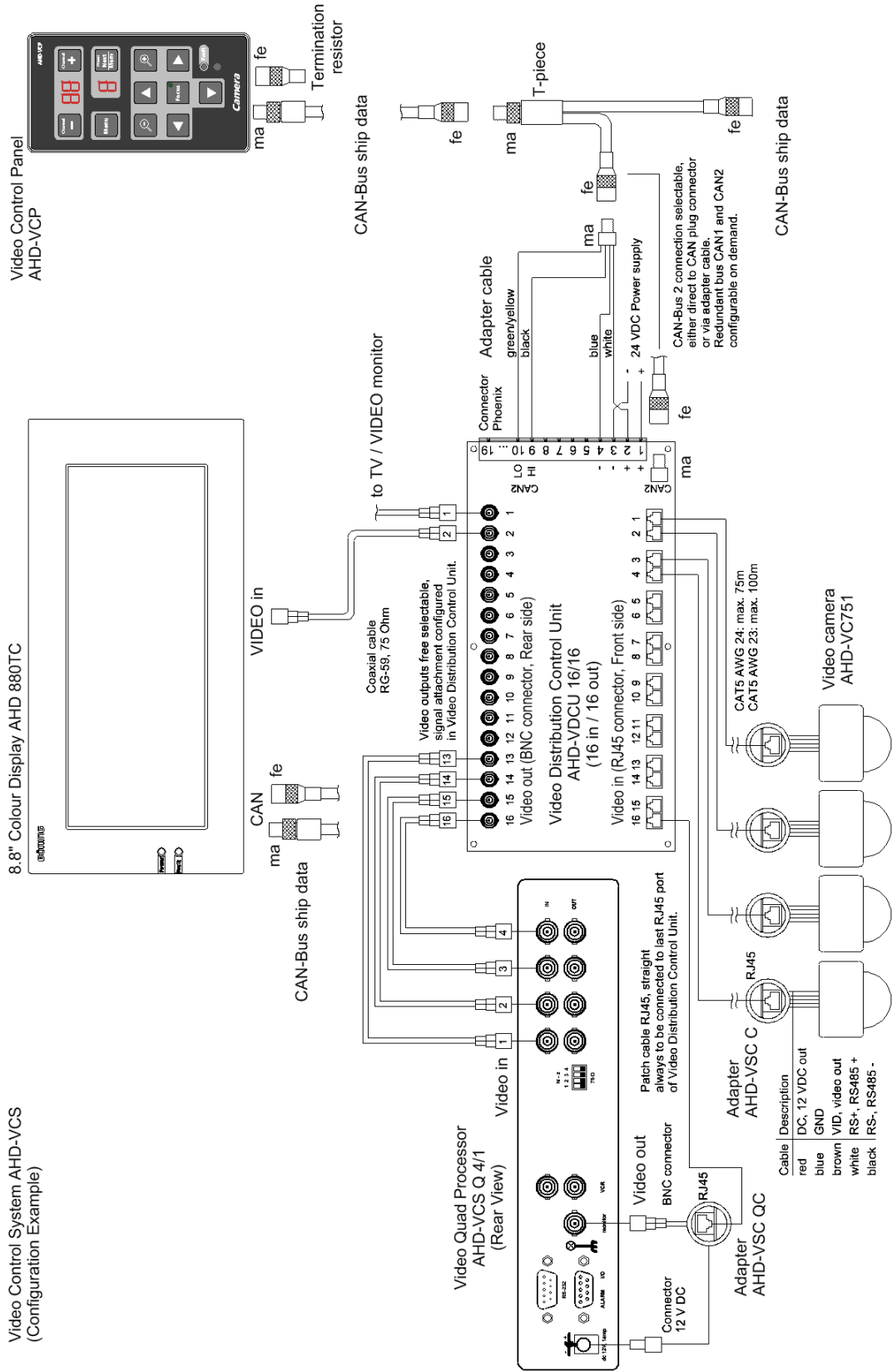
## Installation

Each camera is connected to the video distribution control unit AHD-VDCU via separate video signal converter by a single CAT5 cable. Video signal transmission, camera control and power supply (12 V DC) are completely integrated by the connection.

The connection of video outputs with displays and monitors is performed by 75 Ω coaxial cable. For transmission of control data, the displays and video control panels AHD-VCP are connected via CAN-bus video distribution control unit AHD-VDCU (see system scheme below).



Standard Configuration, Example:



## Video Distribution Control Unit AHD-VDCU



AHD-VDCU Versions Video In/Video Out	AHD-VDCU 4/4 AHD-VDCU 8/8 AHD-VDCU 16/16
Video Inputs:	RJ45 (4x, 8x or 16x, depending on AHD-VDCU type)
Video Outputs:	1.0 Vpp 75 Ω, BNC (4x, 8x or 16x, depending on AHD-VDCU type)
Power Supply:	18 ... 32 V DC
Power Consumption:	max. 300 mA without cameras (max. appr. 400 mA/camera in ad- dition)
Interfaces:	2 x CAN Bus (Communication) 1 x RS232 1 x RS 485 (Option) 3 x serial In (Optocoupler)
Operating Temperature:	-25°C ... +70°C
Storage Temperature:	-30°C ... +85°C
Dimension W x H x D:	330 mm x 160 mm x 32 mm
Weight:	appr. 1.30 kg
Installation:	Surface mounting, installation on mounting plate

## Video Quad Processor AHD-VCS Q 4-1



Video Standard	PAL 1024 x 625 Pixels Refresh rate 50 NTSC 1024 x 525 Pixels Refresh rate 60
Video Inputs:	4 x 1.0 Vpp, 75 Ω (Camera-In) 1 x 1.0 Vpp, 75 Ω (VCR-In)
Video Outputs:	1 x 1.0 Vpp, 75 Ω (Live-Monitor) 4 x 1.0 Vpp, 75 Ω (Camera-Out) 1 x 1.0 Vpp, 75 Ω (VCR-Out)
Power Supply:	12 V DC
Power Consumption:	appr. 850 mA
Operating Temperature:	0°C ... +50°C
Storage Temperature:	-10°C ... +85°C
Degree of Protection:	IP 20
Dimension W x H x D:	215 mm x 44.1 mm x 200 mm
Weight:	appr. 2.50 kg
Installation:	Surface mounting

## Video Control Panel AHD-VCP



Power Supply:	18 ... 32 V DC
Power Consumption:	appr. 30 mA (24 V DC)
Interfaces:	1 x CAN Bus (In- and Output)
Operating Temperature:	-25°C ... +70°C
Storage Temperature:	-30°C ... +85°C
Degree of Protection:	IP 67 (front side) IP 20 (rear side)
Dimension W x H x D:	70 mm x 130 mm x 65 mm
Panel Cut-Out W x H:	60 mm x 112.5 mm
Req. Installation depth:	min. 100 mm
Weight:	appr. 0.2 kg
Installation:	Built-in casing

## Digital Video Recorder AHD-VC VR8



Video Standard	SVGA PAL/NTSC auto-detect or menu selectable
Compression:	H.264
Inputs:	Composite video 1 Vpp, 75 ohm, automatic termination PAL/NTSC auto-detect
Outputs:	Monitor A – VGA RGB Monitor B – VGA RGB
Video Inputs	8/16 looping BNC, auto- terminating
Audio inputs	4 RCA (CINCH)
Ethernet	RJ45, 10/100/1000BaseT according to IEEE802.3
Monitors	VGA D-sub (2)
Audio outputs	2 RCA
USB 2.0	on front and rear for mouse and USB
Power Supply:	100 ... 240 V AC, 50/60 Hz
Power Consumption:	1.8A
Hard disks	2 SATA hard drives, maximum 2TB
Operating Temperature:	0°C ... +40°C
Dimension W x H x D:	355 x 78 x 362 mm

### Motor Dome Colour Camera AHD-VC 753



Design	Anti-vandal Aluminium Dome Cas- ing, degree of protection IP 66, pan/tilt function controllable Also available with heating
Image Sensor:	1/4" Sony Ex-View HAD CCD
Resolution:	752(H) x 582(V) Pixels eff. (PAL) 550 TV Lines hor.
Zoom:	12 x optical , 12 x digital
Lens:	F1.6~F2.5; f = 3.4 – 44.4 mm
Panning:	360° endless; max 360°/s
Tilting:	0 – 90°, 0 – 180° Auto-Flip Mode
Power Supply:	12 V DC
Power Consumption:	0.84 A (1.75 A with heating)
Operating Temperature:	-10°C ... +50°C
Storage Temperature:	-10°C ... +60°C
Dimension Ø x H:	165 mm x 157.5 mm
Weight:	appr. 2.5 kg

### FlexiDome Colour Camera AHD-VC 731



Design	Bosch Colour Camera VDC-455 in anti-vandal Aluminium Dome Cas- ing, degree of protection IP 66, pan/tilt function manual
Image Sensor:	1/3" Interline Transfer CCD
Luminous Sensitivity:	< 0.7 Lux incl. Night sense func- tion with increased sensitivity
Resolution:	752(H) x 582(V) Pixels eff. (PAL) 540 TV Lines hor.
Zoom:	Manual
Lens:	Vario Focal F1.4/ 2.6 – 6 mm
Panning:	360°
Tilting:	0 – 90°, ± 90°Azimuth
Power Supply:	10.8 V DC... 39 V DC 12 V AC...28 V AC, 45Hz ...65 Hz
Power Consumption:	4.0 W (6.0 W with heating)
Operating Temperature:	-50°C ... +50°C (with heating On)
Storage Temperature:	-40°C ... +70°C
Dimension Ø x H:	158 mm x 124.5 mm
Weight:	appr. 0,74 kg

### Infrared Dome Colour Camera AHD-VC 720IR



Design	Anti-vandal Metal Dome Casing, degree of protection IP 65, pan/tilt function manual
Image Sensor:	1/3" Sony Super HAD CCD
IR-LED Reflector:	850 nm, max. 15 m lighting range
Zoom:	10 x digital Auto focus
Lens:	f = 4.0 – 9.0 mm
Panning:	360° manual
Tilting:	10° – 90° manual
Power Supply:	12 V DC
Power Consumption:	appr. 6.0 W
Operating Temperature:	-10°C ... +50°C
Storage Temperature:	-10°C ... +60°C
Dimension Ø x H:	165 mm x 162 mm
Weight:	appr. 1.85 kg

### Bullet Colour Camera AHD-VC 711



Design	CCD Cylindric Colour Camera VKC13002, degree of protection IP 67, mounting stand with swivel head
Image Sensor:	1/3" CCD
Luminous Sensitivity:	0.1 Lux
Resolution:	700 TV Lines hor.
Lens:	3.6 mm (69°h)
Panning:	360° manually
Tilting:	10° – 90° manually
Power Supply:	12 V DC
Ambient Temperature:	-10°C ... +50°C
Storage Temperature:	-10°C ... +60°C
Dimension Ø x L:	23 mm x 91 mm
Weight:	appr. 0.08 kg

## Weather-proof colour cameras in stainless steel housing with integrated heating for ambitious outdoor installation

These cameras are prepared for the integration into Video Control System AHD-VCS. Due to different supply voltages and increased power requirement (i.e. heating), the standard power supply via video distribution control unit AHD-VDCU cannot be used. Power supply must be provided by the customer according to technical specification.

### Weather-Proof Colour Camera AHD-VC 732



Design	Weather-proof Bosch Day/Night Camera LTC-0495/51 in stainless steel housing NXM1K1000B/AISI 316, incl. sun shade, pan/tilt-head manual, integr. thermostat regulated heating, degree of protection IP 66/IP 67
Image Sensor:	1/3" Interline Transfer CCD
Luminous Sensitivity::	< 0.7 Lux
Resolution:	540 TV Lines hor.
Lens (Vario Focal):	F1.0/3.0 – 8.0 mm (33°h – 90°h)
Power Supply:	230 V AC ±10%, 50/60 Hz ±5%
Ambient Temperature:	-35°C ... +50°C
Dimension Ø x L:	154 mm x 460 mm
Weight, Camera:	appr. 8.0 kg
Pan/Tilt-Head:	appr. 2.1 kg (AS-42/V4A)

### Weather-Proof Motor Colour Camera AHD-VC 760



Design	Weather-proof Bosch Day/Night Camera LTC-0495/11 in stainless steel housing NXM2K1000B/AISI 316, incl. sun shade, remote controllable pan/tilt-head NXPTH211 and connection box AK-380/V4A, integr. thermostat regulated heating, degree of protection IP 66/IP 67
Image Sensor:	1/3" Interline Transfer CCD
Luminous Sensitivity:	< 0.7 Lux with day/night function
Resolution:	540 TV lines (color) 570 TV lines (B/W)
Lens:	F1.2/6.0 – 48 mm (38°h – 7°h)
Panning:	340°, 5°/s
Tilting:	± 340°, 3°/s
Power Supply:	230 V AC , 50/60 Hz Conn. box 24 V AC , 50/60 Hz Camera+ P/T
Ambient Temperature:	-35°C ... +50°C
Dimension:	
Camera Ø x L:	154 mm x 460 mm
P/T-Head: W x H x L:	160 mm x 250 mm x 286 mm
Connection Box: W x H x D:	380 mm x 300 mm x 155 mm
Weight, Camera:	appr. 8.0 kg
Pan/Tilt-Head:	appr. 15.0 kg



## Colour cameras for special applications

These cameras are prepared for the integration into Video Control System AHD-VCS. Power supplies for accessories (i.e. LED spot light) must be provided by the customer according to technical specification

### Anchor Pocket Camera AHD-VC 740 with LED Spot Light



Design	Colour camera with add. LED spot light, integrated in submersible special built-in casing for installation into anchor pocket, degree of protection IP68/10 bar
Image Sensor:	1/3" Sony CCD-Chip
Luminous Sensitivity:	0.1 / 0.0 Lux
Resolution:	540 TV Lines hor. 752 (H) x 582 (V) Pixels
Lens:	4.0 – 9.0 mm , man. Zoom
Lamp Type Spot Light:	7 x Single-LED 110 Lumen 30000 h Lamp life, 7000 K Colour temperature 3500 Lumen Light output
Power Supply:	12 V DC , 3.5 W (Camera) 12 V DC, 1.6 A (LED Spot Light)
Casing:	Aluminium bronze and 770 Aluminium, Glass lens Borosilicate glass IP68/10 bar
Dimension:	
Camera Ø x L:	82 mm x 325 mm
LED Spot Light Ø x L:	82 mm x 138.5 mm
Weight:	appr. 1.5 kg (Camera) appr. 1.0 kg (LED Spot Light)

### Bulbous Bow / Dolphin Camera FAC 940L



Design	Plettac Colour camera, integrated in submersible special built-in casing for installation into bulbous bow, degree of protection IP68/10 bar Available in two versions
Image Sensor:	1/2" Interline Hyper HAD CCD
Luminous Sensitivity:	< 0.05 Lux
Resolution:	580 TV Lines hor. CVBS 752 (H) x 582 (V) Pixels
Lens:	F1.4/4.5 mm (79°h), SCS
Power Supply:	10 V DC ... 29 V DC
Ambient temperature:	+5°C ... +45°C
Degree of Protection, Camera:	IP 32
Dimension, Camera Ø x L:	70 mm x 61.5 mm req. Installation length 110 mm
Weight, Camera:	appr. 0.25 kg
Casing:	Aluminium bronze and 5083 Aluminium, Glass lens Borosilicate glass IP68/10 bar
Dimension Ø x L:	130 mm x 222 mm

## FLIR Thermal Imaging Cameras

The Video Control System AHD-VCS will be extended by integration of night view thermal imaging cameras of Flir Systems and offers now a suitable solution for nearly every application.

The presentation of video images may be performed on our displays in sizes of 8.8", 15" and 19". The presentation on conventional TV and monitors is applicable.

For control, we offer either our video control panel AHD-VCP, our touchscreen displays with integrated operating elements or the appropriate operating units of Flir Systems.

Thermal imaging systems by Flir Systems are operating extremely efficiently at sea. They can detect drifting objects in the water which may damage a ship or more worse sink it. Other vessels, traffic on sea lanes, buoys, bridges ... all this may be detected by thermal imaging systems without any problem.

Even objects, which cannot be discovered by a Radar system like sailing boats, wooden boats, flotsam ... will be made clearly visible by thermal imaging systems.

Presentation of night view thermal images on video page of 19" colour display AHD 1219 G with touchscreen operating elements:





- **HM-Series, Portable thermal imaging cameras for maritime applications (no connection with Video Control System AHD-VCS)**

The HM-Series are handheld shock-resistant thermal imaging cameras. They produce a crisp image in the darkest of nights. The HM-Series will dramatically increase your situational awareness. The HM-Series can be used on board of all types of vessels. Yachts, commercial ships, tug and tow boats, work boats, police and law enforcement boats will all benefit from the power of thermal imaging.

The HM-Series thermal imaging cameras are excellent tools for night-time navigation, securing any shipboard environment, anti-piracy and many other maritime applications. Whether you are anchored in port or sailing in the open sea, you will be able to see in total darkness.



#### Portable Thermal Imaging Camera HM-224

Design	Portable thermal imaging camera, degree of protection IP 67, shock-resistant
Image Sensor:	Focal plane array, Vanadium Oxide (VOx) Microbolometer, uncooled: 240 x 180 Pixels
Spectral Range:	7.5 ... 13.5 $\mu\text{m}$
Field of View:	24° (H) x 18° (V) 12° (H) x 9° (V) with 2X Extender lens
Thermal Sensitivity:	< 50 mK at f/1.0 and + 25°C
Image frequency:	8.3 Hz PAL / 7.5 Hz NTSC
Display:	LCD Screen
Video Output:	PAL or NTSC Composite Video, RCA Jack
Image Polarity:	White-hot or black-hot, selectable
Power Supply:	4 x AA NiMH Accus (incl.), > 5h Battery life
Ambient temperature:	0°C ... +50°C
Dimension L x W x H:	240 mm x 85 mm x 60 mm
Weight:	appr. 0.66 kg

#### Portable Thermal Imaging Camera HM-324 XP+

Design	Portable thermal imaging camera, degree of protection IP 67, shock-resistant
Image Sensor:	Focal plane array, Vanadium Oxide (VOx) Microbolometer, uncooled: 320 x 240 Pixels
Spectral Range:	7.5 ... 13.5 $\mu\text{m}$
Field of View:	24° (H) x 18° (V) 12° (H) x 9° (V) with 2X Extender lens
Thermal Sensitivity:	< 50 mK at f/1.0 und + 25°C
Image frequency:	8.3 Hz PAL / 7.5 Hz NTSC
Display:	LCD Screen
Video Output:	PAL or NTSC Composite Video, RCA Jack
Image Polarity:	White-hot or black-hot, selectable
Image Storage:	Single image, Standard JPEG, 1GB SD-Card
Video Storage:	9 Hz, Full Frame, MPEG4 1 GB SD-Card (appr. 8 s / MB)
Interfaces:	SD-Card-Slot USB 2.0
Power Supply:	4 x AA NiMH Accus (incl.), > 5h Battery life
Ambient temperature:	-20°C ... +60°C
Dimension L x W x H:	265 mm x 85 mm x 75 mm
Weight:	appr. 0.97 kg

- **M-Series, Premium Multi-Sensor systems for maritime applications**

The M-Series combine a thermal imaging camera with a low light camera. They provide crisp, clear thermal imagery in total darkness and light fog or smoke. Packaged in a small, ultra-compact gimbal they are designed for the most demanding maritime applications.

The FLIR M-Series are perfect tools for night-time navigation, shipboard security, man overboard situations, anti-piracy and many other applications. The FLIR M-Series are the standard for maritime thermal imaging systems against which all others are compared.



### Combined Thermal Imaging and Low Light Camera M-626L

Design	Combined thermal imaging and high-sensitive low light camera with controllable pan-/tilt-head, degree of protection IP 66
Image Sensor:	Focal plane array, Vanadium Oxide (VOx) Microbolometer, uncooled: 640 x 480 Pixels (Thermal imaging) 1/2" Interline Transfer CCD 768 (H) x 494 (V) Lines 0.1 Lux at f/1.4 (Low light)
Spectral Range:	7.5 ... 13.5 $\mu\text{m}$
Field of View:	26° (H) x 20° (V) with 35 mm-lens
Thermal Sensitivity:	< 50 mK at f/1.0 and + 25°C
Image frequency:	8.3 Hz PAL / 7.5 Hz NTSC
Video Output:	PAL or NTSC, BNC incl. BNC-to-RCA Adapter
Panning:	360° continuous
Tilting:	+/- 90°
Power Supply:	12 V DC ... 24 V DC (-10% / + 30%)
Power Consumption:	25 W nominal, max. 50 W (Heating)
Ambient Temperature:	-25°C ... +55°C
Dimension $\varnothing$ x H:	178 mm x 279 mm
Weight:	appr. 4,1 kg

**Notice: Power supply for M-Series to be provided by customer.**

### Combined Thermal Imaging and Low Light Camera M-320L

Design	Combined thermal imaging and high-sensitive low light camera with controllable pan-/tilt-head, degree of protection IP 66
Image Sensor:	Focal plane array, Vanadium Oxide (VOx) Microbolometer, uncooled: 320 x 240 Pixels (Thermal imaging) 1/2" Interline Transfer CCD 768 (H) x 494 (V) Lines 0.1 Lux at f/1.4 (Low light)
Spectral Range:	7.5 ... 13.5 $\mu\text{m}$
Field of View:	26° (H) x 15° (V) with 35 mm-lens
Thermal Sensitivity:	< 50 mK at f/1.0 and + 25°C
Image frequency:	8.3 Hz PAL / 7.5 Hz NTSC (25 Hz PAL / 30 Hz NTSC available; Subject to approval of the US Department of Commerce for use outside the USA.)
Video Output:	PAL or NTSC, BNC incl. BNC-to-RCA Adapter
Panning:	360° continuous
Tilting:	+/- 90°
Poier Supply:	12 V DC ... 24 V DC (-10% / + 30%)
Power Consumption:	25 W nominal, max. 50 W (Heating)
Ambient Temperature:	-25°C ... +55°C
Dimension $\varnothing$ x H:	178 mm x 279 mm
Weight:	appr. 4,1 kg

- **FLIR MD Series Thermal Imaging Camera for maritime applications**

This affordable, fixed-mount thermal night vision system helps with steering around obstacles, collision avoidance and finding people in the water at night. Simple to mount and easy to integrate into your existing electronics, MD-Series outputs standard analog video that can be easily displayed on any monitor at the helm or other monitors on the vessel.



### Thermal Imaging Camera MD-324

Design	Thermal imaging camera, degree of protection IP x6
Image Sensor:	320 × 240 VOx Microbolometer
Field of View:	24° × 18°
Video Output:	NTSC or PAL, 30 Hz or < 9 Hz
Panning / Tilting:	Pan: ±30° per key, Tilt: +34°, -27° (Locked in at Installation)
Power Supply:	12VDC – 24VDC(-10% / + 30%)
Power Consumption:	4.8 W nominal; 12.5 W max
Ambient Temperature:	-25°C ... +55°C
Dimension L x W x H:	152 mm x 178 mm
Weight:	1360 g

### Thermal Imaging Camera MD-615

Design	Thermal imaging camera, degree of protection IP x6
Image Sensor:	640 × 480 VOx Microbolometer
Field of View:	25° × 20°
Video Output:	NTSC or PAL, 30 Hz or < 9 Hz
Panning / Tilting:	Pan: ±30° per key, Tilt: +34°, -27° (Locked in at Installation)
Power Supply:	12VDC – 24VDC(-10% / + 30%)
Power Consumption:	4.8 W nominal; 12.5 W max
Ambient Temperature:	-25°C ... +55°C
Dimension L x W x H:	152 mm x 178 mm
Weight:	1360 g

**Notice: Power supply for FLIR MD Series to be provided by customer.**

- **Voyager II, Gyro-stabilized multi-sensor thermal imager with Pan/Tilt for maritime applications**

Voyager II was especially developed for maritime applications. It is a powerful, multi-sensor, mid range thermal night vision system. It features two thermal imaging cameras and one daylight / low light camera. One thermal imager has a wide angle field of view and is ideal for navigation and situational awareness. The other, with the narrow field of view, allows the user to zoom in onto objects that are very small or far away.

The Voyager II will allow you to detect objects, which are the size of a human being, more than 2 km away. Objects floating in the water, the size of 2.3 x 2.3 meter, can be detected up to practically 6 km away. The Voyager II will detect these objects even in total darkness, through smoke, light fog and in the most diverse weather conditions.

The Voyager II comes with a fully integrated and gyro-stabilized Pan/Tilt. It provides you with a continuous 360° rotation and a steady image in any sea state.

The Voyager II can be connected to a radar system in a so-called "slew-to-cue" configuration. The Voyager II is able to identify and track radar targets by using the National Marine Electronics Association (NMEA) 0183 protocol. The NMEA 0183 protocol allows the camera to automatically point towards vessels and other objects that show up on the radar display and to track their movement. When enabled, this means that if the radar detects an object, the Voyager II will automatically turn in the right direction and follow the object, so that you can see what the blip on your radar screen really means.

**Notice: Power supply for Voyager II to be provided by customer.**



### Multi-Sensor Thermal Imager Voyager II

Design	Multi-sensor thermal imager with two thermal imaging cameras and one day light / low light camera, with pan-/tilt-head gyro-stabilized and controllable, degree of protection IP 66
Image Sensor:	Focal plane array, Vanadium Oxide (VOx) Microbolometer, uncooled: 320 x 240 Pixels (Thermal imaging) 1/4" Super HAD (Day light)
Spectral Range:	7.5 ... 13.0 μm
Field of View:	20° (H) x 15° (V), NTSC 20° (H) x 16° (V), PAL Camera 1 with 35 mm-lens 5° (H) x 3,75° (V), NTSC 5° (H) x 4,0° (V), PAL Camera 2 with 140 mm-lens
Thermal Sensitivity:	max. 65 mK at + 25°C
Image frequency:	8.3 Hz PAL / 7.5 Hz NTSC (Subject to approval of the US Department of Commerce for use outside the USA)
Video Output:	PAL or NTSC, BNC incl. BNC-to-RCA Adapter
Panning:	+/- 180°
Tilting:	+/- 45°
Power Supply:	24 V DC (-10% / + 30%)
Power Consumption:	< 50 W nominal, max. 130 W max. 270 W with heaters
Ambient Temperature:	-25°C ... +55°C
Dimension Ø x H:	381 mm x 584 mm
Weight:	appr. 20.4 kg