DWARF
CONNECTION

DC-LINK
USER MANUAL

ULR1
LR2
X.LINK-L1

Contents

AT	BE	CY	CZ	DK	EE	FI
FR	DE	EL	HU	IE	IT	LV
LT	LU	MT	NL	PL	PT	SK
SI	ES	SE	UK	BG	RO	HR

In all EU member states, operation of 5150-5250MHz is restricted to indoor use only.

Congratulations on purchasing the DC-LINK video transmission system!

Please read this manual carefully before operating your product. You can also access this through our website: www.dwarfconnection.com
Also read the safety information enclosed with your DwarfConnection product, as it contains more detailed information on product and health safety!
The technology contained in this product, including the device itself as well as related software and trademarks, is protected by law. Any duplication or reproduction without the written permission of the copyright owner is prohibited, in part or in full. All third-party brands or copyrights mentioned in this manual are the property of their respective owners.

This manual is valid for:
DC-LINK-ULR1, DC-LINK-ULR1.MKII
DC-LINK-LR2, DC-LINK-LR2.MKII
DC-X.LINK-L1, DC-X.LINK-L1.MKII

Warranty

This product has a limited warranty of one year, starting from the date of purchase. Warranty may be voided by:

- Physical damage of the product

- Any damage caused by improper use, maintenance or storage

- Damage resulting from the use of incorrect power supplies

- Damage not related to the design of the product or the quality of its manufacture

For more information about warranty procedures please contact your retailer or simply ask us.

Safety Precautions

WARNING: READ BEFORE USE TO REDUCE THE RISK OF PERSONAL INJURY OR PROPERTY DAMAGE, INCLUDING DAMAGE TO YOUR TRANSMITTER/RECEIVER AND OTHER POTENTIAL HAZARDS.

HANDLING
Handle your DC-LINK system with care. You may damage the devices if you disassemble, drop, bend, burn, crush or otherwise subject them to unnecessary force. Do not use a device with a damaged enclosure. Using a damaged product may cause injury. Do not expose your devices to liquids of any kind! This can cause a short circuit and overheating. If your devices do come into contact with liquids, do not attempt to dry them using an external heat source. If the device comes into contact with liquid or corrosive chemicals, immediately turn off the power and remove the power supply. Do not operate the device near fire, gas lines or electrical mains or in high humidity or dusty surroundings.

Do not block or otherwise impede ventilation slots or unused connectors, as this may result in a short circuit, fire or electric shock.

DC-LINK systems are designed to work in ambient temperatures between 0° and 40°C / 32° to 100°F and should be stored between ambient temperatures of -20° and 60°C / 0° and 140°F. Ensure sufficient ventilation when operating your DC-LINK system in warm temperatures to prevent overheating. Do not leave your devices in places in which the temperature may exceed 60°C / 140°F as this may damage the product or pose a potential fire risk. Keep your device away from heat sources and out of direct sunlight. If your device becomes too hot, disconnect it from its power source if it is plugged in, move it to a cooler place, and do not use it until it has cooled. If you accidently operated your DC-LINK system at temperatures lower than 0° C / 32° F try to avoid condensation water: Do not allow your device to cool down in the cold! Put your device in the case immediately after turning it off!

CARE & CLEANING
Unplug the product and power adapter before cleaning, during lightning storms, or when unused for extended periods of time. Use a clean, soft, and dry cloth to clean devices and their accessories. Do not use any chemical detergent, powder, or other chemical agents (such as alcohol or benzene) to clean the product or accessories.

REPAIR, SERVICE & SUPPORT
Disassembling the devices may cause injury to you or damage to your device. Do not attempt to repair your DC-LINK system yourself. Opening your device voids warranty. If devices cease working or have been damaged, contact our support team.

PROLONGED HEAT EXPOSURE
Your DC-LINK system generates heat during normal operation and complies with applicable surface temperature standards and limits. Avoid prolonged, direct or indirect skin contact when the devices are in use because exposing skin to hot surfaces for a long period of time may cause discomfort or burns.

ENVIRONMENTAL RESTRICTIONS
To prevent damage to your DC-LINK system, do not use or store the devices or accessories in dusty, smoky, damp, or dirty environments. Leaving the devices in places in which the temperature may exceed 60°C / 140°F may cause damage to the devices or pose a fire risk.

RADIO FREQUENCE INTERFERENCE
Observe rules that prohibit the use of wireless technology in certain environments. Your devices are designed to comply with regulations governing radio frequency emissions but use of such systems can negatively affect other electronic equipment.

RECYCLING
Please recycle all packaging, devices and accessories in accordance with U.S. regulations.

Overview

The DC-LINK-CLR2 is a high-performance WHDI video transmission system which transmits uncompressed video and audio signals. Maximum transmission range (line of sight) for the LR2 is 700m / 2,300ft, maximum transmission range for the ULR1 is 1.200m / 4,000ft.

Due to the conscious decision not to implement DFS (Dynamic Frequency Selection) the device has a longer range, greater stability and better usability than comparable systems that DO use DFS.

The transmitter and receiver both have 3G-SDI and HDMI connectors (Plug & Play). When a video source is attached, the transmitter automatically selects the input (SDI is prioritized). The receiver's 3G-SDI and HDMI outputs can be used simultaneously.

Characteristics

- **Max. transmission range 300m/1000ft line of sight**

- **Rapid and reliable connectivity, no need for complex pairing**

- **Real-time transmission with no latency (< 0.001s)**

- **Uncompressed transmission. 10-bit, 4:2:2 transmissions via 3G-SDI and HDMI without format conversion**

- **Supports formats up to and including 1080p 60Hz**

- **2- channel audio transmission, embedded audio transmission on CH1 & CH2 via SDI and HDMI**

- **Operates within the license-free 5GHz ISM band, frequency range from 5.1 to 5.9GHz**

- **Multicast support 1:1 or 1:n transmissions with up to four parallel systems**

- **Metadata and Time Code transmission***

- **High grade aluminium casing: extremely durable and heat regulating**

- **Variable Input Voltage from 7,2-18,0V DC allows the system to be operated with a variety of batteries or power supplies**

- **Status displays for DC power, video and RSSI signal strength**
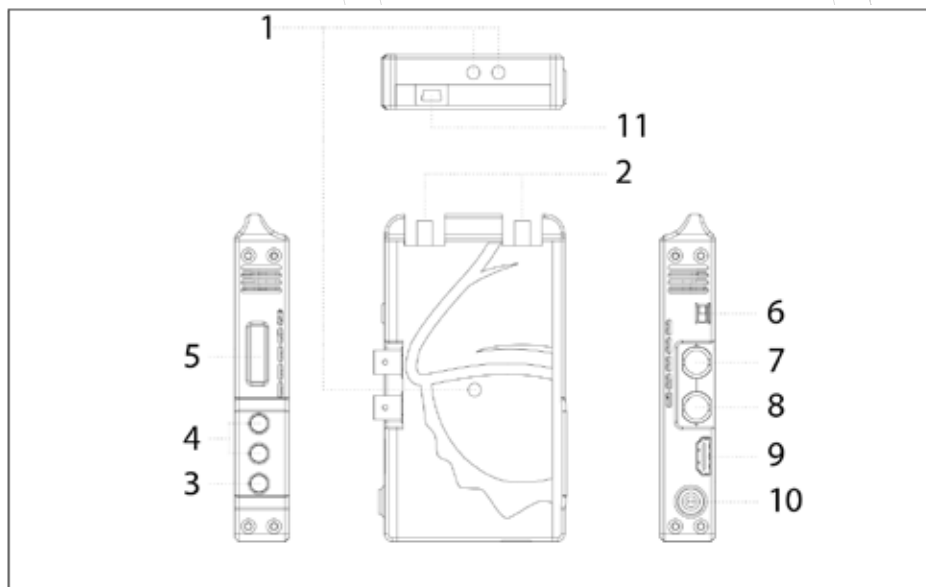
- **1/4" tripod mount**

Receiver with V-mount plate

- **Battery adapter plate (V-mount / NPF) is available as an optional accessory and can easily be mounted to the back**

- **Plug-and-Play design. Ready to use without the need for complex configuration**

- **1 Year warranty by manufacturer**

* Metadata support available for most cameras and industry standard video assist solutions (such as QTAKE).

Product Description

ULR1 and LR2 Transmitter

1) 1/4" Tripod Mount

2) Antenna Connection: SMA (male) Connector

3) Menu Button

4) Control Buttons

5) OLED display

6) Power Switch

7) SDI-IN: 3G/HD/SD-SDI Input, (BNC Female Connector)

8) SDI LOOP-OUT: 3G/HD/SD-SDI Output, (BNC Female Connector)

9) HDMI-IN: HDMI Input (Type A Female Connector)

10) DC-IN: 7,2 – 18,0V DC

11) Mini USB: For firmware upgrade

Product Description

ULR1, LR2 and X.LINK-L1 Receiver
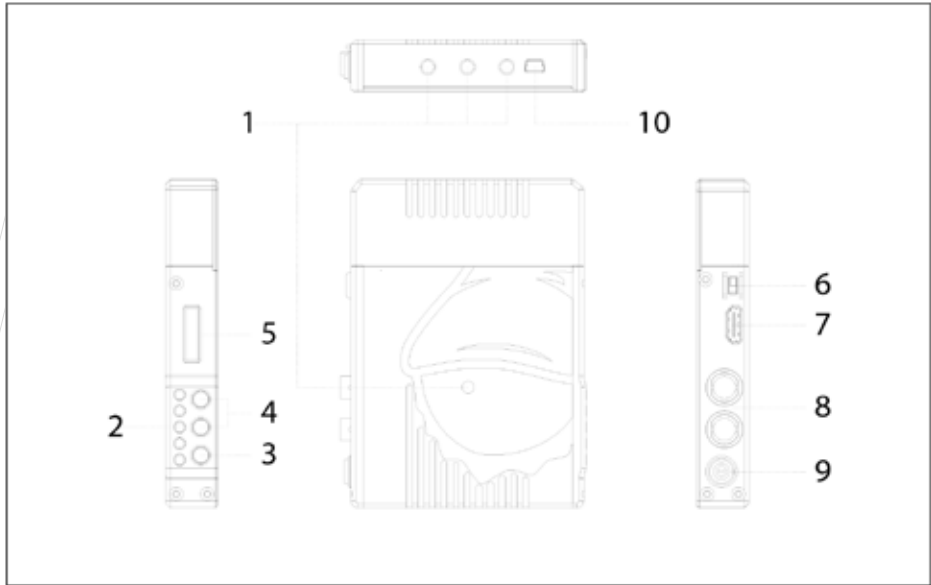
1) 1/4" Tripod Mount

2) RSSI Status Display: Signal Strength

3) Menu Button

4) Control Buttons

5) OLED display

6) Power Switch

7) HDMI-OUT: HDMI Output (Type A Female Connector)

8) Dual SDI-OUT: 3G/HD/SD-SDI Output, (BNC Female Connector)

9) DC-IN: 7,2 – 18,0V DC

10) Mini USB: For firmware upgrade

Scope of Delivery

DC-LINK ULR1, DC-LINK-LR2

1x Transmitter

1x Receiver

9x External Antenna

2x D-Tap cable 4pin

2x Power supply 4pin

1x Magic arm with 1/4" screw

1x Hotshoe Mount

Quick Start Guide

USB flash drive with product manual

DC-X.LINK-L1

1x Receiver

6x External antenna

1x D-Tap cable 4pin

1x Magic arm with 1/4" screw

1x Hotshoe Mount

Quick Start Guide

USB flash drive with product manual

Operation

1. Connect the antennas to the SMA male connectors (2) of your devices.
2. There is a 1/4" tripod mount at the base of the transmitter if required.
3. Power your devices with the enclosed power supplies or use the enclosed D-Tap cables to connect to a battery. Only use 4-pin cables provided by DwarfConnection to power your DC-LINK system! Other cables might cause damage of your products!
4. Turn on your devices.
5. Make sure transmitter and receiver are set to the same channel. Switch channels if necessary. (Find detailed instructions in "Features")

Signal Distribution

Connect the camera's SDI or HDMI output to the transmitter's SDI or HDMI input. If both SDI and HDMI inputs are active, the transmitter will prioritize the SDI signal.

Connect the receiver's SDI or HDMI output to the SDI or HDMI input of the monitoring/recording device. During active transmission, both the SDI and the HDMI output on the receiver can be used simultaneously.

Make sure that the antennas are connected firmly, and all other connections are stable. Only use high quality 7,2 - 18,0V batteries.

Antenna Positioning
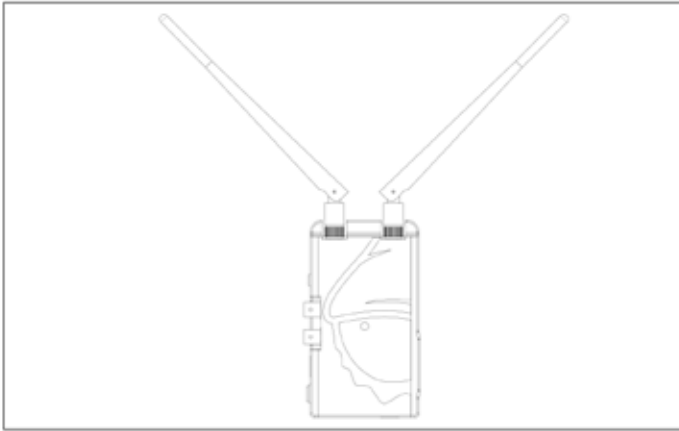
Position the antennas on transmitter and receiver as shown in the illustration. This ensures the best possible RF performance.

Install the transmitter and the receiver as high as possible (at least 2 meters above ground level) to maintain a good line-of-sight. During operation, try to keep the transmitter and the receiver at similar heights.

Avoid obstacles such as walls, trees, water and steel structures between transmitter and receiver.

The connection is at its strongest when the flat surfaces of the transmitter and receiver face each other.

Find more information on how to optimize your wireless setup in the WHDI guide on our website.

Features

Menu Navigation

Use the MENU button to easily navigate through the sub menus of your DC-LINK device. Press several times until the referring indicator is flashing. Then use + and – to change the state and confirm with MENU.

OLED Display

The OLED Display shows all important information on the transmitter and the receiver. To make any changes to your settings, use MENU to navigate to the OLED Menu. Then use + and – to make your changes and confirm with MENU.
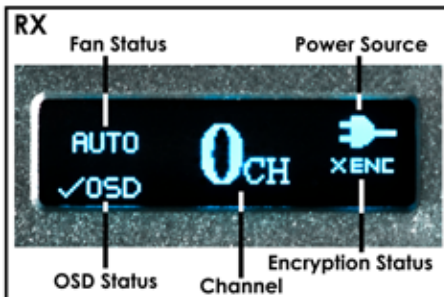
Received Signal Strength Indicator (RSSI)

The RSSI display shows the strength of the signal, allowing the operator to check, if the system is working properly. On MKII devices, the RSSI lights are turned off in Dark Mode. To learn more about Dark Mode, please read the corresponding section of this manual.

Display	Status	Description
RSSI	0-1 LEDs	Radio signal strength is weak and artefacts are visible in the video signal
	2-3 LEDs	Radio signal strength is normal and video quality is good
	4-5 LEDs	Radio signal strength is very strong and video quality is very good

Choosing a Channel

To choose a channel on the transmitter/receiver press MENU and select with the + or - button. Press MENU again to confirm.

The system works on 10 channels in the license-free 5 GHz ISM frequency band, using numbers 0-9.

On MKII receivers you can choose from 41 different channels. This is due to Multi Brand Connectivity, which makes your DC-LINK receiver compatible with multiple other Brands. When working with a DwarfConnection transmitter, always use channels 0-9! To learn more about Multi Brand Connectivity, please read

the corresponding section of this manual.

Transmitter and receiver have to be set to the same channel to work. If several systems are used at the same time, do not use neighboring channels to avoid interferences. A maximum number of 4 systems can be used simultaneously.

Master Channel Selection (for all MKII devices)
All receivers on the same channel will react to channel changes of the transmitter and follow automatically. Of course, a receiver can switch to another channel independently at any time.

Multi Brand Connectivity (for MKII receivers)
All MKII receivers are equipped with DwarfConnections's unique Multi Brand Connectivity Feature that makes them compatible with most common non-DFS WHDI wireless video systems on the market by letting you choose from different frequency sets. This is as easy as choosing a channel:

Use the MENU button to go to channel selection
Choose a channel from different frequency sets using the + and – buttons.
The letter on your display shows the frequency set, the number shows the channel. The channels used by DwarfConnection transmitters, do NOT show a letter. Therefore, when working with a DC-LINK transmitter, choose from channel 0 to 9 on your receiver.
Besides the DwarfConnection frequencys there are 31 more channels: A0-A9, B0-B9, C0-C9 and CA. These frequency sets correspond with the channel sets, other manufacturers are using.

The channel sets and referring frequencies are:

0-9 (DwarfConnection):
5550, 5590, 5630, 5670, 5150, 5190, 5230, 5270, 5310, 5510

A0-A9:
5825, 5190, 5230, 5755, 5795, 5745, 5765, 5775, 5785, 5805

B0-B9:
5130, 5210, 5250, 5330, 5370, 5450, 5530, 5610, 5690, 5770

C0-C9 plus CA:
5150, 5230, 5270, 5310, 5510, 5550, 5590, 5630, 5670, 5755, 5795

DC-Scan
DC-SCAN is a spectrum analyzer of the 5 GHz band and shows how busy the respective channels are. Choose a free channel for proper performance before operating your DC-LINK system.
To enter DC-SCAN, connect a monitor to the HDMI output of your receiver, then

press and hold the - button for 3 seconds. The frequency scanner is only available on the HDMI output. To leave DC-SCAN press and hold the - button again. When entering DC-SCAN from channel 0, it will also show you the antenna check. Green antennas show flawless operation, red antennas indicate that there is a problem. Possible reasons might be improper connection or defective antennas.

On Screen Display (OSD)

The OSD shows status information in case of transmission or signal problems. In live situations the OSD might be distracting or simply unwanted. Therefore, it can be turned off: Press the MENU button several times to navigate to the OSD menu and select the desired state by using the + or - button. Confirm your selection with MENU. An indicator on the OLED display of the receiver shows the OSD state.

On MKII devices a Record Indicator within the OSD shows, whether the camera is recording or not.
NOTE: This feature is bound to meta data support*.

Fan Control & Cinema Mode

Fan control allows you to turn the fans of the devices on or off to keep them cool but also prevent unwanted noise. Press MENU to navigate to the fan menu and select the desired state by using + or - .
AUTO indicates cinema mode, which triggers the fans using the start / stop flags of the camera. Once you hit record, the fan will stop, ensuring total silence. After recording, it will turn back on automatically. Cinema mode is bound to metadata support* and only available with active SDI connection.
√ switches the fans on permanently. X switches the fans off.

CAUTION!

For a long product life, we highly recomment NOT to operate your DC-LINK with permanently switched off fans. Whenever you are operating your devices without cooling, monitor the temperature and make cooling breaks when the indicator on your display is flashing (60°C / 140°F).
THE DEVICES DO NOT HAVE AN EMERGENCY OUT!
If you allow your devices to get too hot, you might cause serious damage of your equipment.

Dark Mode

Dark Mode turns off any lights on your DC-LINK device. Press and hold + for 3 seconds to (de)activate Dark Mode. When in Encryption Mode, all receivers will react to changes made on the transmitter and follow into or out of Dark Mode.

---

* Metadata support available for most cameras and industry standard video assist solutions (such as QTAKE).

Encryption (for all MKII devices)

In encryption mode, the transmitter sends an encoded signal that only linked receivers can read, making it to protect confidential content that is not meant for everyone's eyes.

To activate encryption mode, press and hold the MENU button on your device to enter the encryption menu. Use + or – to check either ON or OFF and confirm with MENU. The main menu will show either ENC or ENC to indicate whether encryption is on or off.

To link your devices, set your transmitter and all the receivers to the same channel, then activate encryption on your transmitter. All receivers will follow into encryption mode automatically. Settings remain active after turning your devices off. This means that ENC can be prepared prior to shooting and will stay active unless you turn it off.

A linked receiver does not HAVE to stay linked. To take a receiver out of the encrypted system, simply turn off ENC. Then you can easily access another (unencrypted) transmitter's images by choosing the referring channel within seconds. To link back to the previous (encrypted) transmitter, turn ENC on again.

IMPORTANT:

Switching back and forth between two encrypted systems is not possible. You cannot slip into an encrypted wireless system, if your receiver was not initially linked to the transmitter. If you want to add a new receiver to an encrypted system, you need to link the whole system again.

Maintenance

Please do not attempt to repair, modify or alter these devices under any circumstances.
Clean the devices with a soft, clean, dry and lint-free cloth. Do not open the devices, they contain no user-serviceable parts.

Storage
The devices can be stored at temperatures between -20°C and 60°C. For long-term storage, please use the original transport case and avoid environmental conditions such as high humidity, dust, or excessively acidic or base surroundings.

⚠ WARNING! ⚠

To ensure your own safety, please use only high-quality brand name batteries, and follow the safety instructions provided by the manufacturer.

Troubleshooting

	Possible Cause	Possible Solution
No video output	Lack of power	Check power supplies of transmitter and receiver and ensure that all cables are connected properly and that there is sufficient power.
	Antennas	Ensure antennas are not damaged and are firmly connected. Please use the DC-Scan to check.
	Video connection cable	Examine the transmitter's "Video" LED display. If the LED is dark, check the HDMI or SDI connection cable.
	Frequency selection	Ensure that the transmitter and receiver are set to the same channel.
	Unsupported video format	Make sure you using a supported video format.
Inadequate video quality	Connections	Ensure that all SDI or HDMI cables are firmly connected.
	Range is too great or signal is obstructed	Check how many "RSSI" LEDs are lit on the receiver. For decent quality, at least 2-3 LEDS should be lit. If only one is lit, the signal is weak and the distance between transmitter and receiver should be reduced. Alternatively, obstacles between the devices should be removed or another channel selected.
	Radio signal is experiencing interference	Open the DC-Scan and choose a free channel.

For more input, please visit **www.dwarfconnection.com/faq**

Technical Specifications

	Transmitter	Receiver
Connections	1x SDI Input (BNC female) 1x SDI Output (BNC female) 1x HDMI Input (Type A female) 2x Antenna (RP-SMA male) 1x DC Input (4-pin female)	2x SDI Output (BNC female) 1x HDMI Output (Type A female) 5x Antenna (RP-SMA male) 1x DC Input (4-pin female)
Power	7,2 – 18,0V DC	7,2 – 18,0V DC
Power Consumption	< 8 W	< 8 W
Dimensions (LxWxH), w/oAntennas	143.5 x 74.5 x 21.4mm 5.1" x 2.8" x 0.9"	147.8 x 100 x 20mm 5.5" x 3.9" x 0.9"
Weight	380g / 10.2oz	540g / 13.3oz
Supported Video Formats	1080p (60, 59.94, 50, 30, 29.97, 25, 24, 23.98) 1080i (60, 59.94, 50) 720p (60, 59.94, 50) 576i (50) 480i (59,94)	1080p (60, 59.94, 50, 30, 29.97, 25, 24, 23.98) 1080i (60, 59.94, 50) 720p (60, 59.94, 50) 576i (50) 480i (59,94)
Audio Format	SDI Embedded 2 Channel Audio 24bit/48kHz	SDI Embedded 2 Channel Audio 24bit/48kHz
Displays	0.91" OLED panel	0.91" OLED panel 5 LEDs for RSSI indicator
Transmitting Power	Less than 20 dBm	-
Receiver Sensitivity	-	- 75 dBm
Bandwidth	40MHz	40MHz
Operating Temperature	32 – 100°F (Operation) 0 – 140°F (Storage)	32 – 100°F (Operation) 0 – 140°F (Storage)
Certification	CE, RoHs, FCC	CE, RoHs, FCC

U.S. Regulatory Information

Please find regulatory information, certification and compliance marks at the bottom of your DC-LINK product.

Regulatory Information: United States

FCC Regulatory Compliance

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the transmitting/receiving antenna.
- Increase the separation between equipment experiencing interference and transmitter/receiver.
- Connect the equipment into an outlet on a circuit different from that to which the transmitter/receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Responsible Party

DwarfConnection GmbH & Co KG
Münzfeld 51
4810 Gmunden
AUSTRIA

Contact: office@dwarfconnection.com

Changes or modifications not expressly approved by DwarfConnection could void your authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following 2 conditions:

1. These devices may not cause harmful interference.
2. These devices must accept any interference received, including interference that may cause undesired operation.
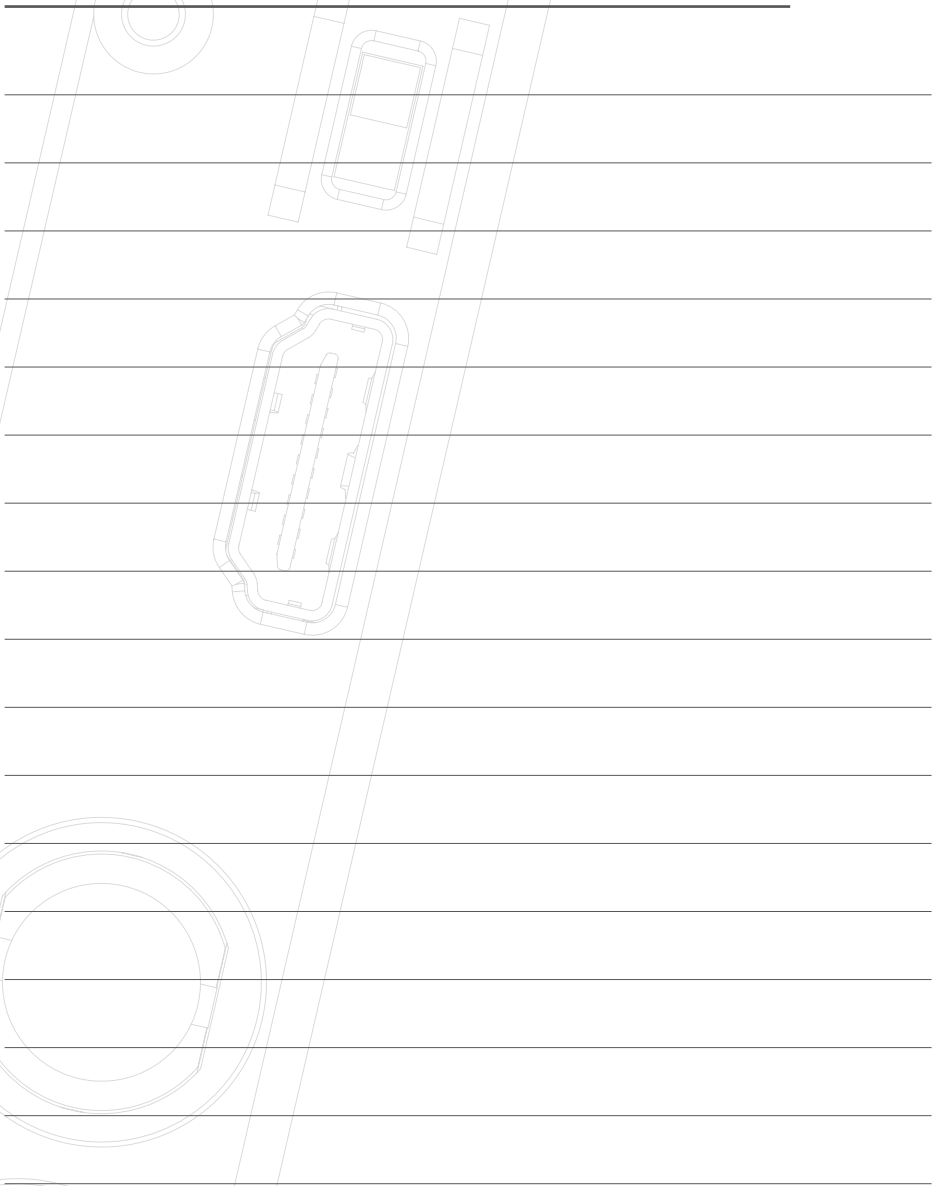
Radio Frequency Exposure

These devices meet the U.S. Federal Communications Commission's (FCC) requirements for exposure to radio waves and are designed and manufactured not to exceed the FCC's emission limits for exposure to radio frequency (RF) energy. To comply with FCC RF exposure compliance requirements, a distance of at least 25.5 cm should be maintained between the antennas of these devices and persons during device operation. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

EMC Compliance Statement

Important: These devices and their power adapters have demonstrated Electromagnetic Compatibility (EMC) compliance under conditions that included the use of compliant peripheral devices and shielded cables between system components. It is important that you use compliant peripheral devices and shielded cables between system components to reduce the possibility of causing interference to radios, televisions, and other electronic devices.

Notes

Notes

DWARF
CONNECTION

DwarfConnection GmbH & Co KG
Münzfeld 51
4810 Gmunden
AUSTRIA

www.dwarfconnection.com