Draco vario KVM Extender Series 490

User Manual

Document H-490-DP_en_Rev2

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Introduction

This manual contains important safety instructions as well as instructions for setting up the product and operating it. Please read the general safety instructions (see chapter 2, page 7) and additional notice in the respective chapters. Read carefully through the User Manual before you switch on the product.

Product Identification

The model and serial number of your products are indicated on the bottom of our products. Always refer to this information when you need to contact your distributor or the support of IHSE GmbH (see chapter 12, page 67).

Trademarks and Trade Names

All trademarks and trade names mentioned in this document are acknowledged to be the property of their respective owners.

Validity of this Manual

This manual applies to all products of the series named on the cover page. Differences between the various models are clearly described.

The manufacturer reserves the right to change specifications, functions or circuitry of the series described here without notice. Information in this manual can be changed, expanded, or deleted without notice. You can find the current version of the manual in the download area of our website.

Copyright

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Available Documentation

Name	Format	Description	Provision
User Manual	PDF	Provides an overview of the product together with technical data and safety instructions. Contains all instructions required to operate the product to a basic level.	Download from website
Quick Setup	Print	Provides a quick installation guide and safety instructions	Contained in the scope of delivery

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1 Important Information

1.1 Firmware and Software

The information in this manual refers to the latest extender firmware available at the date of manual release. Please refer to the change log (see chapter 16, page 73) for user manual updates.

1.2 Symbols for Warnings and Helpful Information

The meaning of the symbols used for warnings and helpful information in this manual is described below:

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
NOTICE identifies information, if not observed, endangers the functionality of your device or the security of your data.

This symbol indicates information about special features on the device or when using device and function variants.

This symbol indicates instructions for procedures recommended by the manufacturer for an effective utilization of the device potential.

1.3 Terms and Spellings

Uniform terms and spellings are used in this manual for better readability or easier assignment.

The following terms are used for products and system descriptions:

Term	Description
Tera Tool	Tera Tool software to configure, monitor and operate the device
Source	Computer, graphics card (USB, video, audio, data)
Sink	Console (monitor, keyboard, mouse, video, audio, data)
CPU Unit	Encoder to connect to the source.
CON Unit	Decoder to connect at the peripherals.

The following spellings are used for keyboard commands:

Keyboard command	Description
key	Key on the keyboard
key + key	Press keys simultaneously
key, key	Press keys successively
2x key	Press key quickly, twice in a row (like a mouse double-click)

The following spelling is used for, e.g., descriptions of editing files or updating firmware:

Keyboard command	Description
`Config.txt`	E.g., file name
`#CFG`	E.g., file content

The following spellings are used for software descriptions:

Spelling	Description
Bold print	Description of terms that are used in the Tera Tool software, e.g., menus and buttons
Bold print > Bold print	Tera Tool software: selection of a menu item in the menu bar or the toolbar, e.g., **Extras > Options**

Mouse button	Description
Left mouse button	Primary mouse button* (default in most operating systems)
Right mouse button	Secondary mouse button*
* Unless you have customized your mouse settings in the used operating system.	
Descriptions containing "click", "mouse click" or "double-click" each means a click with the primary (left) mouse button. If the right mouse button has to be used, this is explicitly declared in the description.	

1.4 Intended Use

Extender modules are used to increase the distance between sources and associated consoles. The signals can be extended using Cat X cables or fiber optic cables.

Extender modules with Cat X Interface:
Extender modules with Cat X connections are unsuitable for connection between buildings. Use a fiber optic-based extender module instead.

Extender modules with Fiber Interface:
Extender modules with fiber connections can also be used with applications in environments which are subject to electromagnetic interference.

NOTICE

Interferences when the immunity limit values are exceeded

If the limit values listed in EN55024 are exceeded, reliable and fault-free functioning of the devices cannot be guaranteed.

NOTICE

Possible radio interference in a domestic environment

This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

➡ Follow the safety and installation instructions given in this manual.

➡ Use connection cables according to the specifications for the length and type given in this manual.

1.5 Certificates/Directives

1.5.1 North American Regulatory Compliance

The "equipment" referred to in the "North American Regulatory" chapter consists of a fully assembled modular system and includes the chassis, extender modules and possibly add-on modules along with supplied cables. For more details about the modular system, please refer to chapter 3.1.2, page 12.

This equipment has been found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded cables must be used with this equipment to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

All power supplies are certified to the relevant major international safety standards.

1.5.2 EU Declaration of Conformity

Please find the EU Declaration of Conformity for the device under:
www.ihse.com/eu-declaration-of-conformity

A copy of the original, product-specific EU Declaration of Conformity can be provided upon request. For contact details, see page 2 of this manual.

1.5.3 WEEE

The device label carries a symbol (crossed-out dustbin) for marking electrical and electronic equipment. The manufacturer complies with the EU Directive 2012/19/EU on the prevention of waste electrical and electronic equipment (WEEE). The manufacturer is a WEEE registered company (registration number DE39900275).

Equipment Disposal/Take-back

- The symbol of a crossed-out dustbin displayed on electrical and electronic equipment indicates that the product and the supplied electronic accessories (e.g., power supply units, cables) must not be disposed of with household or commercial waste at the end of its service life.
- By disposing of the product irresponsibly you may enable unauthorized people to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- The manufacturer takes back old devices and guarantees adequate waste disposal. Please contact the manufacturer's technical support to register the return for a device to be disposed of.
- It is the customer's own responsibility to delete personal data on the equipment to be disposed of.

2 Safety instructions/Consignes de Sécurité

2.1 Englisch

To ensure reliable and safe long-term operation of your device, please note the following guidelines:

- ➡ Read this user manual carefully.
- ➡ Read the manual for the chassis in which the extender modules are installed. The instructions, safety and warning notes contained therein must also be observed.
- ➡ Only use the device according to this user manual. Failure to follow the instructions described can result in personal injury, damage to the device, or endanger the security of your data.
- ➡ Take any required ESD precautions.

Two safety instructions from the chassis user manual:

⚠ WARNING

Risk of electric shock due to freely accessible power connections when the chassis is open

Risk of bruising, abrasion or shearing of fingertips due to rotating fan when the chassis is open

If the chassis is opened while power is supplied to the device, electric shock may occur if the internal wiring is touched. If a running fan is touched while the case is open, bruises, abrasions or shearing of fingertips may occur.

There are no necessary maintenance procedures that require opening the chassis.

- ➡ Do NOT remove the cover of the chassis.
- ➡ Do NOT install the device in environments where children are likely to be present.

⚠ CAUTION

Risk of burns due to tremendously heated chassis surface after a long period of operation

When the chassis is fully equipped, the surface of the chassis can become very warm after a long period of operation. If the chassis surface is touched after a long period of operation, this can cause skin burns.

- ➡ Wear protective gloves to transport a fully equipped chassis after a long period of operation.
- ➡ Ensure that there is sufficient distance from the operator, e.g., for mounting under a table.
- ➡ Do NOT install the device in environments where children are likely to be present.

Installation Location

While operating the device can get warm. Damage to the device can occur in a damp environment.

- ➡ Use the device only in dry, indoor environments.
- ➡ Use the device only in a room with adequate ventilation.
- ➡ For rack-mount installations, at least 0.5 RU (rack unit) is required above the device for ventilation.
- ➡ Do not place the power supply units directly on top of the device.
- ➡ Existing ventilation openings on the device must always be free.
- ➡ Place the device at a sufficient distance from the operator.
- ➡ Place all power sockets including the sockets for the supplied external power supply units easily accessible and directly next to each other.

Connection

- ➡ Check the device and the power supply units for visible damage before connecting it.
- ➡ Only connect the device if the device and the ports are not damaged.
- ➡ Only use power supply units originally supplied with the product or manufacturer-approved replacements.
- ➡ Only use power supply units without any visible damage to the chassis or the cable.
- ➡ Connect all power supply units to grounded outlets.

- ➡ Only use cables supplied by the manufacturer or cables that comply with the technical specification, see chapter 11.2.2, page 61.
- ➡ Only connect the device to KVM devices using the interconnecting cable - not to other devices, particularly not to telecommunications or network devices.

Disconnect the Device from the Circuit

NOTICE
The cable plugs on the device side can contain a lock. In the event of a necessary quick and complete disconnection from external electric circuits: ➡ Remove all corresponding cable plugs from the socket, ➡ Or set the power switch of the power outlets (if available) to the “Off” position.

2.2 Français

Pour garantir un fonctionnement fiable et sûr de votre périphérique à long terme, veuillez respecter les directives suivantes :

- ➡ Lisez attentivement ce manuel d'utilisation.
- ➡ Lisez le manuel d'utilisation du châssis dans lequel les modules d'extension sont installés. Les instructions, les consignes de sécurité et les avertissements qu'il contient doivent également être respectés.
- ➡ N'utilisez le périphérique que conformément à ce manuel d'utilisation. Le non-respect des instructions décrites peut entraîner des blessures corporelles, endommager le périphérique ou mettre en danger la sécurité de vos données
- ➡ Prenez toutes les précautions nécessaires contre les décharges électrostatiques.

Deux consignes de sécurité tirées du manuel d’utilisation du châssis :

⚠ AVERTISSEMENT
Risque de choc électrique dues de l'accès libre aux connexions électriques lorsque le châssis est ouvert Risque de contusion, d'abrasion ou de cisaillement des bouts des doigts dues de la rotation du ventilateur lorsque le châssis est ouvert Si le châssis est ouvert alors que le périphérique est sous tension, un choc électrique peut se produire si le câblage interne est touché. Si vous touchez un ventilateur en marche alors que le châssis est ouvert, vous risquez de vous blesser, de vous abraser ou de vous cisailler le bout des doigts. Aucune procédure d'entretien nécessaire ne requiert l'ouverture du châssis. ➡ Ne retirez PAS le couvercle du châssis. ➡ N'installez PAS le périphérique dans des environnements où des enfants sont susceptibles d'être présents.

⚠ ATTENTION
Risque de brûlures dues à la surface du châssis très chaude après une longue période d'utilisation Lorsque le châssis est entièrement équipé, la surface du châssis peut devenir très chaude après une longue période de fonctionnement. Si la surface du châssis est touchée après une longue période d'utilisation, cela peut provoquer des brûlures de la peau. ➡ Des gants de protection doivent être portés pour transporter un châssis entièrement équipé après une longue période d'opération. ➡ Veillez à ce que la distance avec l'opérateur soit suffisante, par exemple pour un montage sous une table. ➡ N'installez PAS le périphérique dans des environnements où des enfants sont susceptibles d'être présents.

Emplacement de l'installation

Pendant le fonctionnement, le périphérique peut chauffer. Le périphérique peut être endommagé dans un environnement humide.

- N'utilisez le périphérique que dans un environnement sec et intérieur.
- N'utilisez le périphérique que dans un lieu correctement ventilée.
- Placez le périphérique à une distance suffisante de l'opérateur.
- Pour les installations en rack, au moins 0,5 RU (unité de rack) est nécessaire au-dessus du périphérique pour la ventilation.
- Ne placez jamais les unités d'alimentation sur le dessus du périphérique.
- Les ouvertures de ventilation existantes sur le périphérique doivent toujours être libres.
- Si vous installez le périphérique sous la table, placez le périphérique à une distance suffisante de l'opérateur.
- Placez toutes les prises de courant, y compris les prises de courant pour les unités d'alimentation externes fournis, de manière facilement accessible et directement les unes à côté des autres.

Connexion

- Avant de connecter le périphérique et les unités d'alimentation, vérifiez qu'ils ne présentent pas de dommages visibles.
- Seulement connectez le périphérique et les unités d'alimentation que si le périphérique et les ports ne sont pas endommagés.
- Utilisez uniquement les unités d'alimentation fournis à l'origine avec le produit ou des pièces de rechange approuvées par le fabricant.
- N'utilisez que des unités d'alimentation sans dommages visibles au niveau du châssis ou du câble.
- Connectez tous les unités d'alimentation à des prises de terre.
- Raccordez tous les unités d'alimentation à des prises de courant mises à la terre.
- Veillez à ce que la connexion à la terre soit maintenue depuis la prise de courant jusqu'à l'entrée d'alimentation CA du les unités d'alimentation.
- Ne connectez le périphérique qu'à des périphériques KVM à l'aide du câble d'interconnexion - pas à d'autres périphériques, en particulier pas à des périphériques de télécommunications ou de réseau.

Déconnecter le périphérique du circuit

AVIS
Les fiches de câble du côté du périphérique peuvent contenir un verrou. En cas de nécessité d'une déconnexion rapide et complète des circuits électriques externes : ➡ Retirez toutes les fiches de câble correspondantes de la prise. ➡ Ou mettez l'interrupteur des prises de courant (si elles existent) sur la position « Off ».

3 Description

3.1 System Overview

3.1.1 KVM System

This is an example of a point-to-point connection of KVM extender modules. For more installation examples, see chapter 5.3, page 31.

The CPU Unit is connected directly to the source using the supplied cables. The CON Unit is connected to the sink. The CPU Unit and the CON Unit communicate with each other through the interconnection cable.

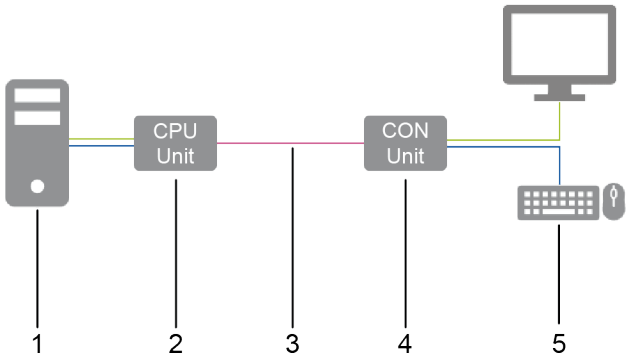


Fig. 1 Installation example (point-to-point connection, Single-Head)

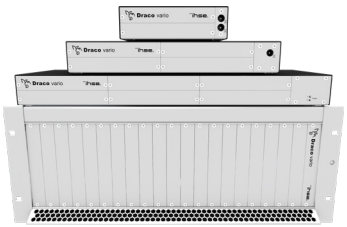
1 Source
2 CPU Unit
3 Interconnection cable
4 CON Unit
5 Sink (monitor, keyboard, mouse)

3.1.2 Modular Draco vario System

Draco vario chassis permit individual Draco vario series extender modules and add-on modules to be combined in stand-alone or rack mounted configuration. The flexible, modular system allows customized integration of devices to meet specific installation requirements. Chassis are available in sizes to accommodate 2, 4, 6 and 21 individual modules.

Therefore, please first select a chassis, then select one or more extender module(s), then select one or more add-on module(s) if required.

The Draco vario configurator, available on the IHSE website, is available to assist with system configuration. Please refer to the Draco System Designer at https://dsd.ihse.com.



For more information, please refer to the manual 474-BODY.

Extender modules, described in this manual.

For more information, please refer to the manual 474-Add-on modules.

3.1.3 System Structure and Terms

A KVM pair consists of 2 KVM extender modules, each with at least one CPU extender module and at least one CON extender module. The various extender modules are installed respectively in a Draco vario chassis (2-slot, 4-slot, 6-slot, or 21-slot) on the CPU side (CPU Unit) and console side (CON Unit). With 2-slot, 4-slot and 6-slot chassis add-on modules are placed above an extender, with 21-slot chassis, add-on modules are placed to the right of an extender module. An add-on module will not work if it is mounted above an empty slot.

The assignment of the extenders or add-on modules can be recognized by the article number:

- Extender module or add-on module for the CPU Unit: **L**4XX (L = Local)
- Extender module or add-on module for the CON Unit: **R**4XX (R = Remote)

The assignment of the extenders or add-on modules can be recognized by the article number:

- Extender module or add-on module for the CPU Unit: **L**4XX (L = Local)
- Extender module or add-on module for the CON Unit: **R**4XX (R = Remote)

An add-on module can contain up to 2 independent function parts (part A and B), one on the left and one on the right, see Fig. 2.

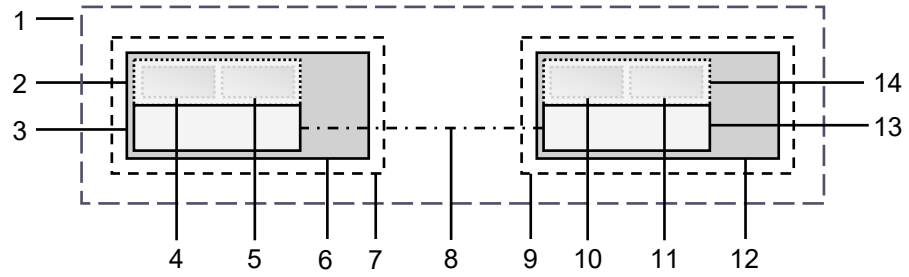


Fig. 2 KVM Extender pair with CPU Unit and CON Unit

1 KVM Extender pair
2 Extender module or add-on module (optional)
3 Extender module
4 Part A of the CPU add-on module (optional)
5 Part B of the CPU add-on module (optional)
6 Chassis
7 CPU Unit
8 Interconnection cable
9 CON Unit
10 Part A of the CON add-on module (optional)
11 Part B of the CON add-on module (optional)
12 Chassis
13 Extender module
14 Extender module or add-on module (optional)

3.1.4 Embedded Signals

If optional add-on modules are used, signals such as, e.g., audio (analog, serial, digital or symmetrical) or USB 2.0 are transferred to the underlying extender module and embedded as well as transmitted via the link connection to the CON Unit. The embedded signals are extracted in the CON Unit, transferred to the add-on module above and output there separately.

Example with optional Add-on Module L-/R474-BAE

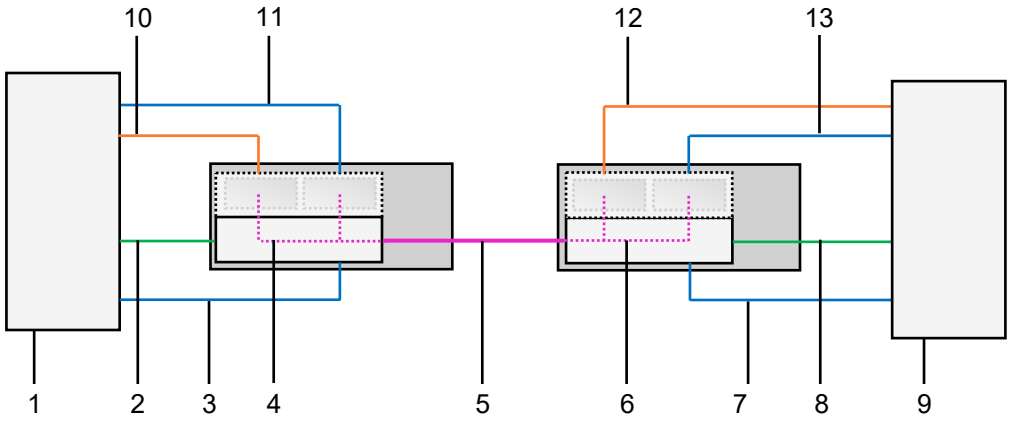


Fig. 3 Embedding/de-embedding of signals in a KVM extender pair (example L-/R474-BAE)

1 Source
2 Video signal with embedded audio signal
3 USB-HID signal
4 Embedding the audio and USB 2.0 signal
5 Interconnection cable
6 De-embedding the audio and USB 2.0 signal
7 USB-HID signal
8 Video signal with embedded audio signal
9 Sink (console with monitor, keyboard, and mouse)
10 Audio signal
11 USB 2.0 signal
12 Audio signal, de-embedded
13 USB 2.0 signal, de-embedded

Example with optional Add-on Module R474-BDX

To output an audio signal with separate speakers, there is only the optional audio add-on module for the CON Unit required.

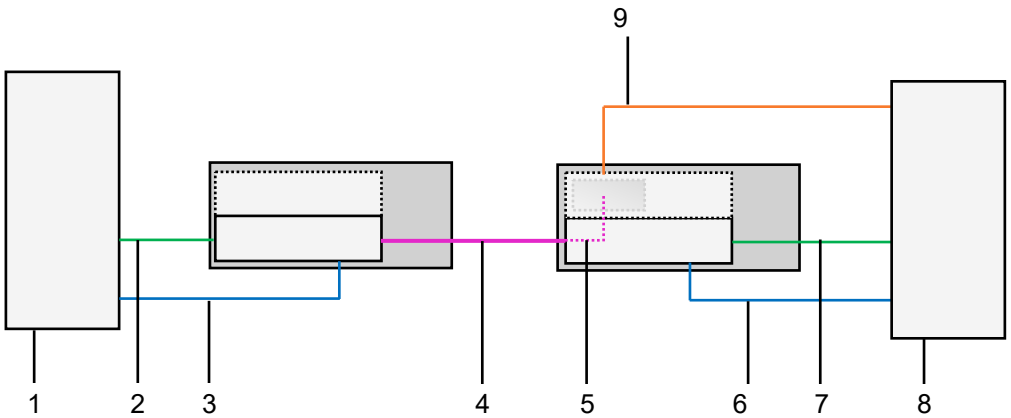


Fig. 4 De-embedding of audio signals in a KVM extender pair (example R474-BDX)

1 Source
2 Video signal with embedded audio
3 USB-HID signal
4 Interconnection cable
5 De-embedding digital audio signal
6 USB-HID signal
7 Video signal with embedded audio
8 Sink (console with monitor, keyboard, mouse, and speakers)
9 De-embedded digital audio signal

3.2 System Compatibility

3.2.1 Video Compatibility

Extender modules are operated with a different firmware and technology and are not completely compatible with each other. The following table lists video compatibility (X) and non-video compatibility (-) (see footnotes).

		R474	R477	R481	R482		R483		R486	R488	R490	R491	R491-BUHx	R492	R493		R495
		SH	SH	SH	SH	DH	SH	DH	DH	SH	SH	SH	SH	SH	SH	DH	SH
L474	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L477	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L481	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L482	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
	DH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L483	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
	DH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L484	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L486	DH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L488	SH	X	X	X	X	X	X	X	X	X	X	-	-	-	-	X	-
L490	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
L491	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
L492	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
L493	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
	DH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
L494	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
L495*	SH	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X

1) Compatibility is based on video/USB-HID signals only, not on embedded signals like audio or USB 2.0.
2) Compatible up to the maximum specified resolution of the console.
No image is displayed when a Single Link CON Unit (e.g., R482-B2HC with 1080p monitor) is switched to a Dual Link CPU Unit (e.g., L482-BDHC with a 4k30 video signal) unless the configuration is set up accordingly.
3) If using CPU Unit and CON Unit with different video signals (e.g., a DP 1.1 CON Unit with a HDMI CPU Unit), transmitting the EDID to the CPU Unit will result in an error.
4) Transmission speed must be identical (1G or 3G) except with Bridge card.

3.2.2 Audio Compatibility

The audio compatibility depends on the combination of extender modules and add-on modules, see following figure.

HDMI 1.3: 5.1-Channel LPCM digital audio, embedded/
HDMI 2.0: 2-Channel LPCM digital audio, embedded

DP 1.1: 5.1-Channel LPCM digital audio, embedded/ DP 1.2:
2-Channel LPCM digital audio, embedded

5.1-Channel PCM digital audio

Balanced audio

2-Channel analog audio + RS232 (19.2 kBd)

2-Channel analog audio + RS422 (115.2 kBd)

2-Channel analog audio + RS232 (115.2 kBd)

HDMI 1.3: 5.1-Channel LPCM digital audio, embedded/
HDMI 2.0: 2-Channel LPCM digital audio, embedded

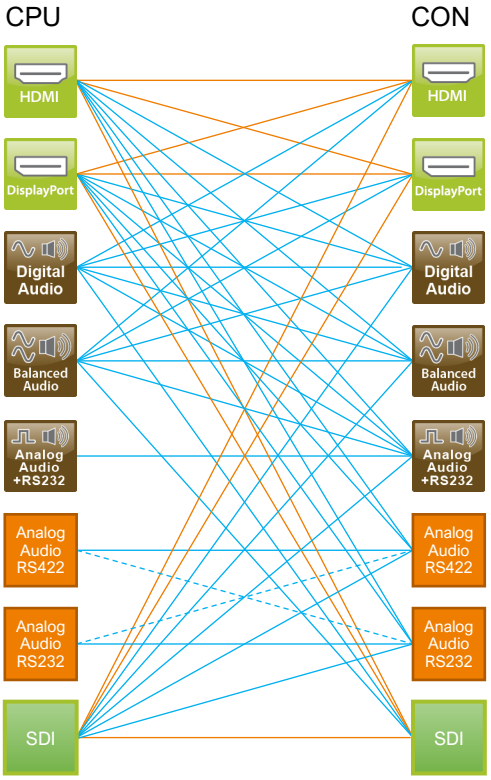


Fig. 5 Audio compatibility of extender modules and add-on modules

* Extender modules of HDMI 1.3 series 481/491 and DP 1.1 series 483/493 support 5.1 channel digital audio whereas extender modules of HDMI 2.0 series 495 and DP 1.2 series 490 only support 2-channels.

Requires an audio add-on module on the CPU Unit or the CON Unit

True embedded audio

Connection represents audio content only

Analog audio add-on modules are not necessarily audio compatible to each other since they use different protocols. The following table lists the audio compatibility (X) and non-audio compatibility (-) for analog audio add-on modules:

	R474-BAX RS232 @ 19.2 kBd	**R474-BRX RS232 @ 115 kBd**
L474-BAX RS232 @ 19.2 kBd	X	-
L474-BRX RS232 @ 115 kBd	-	X
L474-BSX RS422 @ 115 kBd	-	X

3.2.3 Interconnection Compatibility

Extender modules are available in the following connection versions. The type of interconnection of extenders can be recognized by the article number:

- Interconnection (1.25 Gbit/s = "1G") via Cat X cable ("C")
- Interconnection (1.25 Gbit/s = "1G") via single-mode fiber cable ("S")
- High speed interconnection (3.125 Gbit/s = 3G) via single-mode fiber cable ("X")

Fiber devices can be used with Multi-mode and Single-mode cables (see chapter 11.2.2, page 61).

Point-to-point Interconnection between Extender Modules

	Cat X 1G	Fiber 1G	Fiber 3G
Cat X 1G	Compatible	Not compatible	Not compatible
Fiber 1G	Not compatible	Compatible	Not compatible
Fiber 3G	Not compatible	Not compatible	Compatible

Interconnection of Extender Modules via Matrix or Cross-Repeater 485-BX/485-BXX

	Cat X 1G	Fiber 1G	Fiber 3G
Cat X 1G	Compatible	Compatible	Not compatible
Fiber 1G	Compatible	Compatible	Not compatible
Fiber 3G	Not compatible	Not compatible	Compatible (not with Cross-Repeater)

Interconnection of Extender Modules via Draco tera Matrix with Bridge Card

	Cat X 1G CON Unit	Fiber 1G CON Unit	Fiber 3G CON Unit
Cat X 1G CPU Unit	Not compatible	Not compatible	Compatible
Fiber 1G CPU Unit	Not compatible	Not compatible	Compatible
Fiber 3G CPU Unit	Not compatible	Not compatible	Compatible

A special card (bridge card) is available to be used with the matrix Draco tera enterprise and Draco tera flex to connect up to 8 CPU Units with 1G transmission speed (Cat X or fiber version). The transmission speed will be increased within the bridge card from 1G to 3G. The signals are transmitted to the backplane of the matrix and can be output to up to 8 CON Units, connected to the matrix.
This function is only available in one direction.
1G CPU Unit - Draco tera enterprise and Draco tera flex with bridge card - 3G CON Unit

3.3 Product Types

3.3.1 Extender Modules without Local Input/Output

Product type	Interconnection		DisplayPort 1.2	USB-HID
L490-BPHX	1x	Single-mode fiber 3G	1x	1x USB type B
R490-BPHX				2x USB type A
L490-BPHXR	2x (redundancy)			1x USB type B
R490-BPHXR				2x USB type A

3.3.2 Extender Modules with Local Input/Output

Product type	Interconnection		DisplayPort 1.2	Local Mini DisplayPort 1.2	USB-HID
L490-BPHCXL-R1	1x	Cat X 3G	1x	Output	1x USB type B
R490-BPHCXL-R1				Input	2x USB type A
L490-BPHCXLR	2x (redundancy)			Output	1x USB type B
R490-BPHCXLR				Input	2x USB type A
L490-BPHXL	1x	Single-mode fiber 3G	1x	Output	1x USB type B
R490-BPHXL				Input	2x USB type A
L490-BPHXLR	2x (redundancy)			Output	1x USB type B
R490-BPHXLR				Input	2x USB type A

3.3.3 Extender Modules with MST (Multi Stream Transport)

Product type	Interconnection		DisplayPort 1.2	USB-HID
L490-BPHCX-M	1x	Cat X 3G	1x	1x USB type B
R490-BPHCX-M				2x USB type A
L490-BPHCXR-M	2x (redundancy)			1x USB type B
R490-BPHCXR-M				2x USB type A
L490-BPHX-M	1x	Single-mode fiber 3G	1x	1x USB type B
R490-BPHX-M				2x USB type A
L490-BPHXR-M	2x (redundancy)			1x USB type B
R490-BPHXR-M				2x USB type A

3.3.4 Supplementary with Extended Function for Extender Modules

SNMP Module

To monitor all function- and safety-critical components of extender modules and add-on modules of a chassis, an SNMP module installed in the same chassis can be used.

The SNMP module can be used to query the status of the extender modules, configure extender module settings, and query and update the firmware of the extender modules and add-on modules. For more information, please refer to the SNMP manual.

Part number	Description
474-SNMPV3	SNMP module for sliding-in into slot 5 of the chassis 474-BODY6BP/474-BODY6BP-S and 474-BODY6BPF/474-BODY6BPF-S and into slot 21 of the chassis 474-BODY21/4U(-R1) and 474-BODY21/4UR(-R1). The transmission of the traps is encrypted (SNMP v3).

U-Switch Module

Extender modules can be combined with a U-Switch module that can seamlessly control multiple sources as one source using just a single USB-HID set (keyboard and mouse), while the video outputs of the sources are directly connected to the monitors. For more information, please refer to the Draco U-Switch manual.

Part number	Description
B476-4U4T	Draco vario U-Switch Module 4-Port USB-HID + USB 2.0

3.4 Accessories

Part. No.	Description	Interface
VC-DP2DP-020-MM	DisplayPort cable male/male, 2.0 m	Video
VC-DP2MDP	DisplayPort cable to MiniDP male/male, 2.0 m	Video
436-DPDV	DisplayPort cable to DVI male/male, 2.0 m (VGA/DVI-I)	Video
247-U1	USB cable Type A-B, 1.8 m	USB/USB HID
247-U2	USB cable Type A-B, 3.0 m	USB/USB HID
436-USB20	USB extension cable Type A-A, 3.0 m	USB/USB HID
459-10X	SFP single-mode, LC duplex, bidirectional, 10G, compatible with 3G fiber extender modules	Fiber, 3G

3.5 Scope of Delivery

Depending on the order, the scope of delivery contains the following items and may vary depending on the country of delivery and customer specification:

Product type	Scope of delivery
KVM Extender pair	• 1x CPU Unit in Draco vario chassis • 1x CON Unit in Draco vario chassis • 1x DisplayPort cable male/male, 2.0 m • 1x USB cable 1.8 m (type A-B) • Quick Setup

Product type	Scope of delivery
CPU Unit	• 1x CPU Unit in Draco vario chassis • 1x DisplayPort cable male/male, 2.0 m • 1x USB cable 1.8 m (type A-B) • Quick Setup
CON Unit	• 1x CON Unit in Draco vario chassis • Quick Setup

If anything is missing, please contact your distributor.

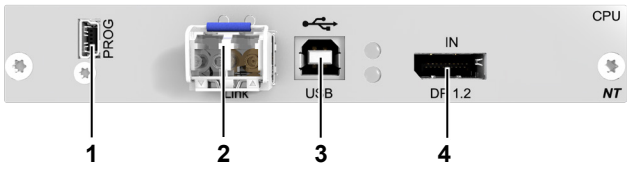
For information about the scope of delivery for the chassis, please refer to the user manual 474-BODY.

3.6 Device Views

3.6.1 Extender Modules without Local Input/Output

3.6.1.1 Extender Module L-/R490-BPHX

Source side (CPU module)



Sink side (CON module)

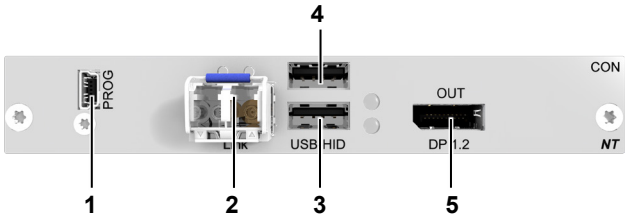
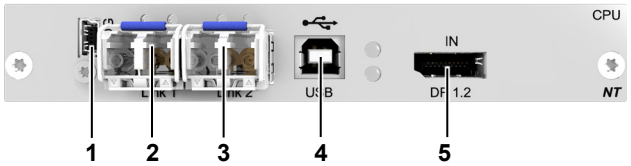


Fig. 6 Interface side L-/R490-BPHX

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type B, USB-HID
4 DisplayPort 1.2, input source

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type A, USB-HID device 1
4 USB type A, USB-HID device 2
5 DisplayPort 1.2, output to monitor

3.6.1.2 Extender Module L-/R490-BPHXR



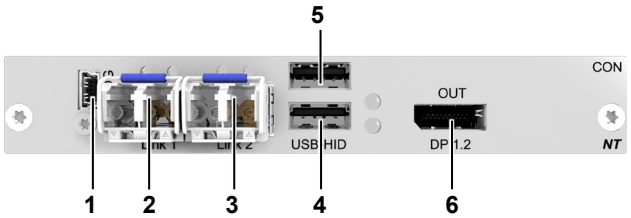


Fig. 7 Interface side L-/R490-BPHXR

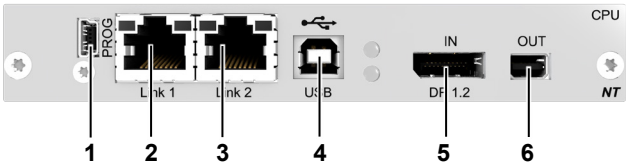
1 Mini-USB, service interface
2 Fiber, interconnection 1
3 Fiber, interconnection 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source

1 Mini-USB, service interface
2 Fiber, interconnection 1
3 Fiber, interconnection 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor

3.6.2 Extender Modules with Local Input/Output

3.6.2.1 Extender Module L-/R490-BPHCXLR

Source side (CPU module)



Sink side (CON module)

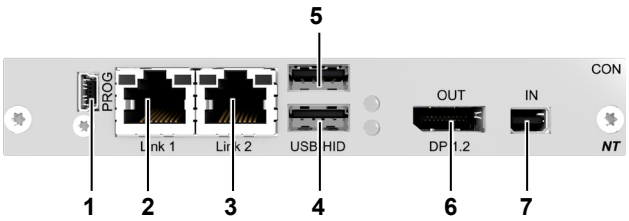
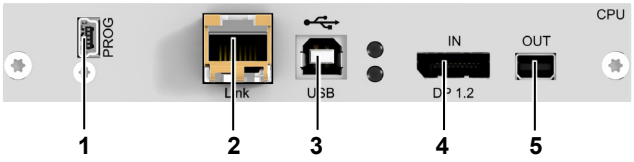


Fig. 8 Interface side L-/R490-BPHCXLR

1 Mini-USB, service interface
2 Cat X, interconnection 1
3 Cat X, interconnection 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source
6 Mini-DisplayPort 1.2, local output

1 Mini-USB, service interface
2 Cat X, interconnection 1
3 Cat X, interconnection 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor
7 Mini-DisplayPort 1.2, local input

3.6.2.2 Extender Module L-/R490-BPHCXL-R1



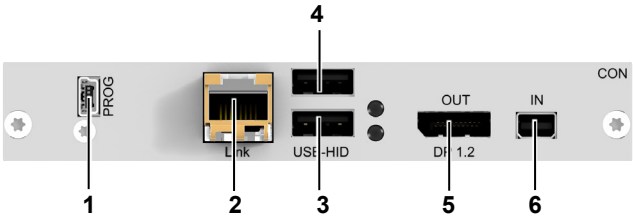
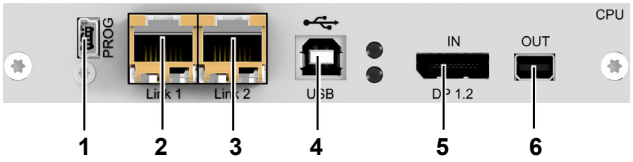


Fig. 9 Interface side L-/R490-BPHCXL-R1

1 Mini-USB, service interface
2 Cat X, interconnection
3 USB type B, USB-HID
4 DisplayPort 1.2, input source
5 Mini-DisplayPort 1.2, local output

1 Mini-USB, service interface
2 Cat X, interconnection
3 USB type A, USB-HID device 1
4 USB type A, USB-HID device 2
5 DisplayPort 1.2, output to monitor
6 Mini-DisplayPort 1.2, local input

3.6.2.3 Extender Module L-/R490-BPHCXLR-R1



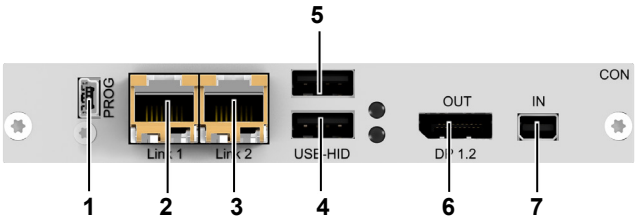


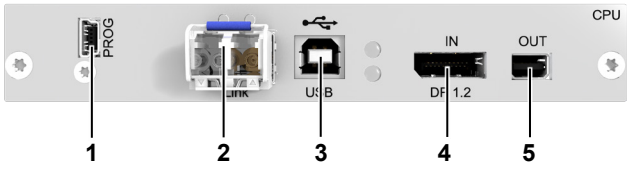
Fig. 10 Interface side L-/R490-BPHCXL-R1

1 Mini-USB, service interface
2 Cat X, interconnection 1
3 Cat X, interconnection 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source
6 Mini-DisplayPort 1.2, local output

1 Mini-USB, service interface
2 Cat X, interconnection 1
3 Cat X, interconnection 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor
7 Mini-DisplayPort 1.2, local input

3.6.2.4 Extender Module L-/R490-BPHXL

Source side (CPU module)



Sink side (CON module)

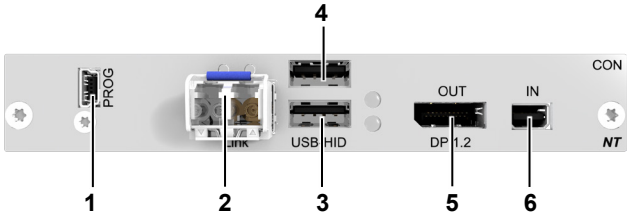
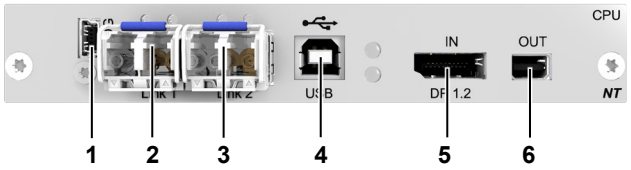


Fig. 11 Interface side L-/R490-BPHCXLR

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type B, USB-HID
4 DisplayPort 1.2, input source
5 Mini-DisplayPort 1.2, local output

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type A, USB-HID device 1
4 USB type A, USB-HID device 2
5 DisplayPort 1.2, output to monitor
6 Mini-DisplayPort 1.2, local input

3.6.2.5 Extender Module L-/R490-BPHXLR



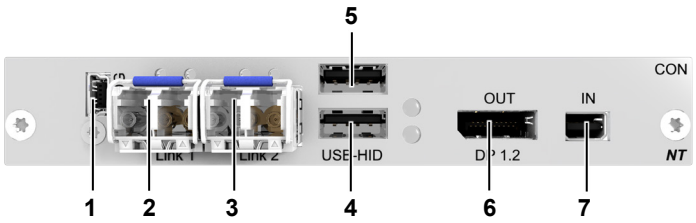


Fig. 12 Interface side L-/R490-BPHCXLR

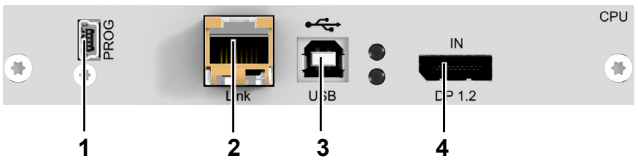
1 Mini-USB, service interface
2 Fiber, interconnection 1
3 Fiber, interconnection 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source
6 Mini-DisplayPort 1.2, local output

1 Mini-USB, service interface
2 Fiber, interconnection 1
3 Fiber, interconnection 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor
7 Mini-DisplayPort 1.2, local input

3.6.3 Extender Modules with MST (Multi Stream Transport)

3.6.3.1 Extender Module L-/R490-BPHCX-M

Source side (CPU module)



Sink side (CON module)

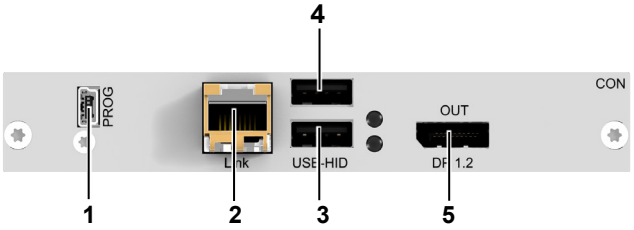
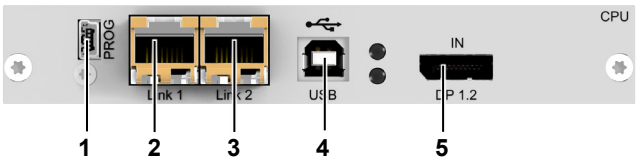


Fig. 13 Interface side L-/R490-BPHCX-M

1 Mini-USB, service interface
2 Cat X, interconnection
3 USB type B, USB-HID
4 DisplayPort 1.2, input source

1 Mini-USB, service interface
2 Cat X, interconnection
3 USB type A, USB-HID device 1
4 USB type A, USB-HID device 2
5 DisplayPort 1.2, output to monitor

3.6.3.2 Extender Module L-/R490-BPHCXR-M



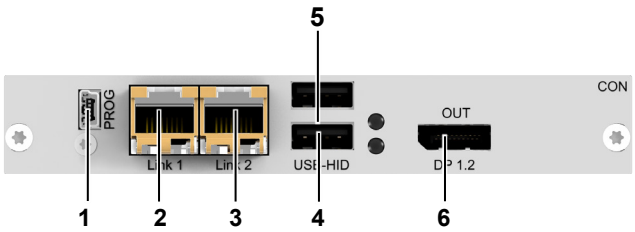
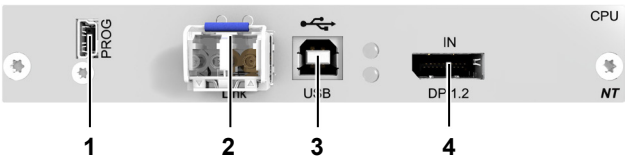


Fig. 14 Interface side L-/R490-BPHCXR-M

1 Mini-USB, service interface
2 Cat X, interconnection link 1
3 Cat X, interconnection link 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source

1 Mini-USB, service interface
2 Cat X, interconnection link 1
3 Cat X, interconnection link 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor

3.6.3.3 Extender Module L-/R490-BPHX-M



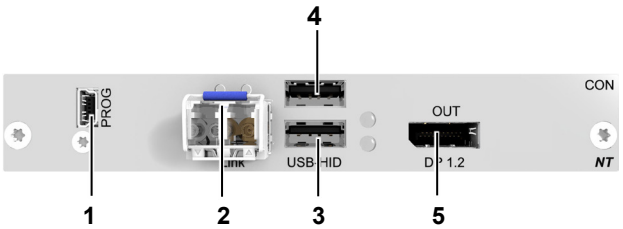


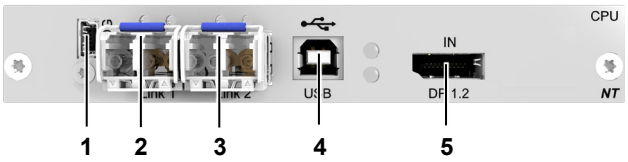
Fig. 15 Interface side L-/R490-BPHX-M

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type B, USB-HID
4 DisplayPort 1.2, input source

1 Mini-USB, service interface
2 Fiber, interconnection
3 USB type A, USB-HID device 1
4 USB type A, USB-HID device 2
5 DisplayPort 1.2, output to monitor

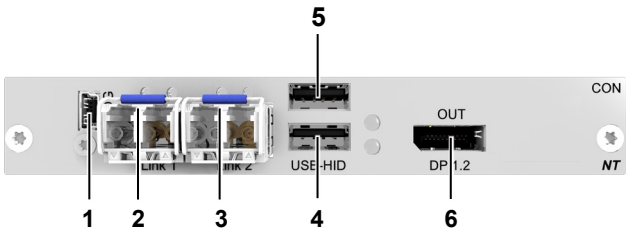
3.6.3.4 Extender Module L-/R490-BPHXR-M

Source side (CPU module)



1 Mini-USB, service interface
2 Fiber, interconnection link 1
3 Fiber, interconnection link 2
4 USB type B, USB-HID
5 DisplayPort 1.2, input source

Sink side (CON module)



1 Mini-USB, service interface
2 Fiber, interconnection link 1
3 Fiber, interconnection link 2
4 USB type A, USB-HID device 1
5 USB type A, USB-HID device 2
6 DisplayPort 1.2, output to monitor

Fig. 16 Interface side L-/R490-BPHCXR-M

3.7 Status Indication of the Extender Modules

LED of Extender Modules on Board

The extender modules have a multicolor LED for status indication on the PCB that is visible on the front side of the chassis at the CON and CPU Unit of following chassis:

474-BODY2, 474-BODY2R, 474-BODY2N, 474-BODY4, 474-BODY4R and 474-BODY6R-R1.

Fig. 17 Chassis front view with LEDs of modules

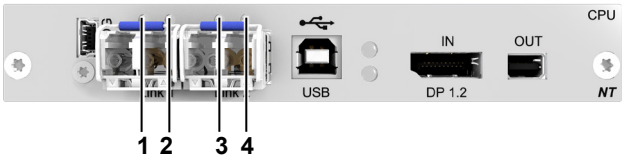
1 Status LED of PCBs of modules

LED Status	Description
Dark red	Video processor in failure status (e.g., incorrect firmware uploaded).
Red	No video signal available, no USB-HID connection available.
Green	Video signal available, no USB-HID connection available.
Violet	No video signal available, USB-HID connection available.
Light blue	Video signal available, USB-HID connection available.

LED of Extender Modules at the Interface Side

The LED status of the extender modules is described using the redundant Cat X and fiber extender modules with local input/output as an example.

Source side (CPU module)



Sink side (CON module)

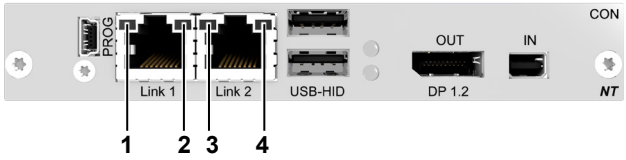


Fig. 18 Interface side extender modules - Status LEDs (example)

1 Failure LED link 1
2 Status LED link 1
3 Failure LED link 2
4 Status LED link 2

1 Failure LED link 1
2 Status LED link 1
3 Failure LED link 2
4 Status LED link 2

The tables in the following sections show the respective LED states/colors of CPU Unit and CON Unit for situations regarding link connection (LEDs 1/3 to 2/4).

3.7.1 Interconnection Cat X

Pos. 1/3	Pos. 2/4	Description
Off	Green	Link connection available.
Off	Flashing green	No link connection available.
Flashing green	Green	Link connection failure (flashes for approx. 20 s following each occurring connection failure).

3.7.2 Interconnection Fiber 3G

Pos. 1/3	Pos. 2/4	Description
Off	Green	Link connection available.
Off	Flashing red	No link connection available.
Flashing red	Green	Link connection failure (flashes for approx. 20 s following each occurring connection failure).

3.7.3 Video and USB-HID - Point-to-Point Connection

When extender modules are connected directly, the LEDs behave differently depending on whether there is a link connection between the CON Unit and the CPU Unit, whether a video signal is present, at which effective data rate a video signal is transmitted, or whether a USB connection exists.

The USB connection is missing, when the command mode is started, or when the CON Unit currently has no USB-HID control with shared operation of a redundant CPU Unit.

The LED status of the extender modules is described using the redundant Cat X extender modules and the redundant fiber extender modules with local input/output as an example.

Source side (CPU module) **Sink side (CON module)**

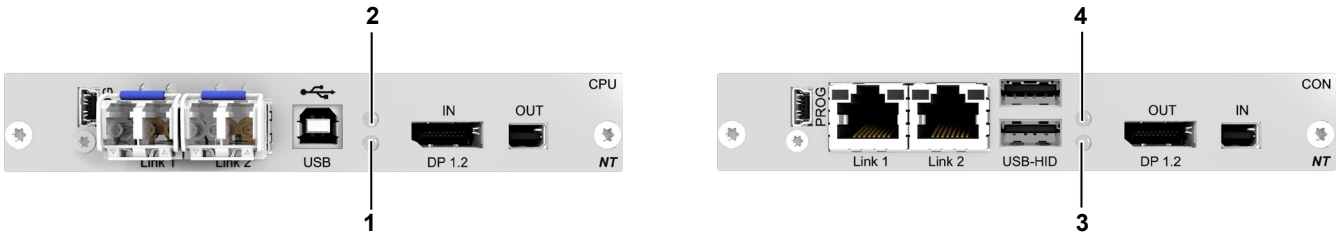


*Fig. 19 Interface side extender modules - Status LEDs **USB-HID/video connection***

1 Status LED 1 USB-HID and video
2 Status LED 2 USB-HID and video
3 Status LED 3 USB-HID and video
4 Status LED 4 USB-HID and video

The following tables show the respective LED states/colors (upper LED (2, 4) and the lower LED (1, 3) of the CPU Unit and the CON Unit for the respective situation.

CPU Unit

LED 2	**Red**	**Violet**	**Red**	**Green**	**Violet**	**Light blue**
LED 1	**Red**	**Violet**	**Green**	**Green**	**Light blue**	**Light blue**
Link	---	X	--- X	--- X	X	X
Effective data rate	---	---	Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s	Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s
USB-HID	---	---	---	---	X	X

CON Unit

LED 4	**Flashing red/violet**	**Violet**	**Flashing red/violet**	**Flashing green/light blue**	**Violet**	**Light blue**
LED 3	**Flashing red/violet**	**Violet**	**Flashing green/light blue**	**Flashing green/light blue**	**Light blue**	**Light blue**
Link	---	X	X	X	X	X
Effective data rate	---	---	Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s	Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s
USB-HID	---	---	---	---	X	X

3.7.4 Video and USB-HID - Matrix Connection

When extender modules are connected to a matrix, the LEDs behave differently depending on whether there is a switched connection between the CON Unit and the CPU Unit, whether a video signal is present, at which effective data rate a video signal is transmitted, or whether a USB connection exists.

The USB connection is missing, when the command mode is started, the OSD is opened, only Video-only Access is present, or Full Access is present in sharing operation without current USB-HID control, or the CON Device is not switched to the CPU Device.

The following tables show the respective LED states/colors (upper LED (2, 4) and the lower LED (1, 3)) of the CPU Unit and the CON Unit for the respective situation.

CPU Unit

LED 2	**Red**		**Violet**	**Red**			**Green**			**Violet**	**Light blue**
LED 1	**Red**		**Violet**	**Green**			**Green**			**Light blue**	**Light blue**
Link to matrix	---	X	X	---	X	X	---	X	X	X	X
Device switched	---		X	---	---	X	---	---	X	X	X
Effective data rate	---		---	Max. 4.14 Gbit/s			4.14 to 17.28 Gbit/s			Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s
USB-HID	---		---	---			---			X	X

CON Unit

LED 4	**Flashing red/violet**	**Violet**	**Flashing red/violet**		**Flashing green/light blue**	**Violet**	**Light blue**
LED 3	**Flashing red/violet**	**Violet**	**Flashing green/light blue**		**Flashing green/light blue**	**Light blue**	**Light blue**
Link to matrix	---	X	X	X	X	X	X
Device switched	---	X	---	X	X	X	X
Effective data rate	---	---	---	Max. 4.14 Gbit/s	4.14 to 17.28 Gbit/s	Max. 4.14 Gbit/s	Max. 4.14 Gbit/s
USB-HID	---	---	---		---	X	X

4 Access Options

You have the following options to configure and/or operate extender modules:

Access option	Description
Command mode	The CON extender modules include a command mode that enables access to several functions of connected KVM devices, e.g., Draco U-Switch or Draco tera matrix switch when using additional keyboard commands. In addition, individual extender module functions for USB-HID Ghosting and the EDID, as well as switching via command mode and additional keyboard commands can be executed.
Tera Tool software	Firmware updates for extender modules can be performed via the Tera Tool software (see section 9.4, page 44. The Tera Tool software is available in the form of a single executable program file. It can be downloaded from the link https://www.ihse.com/software. For extender modules connected to a matrix, additional functions are available in the Tera Tool software. For more information, please refer to the manual of the respective IHSE Draco tera matrix.
Mini-USB interface	Extender modules can be parametrized or updated via Mini-USB interface.

4.1 Command Mode

To start the command mode, use a keyboard sequence (Hot Key) at the keyboard of a CON Unit plugged in a KVM device. The command mode can also be called up using a keyboard with USB-HID interface connected to the R474-BXH add-on module.

NOTICE

While in command mode,
➡ the Caps Lock and Scroll Lock LEDs on the keyboard are flashing,
➡ the USB-HID devices are not operable, mouse and keyboard functions are deactivated,
➡ only selected keyboard commands are available.

If there is no keyboard command entered within 10 seconds after activating the command mode, it will be deactivated automatically.

The following keyboard commands are used to enter, and to exit the command mode, and to change the Hot Key.

Function	Keyboard command
Start the command mode	2x Left Shift (Hot Key, factory setting)
Exit the command mode	Esc and also Left Shift + Esc, if necessary
Change the Hot Key	current Hot Key, c, new Hot Key Code, Enter

NOTICE

In a combined KVM matrix/U-switch configuration, select different Hot Keys for the connected extender modules, e.g., 2x Left Shift for access to the matrix and e.g., 2x Right Shift for access to the U-Switch.

Hot Keys currently can only be changed at the console and only for that console.

Hot Key Code

The Hot Key to start the command mode can be changed. The following table lists the Hot Key codes for the available Hot Keys.

Hot Key Code	Hot Key
0	Freely selectable, except Esc, Del, Backspace and Enter
2	2x Scroll
3	2x Left Shift (default)
4	2x Left Ctrl
5	2x Left Alt
6	2x Right Shift
7	2x Right Ctrl
8	2x Right Alt

Change the current Hot Key via Hot Key Code (exemplary)

To change the current Hot Key to, e.g., 2x Left Alt, enter Hot Key, c, 5, Enter.

Set a freely selectable Hot Key (exemplary)

To set a freely selectable Hot Key (e.g., 2x Space), enter Hot Key, c, 0, Space, Enter.

Keyboard commands are fixed to the position of the keys on the keyboard. Keyboard mapping tables may vary for country-specific layouts.

➥ Note the key position of a freely defined Hot Key when changing the keyboard layout, e.g., from QWERTZ to AZERTY. E.g., if defining 2x a as Hot Key on a German or US keyboard layout, the French keyboard layout (AZERTY) requires then 2x q as Hot Key to be pressed instead

Reset the Hot Key

To set a Hot Key back to default settings, press Right Shift + Del within 5 s after switching on the CON Unit or plugging in a keyboard.

The Hot Key is set back to Left Shift.

5 Installation

NOTICE
Please verify that interconnection cables, interfaces, and handling of the devices comply with the requirements (see chapter 9, page 44).

☑ We recommend that first-time users set up the system in a test environment that is limited to a single room. This makes it easier to identify and solve any cabling problems, and experiment with your system more conveniently.

➡ Switch off all devices.

Installing the CON Unit

1. Connect the monitor(s), keyboard, and mouse to the CON Unit.
2. Connect the chassis of the CON Unit to the power supply unit(s)/power socket(s).

Installing the CPU Unit

1. Connect the source to the CPU Unit with the cables supplied. Please ensure the cables are not strained.
2. Connect the chassis of the CPU Unit to the power supply unit(s)/power socket(s).

5.1 Establishing a Point-to-Point Connection of CON Unit and CPU Unit

1. Connect the CON Unit to the CPU Unit by using interconnection cables.
2. Power up the system, following the recommended sequence:
   Monitor - CON Unit - CPU Unit - source
3. Boot the source and check that everything works correctly.

5.2 Establishing a Matrix Connection

The matrix does not need to be switched off. New extender modules can be hot plugged.

1. Connect installed CON and CPU Units to free ports of the matrix using a link cable (Cat X, fiber).
2. Optional: With redundant extender modules, connect link port 2 also to a free port of the matrix, preferably to another I/O board.
3. Switch on the extender modules or connect them to the power supply.

The extender modules are recognized by the matrix and an EXT Unit is created with the serial number of the module. Via the matrix, a CON Unit can be switched to a CPU Unit. How this is done is described in the user manuals of the matrices and the Tera Tool software.

5.3 Installation Examples

This section illustrates typical installations of KVM extender modules.

5.3.1 Single-Head Point-to-Point Installation with Audio Add-on Module

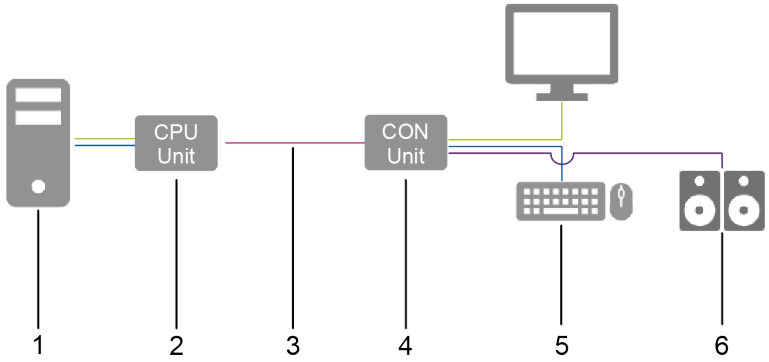


Fig. 20 Installation example (point-to-point connection, Single-Head audio add-on module)

1 Source
2 CPU Unit
3 Interconnection cable
4 CON Unit
5 Sink (monitor, keyboard, mouse)
6 Audio sink (optional, only with devices with add-on module analog audio/Serial option, digital audio, or balanced analog audio

5.3.2 Dual-Head Point-to-Point Installation with Add-on Module USB 2.0

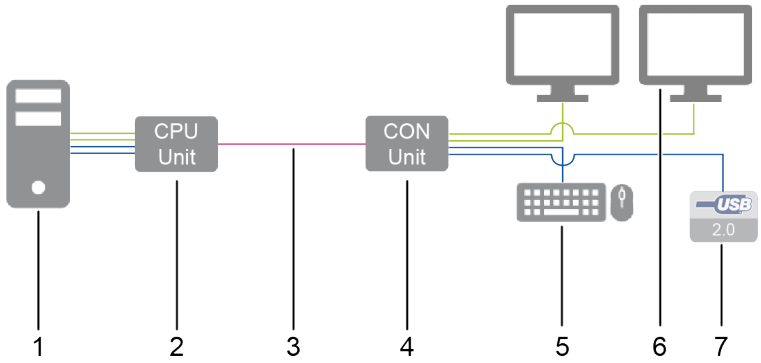


Fig. 21 Installation example (point-to-point connection, Dual-Head with add-on module USB 2.0)

1 Source
2 CPU Unit
3 Interconnection cable
4 CON Unit
5 Sink (monitor, keyboard, mouse)
6 Second monitor (optional, only with Dual-Head extender modules)
7 USB 2.0 devices (optional, only with add-on modules USB 2.0)

5.3.3 Matrix Installation

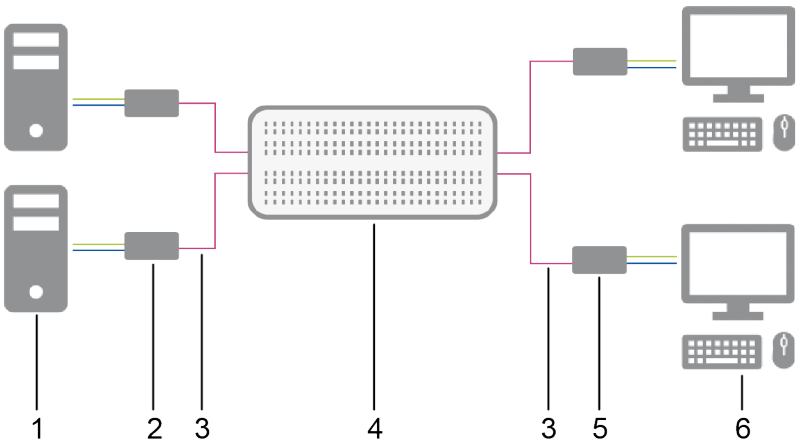


Fig. 22 Installation example (matrix connection)

1 Sources
2 CPU Units
3 Interconnection cable
4 Matrix
5 CON Units
6 Sinks (monitor, keyboard, mouse)

5.3.4 Multi Stream Transport (MST) Installation

Fig. 23 Installation example (Dual monitor setup via MST Daisy-Chain)

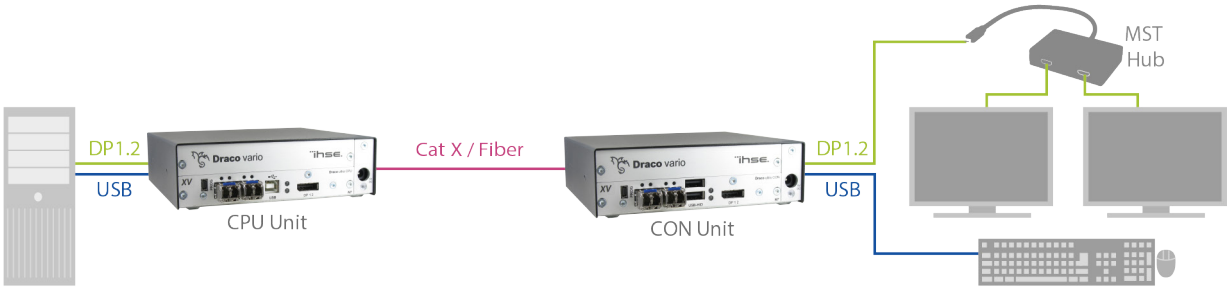


Fig. 24 Installation example (Dual monitor setup via MST Hub)

Extenders with MST support audio signals only via add-on modules (no embedded audio). Color depth is 8 bit per color.

6 Configuration

6.1 Transmission Parameters

The device operates with a manufacturer optimized compression method, the so-called Video-Codec Lici® (Lightweight Image Coding) of the Fraunhofer Institute for Integrated Circuits IIS. The transmission is handled visibly and up to mathematically lossless, at the same time without the loss of frames (no frame drops) and at low latency.

In default configuration, the device adapts dynamically to monitor resolution and image content. This configuration is suitable for almost all conditions and should only be modified if image quality is not fully satisfactory.

6.2 Configuration Options via Mini-USB Service Port

Both the CPU Unit and the CON Unit can be configured and updated via the Mini-USB service port. When a CPU Unit/CON Unit is connected to a computer using a mini-USB cable, the CPU Unit/CON Unit is displayed in the computer's file manager as an external drive "401xxxxx" or "101xxxxx" (Serial No.).

This directory contains the configuration file `Config.txt`, the EDID and firmware files.

The `Config.txt` file shows the Serial No., the manufacturing p/n, and the video signal details. If present, additional configuration parameters are displayed in the line directly below `#CFG`.

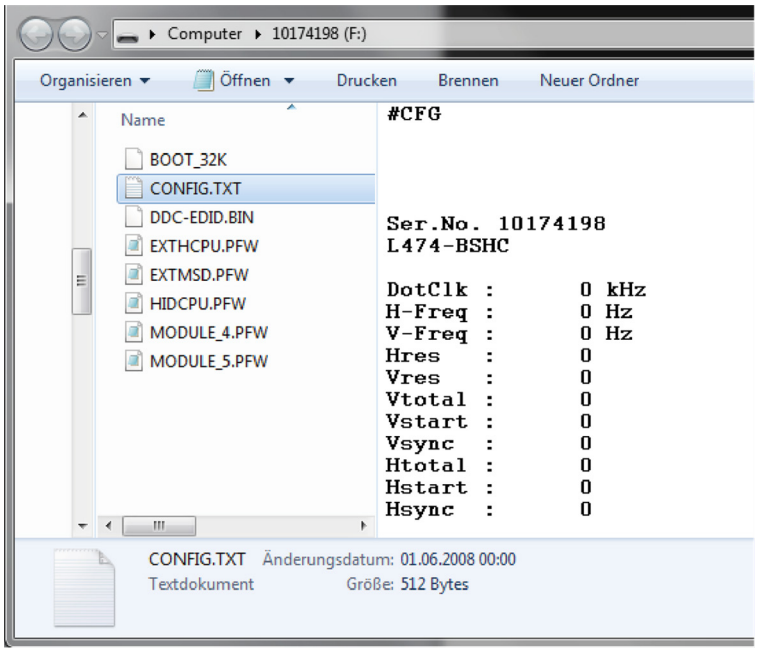


*Fig. 25 Example **Opened Flash drive of a CPU Unit***

6.3 Customized EDID Settings

By default, the CPU Unit provides the EDID for the sources. This information is suitable in most cases. Loading the EDID from the console monitor can be performed during normal operation (see chapter 7.1, page 40).

For special requirements, the EDID can be retrieved from and uploaded to the CPU Unit as a binary file.

➡ Connect your computer with a Mini-USB cable to the service port of the CPU Unit.

The data area of the CPU Unit is now accessible as a flash drive "Extender".

Retrieving the EDID

1. Copy the file `DDC-EDID.bin` on the flash drive of the CPU Unit to your computer.
2. To open the binary file, you have to install suitable software, e.g., WinDDCwrite, on your computer. You can download this software on our website https://www.ihse.com/software/.
3. Change the EDID according to your wishes and save it under the name `DDC-EDID.bin`.

Uploading the EDID

➡ Copy the binary file containing your specific EDID to the flash drive of the CPU Unit.

The current EDID is replaced.

Reset the EDID to Factory Settings

1. Delete the file called `DDC-EDID.bin` on the flash drive of the CPU Unit.
2. Manually power off the extender module.
3. Power on the extender module to restart the extender module.

   The extender module starts automatically, and the factory EDID is restored.

6.4 USB-HID Ghosting

This function allows specific keyboard and mouse descriptors (device descriptions) to be permanently stored in the CPU Unit. This permanent storage eliminates the need to register and deregister the keyboard and mouse on an operating system each time there is a shared use of a source by two or more consoles within a KVM matrix.

The following table lists the keyboard commands for the configuration of USB-HID ghosting:

Keyboard command	Function
Hot Key, h, w, Enter	Writes the device descriptions of the input devices connected to the CON Unit into the CPU Unit. Activates the emulation of these device descriptions in the CPU Unit.
Hot Key, h, e, Enter	Activates the emulation of already stored device descriptions in the CPU Unit.
Hot Key, h, d, Enter	Deactivates the emulation of active device descriptions in the CPU Unit. The input devices connected to the CON Unit will be now passed transparently to the source.
Hot Key, h, r, Enter	Deactivates the emulation of active device descriptions in the CPU Unit. Deletes the descriptions out of the CPU Unit. The input devices connected to the CON Unit will be now passed transparently to the source.

NOTICE

When using a USB combo device as a USB-HID input device, switching to a CPU Unit with activated USB-HID ghosting may cause limited functionality.

Keyboard commands are fixed to the position of the keys on the keyboard. Keyboard mapping tables may vary for country-specific layouts.

➥ E.g., press Hot Key, h, z, Enter on a French keyboard layout (AZERTY) instead of Hot Key, h, w, Enter to write the device descriptions of the input devices connected to the CON Unit into the CPU Unit and to activate the emulation of these device descriptions in the CPU Unit.

6.5 Configuration File

The extender module contains a configuration file (`Config.txt`) to set specific parameters and to read out device and video information. The configuration file is located on the flash drive of the extender module. The flash drive can be opened by a Mini-USB connection to a computer. The configuration file can be edited with all common text editors.

NOTICE
If the start command `#CFG` is missing or is written to the wrong place, or if parameters are not separated in extra lines, the parameterization will fail. For successful parameterization, the following sequence must be strictly observed.

To enter or change a parameter of an extender module, proceed as follows:

1. Connect the extender module to any source using a Mini-USB cable.

   The extender module opens a flash drive containing the `Config.txt` file.
2. Open the `Config.txt` file in a text editor.
3. Ensure that `#CFG` is written in the first line of the file.
4. Add a line break directly behind `#CFG`.
5. Add the parameter/s in capitals in the line below `#CFG` (one line per parameter).
6. Add a line break directly behind each parameter.
7. Delete everything that follows the entered parameter/s, including blanks and blank lines.
8. Save the `Config.txt` file.
9. Manually power off the extender module.
10. Power on the extender module to restart the extender module.

    The extender module starts automatically, and the extender module parameters will be rewritten in the `Config.txt` file.

Example

*Fig. 26 Example **Config.txt with parameters***

6.5.1 Parameters

6.5.1.1 Parameters for CPU Units

The following parameters can be written into the configuration file of a CPU Unit. In the **Series** column is listed if there is a restriction on certain devices (e.g., L490-BPHXLR) or if the mentioned parameters are available for the complete series (e.g., L490/R490).

EDID Management

Parameter	Function	Series
LOCKEDID	Activates EDID write protection	L490

Shared Operation

Parameter	Function	Series
KBDCON	Activates keyboard connect (only with redundant CPU Units)	L490-BPHXR/ -BPHXLR/ -BPHCXLR
MOUCON	Activates mouse connect (only with redundant CPU Units)	L490-BPHXR/ -BPHXLR/ -BPHCXLR
RELEASETIME=n*	Sets the release timer n = 0...9 seconds for mouse and keyboard connect RELEASETIME=X deactivates the shared operation.	L490-BPHXR/ -BPHXLR/ -BPHCXLR

* If no parameter for the release time has been entered for a redundant extender, the release time is 2 seconds.

6.5.1.2 Parameters for CON Units

The following parameters can be written into the configuration file of a CON Unit. In the **Series** column you can see if there is a restriction on certain devices (e.g., R483-BPxx) or if the mentioned parameters are available for the complete series (e.g., v).

Output Settings

Parameter	Function	Series
DISEXTOSD	Deactivates extender module OSD	R490
ENAFRAME	Shows orange colored frame when losing extender module connection	R490
ENAHOLDPIC	Shows the last transmitted picture highlighted by an orange-colored frame when losing connection	R490
ENALOSTMR	Activates LOS timer	R490
ENADDCTX	Activates EDID transmission by unplugging and connecting the monitor back to the CON Unit	R490
ENAAUDIO	Enables RS232 or RS422 and analog audio during Video-only connections	R490
ENATEMPOSD	Displays chip temperature by OSD	R490
DISPLAY2	Shows the second screen of Dual-Head source by default when connected to a Single-Head CON.	R490

Redundancy

Parameter	Function	Series
DISRED	Disables redundancy on the extender module where the parameter is set.	R490
ENAREDFRAME	Enables colored (default: blue) frame in case of using the redundant extender module link	R490

6.5.1.3 Parameters for CPU and CON Units

The following parameters have to be written into the configuration file of both CON Unit and CPU Unit. In the **Series** column you can see if there is a restriction on certain devices (e.g., R483-BPxx) or if the mentioned parameters are available for the complete series (e.g., L483/R483).

USB 2.0 embedded

Parameter	Function	Series
ENAUSB11	Activates USB 1.1 mode for USB 2.0 embedded add-on modules (only with add-on module L474-/R474-BXE, not for L474-/R474-BXE2) Needs to be set on CPU Unit and CON Unit, mixed configurations not supported.	L490/R490

Transmission

Parameter	Function	Series
ENASYNC	Activates a synchronization impulse to adjust the pixel clock between the CPU Unit and CON Unit	L490/R490

6.5.1.4 Parameters for parallel Operation of redundant CPU Units

CPU Units, with a redundant port for interconnection cables, offer the possibility for competing control by two connected CON Units.

Taking over control is performed using a keyboard and/or mouse. The release timer function determines the release time of the input devices at one of the CON Units after that control can be taken over from the second CON Unit.

To configure a redundant CPU Unit for the operation with two parallelly controlling CON Units, proceed as follows:

1. Connect a redundant CPU Unit to any source by using a Mini-USB connection.

   The extender module opens a flash drive containing the `Config.txt` file.
2. Open the `Config.txt` file in a text editor.
3. Ensure that `#CFG` is in the first line of the file.
4. Activate the release timer by writing the parameter `RELEASETIME=n` into the second line. The variable `n` defines the time in seconds and has to be replaced by the numbers 0 to 9 (e.g., `RELEASETIME=5`).

   If this parameter is not activated at all, the release time is set to 2 seconds by default. The parameter `RELEASETIME=X` deactivates the shared operation.
5. Delete everything that follows the entered parameter/s.
6. Save the `Config.txt` file.
7. Manually power off the extender module.
8. Power on the extender module to restart the extender module.

   The extender module starts automatically, and the extender module parameters will be rewritten in the `Config.txt` file.

Example

*Fig. 27 Example **Config.txt with parameter for sharing operation***

NOTICE

When using the redundant CPU Unit in combination with a KVM matrix, the function of competing control will be automatically deactivated in the extender module and will have to be configured by the KVM matrix.

7 Operation

7.1 Downloading the EDID

In the delivery state, the factory-set EDID in the CPU Unit is reported to the source. If these are not the optimal settings for the console monitor, the EDID can be loaded from the console monitor and stored in the internal memory of the CPU Unit.

On extender modules with USB-HID ports, you can load the EDID of the console monitor via keyboard command under operating conditions.

1. Enter the Hot Key to start the command mode (see chapter 4.1, page 28).

   The **Caps Lock** and **Scroll Lock** LEDs on the keyboard are flashing.

2. Press a to load the EDID of the console monitor into the CPU Unit.

   The screen will go black for a short time and the LEDs of the CPU Unit and CON Unit flash briefly.
   At the same time the command mode is closed, and the keyboard LEDs return to previous status.

3. Restart the corresponding source.

   The video mode has been readjusted. Screen quality should be optimal. The source should now show the console monitor as the current screen, together with the available video resolutions.

   If the EDID was loaded once, the EDID can be reloaded by repeating the process.

Keyboard commands are fixed to the position of the keys on the keyboard. Keyboard mapping tables may vary for country-specific layouts.

➥ E.g., press Hot Key + q on a French keyboard layout (AZERTY) instead of Hot Key + a to download the EDID of the monitor connected to the CON Unit into the CPU Unit.

7.2 Switching

7.2.1 Switching of two different CPU Units via redundant CON Unit

Keyboard command	Function
Hot Key, k, 1, Enter	Switches to primary interconnection 1 (Link 1).
Hot Key, k, 2, Enter	Switches to secondary interconnection 2 (Link 2).

Point-to-point connection
With extender modules connected directly, the switching of redundant CON Units to the secondary interconnection 2 is not available for keyboards connected to add-on modules with USB-HID interface.
Matrix connection
With extender modules connected via a matrix, the switching of redundant CON Units to the secondary interconnection 2 is also available for keyboards connected to add-on modules with USB-HID interface.

7.2.2 Switching between KVM and local Input

CON Units with local input have the possibility to connect a local source. These extender modules permit active manual switching between the extender module connection and the local source.

When using the local KVM switch function, the add-on module L474-BXH is necessary to get USB-HID access to the local source.

The following keyboard commands are available for switching at the following devices:

Keyboard command	Function
Hot Key, k, 1, Enter	Switches to primary interconnection 1 (Link 1).
Hot Key, k, 2, Enter	Switches to secondary interconnection 2 (Link 2).
Hot Key, l, Enter	Switches to the local source.

8 Summary of Keyboard Commands

In the following you find a summary of keyboard commands that can be used in conjunction with 474/494 extender modules and add-on modules.

Keyboard commands are fixed to the position of the keys on the keyboard. Keyboard mapping tables may vary for country-specific layouts.

➡ Note the key position of keys when changing the keyboard layout, e.g., from QWERTZ to AZERTY with the French keyboard layout.

8.1 Command Mode

8.1.1 Starting and Exiting the Command Mode

Keyboard command	Function
2x Left Shift	Starts the command mode (Hot Key, factory setting).
Esc	Exits the command mode.

8.1.2 Changing and Resetting the Hot Key

Hot Key

Keyboard command	Function
Current Hot Key, c, new Hot Key code, Enter	Changes the Hot Key according to the predefined Hot Key Code table.
Hot Key, c, 0, new Hot Key, Enter	Defines a freely selectable Hot Key.
Right Shift + Del within 5 s after switching on the CON Unit or plugging in a keyboard	Resets the Hot Key back to default settings.

Hot Key Code

Hot Key Code	Hot Key
0	Freely selectable, except Esc, Del, Backspace and Enter
2	2x Scroll
3	2x Left Shift (default)
4	2x Left Ctrl
5	2x Left Alt
6	2x Right Shift
7	2x Right Ctrl
8	2x Right Alt

8.2 Managing of EDID and USB-HID Ghosting

8.2.1 EDID

Keyboard command	Function
Hot Key, a	Downloads the EDID of a monitor connected to the CON Unit into the CPU Unit.

8.2.2 USB-HID Ghosting

Keyboard command	Function
Hot Key, h, w, Enter	Writes the device descriptions of the input devices connected to the CON Unit into the CPU Unit. Activate the emulation of these device descriptions in the CPU Unit.
Hot Key, h, e, Enter	Activates the emulation of already stored device descriptions in the CPU Unit.
Hot Key, h, d, Enter	Deactivates the emulation of active device descriptions in the CPU Unit. The input devices connected to the CON Unit will be now passed transparently to the source.
Hot Key, h, r, Enter	Deactivates the emulation of active device descriptions in the CPU Unit. Deletes the descriptions out of the CPU Unit. The input devices connected to the CON Unit will be now passed transparently to the source.

8.3 Switching

Keyboard command	Function
Hot Key, k, 1, Enter	Switches to the primary interconnection 1 (link 1)*.
Hot Key, k, 2, Enter	Switches to the secondary interconnection 2 (link 2, only with redundant CON Unit).
Hot Key, l, Enter	Switches to the local source (only with CON Units with local input).

9 Maintenance

9.1 Cleaning of Modules

NOTICE

Possible damage to the mechanical and electronic components

The modules as well as the accessories can be damaged by cleaning with damp or aggressive cleaning agents. If the modules are nevertheless cleaned with damp or aggressive cleaning agents and damaged in the cleaning process, the manufacturer's warranty will be voided.

➡ Remove dust deposits from the device with a dry, antistatic cloth or dehumidified air spray.

9.2 Replacing or Mounting additional Modules in Chassis

For information on the replacement, retrofitting of additional extender modules as well as for mounting of add-on modules with extender modules, please refer to 474-BODY manual. The safety instruction and conditions described in the chassis manual are to be observed to avoid personal injury and damage of components.

9.3 Updating the Firmware via Matrix

The firmware of the extender modules connected to a matrix can be updated via the matrix using the Tera Tool software. This is described in the user manuals for the Matrix and Tera Tool and should be the preferred method. It is also possible to do this directly (see the next section).

9.4 Updating the Firmware via Tera Tool Software

The Tera Tool software is available as a single executable program file that does not require installation. The software can be downloaded from our website https://www.ihse.de/software.

For Windows

Computer/Software/Network		Requirements/Recommendations
Free memory	RAM	Recommendation: 2 GB
Operating system	Microsoft	Windows 10, Windows 11
Connection	Mini-USB port	Between computer and extender module with Mini-USB/USB A cable

For MacOS, Linux

Computer/Software/Network		Requirements/Recommendations
Free memory	RAM	Recommendation: 2 GB
Operating system	Linux	e.g. Debian, Ubuntu, Mint, openSUSE
	macOS	macOS 10.14 (Mojave) or higher, Intel platform
Specification	Java	Java 11 is the minimum version required. However, we recommend using a newer version of Java. (https://adoptopenjdk.net, https://github.com/ojdkbuild/ojdkbuild)
Connection	Mini-USB port	Between computer and extender module with Mini-USB/USB A cable

NOTICE

To process successful firmware updates and avoid failures:

➡ For firmware update of the extender module, use only stand-alone computers that are not integrated into the extender module setup.

➡ Ensure that the computer used for the firmware update is not set into standby mode or sleep mode during the update.

➡ Always update the firmware with firmware of the same name.

1. Run the Tera Tool software.
2. Click **Flash Update** in the toolbar.

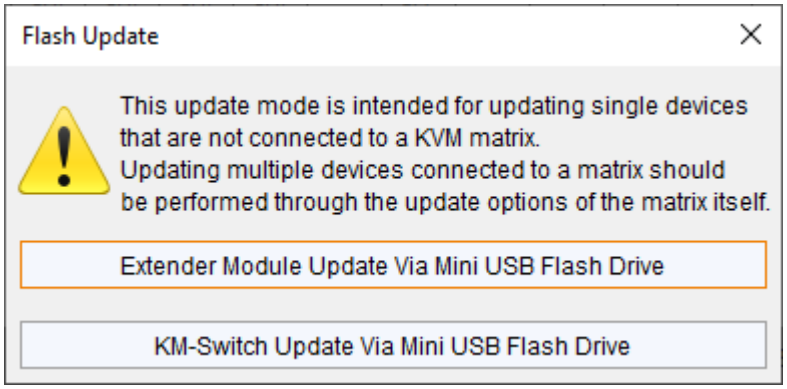


*Fig. 28 Tera Tool - **Flash Update***

3. Click **Extender Module Update Via Mini USB Flash Drive**.

   The update dialog appears.

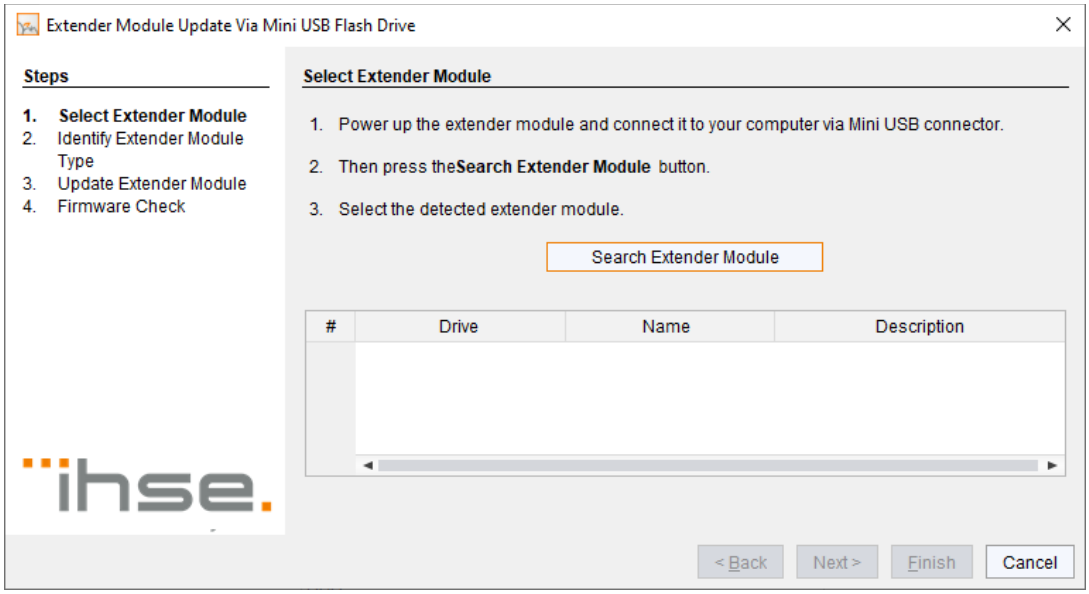


*Fig. 29 Tera Tool - Flash Update - **Select Extender Module***

4. Connect the extender module to your computer running the Tera Tool software using a Mini-USB cable.
5. Power up the extender module.
6. Click **Search Extender Module**.

   The flash drive of the connected extender module is displayed in the drive overview.

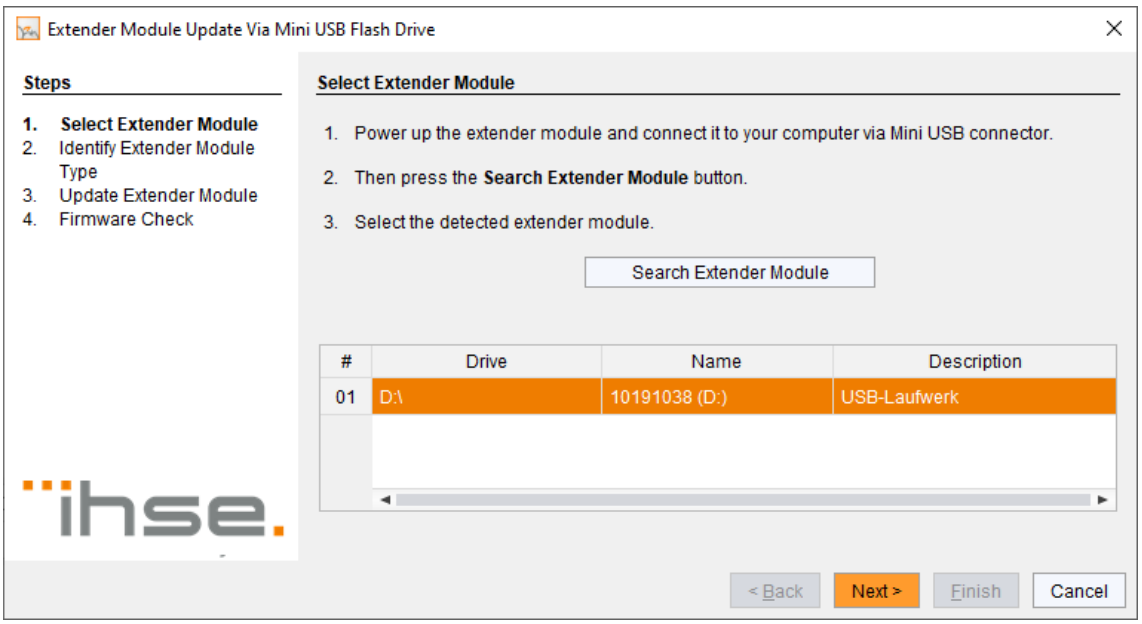


*Fig. 30 Tera Tool - Flash Update - **Select Extender Module***

7. Select the flash drive of the extender module to be updated.
8. Click **Next >**.

   The identification of the extender module type automatically starts.

   After successful identification, the extender module specific firmware is displayed in the **Status Log** area.

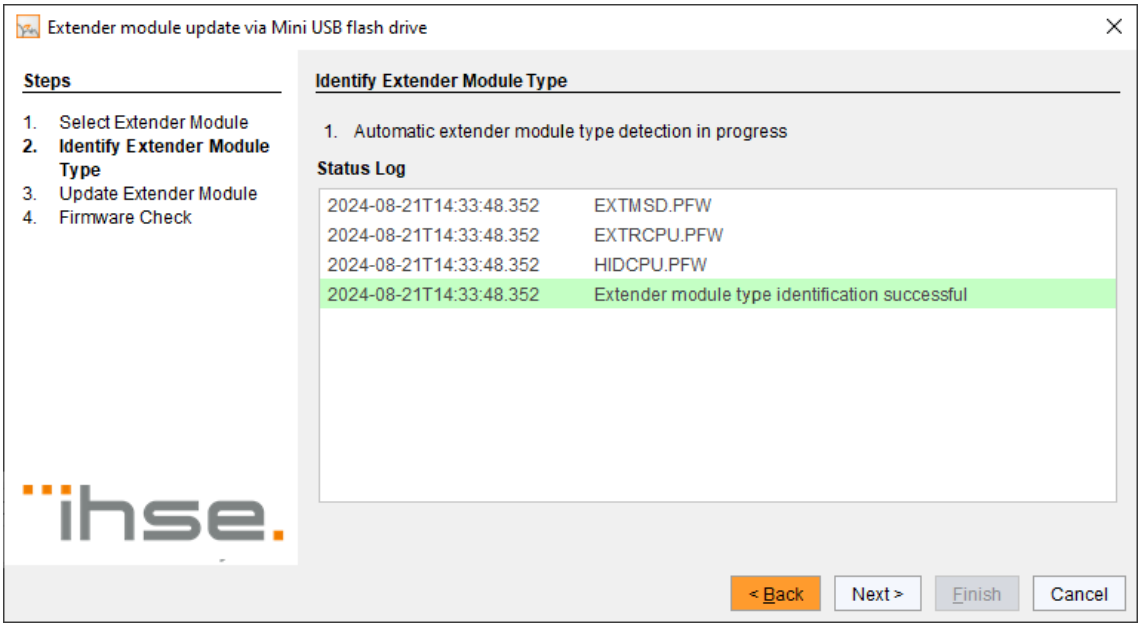


*Fig. 31 Tera Tool - Flash Update - **Identify Extender Module Type***

9. Click **Next >** after successful identification.

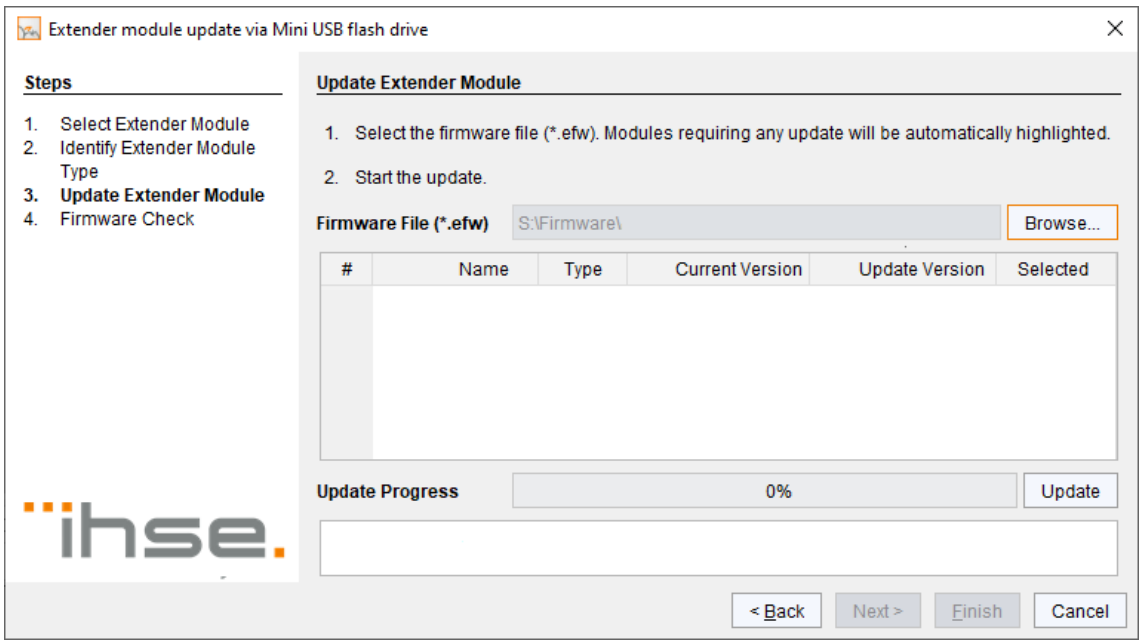


*Fig. 32 Tera Tool - Flash Update - **Update Extender Module - Select files***

10. Click **Browse…** to go to the location where the update files are saved.
11. Select the update files and click **Select** in the selection dialog.

    The firmware available for the extender module is displayed.

    Firmware requiring any update will be automatically highlighted.

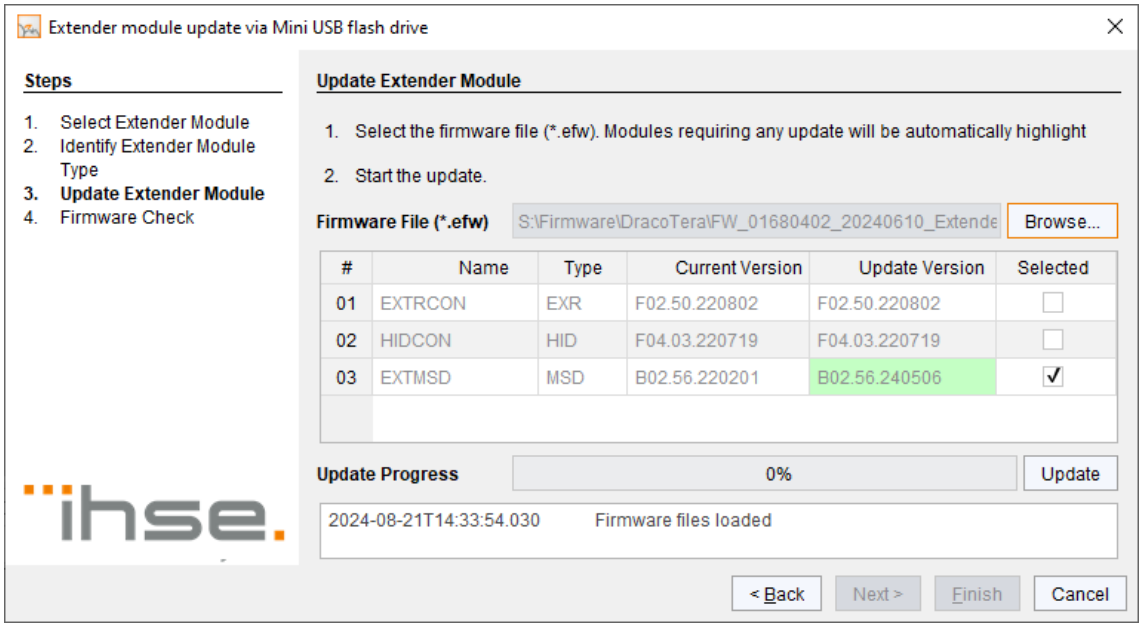


*Fig. 33 Tera Tool - Flash Update - **Update Extender Module - Load files***

12. Click **Update** to start the update process.

After the update of an MSD firmware, the extender module will automatically be restarted.

A green highlighted message appears when the firmware update has been completed.

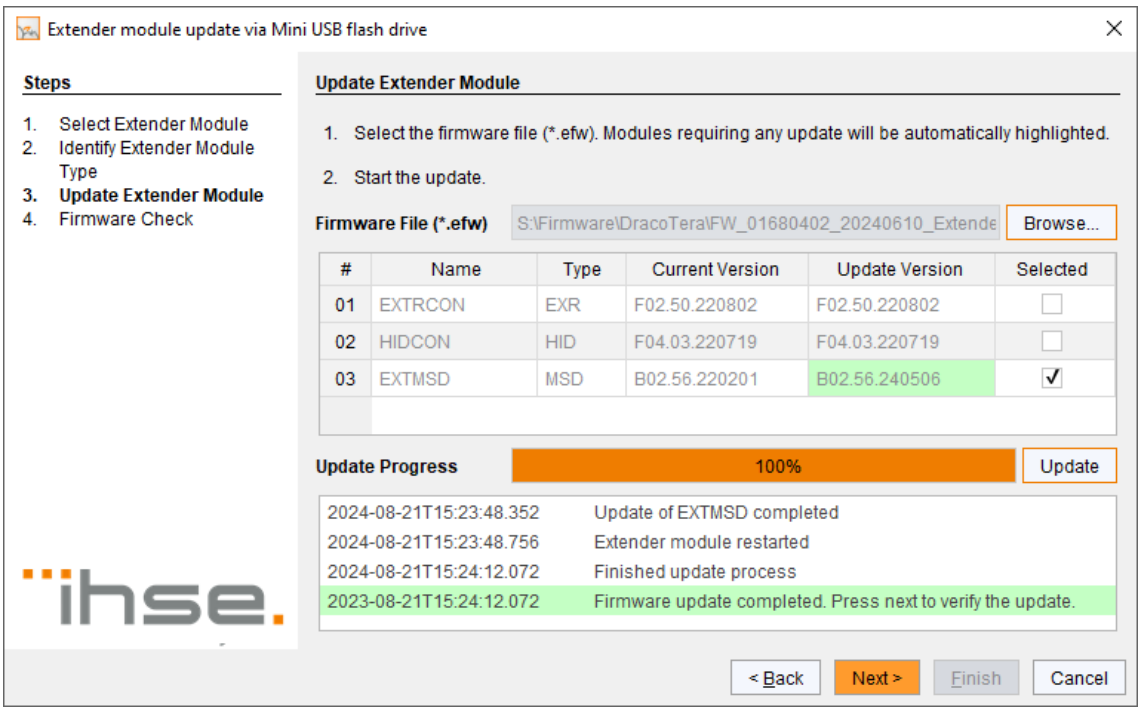


*Fig. 34 Tera Tool - Flash Update - **Update Extender Module - Firmware update completed***

13. Click **Next >** to verify the update.
14. Manually power off the extender module and power it on again.

    The extender module restarts, and validation begins automatically. The completion of the validation is displayed in the **Status Log** area.

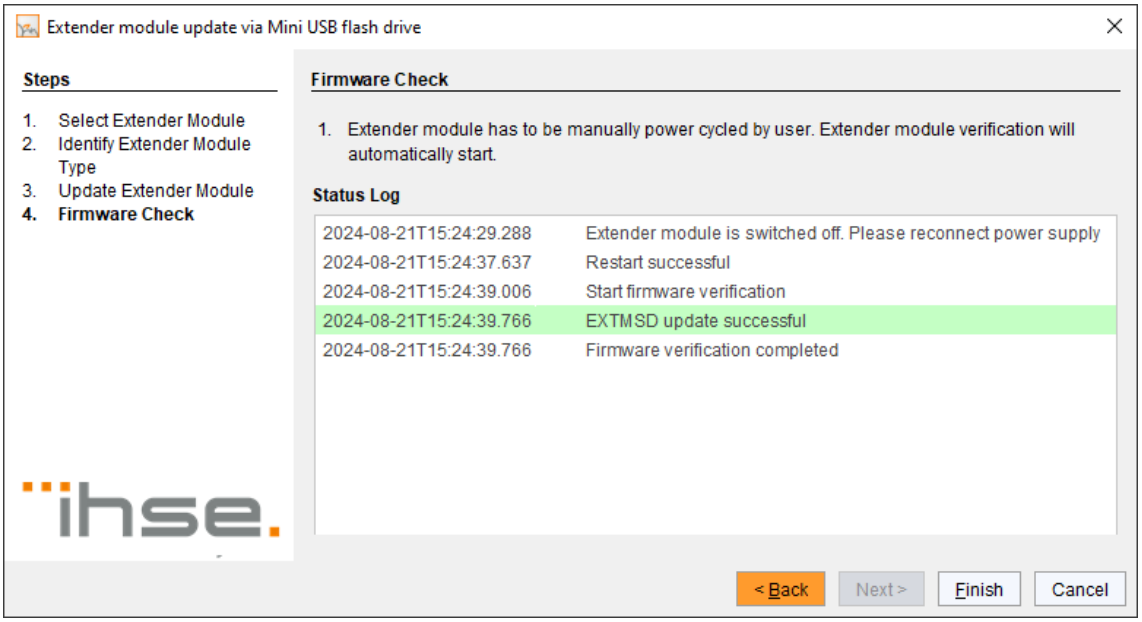


*Fig. 35 Tera Tool - Flash Update - **Firmware Check - Firmware verification completed***

15. Click **Finish**.

    The firmware update of the extender module is completed.

A dialog appears offering to update another extender module.

16. Click **Yes** to update another extender module or click **No** and **Finish** to quit the Update dialog.

9.5 Updating the Firmware of Extender Modules via Copy & Paste

The extender modules can be updated via copy & paste using the Mini-USB service port of the extender modules. The firmware type is part of the file name, e.g., for the MSD firmware `EXTDZMSD.pfw` with the file extension .pfw

Updating the firmware manually via copy & paste is usually not necessary. We recommend using the efficient flash update via Tera Tool software and to manually copy & paste only if a single firmware file should be updated. By means of the Tera Tool software, the parameters set in the `Config.txt` file are retained, and the extender module is automatically updated with firmware of the same name.

In rare cases, e.g., for the xxxMSD firmware, an update may be necessary to expand the functionality of certain extender modules for specific requirements. In this case, please contact the technical support of the manufacturer in advance

NOTICE

To process successful firmware updates and avoid failures:

- ➡ For firmware update of the extender module, use only stand-alone computers that are not integrated into the extender module setup.
- ➡ Ensure that the computer used for the firmware update is not set into standby mode or sleep mode during the update.
- ➡ Always update the firmware with firmware of the same name. The firmware of 483 and 493 series are not compatible with each other. The firmware of 1G extender modules of one series is not compatible with the firmware of 3G extender modules.

NOTICE

Possible failures when updating the extender firmware

In case the xxxMSD firmware part of an extender module requires an update, there may be dependencies between the new contents of xxxMSD firmware files and other extender firmware files. In this case, installing other firmware files before updating xxxMSD firmware files could lead to failed updates.

To perform successful firmware updates:

- ➡ Please check the release notes of the firmware package for dependencies between the extender firmware files.
- ➡ If you get information from the manufacturer's technical support that an update of xxxMSD firmware files of a certain extender module is required, please follow the instructions in this chapter.

By updating xxxMSD firmware via copy & paste, the `Config.txt` file will be overwritten. If there are parameters set in the `Config.txt` file, they are lost and have to be set again. To avoid resetting the parameters:

- ➡ Store the `Config.txt` file locally before updating xxxMSD firmware.
- ➡ Copy the stored `Config.txt` file after updating MSD firmware back to the flash drive of the extender module.

To achieve a successful firmware update, proceed as follows.

- ➡ Always update the firmware with firmware of the same name.
- ➡ First update the required xxxMSD firmware part.
- ➡ Update all firmware files sequentially, one by one, file by file.
- ➡ Wait between each copy process until the respective copy process has been completed.
- ➡ Restart the extender module after all copying operations of the other firmware files are completed.

However, if you are manually updating a single firmware part via Mini-USB service port on an extender module, we recommend updating all firmware on this extender module.

Preserving the Parameters of the Config.txt File

To store the `Config.txt` file before updating MSD firmware, if parameters have been set, proceed as follows:

1. Connect the extender module to any source using a Mini-USB cable.

   The extender module opens a flash drive containing the `Config.txt` file.
2. Copy the `Config.txt` file from the flash drive and paste it to a local directory of the connected computer.

Performing Firmware Updates via Copy & Paste

To perform manually a firmware update of an extender module via copy & paste using the Mini-USB service port, proceed as follows.

1. Connect the extender module to your computer via Mini-USB cable.

   The flash drive of the extender module opens.
2. Go to the location of the firmware update files.
3. If you got instructions from the manufacturer's technical support to update xxxMSD firmware part:
   3.1. Copy the first `xxxMSD.pfw` firmware file and paste it to the flash drive of the extender module.
   3.2. Wait until the copying process is complete.
   3.3. Manually power off the extender module after the copying process of the `xxxMSD.pfw` firmware file is completed. Power it on again.
   3.4. If several xxxMSD firmware parts have to be updated, copy and paste them individually. In each case, wait until the copying process has been completed, power off the extender module and power it on again.
4. Afterwards update the other firmware files if required, regarding the following steps:
   4.1. Copy additional firmware files one by one and paste it to the extender module flash drive.
   4.2. After copying each firmware file, wait until the copying process is complete, power off the extender module and power it on again.
5. Manually power off the extender module after copying all required firmware files.
6. Remove the Mini-USB cable from the extender module.
7. Power on the extender module.

   The extender module starts automatically with the new firmware.

9.6 Resetting an Extender Module to the Factory Settings

NOTICE
If a firmware update has been carried out since the delivery, the latest installed firmware version is retained.

To reset extender modules back to default, there are the following possibilities:

Parameter

1. Connect the extender module to any source using a Mini-USB cable.
   The extender module opens a flash drive containing the `Config.txt` file.
2. Delete the `Config.txt` file.
3. Manually power off the extender module.
4. Power on the extender module.
   The extender module restarts and the extender module's parameters, such as Serial No., the manufacturing p/n, and the video signal details, are written in the `Config.txt` file. The Config.txt file is in the default state and does not contain any parameters.

USB-HID Ghosting

1. Reset the USB-HID Ghosting by entering this keyboard command: Hot Key, h, r, Enter.

EDID of CPU Extender Modules

1. Connect the extender module to any source using a Mini-USB cable.
   The extender module opens a flash drive containing the `*.bin` file.
2. Delete the `*.bin` file.
3. Manually power off the extender module.
4. Power on the extender module.
   The extender module starts automatically, and the factory EDID is restored.

10 Troubleshooting

10.1 General Failures

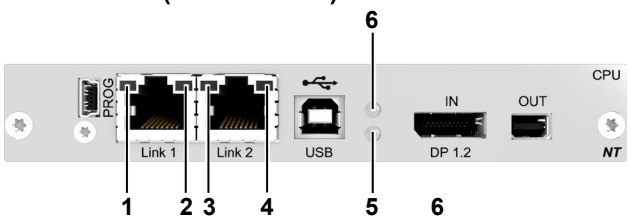
Diagnosis	Possible reason	Measure
`Config.txt` parameter without function.	Parameter not set or saved.	➡ Write the parameter into `Config.txt` file and save changes.
	Start command `#CFG` not set.	➡ Write the start command #CFG into first line of the `Config.txt` file.
	Parameter written incorrectly.	➡ Check correct spelling and capitalization.
	Extender module was not restarted.	➡ Restart the extender module.

10.2 Blank Screen

See also status indication of the extender modules in section 3.7, from page 24.

The LED status of the extender modules is described using the redundant Cat X extender modules with local input/output as an example.

Source side (CPU module)



Sink side (CON module)

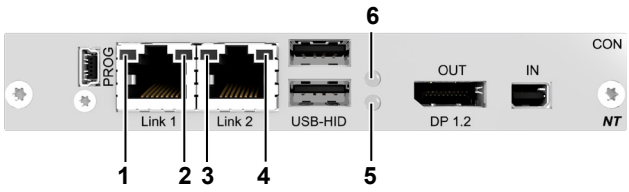


Fig. 36 Interface side of extender modules - Failure indication

10.2.1 Blank Screen with Point-to-Point Connection

Diagnosis	Possible reason	Measure
All LEDs are off.	Power supply voltage not available.	➡ Check the power supply units. ➡ Check the connection to the power network.
LED **1/3** or **2/4** flash.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
CON Unit: LED **5 and 6** flashing red/violet.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.

Diagnosis	Possible reason	Measure
CON Unit: LED **5 and 6** light up violet.	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CPU Unit: LED **5 and 6** light up red.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CPU Unit: LED **5 and 6** light up violet.	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CPU Unit: LED **5** lights up red and LED **6** lights up green.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
CPU Unit: LED **5 and 6** light up green.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.

10.2.2 Blank Screen with Matrix Connection

Diagnosis	Possible reason	Measure
All LEDs are off.	Power supply voltage not available.	➡ Check the power supply units. ➡ Check the connection to the power network.
LED **1/3** or **2/4** flash.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
CON Unit: LED **5 and 6** flashing red/violet.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	CON Device not switched to CPU Device.	➡ Switch the CON Device to the CPU Device.
	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CON Unit: LED **5 and 6** light up violet.	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.

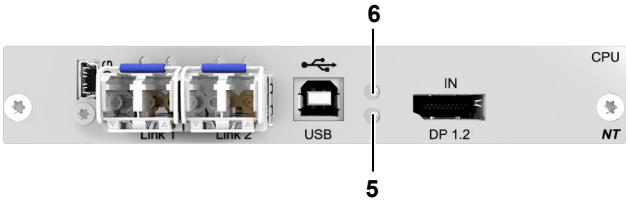
Diagnosis	Possible reason	Measure
CON Unit: LED **5** flashes green/light blue and LED **6** flashes red/violet.	CON Device not switched to CPU Device.	➡ Switch the CON Device to the CPU Device.
CPU Unit: LED **5 and 6** light up red.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	CON Device not switched to CPU Device.	➡ Switch the CON Device to the CPU Device.
	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CPU Unit and CON Unit: LED **5 and 6** light up violet.	No video signal detected.	➡ Check the video cable to the source. ➡ Check the connectors. ➡ Download the EDID from console monitors (see chapter 7.1, page 40). Reboot the source if necessary.
CPU Unit: LED **5** lights up red and LED **6** lights up green.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	CON Device not switched to CPU Device.	➡ Switch the CON Device to the CPU Device.
CPU Unit: LED **5 and 6** light up green.	No link connection between CON Unit and CPU Unit available.	➡ Check the interconnection cables. ➡ Check the connectors.
	CON Device not switched to CPU Device.	➡ Switch the CON Device to the CPU Device.

10.3 USB-HID Failure

See also status indication of the extender modules in section 3.7, from page 24.

The LED status of the extender modules is described using the redundant fiber extender modules as an example.

Quellenseite (CPU-Modul)



Senkenseite (CON-Modul)

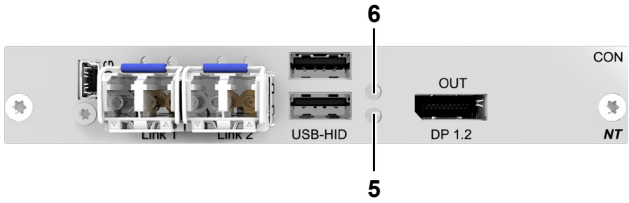


Fig. 37 Interface side of extender modules - Failure indication

10.3.1 USB-HID Failure with Point-to-Point Connection

In the following, diagnoses, causes and measures are described for the case that a video signal is present.

Diagnosis	Possible reason	Measure
The **Caps Lock** and **Scroll Lock** LEDs on the keyboard flash.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
USB device without function	No USB-HID device detected.	➡ Check the connection of the USB-HID cable to the USB-HID device. ➡ Connect a USB-HID device. ➡ Contact your distributor if necessary.
	The USB-HID device is not supported.	➡ Check the compatibility. ➡ New connection of the USB-HID device. ➡ Contact your distributor if necessary.
	No USB-HID connection to the source available.	➡ Check the connection of the USB cable to the source, select another USB-HID port if necessary. ➡ Remove the USB and power cables, first connect the power cable, then connect the USB cable, and restart the CPU Unit.
	Problems with the USB-HID connection at the CON Unit.	➡ Check the connection of the USB-HID cable to the USB-HID device. ➡ Remove the USB-HID and power cables, connect the power cable, then connect the USB cable, and restart the CON Unit.
CON Unit: LED **5** flashes green/light blue and LED **6** flashes red/violet.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.
CON Unit: LED **5** and **6** flash green/light blue.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.

Diagnosis	Possible reason	Measure
CPU Unit: LED **5** lights up green and LED **6** lights up red.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.
CPU Unit: LED **5** and **6** light up green.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.

10.3.2 USB-HID Failure with Matrix Connection

In the following, diagnoses, causes and measures are described for the case that a video signal is present.

Diagnosis	Possible reason	Measure
The **Caps Lock** and **Scroll Lock** LEDs on the keyboard flash.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
USB device without function	No USB-HID device detected.	➡ Check the connection of the USB-HID cable to the USB-HID device. ➡ Connect a USB-HID device. ➡ Contact your distributor if necessary.
	The USB-HID device is not supported.	➡ Check the compatibility. ➡ New connection of the USB-HID device. ➡ Contact your distributor if necessary.
	No USB-HID connection to the source available.	➡ Check the connection of the USB cable to the source, select another USB-HID port if necessary. ➡ Remove the USB and power cables, first connect the power cable, then connect the USB cable, and restart the CPU Unit.
	Problems with the USB-HID connection at the CON Unit.	➡ Check the connection of the USB-HID cable to the USB-HID device. ➡ Remove the USB-HID and power cables, connect the power cable, then connect the USB cable, and restart the CON Unit.
CON Unit: LED **1** flashes green/light blue and LED **2** flashes red/violet.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Device switched in **Video-only** Mode.	➡ Change access mode from **Video-only** to **Full Access**.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.
CON Unit: LED **1** and **2** flash green/light blue.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Device switched in **Video-only** Mode.	➡ Change access mode from **Video-only** to **Full Access**.

Diagnosis	Possible reason	Measure
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.
CPU Unit: LED **5** lights up green and LED **6** lights up red.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Device switched in **Video-only** Mode.	➡ Change access mode from **Video-only** to **Full Access**.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.
CPU Unit: LED **5** and **6** light up green.	The keyboard is in command mode.	➡ Press Esc to leave the command mode. ➡ Or press Left Shift + Esc to leave the command mode.
	Device switched in **Video-only** Mode.	➡ Change access mode from **Video-only** to **Full Access**.
	Shared operation of a redundant CPU Unit.	➡ Move the mouse or press any key to get back USB-HID control.

11 Technical Data

11.1 Interfaces

11.1.1 DisplayPort 1.2

Video

Parameters	Values	
Standard	DisplayPort 1.2	
Max. resolution with frame rate	Without MST	4096 px x 2160 px @ 60 Hz
	With MST	2x 1920 px x 1080 px @ 60 Hz or 2x 3840 x 2160 @ 30 Hz
Color depth/color component	Without MST	30 bit (4:4:4)
	With MST	8 bit (4:4:4)
Effective data rate	Max. 17.28 Gbit/s in High Bit Rate 2 (HBR2)	

Audio

Parameter	Value
Standards	Stereo Linear Pulse Code Modulation (LPCM)
Bit depth	16 to 24 bit
Sample rate	32 to 192 kHz

If using the MST functionality, the audio function is not available.

11.1.2 Mini DisplayPort 1.2

Video

Parameters	Values
Standard	DisplayPort 1.2
Max. resolution with frame rate	4096 px x 2160 px @ 60 Hz
Color depth/color component	10 bit per color (4:4:4)
Effective data rate	Max. 17.28 Gbit/s in High Bit Rate 2 (HBR2)

Audio

Parameter	Value
Standards	Stereo Linear Pulse Code Modulation (LPCM)
Bit depth	16 to 24 bit
Sample rate	32 to 192 kHz
Parameter	Value

11.1.3 USB-HID

Our devices with USB-HID interface support a maximum of two devices with USB-HID protocol. Each USB-HID port provides a maximum current of 100 mA.

Keyboard

Compatible with most USB keyboards. Certain keyboards with additional functions may require custom firmware to operate. Keyboards with an integral USB hub (Mac keyboards e.g.) are also supported, however, only a maximum of two devices are supported.

Mouse

Compatible with most 2-button, 3-button and scroll mice.

Other USB-HID Devices

The proprietary USB emulation supports certain other USB-HID devices, such as specific touch screens, graphic tablets, barcode scanners or special keyboards. However, support cannot be guaranteed for every USB-HID device. In certain cases, such devices can be operated with special firmware.

Extension

If it is required to extend the USB-HID signals on CPU or console side (e.g., mounting requirement), the signals can be extended either via a 3.0 m A-B cable (247-U2) or a 3.0 m USB A-A extension cable (436-USB20). The compatibility with other extension cables cannot be guaranteed.

Only two USB-HID devices are supported concurrently, such as keyboard and mouse or keyboard and touch screen. A hub is allowed, but it does not increase the number of devices allowed.
To support other USB 'non-HID' devices, such as scanners, web cams or memory devices, use the USB 2.0 interfaces.

11.1.4 Mini-USB

The Mini-USB interface enables a customer specified communication with extender modules. The firmware could also be updated using this interface.

11.1.5 RJ45 (Interconnection)

3G Cat X devices offer a 2.5GBASE-T interface to establish an interconnection between 3G Cat X devices. All four wire pairs are used in both directions. The cabling is suitable for a full duplex operation.

11.1.6 Fiber SFP Type LC (Interconnection)

The communication of fiber devices is performed via Gigabit SFPs and suitable fibers fitted with connectors of type LC (see chapter 11.2.2, page 61).

NOTICE

The correct function of the device can only be guaranteed with SFPs provided by the manufacturer.

NOTICE

SFP modules can be damaged by electrostatic discharge (ESD).
➥ Please consider ESD handling specifications.

11.2 Interconnection Cables

11.2.1 Cat X

NOTICE

Transmission problems

Routing over an active network component, such as an ethernet hub, switch, or router is not allowed. Operation with several patch fields is possible.

➡ Establish a point-to-point connection.

➡ Avoid routing Cat X cables along power cables.

NOTICE

Exceeding the limit of the device class

The use of unshielded Cat X cables with higher electromagnetic emissions/radiation can exceed the limit values for the specified device class.

➡ Correctly install shielded Cat X cable throughout interconnection, to maintain regulatory EMC compliance.

NOTICE

Exceeding limit values for electromagnetic radiation

The limit values for the electromagnetic radiation of the device are complied with if ferrites are mounted on both sides of all Cat X cables near the device. With installed ferrites, the devices meet the EU guidelines for electromagnetic compatibility. The operation of the devices without mounted ferrites leads to a loss of conformity with the EU directives.

➡ Mount ferrites on both sides of all Cat X cables near the device to maintain regulatory EMC compliance.

Type of Interconnection Cable

The extender modules require interconnection cabling specified for Gigabit Ethernet (1000BASE-T). The use of solid core (AWG24), shielded, Cat 5e (or better) is recommended.

Type of cable	Specification
Cat X installation cable AWG24	S/UTP (Cat 5e) cable according to EIA/TIA-568, standard 568-A or 568-B. Four pairs of wires AWG24. We recommend using standard 568-A, but standard 568-B is also supported.
Cat X patch cable AWG26/8	S/UTP (Cat 5e) cable according to EIA/TIA-568, standard 568-A or 568-B. Four pairs of wires AWG26/8. We recommend using standard 568-A, but standard 568-B is also supported.

The use of flexible cables (patch cables) type AWG26/8 is possible. However, the maximum possible extension distance is halved.

Maximum Transmission Range for Video and USB-HID Signals (End-to-End Connection)

Type of cable	Maximum transmission range
Cat X installation cable AWG24	140 m (460 ft)
Cat X patch cable AWG26/8	70 m (230 ft)

11.2.2 Fiber

NOTICE

Transmission problems

Routing over an active network component, such as an ethernet hub, switch, or router is not allowed. Operation with several patch fields is possible.

➡ Establish a point-to-point connection.

Type of Interconnection Cable*

Type of cable	Specification
Single-mode 9 µm	• Two fibers 9 µm • I-V(ZN)H 2E9 (in-house patch cable) • I-V(ZN)HH 2E9 (in-house breakout cable) • I/AD(ZN)H 4E9 (in-house or outdoor breakout cable, resistant) • A/DQ(ZN)B2Y 4G9 (outdoor cable, with protection against rodents)
Multi-mode 50 µm	• Two fibers 50 µm • I-V(ZN)H 2G50 (in-house patch cable) • I/AD(ZN)H 4G50 (in-house or outdoor breakout cable, resistant)

* Cable notations according to VDE

Maximum Transmission Range for Video and USB-HID Signals (End-to-End Connection)

NOTICE

Transmission ranges when using add-on modules with transparent USB

When using L474/R474 add-on modules with transparent USB, the binding specifications stated in the data sheets of the add-on modules apply.

Type of cable	Bandwidth	Maximum transmission range
Single-Mode 9 µm	1G	10,000 m (32,808 ft)
Single-Mode 9 µm	3G	5,000 m (16,404 ft)
Multi-Mode 50 µm (OM3)	1G/3G	1,000 m (3,280 ft)
Multi-Mode 50 µm	1G/3G	400 m (1,312 ft)

When using single-mode SFPs with multi-mode fiber optic cables, the maximum transmission range can usually be doubled.

Type of Connector

Connector	Type
Plug-in connector	LC-Connector

11.3 Video Cables

NOTICE

For 4K transmission via DisplayPort, the maximum length of the DisplayPort cable between CON module and monitor is 2 m according to the specification. We also recommend a maximum length of 2 m for other resolutions for which error-free transmission has been verified in our company.

If you use longer cables, interference may occur.

➡ Use only video cables with a maximum length of 2 m.

11.4 Connector Pinouts

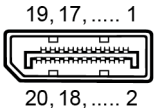
Upstream/Downstream

The pins of the DisplayPort sockets are assigned differently.

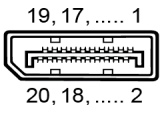
Upstream: data is sent (e.g., source, graphics card, video output of a device)

Downstream: data is received (e.g., sink, monitor, video input of a device

11.4.1 DisplayPort - Upstream

Connector	Pin	Signal	Pin	Signal
	1	ML_Lane 0 (p)	11	GND
	2	GND	12	ML_Lane 3 (n)
	3	ML_Lane 0 (n)	13	CONFIG1
	4	ML_Lane 1 (p)	14	CONFIG 2
	5	GND	15	AUX CH (p)
	6	ML_Lane 1 (n)	16	GND
	7	ML_Lane 2 (p)	17	AUX CH (n)
	8	GND	18	Hot Plug Detect
	9	ML_Lane 2 (n)	19	Power Out Return
	10	ML_Lane 3 (p)	20	Power out (+3.3 V/0.5 A)

11.4.2 DisplayPort - Downstream

Connector	Pin	Signal	Pin	Signal
	1	ML_Lane 3 (n)	11	GND
	2	GND	12	ML-LANE 0 (p)
	3	ML_Lane 3 (p)	13	Config1/GND
	4	ML_Lane 2 (n)	14	Config2/GND
	5	GND	15	AUX CH (p)
	6	ML_Lane 2 (p)	16	GND
	7	ML_Lane 1 (n)	17	AUX CH (n)
	8	GND	18	Hot Plug Detect
	9	ML_Lane 1 (p)	19	Power Out Return
	10	ML_Lane 0 (n)	20	Not connected

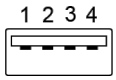
11.4.3 Mini-DisplayPort - Upstream

Connector	Pin	Signal	Pin	Signal
	1	GND	11	ML_Lane 1 (n)
	2	Hot Plug Detect	12	ML_Lane 3 (n)
	3	ML_Lane 0 (p)	13	GND
	4	CONFIG1	14	GND
	5	ML_Lane 0 (n)	15	ML_Lane 2 (p)
	6	CONFIG2	16	AUX_CH (p)
	7	GND	17	ML_Lane 2 (n)
	8	GND	18	AUX_CH (n)
	9	ML_Lane 1 (p)	19	Power Out Return
	10	ML_Lane 3 (p)	20	Not connected

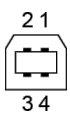
11.4.4 Mini-DisplayPort - Downstream

Connector	Pin	Signal	Pin	Signal
	1	GND	11	ML_Lane 1 (n)
	2	Hot Plug Detect	12	ML_Lane 0 (p)
	3	ML_Lane 3 (n)	13	GND
	4	CONFIG1	14	GND
	5	ML_Lane 3 (p)	15	ML_Lane 2 (p)
	6	CONFIG2	16	AUX_CH (p)
	7	GND	17	ML_Lane 2 (n)
	8	GND	18	AUX_CH (n)
	9	ML_Lane 1 (p)	19	Power Out Return
	10	ML_Lane 0 (n)	20	Power out (+3.3 V/0.5 A)

11.4.5 USB, Type A

Connector	Pin	Signal	Color
	1	+5 V (DC)	Red
	2	D -	White
	3	D +	Green
	4	GND	Black

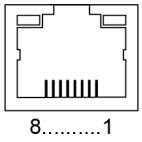
11.4.6 USB, Type B

Anschluss	Pin	Signal	Color
	1	+5 V (DC)	Red
	2	D -	White
	3	D +	Green
	4	GND	Black

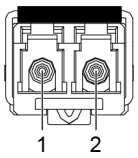
11.4.7 Mini-USB, Type B

Connector	Pin	Signal	Color
	1	+5 V (DC)	Red
	2	Data -	White
	3	Data +	Green
	4	Not connected	-
	5	GND	Black

11.4.8 RJ45 (Interconnection)

Connector	Pin	Signal	Pin	Signal
	1	D1+	5	D3-
	2	D1-	6	D2-
	3	D2+	7	D4+
	4	D3+	8	D4-

11.4.9 Fiber SFP Type LC (Interconnection)

Connector	Diode	Signal
	1	Data OUT
	2	Data IN

11.5 Current Draw and Power Consumption

NOTICE

Exceeding the maximum permissible current consumption

In addition to the current consumption of the extender and additional modules, there is also the current consumption by the connected periphery.

➡ Observe the maximum current consumption of the chassis (see chassis manual 474-BODY).

➡ To optimize the chassis equipment considering the chassis limitations, please refer to the Draco System Designer at https://dsd.ihse.com.

	CPU Unit L490-		CON Unit R490-	
Product type	Max. current draw	Max. power consumption	Max. current draw	Max. power consumption
BPHCXL*	1,900 mA	11 W	2,700 mA	17 W
BPHCXL-R1	1,650 mA	10 W	2,100 mA	12 W
BPHCXLR	2,100 mA	12 W	2,800 mA	16 W
BPHX	1,250 mA	8 W	1,500 mA	9 W
BPHXR	1,400 mA	9 W	1,650 mA	10 W
BPHXL	1,400 mA	9 W	1,790 mA	11 W
BPHXLR	1,550 mA	10 W	1,940 mA	12 W
BPHCX-M	1,700 mA	10 W	1,950 mA	10 W
BPHCXR-M	2,150 mA	12 W	2,400 mA	14 W
BPHX-M	1,250 mA	7 W	1,500 mA	8 W
BPHXR-M	1,250 mA	8 W	1,650 mA	9 W

*no longer available

11.6 Dimensions

Product type	Dimensions (WxHxD)
Extender modules	128.6 x 20 x 145 mm (5.1" x 0.8" x 5.7")

11.7 Weight

Extender	Weight CPU Unit L490	Weight CON Unit R490
BPHCXL*	220 g	230 g
BPHCXL-R1	220 g	230 g
BPHCXLR	235 g	230 g
BPHX	125 g	125 g
BPHXR	135 g	150 g
BPHXL	205 g	205 g
BPHXLR	230 g	210 g
BPHCX-M	140 g	150 g
BPHCXR-M	155 g	160 g
BPHX-M	125 g	125 g
BPHXR-M	135 g	150 g

*no longer available

11.8 Environmental Conditions and Emissions

Parameter	Value
Operating temperature	5 to 45 °C (41 to 113 °F)
Storage temperature	-25 to 60 °C (-13 to 140 °F)
Relative humidity	Max. 80% non-condensing
Operating altitude	Max. 2.500 m (7,500 ft)
Heat dissipation	Corresponds to power consumption in Watt (W)

11.9 MTBF

Specific MTBF values (mean time between failure) can be requested from the manufacturer’s technical support if required.

12 Technical Support

Prior to contacting support please ensure you have read this manual and installed and set-up your KVM extender as recommended.

12.1 Support Checklist

To efficiently handle your request, it is necessary that you complete a support request checklist (Download). Please ensure that you have the following information available before you call:

- Company, name, phone number and email
- Type and serial number of the device
- Date and number of sales receipt and name of dealer if necessary
- Issue date of the existing manual
- Nature, circumstances, and duration of the problem
- Components included in the system (such as graphic source/CPU, OS, graphic card, monitor, USB HID/USB 2.0 devices, interconnection cable) including manufacturer and model number
- Results from any testing you have done

12.2 Shipping Checklist

1. To return your device, you need an RMA number (Return Material Authorization). Therefore, please contact your dealer.
2. Package your devices carefully. Add all pieces which you received originally. Preferably use the original box.
3. Note your RMA number visibly on your shipment.

Devices that are sent in without an RMA number will not be accepted. The shipment will be sent back without being opened, postage unpaid.

13 Glossary

The following terms are commonly used in this manual or in video and KVM technology.

Term	Description
AES/EBU	Interface specification for the transmission of digital stereo, two-channel or mono audio signals between different devices according to the AES3 standard
Cat X	Any Cat 5e (Cat 6, Cat 7) cable
CON Unit	Component of a KVM extender module or Media Extender to connect to the console (monitor(s), keyboard, and mouse; optionally also with USB 2.0 devices)
Console	Keyboard, mouse, and monitor
CPU Unit	Component of a KVM extender module or Media Extender to connect to a source
DDC	Display Data Channel (DDC) is a serial communication interface between monitor and source. DDC enables data exchange via monitor cable and an automatic installation and configuration of a monitor driver by the operating system.
DisplayPort	A VESA standardized interface for all-digital transmission of audio and video data. The signals have LVDS level.
Dual-Head	A system with two video connections
EDID	Extended Display Identification Data (EDID) is a metadata format (128 Byte) for display devices to describe their capabilities to a video source (e.g., graphics card).
ESD	Electrostatic discharge (ESD) describes a sudden flow of electricity between two electrically charged objects. This can be caused by an electrical short circuit or a dielectric breakdown. This must be considered when unpacking the extender modules, during assembly and first usage.
Fiber	Single-mode or multi-mode fiber cables
KVM	Keyboard, video and mouse
LPCM	LPCM (Linear Pulse Code Modulation) is a pulse modulation method, also known as an uncompressed data format. The LPCM method is used for converting analog audio into digital audio with equally sized value ranges.
Mini-DisplayPort	A VESA standardized interface for all-digital transmission of audio and video data. The signals have LVDS level.
Mini-XLR	Industrial standard for electrical plug connections (3 pole) for the transmission of digital audio and control signals
MTBF	Mean Time Between Failure (MTBF) is measured in power-on hours and describes the system reliability.
Multi-Mode	50 µm multi-mode fiber cable or 62.5 µm multi-mode fiber cable
RCA (Cinch)	A non-standard plug connection for transmission of electrical audio and video signals, especially with coaxial cables
S/PDIF	Interface for electrical or optical transmission of digital stereo audio signals between different devices used in consumer electronics.

Term	Description
SFP	SFPs (Small Form Factor Pluggable) are pluggable interface modules for Gigabit connections. SFP modules are available for Cat X and fiber cables.
Single-Head	A system with one video connection
Single-Mode	9 µm single-mode fiber cable
TOSLINK	Standardized fiber connection system for digital transmission of audio signals (F05 plug connection)
USB-HID	USB-HID devices (Human Interface Device) allow users to interact with computers. There is no need for a special driver during installation. When connecting, the message “New USB-HID device found” is reported. Typical USB-HID devices include keyboards, mice, graphics tablets and touch screens. Storage, video, and audio devices are not USB-HID devices.

14 Index

15 Table of Figures

16 Change Log

This table offers an overview of the most important changes available, such as new functions, changed configuration or operation.

Edition	Date	Firmware version	Software version (Tera Tool)	Chapter	New functions/changes
Rev. 2	2025-07-10	Latest versions	V6.0.2.0 2025-05-28	3.3, 3.6	New modules MST and -R1 added
				5.2.4	Installation examples for MST modules added
				12.3	Notice added about recommended length of video cables to monitors
REV01.00	2022-01-07	Latest version	V4.0.2.0, 2021-04-19	-	Initial user manual in new format, generally actualized content