



LIGHTWARE

INNOVATIVE. RELIABLE. MADE IN EUROPE.

User's Manual



USB20-1GBE-DS4
USB20-1GBE-DS4P
USB20-1GBE-HS10
USB20-1GBE-HS13P

USB 2.0 Signal Extender

Important Safety Instructions

Class II apparatus construction.

The equipment should be operated only from the power source indicated on the product.

To disconnect the equipment safely from power, remove the power cord from the rear of the equipment or from the power source. The MAINS plug is used as the disconnect device, the disconnect device shall remain readily operable.

There are no user-serviceable parts inside of the unit. Removal of the cover will expose dangerous voltages. To avoid personal injury, do not remove the cover. Do not operate the unit without the cover installed.

The appliance must be safely connected to multimedia systems. Follow instructions described in this manual.

Ventilation

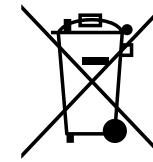
For the correct ventilation and to avoid overheating, ensure enough free space around the appliance. Do not cover the appliance, leave the ventilation holes free and never block or bypass the ventilators (if there are any).

WARNING

To prevent injury, the apparatus is recommended to be securely attached to the floor/wall, or mounted in accordance with the installation instructions. The apparatus shall not be exposed to dripping or splashing, and no objects filled with liquids, such as vases, shall be placed on the apparatus. No naked flame sources, such as lit candles, should be placed on the apparatus.

Waste Electrical & Electronic Equipment WEEE

This marking shown on the product or its literature indicates that it should not be disposed with other household wastes at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources. Household users should contact either the retailer where they purchased this product or their local government office for details of where and how they can take this item for environmentally safe recycling. Business users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes for disposal.



Common Safety Symbols

Symbol	Description
	Direct current
	Alternating current
	Double insulation
	Caution, possibility of electric shock
	Caution

Symbol Legend

The following symbols and markings are used in the document:

WARNING! Safety-related information that is highly recommended to read and keep in every case!

ATTENTION! Useful information for performing a successful procedure; it is recommended to read.


DIFFERENCE: Feature or function that is available with a specific firmware/hardware version or product variant.


INFO: A notice, which may contain additional information. Procedure can be successful without reading it.


DEFINITION: The short description of a feature or a function.


TIPS AND TRICKS: Ideas that you may have not known yet, but can be useful.

Navigation Buttons

 Go back to the previous page. If you clicked on a link previously, you can go back to the source page by pressing the button.

 Navigate to the Table of Contents.

 Step back one page.

 Step forward to the next page.

Document Information

All presented functions refer to the indicated products. The descriptions have been made while testing these functions in accordance with the indicated Hardware/Firmware/Software environment:

Item	Version
Hardware version	1.0

Document revision: **v1.0**

Release date: **24-04-2024**

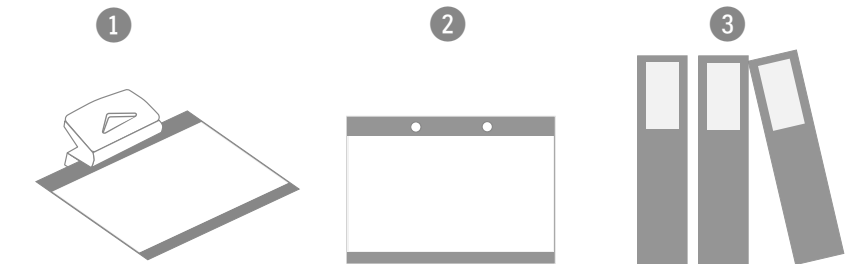
Editor: Nikolett Keindl

About Printing

Lightware Visual Engineering supports green technologies and eco-friendly mentality. Thus, this document is made primarily for digital usage. If you need to print out a few pages for any reason, follow the recommended printing settings:

- Page size: A4
- Output size: Fit to page or Match page size
- Orientation: Landscape

TIPS AND TRICKS: Thanks to the size of the original page, a border around the content (gray on the second picture below) makes it possible to organize the pages better. After punching holes in the printed pages, they can easily be placed into a ring folder.



Hashtag (#) Keywords in the Document

This user's manual contains keywords with hashtags (#) to help you find the relevant information as quick as possible.

The format of the keywords is the following:

#<keyword>

The usage of the keywords: use the **Search** function (Ctrl+F / Cmd+F) of your PDF reader application, type the # (hashtag) character and the wished keyword.

The **#new** special keyword indicates a new feature/function that has just appeared in the latest firmware or software version.

Example

#dhcp

This keyword is placed at the DHCP setting command in the LW3 Programmer's reference section.

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Introduction

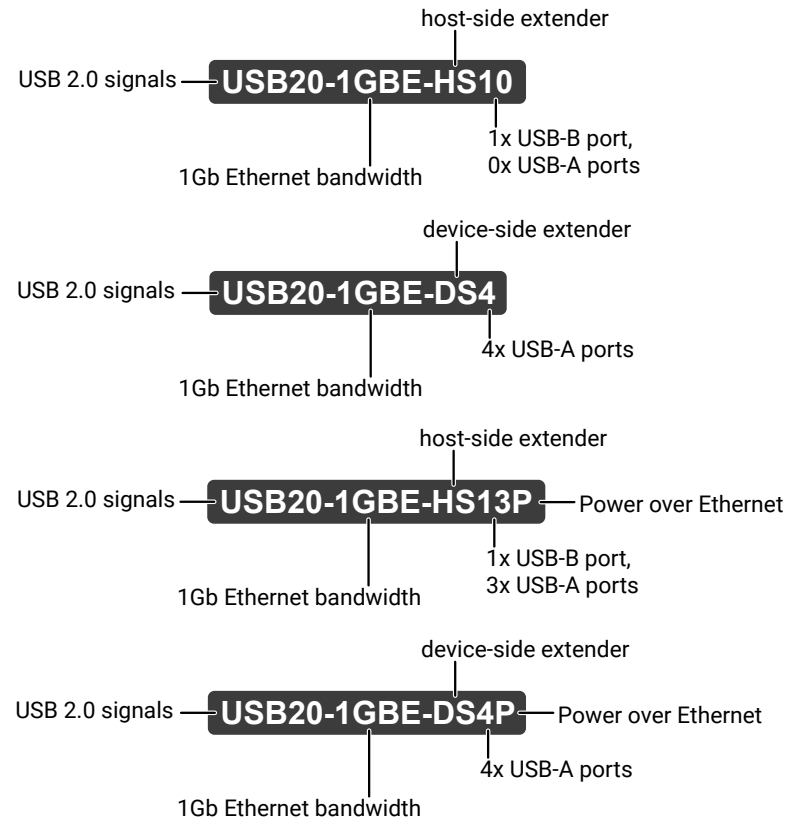
Thank You for choosing Lightware's USB20 Extender series device. In the first chapter we would like to introduce the device, highlighting the most important features in the sections listed below:

- ▶ DESCRIPTION
- ▶ BOX CONTENTS
- ▶ FEATURES OF THE DEVICE
- ▶ TYPICAL APPLICATION

1.1. Description

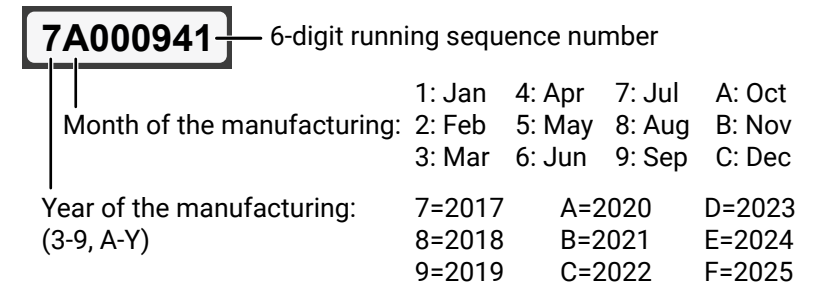
The USB20 Extender series can be used to build a system to transmit USB signals across greater distances than what is generally allowed by a USB cable, taking advantage of the data transmission capabilities of CATx cables and network switches. By using switches, transmission distances of up to 100 meters can be reached. This makes it possible to place USB devices (such as microphone, webcam, keyboard and mouse, mass storage etc.) far away from the Host device while still having full usage of them.

Model Denomination



About the Serial Number

Lightware devices contain a label indicating the unique serial number of the product. The structure is the following:



1.2. Box Contents

	Supplied accessories		
	Extender device	Safety & warranty info, Quick Start Guide	24V DC adaptor with interchangeable plugs
USB20-1GBE-DS4	✓	✓	✓
USB20-1GBE-DS4P	✓	✓	-
USB20-1GBE-HS10	✓	✓	✗
USB20-1GBE-HS13P	✓	✓	-

1.3. Features of the Device



Remote Power (PoE+)

The devices can be Powered over Ethernet (according to IEEE 802.3at) by a compatible power source equipment.

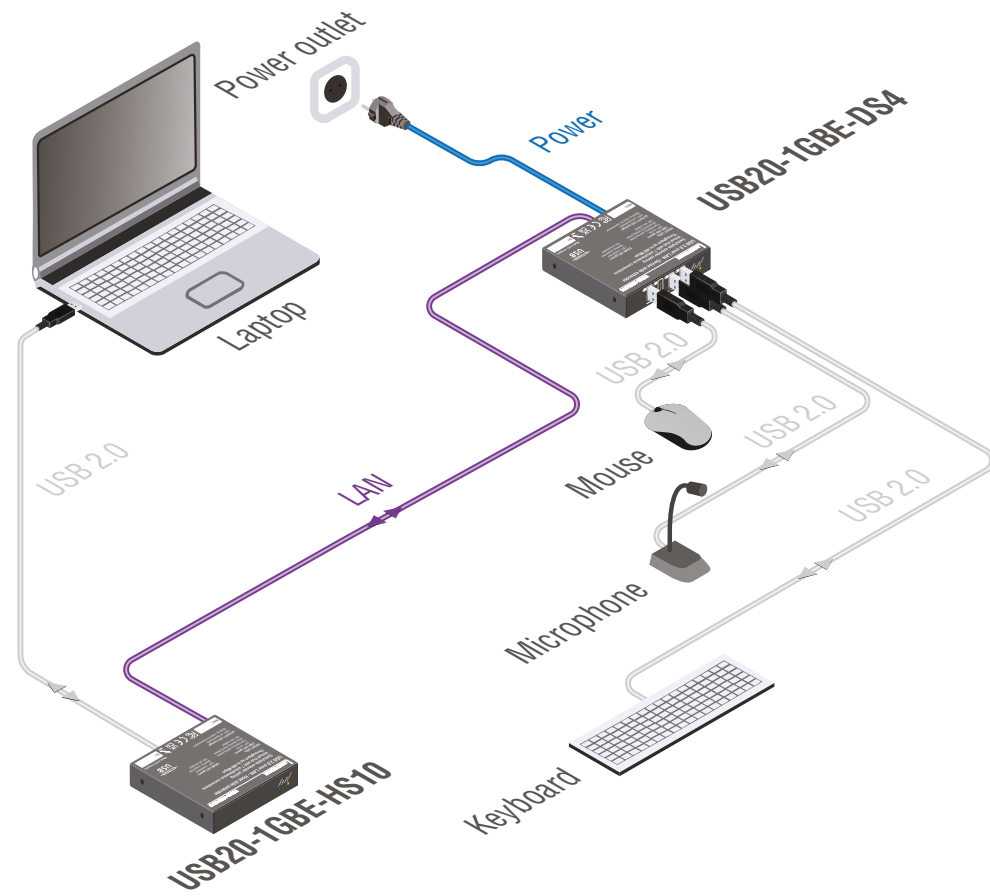


USB Extension

KVM extension for USB HID (Human Interface Devices, e.g. keyboard, mouse, webcam, presenter) and Mass Storage devices (Flash drive, Hard drive).

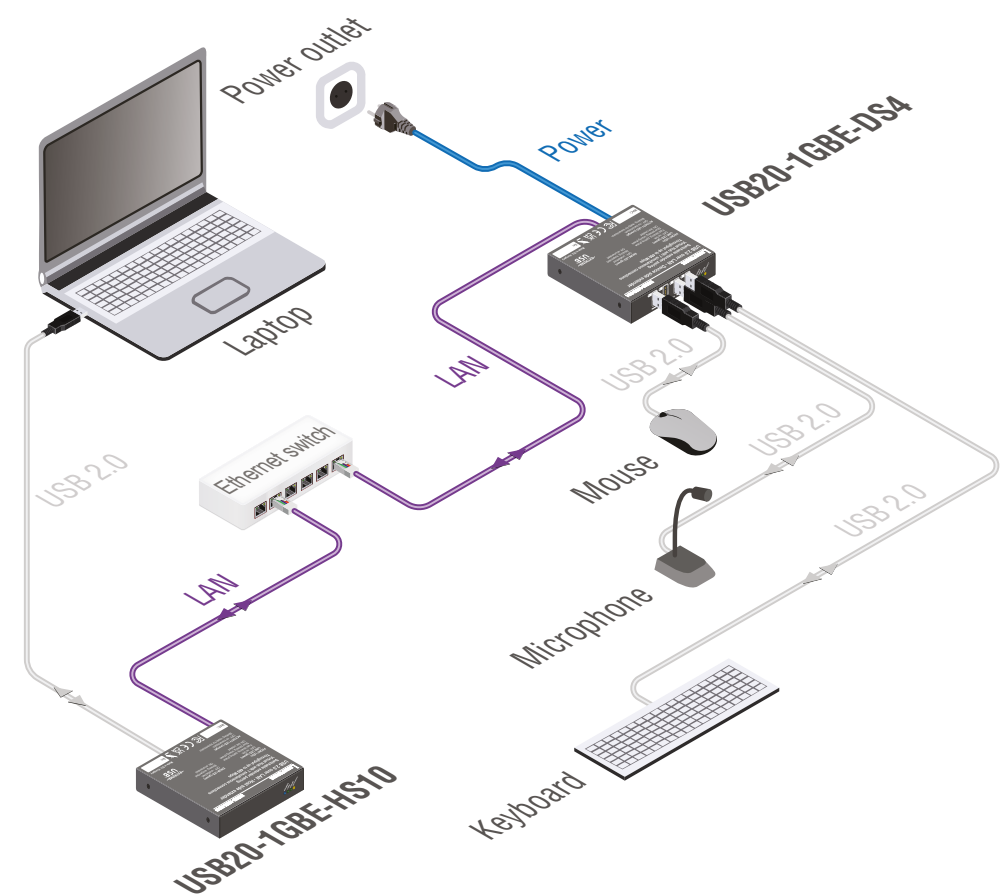
1.4. Typical Application

Connecting the extenders directly



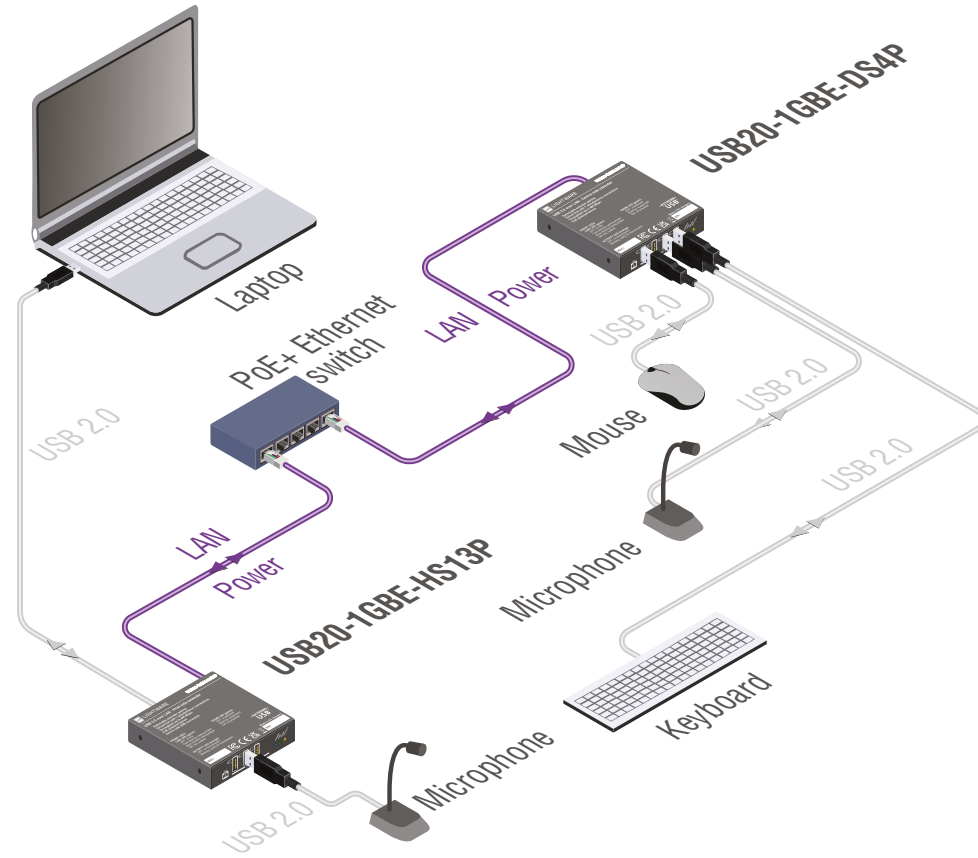
Creating a system by connecting the extenders directly

Connecting the extenders using a switch



Creating a system using an Ethernet switch

Connecting the extenders using a PoE+ switch



Creating a system using a PoE+ capable Ethernet switch

2

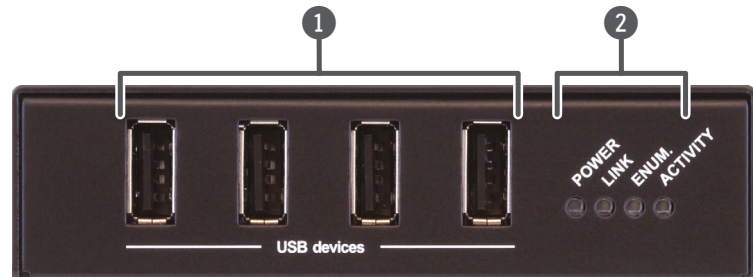
Product Overview

The following sections are about the physical structure of the device, input / output ports, LEDs and connectors:

- ▶ [FRONT VIEW](#)
- ▶ [REAR VIEW](#)
- ▶ [STATUS LEDs](#)
- ▶ [BUTTON FUNCTIONALITY](#)

2.1. Front View

USB20-1BGE-DS4



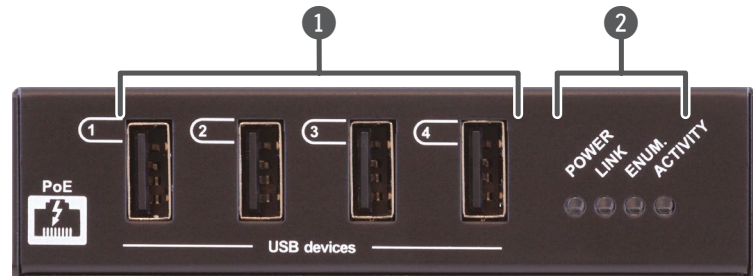
1 **USB-A Ports**

USB A-type connectors for USB devices.

2 **Status LEDs**

See the details in the [Front Panel LEDs](#) section.

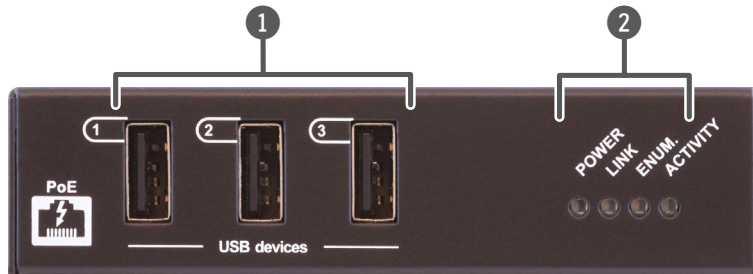
USB20-1BGE-DS4P



USB20-1GBE-HS10

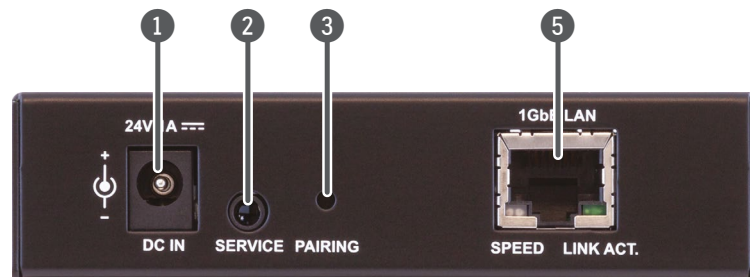


USB20-1GBE-HS13P

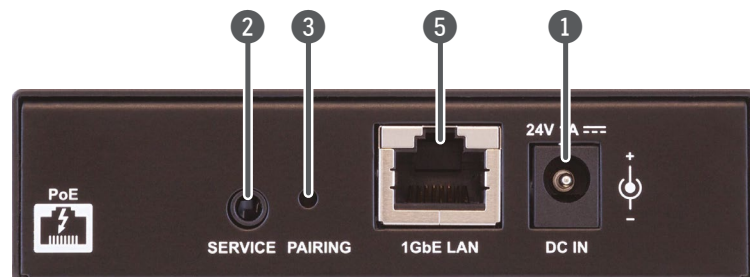


2.2. Rear view

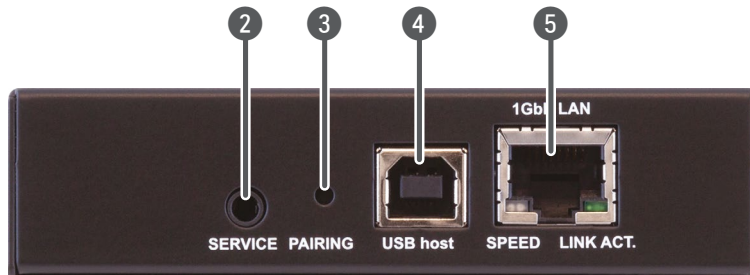
USB20-1BGE-DS4



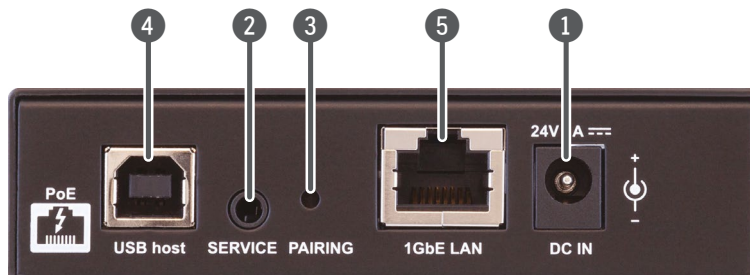
USB20-1BGE-DS4P



USB20-1GBE-HS10






USB20-1GBE-HS13P







- | | | |
|---|---------------------------|--|
| ① | DC Power Connector | 24V DC connector for powering the device. |
| ② | Service Port | Port for service purposes. |
| ③ | Pairing Button | Button for pairing the extenders. For details, see the Button functionality section. |
| ④ | USB-B Port | USB B-type port for connection to the host device. |
| ⑤ | RJ45 Connector | RJ45 connector for Ethernet connection. |




2.3. Status LEDs



Front Panel LEDs

Power LED			
		off	The device is not powered, or PoE source is not detected..
	red	on	The device is powered by PoE, but power is insufficient.
	blue	on	The device is powered on.




DIFFERENCE: PoE-dependent functions are only present in models USB20-1GBE-HS13P and USB20-1GBE-DS4P.





Link LED			
		off	The device is not paired yet.
	green	blinking slow	The linking process has started.
	green	blinking fast	The pairing process has started.
	green	on	The pairing process has finished, link is created.

Enumeration LED			
		off	Extender is not enumerated by the host.
	green	blinking	Extender enumeration is suspended.
	green	on	Extender enumeration is completed.

Activity LED			
		off	There is no transmission.
	yellow	blinking	The extender is ready for transmission.

RJ45 LEDs (USB20-1GBE-HS10 and USB20-1GBE-DS4 models)

Speed LED			
		off	There is no Ethernet connection.
	green	on	The connection bandwidth is 1000 Mbps.
	yellow	on	The connection bandwidth is 10/100 Mbps.

Link Activity LED			
		off	There is no Ethernet connection.
	green	blinking occasionally	Extender is not paired.
	green	blinking repeatedly	Host side extender is attempting to pair.
	green	blinking quickly	Extender is paired..

2.4. Button functionality

The extender devices have a **Pairing** button on the rear side. This button has several functionalities as seen below. *#pairing*

2.4.1. Pairing the Devices

Pairing happens using the MAC address of the devices. It does not happen automatically, it must be done manually. The process is the following:

- Step 1.** Use a long, thin object (e.g. a paper clip) to press the **Pairing** button of one of the devices once shortly. This will cause the Link LED to flash quickly.
- Step 2.** Press the **Pairing** button on the other device in the same way. The **Link** LED of both devices will light continuously, and the MAC address of the device-side extender is added to the list of paired devices in the host-side extender and vice versa.
- Step 3.** Repeat the procedure for each device-side extender in the system. Up to seven device-side extenders can be paired with a single host-side extender at once.

The pairing procedure has a **time limit of 10 minutes**. If the pairing does not occur in this timeframe, the procedure must be restarted.

Paired devices will remain that way even if the devices are turned off or restarted.

■ INFO: If the devices are paired, but there is no network connection, the **Link** LED will blink slowly.

2.4.2. Deleting a Paired Device

You can delete paired devices from the memory by pressing the **Pairing** button for more than 10 seconds. Please keep in mind that this will only delete the pairing list in the current device. To completely remove the pairing in both devices, this procedure must be done on both of them.

2.4.3. Setting a Dynamic IP Address

You can set DHCP by pressing the **Pairing** button for the first 5 seconds of the device turning on. DHCP gets enabled and the device restarts. *#dhcp*

3

Installation

This chapter is about the installation of the device and connecting to other appliances, while also presenting the mounting options, the electrical connections and further assembly steps:

- ▶ [MOUNTING OPTIONS](#)
- ▶ [ELECTRICAL CONNECTIONS](#)
- ▶ [POWERING OPTIONS](#)
- ▶ [CONNECTING STEPS](#)

3.1. Mounting Options

To mount the extenders, Lightware supplies optional accessories for different usage. There are two kinds of mounting kits with similar fixing methods. The extenders have two mounting holes with inner thread on the bottom side; see the bottom view in the [Mechanical drawings](#) section. To order mounting accessories, please contact sales@lightware.com. Fasten the devices with the screws enclosed to the accessory.

For further mounting information, please see the [Mounting Assembly Guide](#).

WARNING! Always use the supplied screws. Using different (e.g. longer) ones may cause damage to the device.

3.1.1. 1U High Rack Shelf

Allows rack mounting for half-rack, quarter-rack and pocket sized units.

INFO: The USB20 Extender series devices are quarter-rack sized.



1U high rack shelf provides mounting holes for fastening two half-rack or four quarter-rack sized units. Pocket sized devices can also be fastened to the shelf.

Mounting steps

- Step 1.** Unplug all the cables connected to the device(s).
- Step 2.** Turn the device(s) upside down.
- Step 3.** Put the shelf upside down on the device(s). Position it to get the mounting holes aligned.
- Step 4.** Fasten the device to the shelf with the provided screws.
- Step 5.** Fix the shelves to the desired place (screws are not supplied).

3.1.2. Under Desk Mounting Kit (UD-kit)

The UD-kit makes it easy to mount one extender under any flat surface (e.g. furniture).



The mounting steps are the same as they are with the rack shelf.

3.1.3. UD Mounting Kit Double (UD-kit double)

The UD-kit double makes it easy to mount two extenders under any flat surface (e.g. furniture).



The mounting steps are the same as they are with the rack shelf.

3.2. Electrical Connections

USB Type-A

USB Type-A connectors for USB devices.

These ports are capable of supplying 1A to the connected USB devices, up to a maximum of 3A across all four ports.*

* USB20-1GBE-HS13P only has 3 USB Type-A ports.



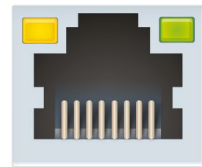
USB Type-B

USB Type-B port for connection to a USB host device.

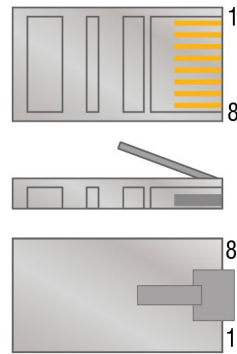


1 GbE LAN

The devices provide standard RJ45 connectors for Ethernet connection



Pin	TIA/EIA T568A	TIA/EIA T568B
1	white/green	white/orange
2	green	orange
3	white/orange	white/green
4	blue	blue
5	white/blue	white/blue
6	orange	green
7	white/brown	white/brown
8	brown	brown



3.3. Powering Options

The powering of the devices can happen in the following ways:

Local Powering

USB20-1GBE-DS4, USB20-1GBE-DS4P and USB20-1GBE-HS13P can all be powered by a DC power adaptor.

INFO: Power adaptor is only supplied with USB20-1GBE-DS4. For the other models please contact sales@lightware.com.

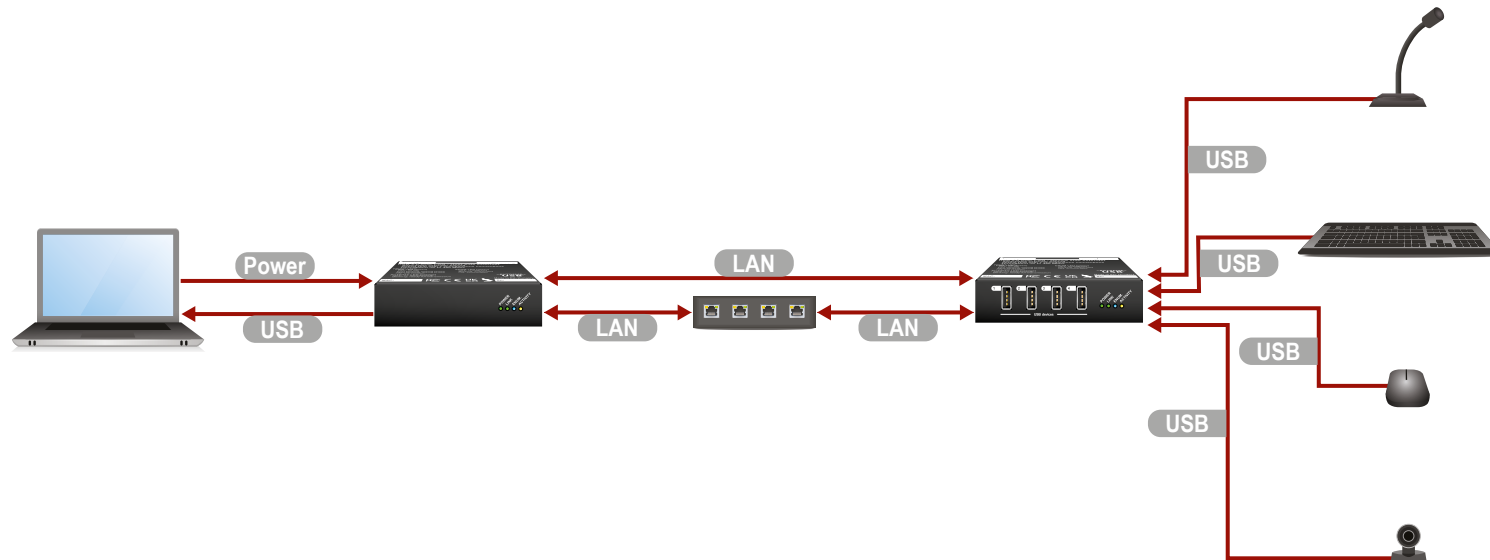
Powering over USB

The USB20-1GBE-HS10 model is powered by the host computer over the USB cable.

Power over Ethernet

USB20-1GBE-DS4 P and USB20-1GBE-HS13P models are able to be powered by a PoE+ capable switch or a PoE+ power injector.

3.4. Connecting Steps



- USB** Connect the host device to the USB20-1GBE-HS10 device with a USB cable through the USB B-type connector.
- Power** The host provides power to the USB20-1GBE-HS10 device via the USB cable.
- LAN** Connect the USB20-1GBE-HS10 and USB20-1GBE-DS4 devices with CATx cables. Optionally you can insert an Ethernet switch between the extenders for additional extension distances.
- USB** Connect the USB devices to the USB20-1GBE-DS4 device with USB cables through the USB A-type connectors.

4

Software Control

The device can be controlled by a computer via UDP commands.

- ▶ [SETUP](#)
- ▶ [PROTOCOL DESCRIPTION](#)
- ▶ [NETWORK BROADCAST](#)
- ▶ [GENERIC REPLIES](#)
- ▶ [SUPPORTED MESSAGES](#)

4.1. Setup

Before you begin configuration, please make sure of the following:

- Step 1.** Take note of the **MAC address** of your devices. You can find this information in the lower left corner of the top of the extenders.
- Step 2.** Connect your extenders to each other (point-to-point mode) or the switch (virtual hub in host-side extender). Make sure that your PoE+ devices (USB20-1GBE-HS13P and USB20-1GBE-DS4P) are powered either by a PoE+ capable switch or locally with an adapter.
- Step 3.** Connect your host-side extender to the host computer via a USB cable. Please be aware that the USB20-1GBE-HS13P model can only be powered locally with an adapter or by a PoE+ capable switch.
- Step 4.** Check that your host (or control) computer is in the same network as your extenders.
- Step 5.** Power on your devices.
- Step 6.** Pair the extenders either via the buttons as seen in the [Pairing the Devices](#) section or with the [Pairing to a Device](#) message.

4.2. Protocol Description

The SwitchableUSB: Device Configuration Network Protocol described in this chapter works on top of User Datagram Protocol (UDP). The protocol is created to be able to discover and configure USB20 Extender series devices on a local Ethernet network. The messages can be sent to the device as UDP packages via port no. 6137. In the following examples the packages are sent in Hexadecimal format.

Generic Packet Structure

Format	Explanation
Magic Number	A value (0x2F03F4A2) that ensures that the following data is a configuration message.
Message ID	When the client sends a request, it chooses any value to insert in this field. The extender responding to the request will set this field in the reply to the same value.
Protocol Version	An integer from 0-255. All devices will support protocol 0 and one other protocol version. The Replying Device Information message will inform the client which version of the protocol it must speak in order to communicate with the extender.
Command	An integer from 0-255. This is the identifier of the command. The combination of the protocol version and the command identify a unique message type.

- All multi-byte fields are packed as big endian.
- Messages are at least 10 bytes and at most 136 bytes in length.
- Any string fields should be encoded using UTF-8.

Example

➡ 2F03F4A2 00112244 00 00

4.2.1. Legend for the Commands

Format	Description
➡	Sent request
⬅	Received response

■ INFO: Spaces seen in the examples are for enhancing readability, they can be left out of the commands.

4.3. Network Broadcast

4.3.1. Subnet Broadcast

To broadcast a packet to subnet you only have to use the broadcast IP of the subnet. For example to broadcast to a network configured as an IP range of 192.168.5.xxx, and a netmask of 255.255.255.0, the IP 192.168.5.255 is the broadcast IP address. In case of a network configured as an IP range of 10.xxx.xxx.xxx, and a netmask of 255.0.0.0, the IP 10.255.255.255 is the broadcast IP address.

Since routers drop broadcast IP packets with a destination outside of the network of the source, these broadcast packages must originate in the same network as the target devices.

4.3.2. All Local Subnet Broadcast

By broadcasting to the IP address 255.255.255.255 a broadcast packet can be sent out without knowing previously what the local network is. Microsoft Windows will, however, only send the packet out through the first configured network interface, so on a computer with multiple interfaces, each interface should send a separate broadcast network packet.

4.3.3. Mismatched Network Configuration

When broadcasting to a subnet using the network broadcast address (e.g. 192.168.5.255) and the extender is configured for a different network (e.g. IP=10.0.9.23 and netmask=255.0.0.0), the extender will not respond to the broadcast, as it will not recognize the IP address as a valid broadcast.

This should not happen when a proper DHCP server allocates addresses from the same pool for the network, however, it may happen when assigning static IP addresses or moving units between networks. In case of this occurrence, the extender must be reset to a DHCP address in the way seen in the section [Setting a Dynamic IP Address](#). After this a static IP address can be assigned to the unit again.

4.4. Generic Replies

4.4.1. Acknowledge

This message is a generic ACK message that will be sent in response to all requests made by clients that do not require returning an additional data payload in the response. The **Message ID** field should be sufficient to determine which message is being acknowledged.

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 0 Command = 3

Example

🔍 2F03F4A2 00112244 00 03

4.4.2. Negative Acknowledge

This message is a generic NAK message that may be sent in response to a **Pairing to a Device, Removing Device Pairing** or **Requesting Device Topology** message. It indicates to the client that their request was received, but that no action will be taken as a result of that message. The Message ID field should be sufficient to determine which message this is a response to.

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 8

Example

🔍 2F03F4A2 00112244 03 08

4.5. Supported Messages

4.5.1. Requesting and Replying Device Information

Request

This message is sent from the client to an extender in order to evoke a **Replying Device Information** message. This message can be sent in a broadcast UDP message in order to discover all of the configurable USB extenders on the local network.

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 0 Command = 0

Reply

This message is sent from an extender to a client in response to a **Requesting Device Information** message.

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 0 Command = 1
10	MAC Address
12	
14	
16	IP Address
18	
20	Network Aquisition Mode Supported Protocol Version
22	Vendor
24	⋮
26	⋮
28	⋮
30	⋮
32	⋮
34	⋮
36	⋮
38	⋮
40	⋮
42	⋮
44	⋮
46	⋮
48	⋮
50	⋮
52	⋮
54	Product
56	⋮
58	⋮
60	⋮
62	⋮
64	⋮
66	⋮
68	⋮
70	⋮
72	⋮
74	⋮
76	⋮
78	⋮
80	⋮
82	⋮
84	⋮
86	Revision
88	⋮
90	⋮
92	⋮
94	⋮
96	⋮

Field Descriptions

Field Data Type	Explanation	Values	Value description
MAC address	The MAC address of the device		
IP address	The current IP address of the device		
Network Acquisition Mode		0 1	DHCP Static
Supported Protocol Version	This number specifies what protocol version the device supports beside protocol 0.		
Vendor	A 32-byte, NUL-terminated string containing the vendor name of the device.		
Product	A 32-byte, NUL-terminated string containing the product name of the device.		
Revision	A 12-byte, NUL-terminated string containing the revision number of the device.		

Example

```

➤ 2F03F4A2 00112244 00 00
⬅ 2F03F4A2 00112244 00 01 A8D236027431 C0A8007D 00 03
4C69676874776172652056697375616C20456E67696E656572696E6700000000
55534232302D314742452D4853313000000000000000000000000000000000
322E302E3600000000000000
    
```

4.5.2. Ping

This message is sent from a client to the device to check if a device is active. An **Acknowledge** message will be sent by the device in response.

Request

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 0 Command = 2

Example

```

➤ 2F03F4A2 00112244 00 02
⬅ 2F03F4A2 00112244 00 03
    
```

4.5.3. Requesting and Replying Extended Device Information

Request

Sent by a client to an extender in order to obtain additional information about the device that is not included in the **Replying Device Information** message from protocol 0.

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 0

Reply

Sent by an extender to a client in response to a **Requesting Extended Device Information** message.

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 1
10	LEX/REX Paired with MAC address
12	
14	
16	

Last six bytes can be repeated 0 or 1 times for an extender in point-to-point mode, or 0 to 7 times for a host side extender with virtual hub enabled.

Field Descriptions

Field Data Type	Explanation	Values	Value description
LEX/REX	This determines whether the responding device is a host-side extender (LEX), or a device-side extender (REX).	0 1	Host-side extender Device-side extender
Paired with MAC address	MAC address of an extender that this device is paired with. This field is optional and may be repeated up to 7 times.		

Example

- 2F03F4A2 00112244 03 00
- 2F03F4A2 00112244 03 01 00 A8D23602B357001B1302E3A4

4.5.4. Pairing to a Device

This message is sent by a client to instruct an extender to try to pair with a different extender specified in the message. The client must send this message to both the host-side and device-side extenders, the contents adjusted respectively, but the order of the two messages does not matter. The extender will respond with an **Acknowledge** message if it is able to pair with a new device or a **Negative Acknowledge** message otherwise. These replies only mean that an attempt will be made to establish a link between the extenders, not that a link is already established. #pairing

Field Descriptions

Field Data Type	Explanation	Values	Value description
Pairing to device MAC address	The MAC address that the client is telling the extender to attempt to pair with.		

Request

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 2
10	Pairing to Device MAC Address
12	
14	

Example

- 2F03F4A2 00112244 03 02 A8D236027431
- 2F03F4A2 00112244 00 03

- 2F03F4A2 00112244 03 02 A8D23602B357
- 2F03F4A2 00112244 00 03

4.5.5. Removing Device Pairing

Sent by a client to an extender, instructing it to discard any existing pairing it has. This will effectively disconnect any USB devices that were downstream of the remote extender. The client must send this message to each of the extenders in the pairing. The extenders will respond with an **Acknowledge** message or with a **Negative Acknowledge** if it is already unpaired or paired to a different extender.

Field Descriptions

Field Data Type	Explanation	Values	Value description
Paired MAC address	The MAC address that the client is telling the extender to disassociate from.		

Request

Byte Offset

0	Magic Number	
2		
4	Message ID	
6		
8	Protocol Version = 3	Command = 3
10	Paired MAC Address	
12		
14		

Example

- 2F03F4A2 00112244 03 03 A8D236027431
- 2F03F4A2 00112244 00 03

- 2F03F4A2 00112244 03 03 A8D23602B357
- 2F03F4A2 00112244 00 03

4.5.6. Requesting and Replying Device Topology

Request

Sent by a client to a host-side extender in order to obtain the set of USB devices in the system. A device-side extender will respond with a **Negative Acknowledge** to this message.

Byte Offset

0	Magic Number	
2		
4	Message ID	
6		
8	Protocol Version = 3	Command = 4

Reply

A host-side extender will send this message in response to a **Requesting Device Topology** message. The length of this message varies depending on the number of devices in the system. The combination of the information is enough for a client to build and display a device tree.

Byte Offset

0	Magic Number	
2		
4	Message ID	
6		
8	Protocol Version = 3	Command = 5
10	USB Address	USB Address Of Parent
12	Port on Parent	Is Device a Hub
14	USB Vendor ID	
16	USB Product ID	

Bytes 10 to 16 can be repeated 0 to 32 times according to the number of USB devices.

■ INFO: Maximum number of USB devices is 32.

Field Descriptions

Field Data Type	Explanation	Values	Value description
USB Address	An integer from 0 to 127.		
USB Address of Parent	An integer from 1 to 127. If a USB Address is seen that is not listed as the USB Address of Parent for any of the devices, then that device is the root of the device topology.		
Port on Parent	An integer from 1 to 127. 0 is not a valid number for a port on a hub, so this field will only be 0 if there is no USB device upstream before the host.		
Is Device a Hub		0 1	False True
USB Vendor ID	The USB Vendor ID from the device descriptor.		
USB Product ID	The USB Product ID from the device descriptor.		

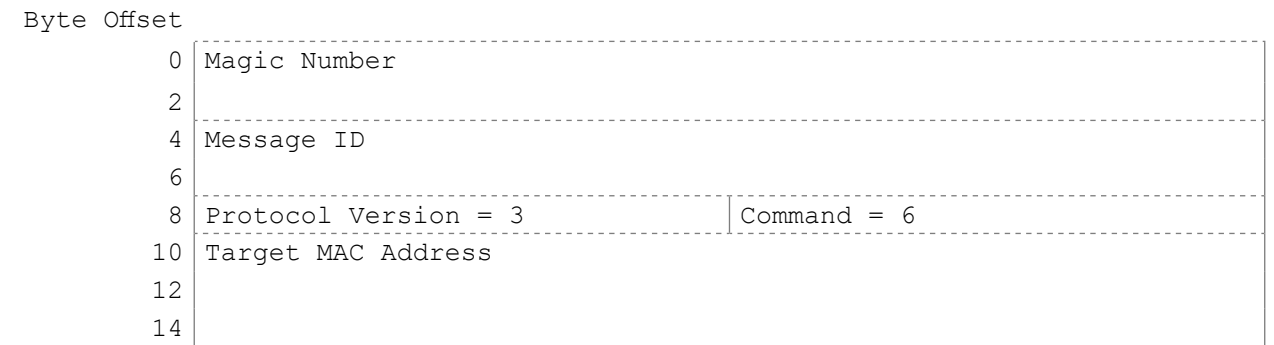
Example

- ➡ 2F03F4A2 00112244 03 04
- ➡ 2F03F4A2 00112244 03 05 2A27020004580186 2724010104B46506 24000001089D0001

4.5.7. Using DHCP

Sent by a client to an extender to tell it to use DHCP to obtain an IP address. This message may be sent either as a UDP broadcast packet or a packet directed to a specific IP address known already. Regardless of whether the message was sent as a broadcast or not, the device will only switch to DHCP mode if the Target MAC Address field matches its own MAC address. When a valid **Using DHCP** message is received, the extender will send an **Acknowledge** message before discarding its static address configuration and acquiring an IP address via DHCP. If the **Using DHCP** message is sent to a device already in DHCP mode, it will still send an **Acknowledge** response, but no further actions are taken such as IP renewal. The client is able to tell the mode an extender is in by inspecting the Network Acquisition Mode field of the **Replying Device Information** message. #dhcp

Request



Field Descriptions

Field Data Type	Explanation
Target MAC address	The MAC address of the device that will be set to use DHCP to obtain an IP address.

Example

- ➡ 2F03F4A2 00112244 03 06 A8D236027431
- ➡ 2F03F4A2 00112244 00 03

4.5.8. Using Static IP

Sent by a client to an extender to tell it to use the static network configuration contained in this message. The IP, subnet mask and default gateway, as well as the network configuration are stored in permanent storage, so the device will keep the same network configuration after being power cycled. Similarly to the **Using DHCP** message, this message can be broadcast or sent to a specific device. Given that the Target MAC Address field matches the MAC address of the device, it will always respond with an **Acknowledge** message. Sending a **Using Static IP** message to a device already in a static configuration will enable the client to change the IP, subnet mask or default gateway of the device.

Request

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 7
10	Target MAC Address
12	
14	
16	IPv4 Address
18	
20	Subnet Mask
22	
24	Default Gateway
26	

Field Descriptions

Field Data Type	Explanation
Target MAC Address	The MAC address of the device that will be set to use static network configuration.
IPv4 Address	The IPv4 address being assigned to this device encoded as a 32-bit integer.
Subnet Mask	The subnet mask of the network the device is on.
Default Gateway	Sets the default gateway of the device.

Example

➤ 2F03F4A2 00112244 03 07 001B1302E3A4 C0A8007E FFFFFFF0 C0A80001
 ⚡ 2F03F4A2 00112244 00 03

4.5.9. Using Filtering Strategy

Sent by a client to an extender to set it to use a certain type of filtering strategy contained in the message. The filtering strategy denotes the type of devices to be filtered out by the extenders. An **Acknowledge** message will be sent back to the client if the extender supports device class filtering and a valid strategy was selected. Otherwise, a **Negative Acknowledge** will be sent to the client.

Field Descriptions

Field Data Type	Values	Value description
Filtering Strategy	0	Allow all devices
	1	Block all devices except HID and hub
	2	Block mass storage devices
	3	Block all devices except HID, hub and smartcard
	4	Block all devices except audio and vendor-specific

Request

Byte Offset	Field
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 9
10	Filtering Strategy

Example

➤ 2F03F4A2 00112244 03 09 02
 ⚡ 2F03F4A2 00112244 00 03

4.5.10. Turning the LED Locator On

This message is sent from the client to an extender. Upon receiving this message, the LED pattern is started on the device. A specific extender can be located physically with this message.

Request

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 10

Example

➡ 2F03F4A2 00112244 03 0A

⬅ 2F03F4A2 00112244 00 03

4.5.11. Turning the LED Locator Off

This message is sent from the client to an extender. Upon receiving this message, the LED pattern is stopped on the device. It only works when the LED pattern is activated on the extender.

Request

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 11

Example

➡ 2F03F4A2 00112244 03 0B

⬅ 2F03F4A2 00112244 00 03

4.5.12. Reseting Device

This message is sent from the client to the extender. Upon receiving this message, the device resets.

Request

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 12

Example

➤ 2F03F4A2 00112244 03 0C

➤ 2F03F4A2 00112244 00 03

4.5.13. Requesting and Replying Configuration Response Data

Request

This message is sent from the client to an extender in order to evoke a **Replying Configuration Response Data** message.

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 13

Reply

This message is sent from an extender to a client in response to a **Requesting Configuration Response Data** message.

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 14
10	High Speed Status MSA Status
12	Vhub Status Current Filter Status
14	IP Acquisition Mode Reserved
16	MAC Address
18	

20	
22	Reserved
24	Paired with MAC Address
	⋮
64	
66	Port Number
68	IP Address
70	
72	Subnet Mask
74	
76	Default Gateway
78	
80	DHCP Server
82	
84	Number of Vhub Ports Reserved
86	VID
88	PID
90	Brand ID
92	Vendor
	⋮
120	
122	Product
	⋮
152	
154	Revision
	⋮
166	

4.5.16. Force Pairing to Device

This command is sent by the client to an extender to instruct it to clear all of its existing pairings and then try to pair with a different extender specified in the message. The client must send this message to both a host-side extender and a device-side extender to instruct them to be paired together, but the order of the two messages does not matter. The extender will respond with an **Acknowledge** message if it is able to pair with a new device or a **Negative Acknowledge** otherwise. #pairing

INFO: The **Acknowledge** message only indicates an attempt will be made to establish a link between the extenders, not that a link is already established.

Field Descriptions

Field Data Type	Explanation
Force Pair to Device MAC Address	The MAC address that the client is telling the extender to attempt to pair with.

Request

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 18
10	Force Pair to Device MAC Address
12	
14	

Example

- 2F03F4A2 00112244 03 12 A8D23602B357
- 2F03F4A2 00112244 00 03

- 2F03F4A2 00112244 03 12 A8D236027431
- 2F03F4A2 00112244 00 03

4.5.17. Resetting Force Pairing to Device

This command is the same as the **Force Pairing to Device** command, but it resets the system after the pairing with the other extender happens.

INFO: This command only works when sent to a host-side extender. When sent to a device-side extender, it will reset the device, but pairing will not happen.

Field Descriptions

Field Data Type	Explanation
Force Pair to Device MAC Address	The MAC address that the client is telling the extender to attempt to pair with.

Request

Byte Offset	
0	Magic Number
2	
4	Message ID
6	
8	Protocol Version = 3 Command = 19
10	Force Pair to Device MAC Address
12	
14	

Example

- 2F03F4A2 00112244 03 13 A8D23602B357
- 2F03F4A2 00112244 00 03

5

Troubleshooting

First, check the front panel LEDs and take the necessary steps according to their states. For more information about status LEDs, refer to the [Status LEDs](#) section.



Link to the LED section.









Link to device operation section.



Link to the UDP protocol section.

- ▶ [USE CASE STUDIES](#)
- ▶ [HOW TO SPEED UP THE TROUBLESHOOTING PROCESS](#)

5.1. Use Case Studies

Symptom	Root cause	Action	Refer to
Power			
The extender does not start	The extender does not receive sufficient power	If the Power LED is lighting red (for PoE+ capable extenders), the power supply is insufficient. Please use PoE+ power sources or local powering.	 2.3
USB signal			
The signal does not go through	Extenders are not paired	Check if the extenders are paired. Be aware that pairing must be started on both devices.	 2.4.1
	Device filtering is turned on	Make sure that your filtering settings allow the signal of the desired device to pass through the system.	 4.5.4
	The extender cannot be reached	Check the CATx cable connecting to the extender.	 4.5.9
Communication			
Pairing does not happen	The number of paired devices reached the limit	Make sure that the extenders you are trying to pair have not reached the maximum number of paired devices. Please note that device-side extenders can only be paired with one host-side extender, while host-side extenders can be paired to 7 device-side extenders simultaneously.	 4.5.3
	Incorrect MAC address	Please make sure that you enter the MAC address of the device you are trying to pair to correctly. In case of pairing it is easy to mix up depending on which device you are sending the request to.	 4.5.4
	Incorrect IP address	Please make sure that the IP address you are using for communication is correct. In case of pairing it is easy to mix up depending on which device you are sending the request to.	
There is no response from the device	Incorrect request	In case of using hexadecimal requests, it may happen that the number or the value of the bytes is incorrect. Please make sure that the request is entered correctly.	

5.2. How to Speed Up the Troubleshooting Process

Lightware's technical support team is always working hard to provide the fastest support possible. Our team's response time is one of the best in the industry and in the toughest of cases we can directly consult with the hardware or software engineer who designed the product to get the information from the most reliable source.

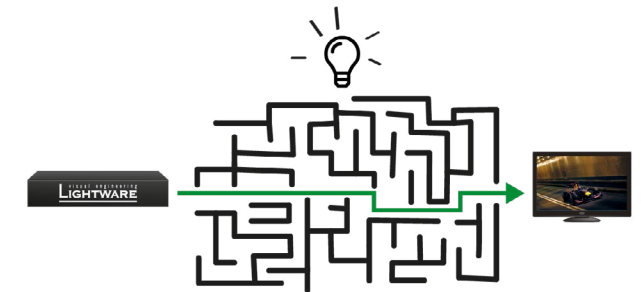
However, the troubleshooting process can be even faster... with your help.

There are certain pieces of information that push us in the right direction to find the root cause of the problem. If we receive most of this information in the first e-mail or it is gathered at the time when you call us, then there is a pretty high chance that we will be able to respond with the final solution right away.

This information is the following:

- Schematic (a pdf version is preferred, but a hand drawing is sufficient).
- Serial number(s) of the device(s) (it is either printed somewhere on the box or you can query it using the control software).
- Firmware versions of the devices (please note that there may be multiple CPUs or controllers in the device and we need to know all of their firmware versions, a screenshot is the best option).
- Cable lengths and types (in our experience, it's usually the cable).
- Patch panels, gender changers or anything else in the signal path that can affect the transmission.
- Signal type (resolution, refresh rate, color space, deep color).
- Actions to take in order to re-create the problem (if we cannot reproduce the problem, it is hard for us to find the cause).
- Photo or video about the problem ('image noise' can mean many different things, it's better if we see it too).

The more of the information above you can give us, the better. Please send this information to the Lightware Support Team (support@lightware.com) to speed up the troubleshooting process.



6

Appendix

Tables, drawings, guides, hashtag keyword list and technical details as follows:

- ▶ [SPECIFICATIONS](#)
- ▶ [MECHANICAL DRAWINGS](#)
- ▶ [HASHTAG KEYWORD LIST](#)
- ▶ [FURTHER INFORMATION](#)

6.1. Specifications

General

Compliance	CE, UKCA
Electrical safety	EN 62368-1:2020
EMC compliance (emission)	EN 55032:2015+A1:2020
EMC compliance (immunity)	EN 55035:2017+A11:2020
RoHS compliance	EN 63000:2018
Warranty	3 years
Operating temperature	0 to 55°C (32 to 122°F)
Operating humidity	20 to 80%, non-condensing

Power

Power supply option	Power adapter
Supported power source	100-240V AC; 50/60 Hz
Power consumption (USB20-1GBE-HS10)	1W
Heat dissipation	4 BTU/h
Power consumption (USB20-1GBE-DS4)	9W
Heat dissipation	31 BTU/h
Power over Ethernet + (PoE+)*	via RJ45 connector (IEEE802.3at)

* Only for models USB20-1GBE-HS13P and USB20-1GBE-DS4P.

Power supply

Supplied power	24V DC, 1A
DC power connector	Locking DC connector (2.1/5.5 mm pin)

Enclosure

Rack mountable	yes, with mounting accessories
Enclosure material	1 mm steel

USB20-1GBE-HS10

Dimensions (mm)	100.4(W), 26(H), 76.3(D)
Dimensions (inch)	3.95(W), 1.02(H), 3(D)
Weight	244 g (0.54 lb)

USB20-1GBE-HS13P

Dimensions (mm)	100.4(W), 26(H), 85.6(D)
Dimensions (inch)	3.95(W), 1.02(H), 3.37(D)
Weight	282 g (0.62 lb)

USB20-1GBE-DS4

Dimensions (mm)	100.4(W), 26(H), 76.3(D)
Dimensions (inch)	3.95(W), 1.02(H), 3(D)
Weight	254 g (0.56 lb)

USB20-1GBE-DS4P

Dimensions (mm)	100.4(W), 26(H), 85.6(D)
Dimensions (inch)	3.95(W), 1.02(H), 3.37(D)
Weight	276 g (0.61 lb)

Control ports

Ethernet port

Connector type	RJ45 female connector
Ethernet data rate	1 GbE
Power over Ethernet	not supported

USB port¹

Connector type	USB B-type receptacle
USB compliance	USB 2.0

USB port²

Connector type	USB A-type receptacle
USB compliance	USB 2.0

¹ In case of the USB20-1GBE-HS10 and USB20-1GBE-HS13P models.

² In case of the USB20-1GBE-HS13P, USB20-1GBE-DS4 and USB20-1GBE-DS4P models.

INFO: Specifications are subject to change without notice.

6.2. Mechanical drawings

	Bottom view	Top view
USB20-1GBE-DS4		
	Side view	Rear view
USB20-1GBE-HS10	Front view	Side view
	Side view	Rear view
USB20-1GBE-DS4P	Front view	Side view
	Side view	Rear view
USB20-1GBE-HS13P	Front view	Side view
	Side view	Rear view

6.3. Hashtag Keyword List

This user's manual contains keywords with hashtags (#) to help you find the relevant information as quick as possible.

The format of the keywords is the following:

#<keyword>

The usage of the keywords: use the **Search** function (Ctrl+F / Cmd+F) of your PDF reader application, type the # (hashtag) character and the wished keyword.

The **#new** special keyword indicates a new feature/function that has just appeared in the latest firmware or software version.

Example

#dhcp

This keyword is placed at the DHCP (dynamic IP address) setting in the front panel operation, the Lightware Device Controller (LDC) and the LW3 programmer's reference section.

The following list contains all hashtag keywords placed in the document with a short description belonging to them. The list is in **alphabetical order** by the hashtag keywords.

Hashtag Keyword ↓	Description
<i>#dhcp</i>	DHCP setting
<i>#pairing</i>	Pairing of the extenders

6.4. Further Information

Limited Warranty Statement

1. Lightware Visual Engineering PLC (Lightware) warrants to all trade and end user customers that any Lightware product purchased will be free from manufacturing defects in both material and workmanship for three (3) years from purchase unless stated otherwise below. The warranty period will begin on the latest possible date where proof of purchase/delivery can be provided by the customer. In the event that no proof can be provided (empty 'Date of purchase' field or a copy of invoice), the warranty period will begin from the point of delivery from Lightware.

1.1. 25G and MODEX product series will be subject to a seven (7) year warranty period under the same terms as outlined in this document.

1.2. If during the first three (3) months of purchase, the customer is unhappy with any aspect of a Lightware product, Lightware will accept a return for full credit.

1.3. Any product that fails in the first six (6) months of the warranty period will automatically be eligible for replacement and advanced replacement where available. Any replacements provided will be warranted for the remainder of the original unit's warranty period.

1.4. Product failures from six (6) months to the end of the warranty period will either be repaired or replaced at the discretion of Lightware. If Lightware chooses to replace the product, then the replacement will be warranted for the remainder of the original unit's warranty period.

2. The above-stated warranty and procedures will not apply to any product that has been:

2.1. Modified, repaired or altered by anyone other than a certified Lightware engineer unless expressly agreed beforehand.

2.2. Used in any application other than that for which it was intended.

2.3. Subjected to any mechanical or electrical abuse or accidental damage.

2.4. Any costs incurred for repair/replacement of goods that fall into the categories above (2.1., 2.2., 2.3.) will be borne by the customer at a pre-agreed figure.

3. All products to be returned to Lightware require a return material authorization number (RMA) prior to shipment, and this number must be clearly marked on the box. If an RMA number is not obtained or is not clearly marked on the box, Lightware will refuse the shipment.

3.1. The customer will be responsible for in-bound, and Lightware will be responsible for out-bound shipping costs.

3.2. Newly repaired or replaced products will be warranted to the end of the originally purchased product's warranty period.

Document Revision History

Rev.	Release date	Changes	Editor
1.0	24-04-2024	Initial document	Nikolett Keindl

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