



## VM-110 User Manual



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# 1 Safety

## 1.1 Safety notes

Read these operating instructions carefully before working with the radio system. This applies especially to the installation, commissioning and maintenance of the radio system.

Always inspect the equipment before use. This includes checking switches, joysticks, mechanical parts and display for any damage. If any damage is found these issues should be corrected before use. Please contact Vision Remote for further guidance.

It is recommended that the carrying harness is used when the VM-110 RU is operated. This will keep the operator`s hands free to safely use switches, joysticks and the touch display.

Only use batteries approved by Vision Remote AS

## 1.2 Operator authorization and responsibility

The VM-110 system utilizes user access control. All log on of users can be password restricted so any unauthorized use can be eliminated.

It is possible to select different applications different users have access to.

This means that certain users have the option to run several machines while others may have limited access to only one machine.

Ensure that your user session is terminated before shutting down for any breaks, lunch or at the end of the day.

The operator has responsibility for operating the machine in control in a safe manner. This means the operator should have visible view of the machine and the surrounding area at all times.

## 1.3 Safety instructions for Installation and Operation

- Inspect the VM-110 system for damage before installation or operation starts
- Do not use outside temperature range
- Do not immerse in water
- Never use or charge damaged batteries
- Only charge batteries by use of charging methods approved by Vision Remote AS
- Only to be installed and used by qualified personnel
- The VM-110 system shall be mounted in a compass safe distance of more than 5 meters

Vision Remote AS denies all responsibility for damage caused to things or personnel due to misuse of this equipment.

## 1.4 Modification of Equipment

Any changes or modifications to any of the equipment not approved by Vision Remote AS may void warranty and any third-party approvals.

# 2 General system information

## 2.1 VM-110 System description

The VM-110 system consists of the following main units:

- VM-110 RU - Remote Unit
- VM-110 BU - Base Unit
- VM-110 VLAP - Vision Link Access Point

In addition, the following accessories are provided:

- VM-110 JB - Junction Box
- Docking Station, Passive
- Docking Station w/charging function



*Figure 2-1: Main units of VM-110 system: VM-110 RU, VM-110 BU and VM-110 VLAP*

Vision Remote VM-110 is a radio remote system designed for control of cranes, winches, pumps etc. in a maritime environment. The product combines a traditional radio remote control with a rugged computer-based system with a multitouch screen. Figure 2-2 below shows the VM-110 system principles.

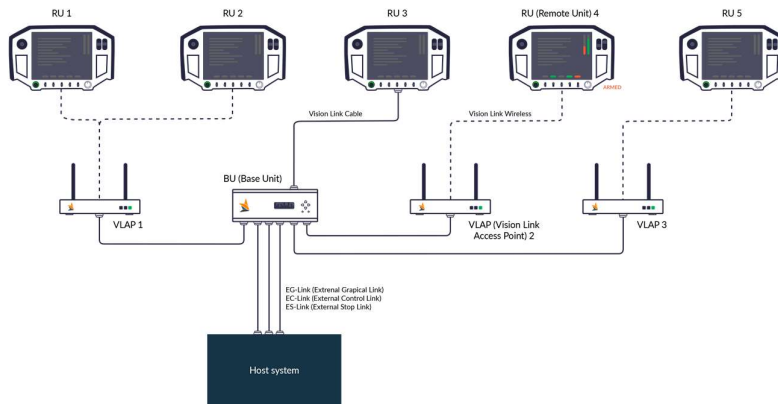


Figure 2-2: VM-110 system concept

The VM-110 RU is carried by an operator near the machinery to be controlled. The user can select the appropriate application which have been tailored for this machine.

Tactile switches and touch screen functions on the VM-110 RU are configurable in SW. This means the same unit may be used for a range of different machinery. The unit is also capable of displaying video streams from strategically located cameras.

The VM-110 RU is connected by wireless link and/or cable to the VM-110 BU, which has an interface to the host system, which again controls the various motors and actuators.

Up to three VM-110 VLAP's may be connected to each VM-110 BU to extend the wireless coverage and/or range. Several VM-110 RU's may be 'paired' for use with the same VM-110 BU.

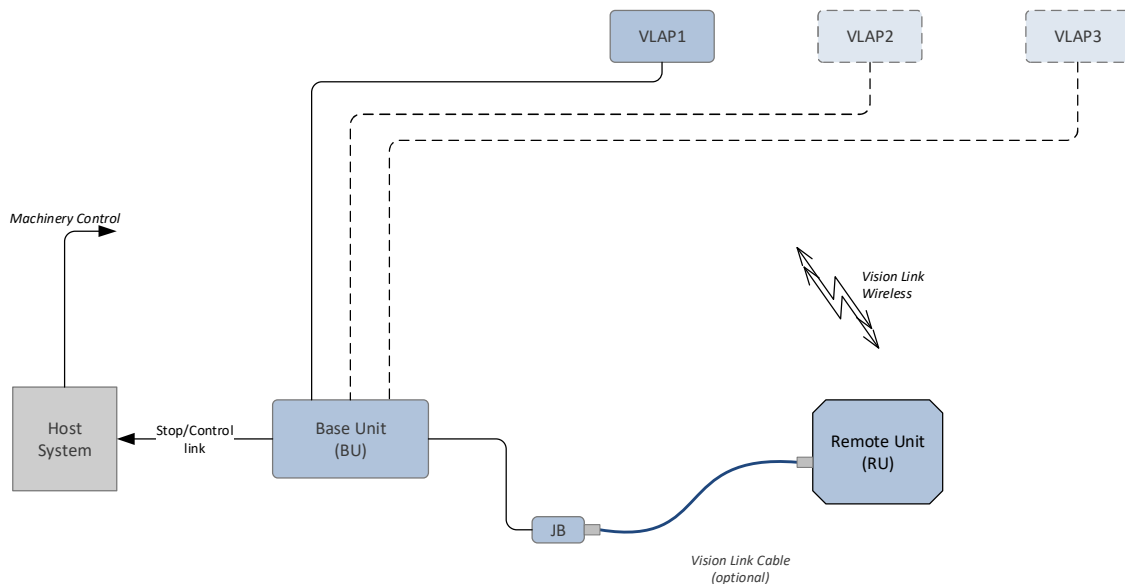


Figure 2-3: Typical VM-110 system arrangement

## 2.2 Security Features

The VM-110 radio communication signals are encrypted using several safety keys to protect against tampering from a hostile third party. It is also protected against spurious communication errors and interference using state of the art technology.

## 2.3 Design of the transmitter

The VM-110 RU is designed to be a universal radio remote control. This flexibility makes it easy to meet many customers' demands.

This is achieved by customer designing their own graphical user interface (GUI) on the display. This gives the customer virtually limitless options to create a look and feel to fit the machine. It is possible to create different applications to run several machines with the same VM-110 RU.

Furthermore, the VM-110 RU can be configured with different switches, joysticks, potentiometers and encoders for functions that requiring physical movements. All of these are protected by the surrounding handle, so any unintended activation will not occur due to placing the unit upside down.

For more information on configuration possibilities, contact VR.

## 2.4 VM-110 System Safety Features

The system is designed for compatibility with relevant directives for use on land, ships and offshore, and has built-in safety functions according to ISO-13849 and IEC 62745. This includes a Machinery-Stop function and redundant communication channels.

The VM-110 RU has several built-in safety features like tilt, shock and zero-g/free-fall sensors. These sensors can prevent any unintended movements of machinery due to accidents.

When the VM-110 RU is armed and in control of a machine an excessive tilt motion (45° sideways or down, or 60° up from the horizontal position) of the unit will disable user inputs, while a force triggering either shock or zero-g/free-fall will put the system into a safe state.

When the VM-110 RU is placed in a docking station the tilt sensor is disabled.

If a shock or zero-g/free-fall has triggered a STOP activation, follow instructions in chapter 2.12.

In addition, the VM-110 RU also has two vibration motors for haptic feedback, buzzer for audio feedback, ambient light sensor for controlling the back light of the display and a sensor for sensing when the remote is placed in a docking station.

## 2.5 VisionLink communication

The VM-110 system communication consists of two separate channels. These are the C-link and G-link. Combined these are referred as a VisionLink. The C-link is a highly reliable channel with long range but limited data rate while the G-link is a channel with much higher data rate but limited range.

These channels also include fall back functionality so if one fails communication still runs but refresh rate for the graphical user interface will be lower. If both radio links fail while the system is armed the system will enter a safe state.

This is even applicable when running via cable interface, but of course the range is now limited by the length of the cable.

The RSSI-signals (0-100%) for both C-link and G-link is transferred to the host system via EC-link and EG-link. The PLC can monitor the signal levels and send information to be displayed on the VM-110 RU display.

## 2.6 STOP function.

The VM-110 BU is designed to fulfill IEC 62745 GSS/ATS and EN ISO 13849 CAT. 3 PLd when the VM-110 RU is armed.

If the VM-110 system is up and running without any errors the STOP-relays will be energized.

Any loss of communication between VM-110 RU, VM-110 BU and VM-110 VLAP while system is armed will cause the system to go into a safe state, meaning the STOP-relays will be de-energized and be opened. This can for instance be if the transmitter is out of radio range or runs out of battery.

For systems that utilize the EC-link and/or EG-link to communicate with an PLC or a host system and communication is lost, power-loss or internal failures will also put the system into a safe state.

If this happen, the system will enter a BLOCKED state. Resolving communication issues, rearming transmitter or manually releasing the blocked situation using menu system on VM-110 BU is required before STOP relays will re-energize. After this is done the system will be operative again.

Please note that only the VM-110 RU initiating STOP can release the blocked situation remotely.

## 2.7 Pairing of units

The VM-110 system structure allows for pairing of units using a service application. This allows a unconfigured/blank VM-110 RU to be paired with the VM-110 BU by downloading configuration and machine application files using the VisionLink cable.



If the customer has upgraded/redesigned the configuration/application of a system, any previous paired units will lose their access to the machine. To regain control the VM-110 RU must download the updated application by using the service application.

Pairing using radio communication is not possible.

Both the VM-110 RU and VM-110 BU can support many units. The customer can either have one remote controlling many machines, several remotes control to one machine or anything between.

This makes the VM-110 system is very versatile and suitable for many different operations.

## 2.8 VM-110 System Status codes

The VM-110 system has several built-in status notifications displayed with the use of LEDs and LCD-display.

The VM-110 RU and VM-110 VLAP has a bi-colored status LED while the VM-110 BU has 1 bi-colored LED, 1 yellow LED and a 2x16 segment LCD-display for status information. Together these can be used to give a quick indication of the system status.

### 2.8.1 VM-110 RU

Status LED	
Green	Communicating with base unit
Amber	Not communicating with base unit
Red	STOP triggered or other error during armed situation

### 2.8.2 VM-110 BU

Status LED	
Green	System status OK
Amber	System initializing
Red	System fault
Stop relay LED	
Yellow	STOP relays active. System OK
No light	STOP relays not active

#### LCD-display

Error messages displayed on the LCD display will give a direct notification of the status of the VM-110 system.

### 2.8.3 VM-110 VLAP

Status LED	
Green	System status OK
Green flashing	System armed
Amber	System initializing
Red	System fault

## 2.9 Activating VM-110 RU.

- Insert battery or use VisionLink cable
- Turn on VM-110 RU by pressing ON/OFF switch for 1 sec.
- Select user
- Select application to control desired machine
- Arm remote

Ensure that the STOP-switch is released before trying to arm and take control of a machine.

## 2.10 De-activating VM-110 RU.

- Disarm VM-110 RU
- Close current application running

## 2.11 Transfer of control between several VM-110 RU units

- Disarm VM-110 RU in control
- Arm remote to take over control\*

\*Steps for activating the transmitter considered done.

## 2.12 Re-Activating system after STOP or loss of communication

- Turn off VM-110 RU by pressing ON/OFF switch for 1 sec.
- Turn on VM-110 RU by pressing ON/OFF switch for 1 sec.
- Select user
- Select application to control halted machine
- Arm remote

## 3 Battery and Battery Charging

### 3.1 Safety instructions:

- Only use specified battery with the VM-110 RU
- Only use dedicated charger to charge batteries
- Only charge batteries in dry environments
- Only charge batteries in temperatures between 0°C to 45°C.
- Never use or charge a damaged battery
- Do not charge batteries in hazardous areas or close to explosive substances
- Disconnect power before cleaning chargers
- Keep contacts free of dirt and other contaminants like water and salt-spray
- Do not short-circuit, damage, open or expose the batteries to fire
- Recycle or dispose old batteries according to respective regulations

### 3.2 Battery

The VM-110 RU uses a 7,5V 6400mAh 48Wh Litium-Ion rechargeable battery pack with a smart battery management module. The battery is designed to protect for over-charge, over-discharge, short circuit, over-temperature and over-current situations.

Operating time with normal use is typically 6 hours. Running applications which requires a lot of processing, like HD-video or in conditions requiring a lot of LCD backlight may reduce operating time.

Recommended storage temperature for the batteries is -20°C to 25°C.

The battery provides a minimum of 6 months shelf life with initial charge of 40%, when stored at 25°C.

Given normal storage and usage the battery delivers 80% or more of its initial capacity after 300 charge/discharge cycles.

The battery has a display with 4 LEDs to show the capacity information by using a push button. Each of the 4 LEDs represent 25% charge. If the battery voltage is too low, the battery is inoperable or damaged there will be no LED indication. See table below.

The battery status (0-100% charge) is also transferred to the host system via EC-link and EG-link so the PLC can have the battery level displayed on the VM-110 RU display.

It is recommended a low battery warning is given on the display when battery level is below 10%. Time to shut down from 10% charge is more than 10 minutes. This should be enough time to safely change the battery or start charging using cable or unit placed in docking station with charge functionality.

Capacity	LED Indicators #				Note
	1	2	3	4	
<10%					Flashing
10%-25%					Lit for 4 seconds
26%-50%					Lit for 4 seconds
51%-75%					Lit for 4 seconds
76%-100%					Lit for 4 seconds

### 3.3 Battery Charging

There are 3 ways of charging the battery used for the VM-110 RU.

- Charging using dedicated table charger
- Charging while VM-110 RU docked in charging docking station
- Charging using VisionLink cable connected to VM-110 RU

Charging with dedicated table charger or in docking station will fully charge an empty battery in less than 3 hours. Charging in docking station is active even if the VM-110 RU is switched of. Charging battery using the VisionLink cable while operating the VM-110 RU will take approx. 5 hours.

### 3.4 Replacing battery

The VM-110 RU's battery is changed by accessing the battery installed in the battery compartment on the bottom side of the unit.

- Open battery compartment lid by turning 2 screws counter clock wise
- Remove lid
- Replace battery
- Re-install lid
- Close battery compartment lid by turning 2 screws clock wise

Ensure gasket is in place and in good condition!

## 4 Installation

- Only qualified personnel with knowledge of the electrical system of the machine should install the VM-110 system
- During installation the entire system shall be turned OFF
- All HSE regulations for the technicians must be followed according to local legislation

#### Location classes:

The equipment is designed for compliance with the following areas and locations according to IACS and DNV-GL terms for installation of Control and Monitoring Systems on ships:

VM-110 RU:	Portable, Open decks, Control rooms
VM-110 BU:	Control rooms, accommodation, general power distribution zone
VM-110 VLAP:	Open decks (not for mounting in masts)
VM-110 JB:	Open decks, Control rooms
Docking station w/charger:	Control rooms

Note: The VM-110 units must be placed at a safe distance from the steering magnetic compass of at least 5m.

## 4.1 Earthing and Cables

Ensure that VM-110 BU, power supply and Ethernet cables are connected to protective earth.

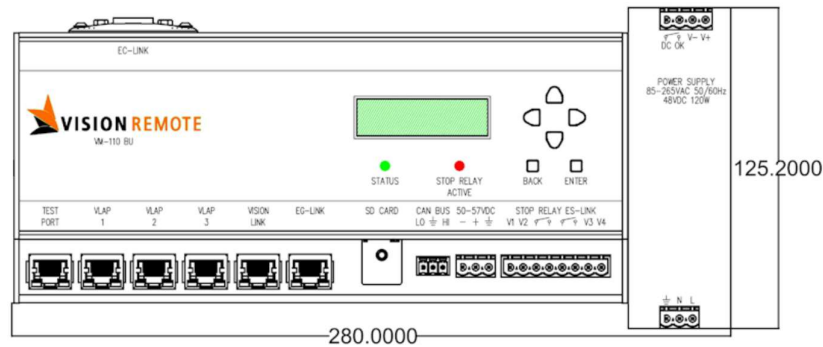
- Only use screened Ethernet cables. All Ethernet cables must be Cat.5e or Cat.6 (S/FTP).
- Maximum length, all Ethernet cables: 100 m  
For VisionLink cable this is the overall length of the cable from the VM-110 BU and to the VM-110 RU.
- VLAP/VisionLink cables require AWG24 (VM-110 RU) or AWG26 (VM-110 VLAP) cross section for full lengths due to PoE supply.
- Note that cables may be subject to local installation requirements and approvals.

## 4.2 Installation of VM-110 BU

The VM-110 BU and power supply are designed for fitting on a DIN-rail inside a cabinet. This can either be an enclosure delivered from Vision Remote AS or installed inside customers enclosure/rack. Access to the VM-110 BU is not necessary during normal operation. The VM-110 BU is not designed for installation on ships bridge, open decks, in masts or on vibrating machinery.

Installation of the VM-110 BU shall be done with power off.

If access to the VM-110 BU while powered is on is required, this is considered as a service function. If enclosure is opened during this operation, please handle the equipment with normal ESD precautions. Discharge tools and yourself before any work is done.



#### 4.2.1 VM-110 BU Connections

The VM-110 BU has six RJ-45 connectors, three terminal blocks, one connection for serial bus and one MicroSD-card slot.

Connector	Description
Test port	RJ45 to test equipment
VLAP1-3	RJ45 connections for up to 3 VM-110 VLAP units
VisionLink	RJ45 cable port for VisionLink connection
EG-link	Ethernet to host system
EC-link	Anybus-module to host system
ES-link	Connections for 2 stop relays. V1-V4 are over-voltage protectors used when inductive loads are connected.
MicroSD-slot	MicroSD-slot for file loading and storage
CAN-bus	For future use
Power supply	100-240VAC/50Hz/120W
	Pin 1 In: PE Pin 2 In: N Pin 3 In: L
	Pin 1 Out: DC ok NO relay (optional) Pin 2 Out: DC ok NO relay (optional) Pin 3 Out: 0VDC Pin 4 Out: 50-57VDC
Supply VM-110 BU	50-57VDC/120W Pin 1: -

	Pin 2: + Pin 3: PE
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Ensure good connection to local ground (see recommended wiring in TD-0020).

Note: Ethernet cables must be grounded at cabinet entry.

### 4.3 Installation of VM-110 VLAP

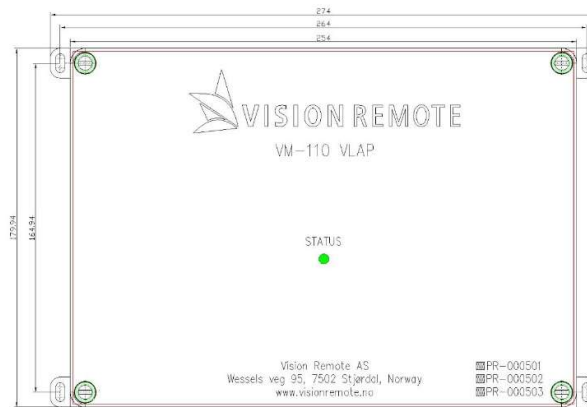
The VM-110 VLAP is designed for installation in an outdoor environment/open deck (not in masts).

The unit has antennas for both C-link and G-link. It is recommended to mount the unit on a wall or ceiling facing the operational area. As a rule of thumb ensure that there are no objects restricting the view between the VM-110 VLAP and VM-110 RU.

Installation of the VM-110 VLAP shall be done with power off.

During installation please handle the equipment with normal ESD precautions as connections are done directly on the PCB. Discharge tools and yourself before any work is done.

If the unit is mounted in an environment with excess vibrations, it's recommended to fit rubber dampeners to isolate the VM-110 VLAP.



#### 4.3.1 VM-110 VLAP Connections

The VM-110 VLAP has two RJ-45 connectors and three terminal blocks.

Connector	Description
Ethernet in (RJ45)	PoE Power, Ethernet and RS-485 communication from VM-110 BU*
Ethernet in (Screw terminals)	PoE Power, Ethernet and RS-485 communication from VM-110 BU*
Ethernet Out	Ethernet communication to WiFi access point

External status LED	Connections to external two-color LED
12VDC out	12VDC supply for access point Pin 1: 0VDC Pin 2: 12VDC
Status LED Connections	Pins for external status LED

\*Use either RJ45 or screw terminals for connecting VM-110 VLAP

#### 4.3.2 Ethernet IN screw terminal connection

Pin	Signal	Color
Pin 1	RX, DC+	White/Orange
Pin 2	RX, DC+	Orange
Pin 3	TX, DC-	White/Green
Pin 4	Spare	Blue
Pin 5	Spare	White/Blue
Pin 6	TX, DC-	Green
Pin 7	RS-485+	White/Brown
Pin 8	RS-485-	Brown

Pinout according to TIA-568B

## 5 Maintenance and Service

The VM-110 system is designed for use in tough environments and does not require any special maintenance but there is always a good idea to take precautions to reduce the risk of any failures. Please follow the maintenance guidelines below to achieve maximum service life and reliability of the system.

- Please clean using a damp cloth and mild soap!
- Do not use any strong solvents for cleaning the VM-110 RU as the display glass may be stained!
- Never use high-pressure cleaner or sharp objects to clean the units!
- Inspect the units for damage regularly. Pay special attention to seals on joysticks and switches. Do not continue to operate if any damage is discovered!
- There are no serviceable parts inside any of the units

If any service is found to be necessary, please contact Vision Remote AS for further guidance.



## 5.1 Spare parts

Spare parts can be ordered through Vision Remote AS. Please refer to the serial number of unit which need service. The serial number is found on a marking label on your unit.

## 6 Troubleshooting

Problem	Possible Cause	Remedy
Transmitter dead	<ul style="list-style-type: none"> <li>Depleted battery</li> <li>No battery inserted</li> </ul>	<ul style="list-style-type: none"> <li>Insert, charge or change battery</li> <li>Try operation with VisionLink cable</li> </ul>
Low operation time	<ul style="list-style-type: none"> <li>Battery not fully charged</li> <li>Battery defective</li> </ul>	<ul style="list-style-type: none"> <li>Charge battery</li> <li>Replace battery</li> </ul>
Short radio range	<ul style="list-style-type: none"> <li>Antenna blocked</li> <li>Antenna cables loose</li> <li>Frequency collision</li> </ul>	<ul style="list-style-type: none"> <li>Relocate VM-110 VLAP</li> <li>Change frequency</li> <li>Consider redundant VM-110 VLAP</li> </ul>
Confirmed interference problems	<ul style="list-style-type: none"> <li>Several systems on same frequencies</li> </ul>	<ul style="list-style-type: none"> <li>Change frequencies used on equipment. Contact Vision Remote AS for guidance</li> </ul>

## 7 Technical Data

### 7.1 VM-110 RU

Dimensions (L-W-H)	406x280x80mm (16,0x11,02x3,15 inch)
Weight	Approx. 4 kg (8,82 lbs.) Depending on configuration
Material	Aluminum housing and ABS handle
IP rating	66
Temperature range	Operating -25 - +55°C
	Storage -30 - +70°C
Display	Size:10,4"
	Resolution: 1024x768
	Contrast: >700:1
	Touch: PCAP multi-touch

Frequency	C-link: 434.040-434.775MHz 433.075-434.775MHz (*) 869.700-869.975MHz 868.025-869.975MHz (*)	G-link: 2,412-2,484/ 4,900-5,850GHz
Channel spacing	25KHz	20/40MHz
Radio Power C-link	<10mW (434MHz)	
	<5mW (868MHz)	
Radio Power G-link	2,4GHz/15+-2dBm typ.	5,8GHz/15+-2dBm typ.
Antennas	Internal	
Operating range	C-link: Typical 200m	
	G-link: Typical 50m	
Battery	Lithium Ion 7.5V 6400 mAh 48Wh	
Operating time	Up to 6 hours	

(\*) Frequency range restricted due to spectrum regulations for Short Range Devices for CEPT member countries and the EU. However, the VM-110 system is also capable of a wider range (433.075-434.775 MHz and 868.025-869.975 MHz) for operation outside for these areas.

## 7.2 VM-110 BU

Dimensions (L-W-H)	280x125x114mm (11.24x4.93x4.49 inch) * * including power supply	
Weight	1,1 kg (2,43 lbs.)	
Material	Aluminum housing	
IP rating	20	
Temperature range	Operating 0 - +55°C	
	Storage -30 - +70°C	
Safety Level Functions	EN ISO 13849 CAT. 3 PLc*	*When remote armed
Safety Level Stop Function	IEC 62745 GSS/ATS	*When remote armed
	EN ISO 13849 CAT. 3 PLd*	
Stop relay	2 x 5A/250VAC (**) Duplicated monitored	Non-inductive loads up to 48V/2A do not require using overvoltage protectors
	Active stop	<175ms

Stop activation delay time	Passive stop	<500ms
Power supply	100-240VAC 50/60Hz - 120W	

Note (\*\*): Relay contacts are protected by an internal 5AT fuse (TR5 time lag fuse). Additional external fuse dimensioned for actual load is recommended. See installation drawing, TD-0020, for connection details.

To preserve contact life breaking current should be reduced for DC-voltages above 48VDC (110VDC/0.65A, 220VDC/0.2A).

### 7.3 VM-110 VLAP

Dimensions (L-W-H)	254x180x90mm (10x7.09x3,54 inch)	
Weight	2,5 kg (4.41 lbs.)	
Material	Polycarbonate	
IP rating	66	
Frequency	C-link: 434.040-434.775MHz 433.075-434.775MHz (*) 869.700-869.975MHz 868.025-869.975MHz (*)	G-link: 2,412-2,484/ 4,900-5,850GHz
Channel spacing	25KHz	20/40MHz
Radio Power C-link	<10mW (434MHz)	
	<5mW (868MHz)	
Radio Power G-link	2,4GHz/18dBm	5,8GHz/23dBm
Antennas	C-link	External TNC connector
	G-link	Internal
Temperature range	Operating -25 - +55°C	
	Storage -30 - +70°C	
Operating range	C-link: Typical 200m	
	G-link: Typical 50m	
Power supply	PoE PD 802.3af 37-57VDC	

(\*) Frequency range restricted due to spectrum regulations for Short Range Devices for CEPT member countries and the EU. However, the VM-110 system is also capable of a wider range (433.075-434.775 MHz and 868.025-869.975 MHz) for operation outside for these areas.

### 7.4 Compliance information

#### 7.4.1 CE Compliance

Please refer to TS-0016 Declaration of conformity VM-110

#### 7.4.2 Maximum transmit power and frequencies:

VM-110 Wireless Link	Max Power	Frequency range
G-Link (WiFi) for RU	17.5 mW	13 overlapping channels each 20 MHz wide and spaced at 5 MHz. Centered at 2.412 to 2.472 MHz.
	62.4 mW	165 overlapping channels each 20 or 40 MHz wide and spaced at 5 MHz. Centered at 5180 to 5825 MHz.
C-Link for RU/VLAP w/option "434MHz"	10 mW	434.040-434.775MHz (CEPT ERC Recommendation, band g3)
C-Link for RU/VLAP w/option "869MHz"	5 mW	869.700-869.975MHz (CEPT ERC Recommendation, band h1.7)

#### Notes:

- The G-link (Wi-Fi) conforms to IEEE 802.11a/b/g/n.
- The 5150 to 5350 MHz frequency range is restricted to indoor use only. Outdoor operation in this range is strictly prohibited.
- C-Link frequency range is restricted by equipment configuration for EU/EFTA area
- The equipment is intended to be used in all EU and EFTA countries.

#### 7.4.3 Maritime regulations

The VM-110 system has been tested for compliance with environmental requirements for use on ships according to DNVGL-CG-0339 (Environmental test specification for electrical, electronic and programmable equipment and systems).

Test reports are available on request from Vision Remote AS.

## 8 Disposal

Vision Remote AS strive to ensure that our product has a life-cycle that has as low environmental footprint as possible. This is valid from development stages, through production and final into end of life of the products.

Please use local laws for environmental disposal of electronic equipment.

## 9 Warranty

All units delivered from Vision Remote are thoroughly tested before delivery. If any damage to units are discovered when receiving the shipment, please contact carrier immediately. Vision Remote AS does not cover any damage caused by transport.

As a general warranty all units are delivered with 1-year warranty for workmanship and material defects. Warranty valid 1-year from delivery date.

The warranty covers repairs done at Vision Remote AS premises.

Any excessive misuse, mishandling, modifications, intentional damage, unauthorized repairs of the units can void warranty.

Information in this document is subject to change without further notice.



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