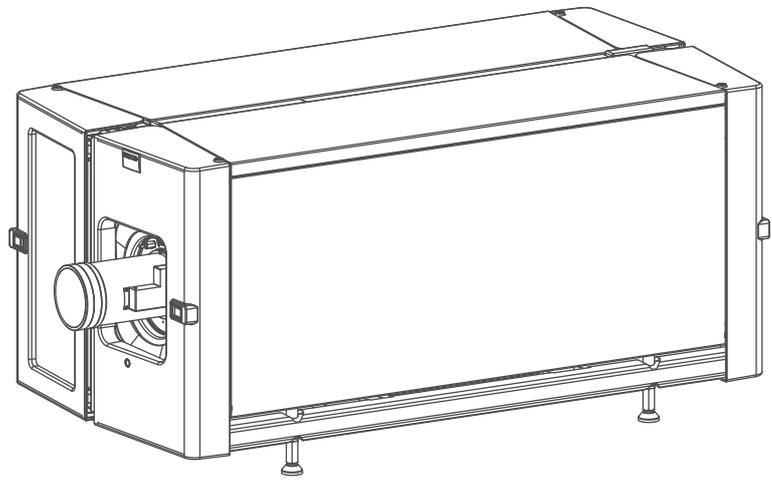


Thor series



Installation manual

Barco NV
President Kennedypark 35, 8500 Kortrijk, Belgium
www.barco.com/en/support
www.barco.com

Changes

Barco provides this manual 'as is' without warranty of any kind, either expressed or implied, including but not limited to the implied warranties or merchantability and fitness for a particular purpose. Barco may make improvements and/or changes to the product(s) and/or the program(s) described in this publication at any time without notice.

This publication could contain technical inaccuracies or typographical errors. Changes are periodically made to the information in this publication; these changes are incorporated in new editions of this publication.

The latest edition of Barco manuals can be downloaded from the Barco web site www.barco.com or from the secured Barco web site <https://www.barco.com/en/signin>.

Copyright ©

All rights reserved. No part of this document may be copied, reproduced or translated. It shall not otherwise be recorded, transmitted or stored in a retrieval system without the prior written consent of Barco.

Federal Communications Commission (FCC Statement)

This equipment has been tested and 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 may cause harmful interference, in which case the user will be responsible for correcting any 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

EN55022/CISPR22 Class A ITE (Information Technology Equipment)

Class A ITE is a category of all other ITE which satisfies the class A ITE limits but not the class B ITE limits. Such equipment should not be restricted in its sale but the following warning shall be included in the instructions for use:

Warning : 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. Contact the installer.

Warning : This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

Product Security Incident Response

As a global technology leader, Barco is committed to deliver secure solutions and services to our customers, while protecting Barco's intellectual property. When product security concerns are received, the product security incident response process will be triggered immediately. To address specific security concerns or to report security issues with Barco products, please inform us via contact details mentioned on <https://www.barco.com/psirt>. To protect our customers, Barco does not publically disclose or confirm security vulnerabilities until Barco has conducted an analysis of the product and issued fixes and/or mitigations.

Patent protection

Please refer to www.barco.com/about-barco/legal/patents

Guarantee and Compensation

Barco provides a guarantee relating to perfect manufacturing as part of the legally stipulated terms of guarantee. On receipt, the purchaser must immediately inspect all delivered goods for damage incurred during transport, as well as for material and manufacturing faults Barco must be informed immediately in writing of any complaints.

The period of guarantee begins on the date of transfer of risks, in the case of special systems and software on the date of commissioning, at latest 30 days after the transfer of risks. In the event of justified notice of complaint, Barco can repair the fault or provide a replacement at its own discretion within an appropriate period. If this measure proves to be impossible or unsuccessful, the purchaser can demand a reduction in the purchase price or cancellation of the contract. All other claims, in particular those relating to compensation for

direct or indirect damage, and also damage attributed to the operation of software as well as to other services provided by Barco, being a component of the system or independent service, will be deemed invalid provided the damage is not proven to be attributed to the absence of properties guaranteed in writing or due to the intent or gross negligence or part of Barco.

If the purchaser or a third party carries out modifications or repairs on goods delivered by Barco, or if the goods are handled incorrectly, in particular if the systems are operated incorrectly or if, after the transfer of risks, the goods are subject to influences not agreed upon in the contract, all guarantee claims of the purchaser will be rendered invalid. Not included in the guarantee coverage are system failures which are attributed to programs or special electronic circuitry provided by the purchaser, e.g. interfaces. Normal wear as well as normal maintenance are not subject to the guarantee provided by Barco either.

The environmental conditions as well as the servicing and maintenance regulations specified in this manual must be complied with by the customer.

Software License Agreement

You should carefully read the following terms and conditions before using this software. Your use of this software indicates your acceptance of this license agreement and warranty.

Terms and Conditions:

1. No redistribution of the software is allowed.
2. Reverse-Engineering. You may not reverse engineer, decompile, disassemble or alter this software product.

Disclaimer of Warranty:

This software and the accompanying files are sold "as is" and without warranties as to performance or merchantability or any other warranties whether expressed or implied. In no event shall Barco be liable for damage of any kind, loss of data, loss of profits, business interruption or other pecuniary loss arising directly or indirectly. Any liability of the seller will be exclusively limited to replacement of the product or refund of purchase price.

GNU-GPL code

If you would like a copy of the GPL source code contained in this product shipped to you on CD, please contact Barco. The cost of preparing and mailing a CD will be charged.

Trademarks

Brand and product names mentioned in this manual may be trademarks, registered trademarks or copyrights of their respective holders. All brand and product names mentioned in this manual serve as comments or examples and are not to be understood as advertising for the products or their manufacturers.

Table of contents

1	Welcome	9
1.1	About this manual	10
2	Safety Information	11
2.1	General considerations	12
2.2	Safety training to be provided by the installer	12
2.3	Important safety instructions	13
2.4	Product safety labels	17
2.5	High Brightness precautions: Hazard Distance (HD)	19
2.6	HD for fully enclosed projection systems	22
2.7	HD in function of modifying optics	23
3	System overview	25
3.1	Thor	27
3.2	Chillers and hoses	28
3.3	Safety system	30
3.4	Communicator Touch Panel	31
3.5	Communicator PC version	33
3.6	Commander & Web Commander	34
4	Getting started	35
4.1	Installation requirements	36
4.2	Unpacking the projector	38
4.3	Initial inspection	40
5	Installation process	41
5.1	Installation process overview	42
6	Physical installation	45
6.1	Removing the transport protection bars	46
6.2	Positioning the projector at port window	46
6.3	Connecting the hoses with projector and chillers	49
6.4	Connecting the data cable with projector and chillers	51
6.5	Accessing the mains compartment	51
6.6	Connecting the external safety interlocks	53
6.7	Three phase power input configuration of the projector	54
6.8	Connecting the projector with the mains electricity	55
6.9	Power loop through to the projector electronics	56
6.10	Connecting a UPS to the projector electronics	57
6.11	Installing the Communicator Touch Panel	58
7	Lenses & Lens selection	61

7.1	Available lenses	62
7.2	Lens selection	62
7.3	Lens installation	63
7.4	Lens removal	65
7.5	Lens shift, zoom & focus	66
8	Input & Communication	69
8.1	Introduction	70
8.2	Projector Status	70
8.3	Laser Status	71
8.4	Local Keypad	72
8.5	Cinema Controller	74
9	ICMP	77
9.1	ICMP introduction	79
9.2	ICMP HDD	80
9.3	ICMP communication ports	82
9.4	ICMP source input ports	83
9.5	ICMP DisplayPort specifications	84
9.6	ICMP SDI specifications	86
9.7	ICMP HDMI 2.0 specifications	89
9.8	ICMP HDMI 1.4 specifications	92
9.9	ICMP status LEDs	95
9.10	ICMP HDD status LEDs	96
9.11	ICMP device certificate	97
9.12	ICMP configuration via Communicator	99
9.13	ICMP reset	100
9.14	Obtaining the Barco ICMP certificate	101
9.15	Removing a HDD from the ICMP	102
9.16	Installing a HDD into the ICMP	103
10	Starting up	105
10.1	Switching the Thor series projector ON	106
10.2	Switching the Thor series projector OFF	107
10.3	Projector ON/OFF cycle explained	108
11	Scheimpflug	111
11.1	Scheimpflug introduction	112
11.2	Scheimpflug adjustment	113
11.3	Fixation of the Lens Holder front plate	116
11.4	Back Focal Length adjustment	117
12	Convergence	123
12.1	Convergence controls	124
12.2	Preparing for convergence adjustment	126
12.3	Converging the red pattern onto the blue pattern	127
12.4	Converging the green pattern onto the blue pattern	128
13	Calibration	131
13.1	Calibration process	132
13.2	White point calibration	133
13.3	Color gamut calibration	135
13.4	Luminance calibration	137
14	Preventative maintenance actions	139
14.1	1 month maintenance actions	140

14.2	3 month maintenance actions	140
15	Maintenance procedures	143
15.1	Check the dust filters	144
15.2	Vacuum cleaning of the dust filters	145
15.3	Washing and drying the dust filters	145
15.4	Cleaning the lens	146
15.5	Cleaning the exterior of the projector.....	147
15.6	Authorization to clear security warning on the projector	147
16	Removal and installation of the projector covers.....	149
16.1	Opening the front and rear cover doors	150
16.2	Removal of the top cover	150
16.3	Removal of the side covers	151
A	Specifications	153
A.1	Specifications of the Thor	154
A.2	Specifications of the Thor+	155
A.3	Specifications of the ICMP	156
A.4	Dimensions of the Thor series projector	158
A.5	Technical Regulations	159
B	Pin configurations	161
B.1	About General Purpose Inputs & Outputs (GPIO)	162
B.2	Pin configurations of the Cinema Controller communication ports.....	163
B.3	Pin configurations of the ICMP communication ports	165
C	Environmental information	169
C.1	Disposal information.....	170
C.2	Turkey RoHS compliance	170
C.3	Hazards	170
C.4	Contact information	171
C.5	Production address.....	171
C.6	Download Product Manual	171
	Glossary.....	173
	Index.....	177

Welcome

1

Congratulations

May we congratulate you on your purchase of a Barco Thor! It is our sincere wish that this digital projector meets up to your every expectation and that you thereby take a little time to page through this important manual. Familiarizing yourself with it's features, important safety instructions and necessary maintenance actions, will ensure you enjoy many years of reliable, trouble-free high quality performance.

Overview

- About this manual

1.1 About this manual

How to use this manual?

We suggest that you read over this manual before you install and use your Thor. Inside it, you will find important information regarding safety, installation and maintenance. We urge even the experienced user to take the necessary time to page through this manual. We believe everyone will benefit from this manual. Not in the least our editors, who will sleep more comfortably knowing their efforts have had their effect.



Some illustrations and descriptions in this document may be different than the product delivered. E. g. Illustrations with two chillers instead of one. For Thor series only one chiller has to be taken into account.

What's expected from you?

For your safety and in the interest of reliable, trouble-free, high quality performance, we urge the user/operator/service technician, to follow all instructions precisely. Follow the maintenance recommendations and procedures in this manual step by step to keep your projector in excellent condition. Doing so will directly impact the lifetime of your Thor.

If, after having read over these instructions, you experience difficulties, please contact your Barco service partner! They will do their best to assist you and get you up and running as soon as possible.

“Treat your Thor as your own and it will reward you with many trouble-free years of exquisite digital entertainment pleasure!”

Safety Information

2

About this chapter

Read this chapter attentively. It contains important information to prevent personal injury while installing and using your Thor series projector. Furthermore, it includes several cautions to prevent damage to your Thor series projector. Ensure that you understand and follow all safety guidelines, safety instructions and warnings mentioned in this chapter before installing and using the Thor series projector. After this chapter, additional “warnings” and “cautions” are given depending on the procedure. Read and follow these “warnings” and “cautions” as well.

Clarification of the term “Thor series” used in this document

When referring in this document to the term “Thor series” means that the content is applicable for following Barco products:

- THOR
- THOR+

Model certification name

- Thor : DP4K-20LHC
- Thor+ : DP4K-40LHC



Barco provides a guarantee relating to perfect manufacturing as part of the legally stipulated terms of guarantee. Observing the specification mentioned in this chapter is critical for projector performance. Neglecting this can result in loss of warranty.

Overview

- General considerations
- Safety training to be provided by the installer
- Important safety instructions
- Product safety labels
- High Brightness precautions: Hazard Distance (HD)
- HD for fully enclosed projection systems
- HD in function of modifying optics

2.1 General considerations

General safety instructions

- Before operating this equipment please read this manual thoroughly and retain it for future reference.
- Installation and preliminary adjustments should be performed by qualified Barco personnel or by authorized Barco service dealers.
- All warnings on the projector and in the documentation manuals should be adhered to.
- All instructions for operating and use of this equipment must be followed precisely.
- All local installation codes should be adhered to.

Notice on safety

This equipment is built in accordance with the requirements of the international safety standards IEC60950-1, EN60950-1, UL60950-1 and CAN/CSA C22.2 No.60950-1, which are the safety standards of information technology equipment including electrical business equipment. These safety standards impose important requirements on the use of safety critical components, materials and insulation, in order to protect the user or operator against risk of electric shock and energy hazard and having access to live parts. Safety standards also impose limits to the internal and external temperature rises, radiation levels, mechanical stability and strength, enclosure construction and protection against the risk of fire. Simulated single fault condition testing ensures the safety of the equipment to the user even when the equipment's normal operation fails.

Notice on optical radiation

This projector embeds extremely high brightness (radiance) lasers; this laser light is processed through the projector's optical path. Native laser light is not accessible by the end user in any use case. The light exiting the projection lens has been defused within the optical path, representing a larger source and lower radiance value than native laser light. Nevertheless the projected light represents a significant risk for the human eye when exposed directly within the beam. This risk is not specifically related to the characteristics of laser light but solely to the high thermal induced energy of the light source; which is equivalent with lamp based systems.

Thermal retinal eye injury is possible when exposed within the Hazard Distance (HD). The HD is defined from the projection lens surface towards the position of the projected beam where the irradiance equals the maximum permissible exposure as described in the chapter "Hazard Distance".



WARNING: No direct exposure to the beam within the hazard distance shall be permitted, RG3 IEC 62471-5:2015



CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Owner's record

The part number and serial number are printed on a label which is stuck on the respective part. Record these numbers in the spaces provided below. Refer to them whenever you call upon your Barco dealer regarding this product.

Product article number	
Product serial number	
Dealer	

2.2 Safety training to be provided by the installer



WARNING: The installer is responsible that the user is instructed. The user will sign a document to confirm that the instructions have been received and understood.

Users definition

The Thor is intended for persons who have been instructed and trained by a skilled person (installer or service personnel) to identify energy sources that may cause injury and to take precautions to avoid unintentional contact with or exposure to those energy sources.

The skilled person must instruct the user about:

- High intensity light beam. The user must respect the exclusion zone, based on the light beam Hazard Distance (HD).
- Dangerous energy sources inside the projector. The user is not allowed to remove any cover from the projector.
- The installation, maintenance or service is for skilled persons only.
- The requirements for a **restricted access location**, an **exclusion zone** and a **restriction zone**.

Restricted access location

To protect untrained persons and children, the projector must be installed in a **restricted access location**. The definition of a **restricted access location** is a location for equipment where both of the following paragraphs apply:

- Access can only be gained by skilled persons (installer or service personnel) or persons who have been instructed and trained by a skilled person. The persons must have been instructed about the reasons for the restriction applied to the location and about the precautions that shall be taken.
- Access is only possible through the use of the tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

Why a restricted access location: This is a RG3 product. Based on international requirements, no person is allowed to enter the projected beam within the zone between the projection lens and the related Hazard Distance (HD). This shall be physically impossible by creating sufficient separation height or by placing optional barriers. Within the restricted area operator training is considered sufficient. The applicable separation heights are discussed in "High Brightness precautions: Hazard Distance (HD)", page 19.

Exclusion zone

The projector radiates heat on its external surfaces and from ventilation ducts during normal operation. Exposing flammable or combustible materials into close proximity of this projector could result in the spontaneous ignition of that material, resulting in a fire. For this reason, it is absolutely necessary to leave an exclusion zone around all external surfaces of the projector whereby no flammable or combustible materials are present:

- The exclusion zone must not be less than 40 cm (16 in).

Restriction zone

To protect untrained users and children against high intensity light beams, the light beam Hazard Distance (HD) shall be taken into account.

2.3 Important safety instructions

To prevent the risk of electrical shock

- This product is equipped with a five-terminal barrier strip for the connection of a 3W+N+PE or 3W+PE three phase power system.
- This projector should be operated from an AC power source. Ensure that mains voltage and capacity matches the projector electrical ratings.
- **Electrical ratings for Star system (3W+N+PE):**
 - The cross-sectional area of the conductors in the power supply cord shall be 4mm² to 6mm², 10AWG to 8AWG.
 - The electrical rating of the Thor+ projector is 200-240V/346-415V 3W+N+PE 16A 50-60Hz (Y connection) (Y connection).
 - The electrical rating of the Thor projector is 200-240V/346-415V 3W+N+PE 10A 50-60Hz (Y connection) (Y connection).

- The building installation has to be provided with a circuit breaker of range 25A to 40A to protect the complete unit.
- **Electrical ratings for Delta system (3W+PE):**
 - The cross-sectional area of the conductors in the power supply cord shall be 6mm², 8AWG.
 - The electrical rating of the Thor+ projector is 200-240V 3W+PE 28A 50-60Hz (Δ connection) (Δ connection).
 - The electrical rating of the Thor projector is 200-240V 3W+PE 15A 50-60Hz (Δ connection) (Δ connection).
 - The building installation has to be provided with a circuit breaker of 40A to protect the complete unit.
- **REMARK for Thor+ projector:** In case of a Delta system (3W+PE) the circuit breakers rated lower than 40A can trip unwanted because of the internal laser power supply redundancy system. The projector remains working if one internal laser power supply module fails or is removed, but this results in a higher current in one mains power line. In case of very low line voltage (between 180V and 200V), and one failed or removed laser power supply, the line current can reach 35A.
- Installation according to the local electrical code and regulations by qualified technical personnel only. Do not defeat the purpose of the grounding.
- The cross-sectional area of the UPS inlet cord shall be not less than 0.75 mm² or AWG 18.
- The electronics of the projector (UPS INLET) must be powered either from a suitable UPS unit or from the power outlet socket (UPS OUTLET) provided on the projector. An adapted short power cord (2-pole 3-wire grounding) is added to the projector accessories to loop through the power from UPS OUTLET to UPS INLET.
- The provided power output socket (UPS OUTLET) on the projector may only be used to provide power to the projector electronics (UPS INLET). Never connect other devices to this power output socket.
- A readily accessible disconnect device must be incorporated externally to the equipment for removal of the power to the projector mains terminals.
- Disconnect the power to the projector mains terminals and unplug the power cord at UPS INLET for removal of all power from the projector.
- Warning: High leakage current. Earth connection essential before connecting supply.
- Do not allow anything to rest on the power cord. Do not locate this projector where persons will walk on the cord.
- Do not operate the projector with a damaged cord or if the projector has been dropped or damaged - until it has been examined and approved for operation by a qualified service technician.
- Position the cord so that it will not be tripped over, pulled, or contact hot surfaces.
- If an extension cord is necessary, a cord with a current rating at least equal to that of the projector should be used. A cord rated for less amperage than the projector may overheat.
- Never push objects of any kind into this projector through cabinet slots as they may touch dangerous voltage points or short circuit parts that could result in a risk of fire or electrical shock.
- Do not expose this projector to rain or moisture.
- Do not immerse or expose this projector in water or other liquids.
- Do not spill liquid of any kind on this projector.
- Should any liquid or solid object fall into the cabinet, unplug the set and have it checked by qualified service personnel before resuming operations.
- Do not disassemble this projector, always take it to a trained service person when service or repair work is required.
- Do not use an accessory attachment which is not recommended by the manufacturer.
- Lightning - For added protection for this video product during a lightning storm, or when it is left unattended and unused for long periods of time, remove all power from the projector. This will prevent damage to the projector due to lightning and AC power-line surges.

To prevent fire hazard

- Do not place flammable or combustible materials near the projector!
- Barco large screen projection products are designed and manufactured to meet the most stringent safety regulations. This projector radiates heat on its external surfaces and from ventilation ducts during normal operation, which is both normal and safe. Exposing flammable or combustible materials into close proximity of this projector could result in the spontaneous ignition of that material, resulting in a fire. For this reason, it is absolutely necessary to leave an "exclusion zone" around all external surfaces of the projector whereby no flammable or combustible materials are present. The exclusion zone must be not less than 40 cm (16") for all DLP Cinema projectors. The exclusion zone on the lens side must be at least 5 m. Do not

cover the projector or the lens with any material while the projector is in operation. Keep flammable and combustible materials away from the projector at all times. Mount the projector in a well ventilated area away from sources of ignition and out of direct sun light. Never expose the projector to rain or moisture. In the event of fire, use sand, CO₂ or dry powder fire extinguishers. Never use water on an electrical fire. Always have service performed on this projector by authorized Barco service personnel. Always insist on genuine Barco replacement parts. Never use non-Barco replacement parts as they may degrade the safety of this projector.

- Ensure no miss alignment can occur. Prolonged long time exposure of back wooden walls at close distance (< 20cm) can represent a fire risk. After alignment the projector shall be securely mounted to the pedestal.
- Slots and openings in this equipment are provided for ventilation. To ensure reliable operation of the projector and to protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the projector too close to walls, or other similar surface. This projector should never be placed near or over a radiator or heat register. This projector should not be placed in a built-in installation or enclosure unless proper ventilation is provided.
- Projection rooms must be well ventilated or cooled in order to avoid build up of heat. It is necessary to vent hot exhaust air from projector and cooling system (chiller units) to the outside of the building.
- Let the projector cool completely before storing. Remove cord from the projector when storing.

To prevent battery explosion

- Danger of explosion if battery is incorrectly installed.
- Replace only with the same or equivalent type recommended by the manufacturer.
- For disposal of used batteries, always consult federal, state, local and provincial hazardous waste disposal rules and regulations to ensure proper disposal.

To prevent personal injury

- To prevent injury and physical damage, always read this manual and all labels on the system before powering the projector or adjusting the projector.
- Do not underestimate the weight of the projector. The projector weighs ± 240 kg (± 529 lbs). To prevent personal injury a hoisting tool should be used to lift the projector.
- To prevent injury, ensure that the lens, cooling system and all cover plates are correctly installed. See installation procedures.
- Warning: high intensity light beam. NEVER look into the lens ! High luminance could result in damage to the eye.
- **Warning: extremely high brightness projector:** This projector embeds extremely high brightness (radiance) lasers; this laser light is processed through the projectors optical path. Native laser light is not accessible by the end user in any use case. The light exiting the projection lens has been defused within the optical path, representing a larger source and lower radiance value than native laser light. Nevertheless the projected light represents a significant risk for the human eye when exposed directly within the beam. This risk is not specific related to the characteristics of laser light but solely to the high thermal induced energy of the light source; which is comparable with lamp based systems. Thermal retinal eye injury is possible when exposed within the Hazard Distance. The Hazard Distance (HD) is defined from the projection lens surface towards the position of the projected beam where the irradiance equals the maximum permissible exposure as described in the chapter "High Brightness precautions: Hazard Distance (HD)", page 19.
- Based on international requirements, no person is allowed to enter the projected beam within the zone between the projection lens and the related Hazard Distance (HD). This shall be physically impossible by creating sufficient separation height or by placing optional barriers. Within the restricted area operator training is considered sufficient. The applicable separation heights are discussed in "High Brightness precautions: Hazard Distance (HD)", page 19.
- The projector shall be installed in a restricted access room equipped with a key or security lock preventing untrained persons entering the Class 4 use zone.
- Before attempting to remove any of the projector's covers, disconnect the projector power cable from the mains electricity for removal of all power from the projector.
- When required to remove all power from the projector (e.g. during service), always disconnect the power from the projector mains terminals and UPS INLET connector. Use the disconnect device in the building installation to disconnect the power to the projector mains terminals, and unplug the power cord at the UPS INLET connector if the UPS INLET is separately powered.
- Do not place this equipment on an unstable cart, stand, or table. The product may fall, causing serious damage to it and possible injury to the user.

- Lenses, shields or screens shall be changed if they have become visibly damaged to such an extent that their effectiveness is impaired. For example by cracks or deep scratches.
- The associated Laser Safety responsible of the unit must evaluate the setup before the unit may be started.
- Never point or allow light to be directed on people or reflective objects within the HD zone.
- If the unit is shut down, remove the key control from the system; avoiding unauthorized startup.
- All operators shall have received adequate training and be aware of the potential hazards.
- Strictly minimize the number of people who have access to the unit. The unit may never be operated without permission of the responsible for laser safety.
- When the projected light causes a dangerous situation the operator must hit the beam stop button which is located close to the control panel. The beam stop removes all power from the laser power supplies.
- Don't put your hand in front of the beam.
- Do not clean the port window when the projector is switched on.
- Position the hoses of the cooling system so that they will not be tripped over, pulled, or contact hot surfaces.

On servicing

- Do not attempt to service this product yourself, as opening or removing covers may expose you to dangerous voltage potentials and risk of electric shock.
- Refer all servicing to qualified service personnel.
- Attempts to alter the factory-set internal controls or to change other control settings not specially discussed in this manual can lead to permanent damage to the projector and cancellation of the warranty.
- Remove all power from the projector and refer servicing to qualified service technicians under the following conditions:
 - When the power cord or plug is damaged or frayed.
 - If liquid has been spilled into the equipment.
 - If the product has been exposed to rain or water.
 - If the product does not operate normally when the operating instructions are followed. Adjust only those controls that are covered by the operating instructions since improper adjustment of the other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
 - If the product has been dropped or the cabinet has been damaged.
 - If the product exhibits a distinct change in performance, indicating a need for service.
- Replacement parts: When replacement parts are required, be sure the service technician has used original Barco replacement parts or authorized replacement parts which have the same characteristics as the Barco original part. Unauthorized substitutions may result in degraded performance and reliability, fire, electric shock or other hazards. Unauthorized substitutions may void warranty.
- Safety check: Upon completion of any service or repairs to this projector, ask the service technician to perform safety checks to determine that the product is in proper operating condition.

To prevent projector damage

- The air filters of the projector must be cleaned or replaced on a regular basis. Cleaning the booth area would be monthly-minimum. Neglecting this could result in disrupting the air flow inside the projector, causing overheating. Overheating may lead to the projector shutting down during operation.
- The projector must always be installed in a manner which ensures free flow of air into its air inlets.
- If more than one projector is installed in a common projection booth, the exhaust air flow requirements are valid for EACH individual projector system. Note that inadequate air extraction or cooling will result in decreased life expectancy of the projector as a whole as well as causing premature failure of the lasers.
- In order to ensure that correct airflow is maintained, and that the projector complies with Electromagnetic Compatibility (EMC) and safety requirements, it should always be operated with all of its covers in place.
- Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should never be placed near or over a radiator or heat register. The device should not be placed in a built-in installation or enclosure unless proper ventilation is provided.
- Ensure that nothing can be spilled on, or dropped inside the projector. If this does happen, switch off and remove all power from the projector. Do not operate the projector again until it has been checked by qualified service personnel.

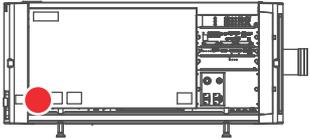
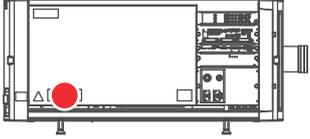
- Do not block the projector cooling fans or free air movement around the projector.
- Proper operation of the projector can only be guaranteed in table mounting. It is not permitted to use the projector in another position. See installation procedure for correct installation.
- **Special care for Laser Beams:** Special care should be used when DLP projectors are used in the same room as high power laser equipment. Direct or indirect hitting of a laser beam on to the lens can severely damage the Digital Mirror Devices™ in which case there is a loss of warranty.
- Never place the projector in direct sunlight. Sunlight on the lens can severely damage the Digital Mirror Devices™ in which case there is a loss of warranty.
- Save the original shipping carton and packing material. They will come in handy if you ever have to ship your equipment. For maximum protection, repack your set as it was originally packed at the factory.
- Disconnect the power to the projectors mains terminals before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning. Never use strong solvents, such as thinner or benzine or abrasive cleaners, since these will damage the cabinet. Stubborn stains may be removed with a cloth lightly dampened with mild detergent solution.
- To ensure the highest optical performance and resolution, the projection lenses are specially treated with an anti-reflective coating, therefore, avoid touching the lens. To remove dust on the lens, use a soft dry cloth. For lens cleaning follow the instructions precisely as stipulated in the projector manual.
- Rated maximum ambient temperature, $t_a = 30^{\circ}\text{C}$ (86°F).
- Rated humidity = 0% RH to 80% RH Non-condensed.
- An external frame must be used to stack projectors.
- For functionality and reliability, the projector requires accurate temperature control and cooling below ambient. Therefore a liquid cooling system is provided consisting of liquid circuits inside the projector which are connected via hoses to external chillers. Only chiller models and hoses exclusively developed for this application and approved by Barco are allowed to be used. Barco approved chillers models are listed on the Barco website.
- An adequate draining system must be coupled with the drain pipes at the bottom of the projector to collect and lead away the condensed water from the built-in air-dryers. The capacity of the draining system must meet the humidity conditions wherein the projector operates. The water drain must arrive into an 'open' water container!

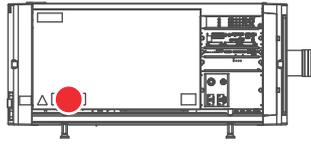
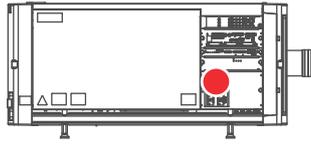
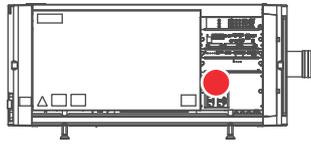
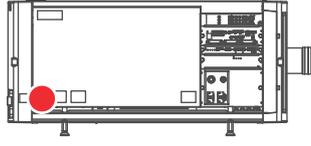
Safety Data Sheets for Hazardous Chemicals

For safe handling information on chemical products, consult the Safety Data Sheet (SDS). SDSs are available upon request via safetydatasheets@barco.com.

2.4 Product safety labels

Light beam related safety labels

Label image	Label description	Label location
	Hazard RG3: optical radiation warning symbol	
	WARNING! DO NOT LOOK INTO THE LIGHT BEAM NO DIRECT EYE EXPOSURE TO THE BEAM IS PERMITTED. RG3 IEC EN 62471-5:2015 CLASS 1 IEC EN 60825-1:2014 HAZARD DISTANCE: CONSULT SAFETY MANUAL. COMPLIES WITH 21 CFR 1040 EXCEPT WITH RESPECT TO THOSE CHARACTERISTICS AUTHORIZED BY VARIANCE NUMBER 2014-V-0285 DATED APRIL 14, 2016 RISK GROUP 3 LIP IEC 62471:2006	

Label image	Label description	Label location
	<p>警告！勿观看光束 眼睛勿直接接触可允许暴露的光束 (RG3 IEC EN 62471-5:2015 CLASS 1 IEC EN 60825-1:2014) 危害距离：请参考安全手册</p> <p>DANGER ! NE PAS REGARDER LE FAISCEAU EVITER TOUTE EXPOSITION DIRECTE DES YEUX AU FAISCEAU (RG3 IEC EN 62471-5:2015 CLASS 1 IEC EN 60825-1:2014) DISTANCE DE SECURITE : CONSULTER LE MANUEL DE SECURITE</p>	
	<p>Beam stop. Arrêt de faisceau. 光束衰减器</p>	
	<p>Enable key. Clé de active. 启动钥匙</p>	
	<p>Hazard RG3: not for household use symbol</p>	

Electric related safety labels

Label image	Label description	Label location
	<p>Disconnect the power to the unit mains terminals and unplug power cord at UPS inlet for removal of all power from the unit.</p> <p>WARNING : HIGH LEAKAGE CURRENT EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY SEE INSTALLATION INSTRUCTIONS BEFORE CONNECTING TO THE SUPPLY.</p> <p>Déconnecter l'alimentation des bornes du réseau et déconnecter le câble de la prise UPS pour la coupure de toute l'alimentation de l'appareil. ATTENTION : COURANT DE FUITE ÉLEVÉ RACCORDEMENT À LA TERRE INDISPENSABLE AVANT LE RACCORDEMENT AU RÉSEAU VOIR LA NOTICE D'INSTALLATION AVANT DE RACCORDER AU RÉSEAU.</p> <p>断开放映机主电源端的电源并从UPS电源接入插座上拔下电源线。警告：大漏，电流在接通电源之前必须先接地。在与电源连接前请查看安装说明书。</p>	<p>(located behind cover)</p>
	<p>UPS INLET : 200-240V 6A max. 50-60Hz</p> <p>UPS OUTLET : ONLY FOR CONNECTION TO UPS INLET</p> <p>WARNING : Disconnect the power to the mains terminals and unplug power cord at UPS inlet for removal of all power from the unit.</p> <p>ATTENTION : Eteindre et déconnecter le câble dans la prise UPS pour la coupure de toute l'alimentation de l'appareil</p> <p>UPS电源输入插座：200-240V 最大电流 6A 50-60Hz</p> <p>UPS 输出插座：仅用于连接 UPS电源输入插座</p> <p>警告 断开放映机主电源端的 电源并从UPS电源接入 插座上拔下电源线， 切断放映机的所有电源。</p>	

2.5 High Brightness precautions: Hazard Distance (HD)

HD

Hazard Distance (HD) is the distance measured from the projection lens at which the intensity or the energy per surface unit becomes lower than the applicable exposure limit on the cornea or on the skin. The light beam is considered (to be) unsafe for exposure if the distance from a person to the light source is less than the HD.

Restriction Zone (RZ) based on the HD

The HD depends on the amount of lumens produced by the projector and the type of lens installed. See next chapter “HD in function of modifying optics”, page 23.

To protect untrained end users (as cinema visitors, spectators) the installation shall comply with the following installation requirements: Operators shall control access to the beam within the hazard distance or install the product at the height that will prevent spectators' eyes from being in the hazard distance. Radiation levels in

excess of the limits will not be permitted at any point less than 2.0 meter (SH) above any surface upon which persons other than operators, performers, or employees are permitted to stand or less than 1.0 meter (SW) lateral separation from any place where such persons are permitted to be. In environments where unrestrained behavior is reasonably foreseeable, the minimum separation height should be greater than or equal to 3.0 meter to prevent potential exposure, for example by an individual sitting on another individual's shoulders, within the HD.

These values are minimum values and are based on the guidance provided in IEC 62471-5:2015 section 6.6.3.5.

The installer and user must understand the risk and apply protective measures based upon the hazard distance as indicated on the label and in the user information. Installation method, separation height, barriers, detection system or other applicable control measure shall prevent hazardous eye access to the radiation within the hazard distance.

For example, projectors that have a HD greater than 1 m and emit light into an uncontrolled area where persons may be present should be positioned in accordance with “the fixed projector installation” parameters, resulting in a HD that does not extend into the audience area unless the beam is at least 2.0 meter above the floor level. In environments where unrestrained behavior is reasonably foreseeable, the minimum separation height should be greater than or equal to 3.0 meter to prevent potential exposure, for example by an individual sitting on another individual's shoulders, within the HD. Sufficiently large separation height may be achieved by mounting the image projector on the ceiling or through the use of physical barriers.

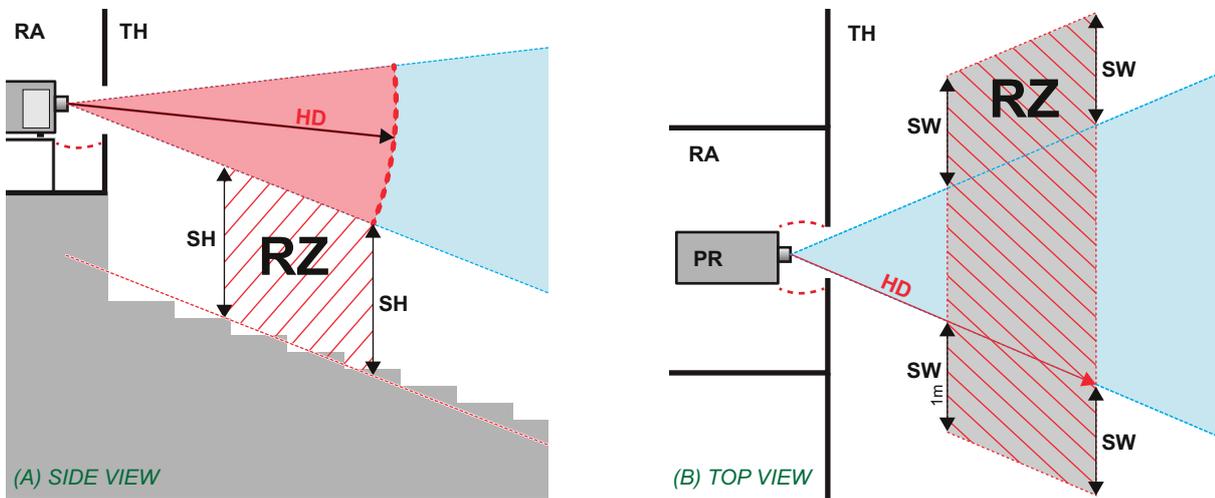


Image 2-1

- A** Side view.
- B** Top view.
- RA** Restricted Access location (boot area of projector).
- PR** Projector.

- TH** Theater.
- RZ** Restriction Zone in the theater.
- SH** Separation Height.
- SW** Separation Width.

Based on national requirements, no person is allowed to enter the projected beam within the zone between the projection lens and the related hazard distance (HD). This shall be physically impossible by creating sufficient separation height or by placing barriers. The minimum separation height takes into account the surface upon which persons other than operator, performers or employees are permitted to stand.

On Image 2-2 a typical setup is displayed. It must be verified if these minimum requirements are met. If required a restricted zone (RZ) in the theater must be established. This can be done by using physical barrier, like a red rope as illustrated in Image 2-2.

The restricted area sticker can be replaced by a sticker with only the symbol.

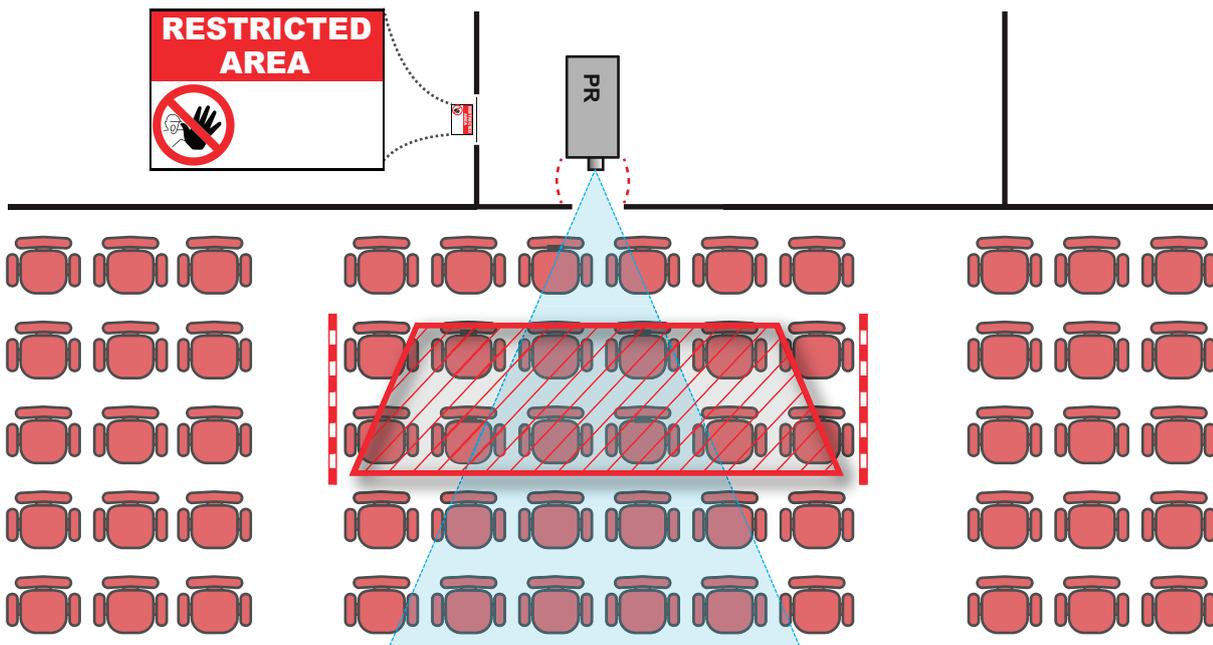


Image 2-2

USA market

For LIPs (Laser Illuminated Projectors) installed in the USA market other restriction zone conditions apply.

LIPs for installation in restrained environment (cinema theaters) shall be installed at height vertically above the floor such that the bottom plane of the hazard distance zone shall be no lower than 2.5 meters above the floor. Horizontal clearance to the hazard distance zone shall be not less than 1 meter.

LIPs for installations in unrestrained environment (large venues,..) shall be installed at a height vertically above the floor such that the bottom plane of the Hazard distance Zone shall be no lower than 3 meters above the floor. Horizontal clearance to the hazard distance zone shall be not less than 2.5 meters. Any human access horizontally to the Hazard Zone, if applicable, shall be restricted by barriers. If human access is possible in an unsupervised environment, the horizontal or vertical clearances shall be increased to prevent exposure to the hazard distance zone.

In addition for temporary installations (e.g.: rental and staging, lease, events ...) the following requirements apply:

- This product can only be installed by Barco or sold or leased only to valid laser light show variance holders. In other words our installers are required to have an approved laser light show variance. Such installers may currently hold a valid variance for production of Class IIIb and IV laser light shows and/or for incorporation of the RG3 LIPs into their shows. Dealers and distributors are also required to obtain a valid laser light show variance.
- This product shall be located in such a way that all propagating beam paths within the Restriction Zone, and the audience can be directly observed at all times.
- Effects other than front or rear screen projections shall not be performed.
- Communication shall be maintained with other personnel assisting in surveillance of the LIP projection.
- In the event of any unsafe condition, immediately terminates (or designate the termination) of LIP projection light.

Install one or more readily accessible controls to immediately terminate LIP projection light. The power input at the projector side is considered as a reliable disconnect device. When required to switch off the projector, disconnect the power cord at the projector side. In case the power input at the projector side is not accessible (e.g. truss mount), the socket outlet supplying the projector shall be installed nearby the projector and be easily accessible, or a readily accessible general disconnect device shall be incorporated in the fixed wiring.

Laser light shows can be requested via the FDA online eSubmitter portal or via FDA Form FDA Form 3147 referencing to Barco's variance approval 2016-V-0144.

The installation checklist for laser illuminated RG3 projectors must be fully completed after the installation and sent to pvg@barco.com. This checklist can be downloaded from the Barco website. Only when the installer is a valid laser light show variance holder the checklist should not be sent to Barco.

2.6 HD for fully enclosed projection systems

HD



Hazard Distance (HD) is the distance measured from the projection lens at which the intensity or the energy per surface unit becomes lower than the applicable exposure limit on the cornea or on the skin. The light beam is considered (to be) unsafe for exposure if the distance from a person to the light source is less than the HD.

Restriction Zone (RZ) based on the HD

The projector is also suitable for rear projection applications; projecting a beam onto a diffuse coated projection screen. As displayed in Image 2-3 two areas should be considered: the restricted enclosed projection area (RA) and the observation area (TH).

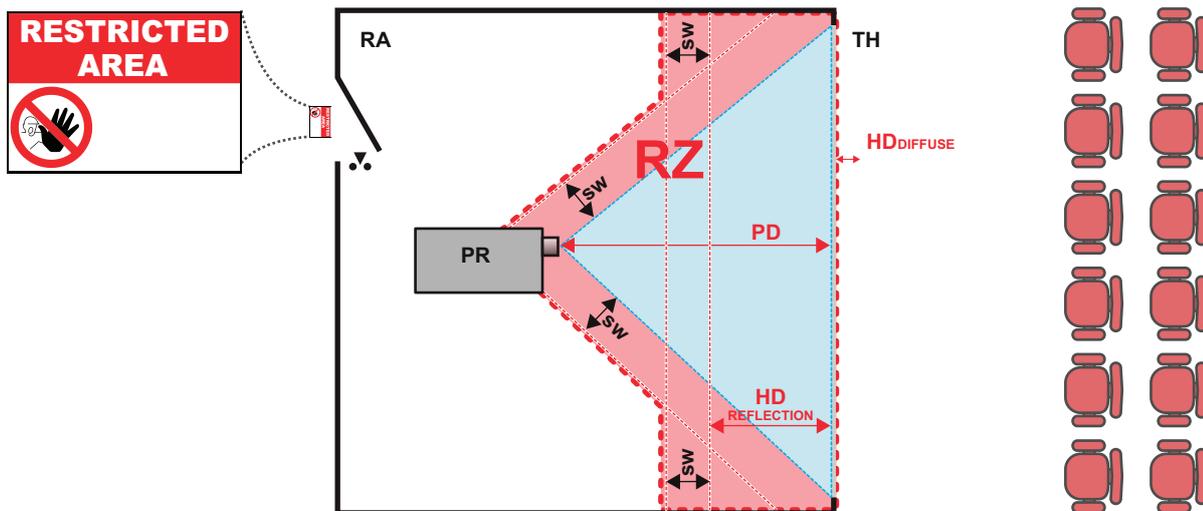


Image 2-3

RA Restricted Access location (enclosed projection area).

PR Projector.

TH Theater (observation area).

RZ Restriction Zone.

PD Projection Distance.

SW Separation Width. Must be minimum 1 meter.

For this type of setup 3 different HD shall be considered:

- HD as discussed in “High Brightness precautions: Hazard Distance (HD)”, page 19, relevant for intrabeam exposure.
- $HD_{\text{reflection}}$: the distance that has to be kept restrictive related to the reflected light from the rear projection screen.
- HD_{diffuse} : the relevant distance to be considered while observing the diffuse surface of the rear projection screen.

As described in “High Brightness precautions: Hazard Distance (HD)”, page 19, it is mandatory to create a restricted zone within the beam areas closer than any HD. In the enclosed projection area the combination of two restricted zones are relevant: The restricted zone of the projected beam toward the screen; taking into account 1 meter Separation Width (SW) from the beam onward. Combined with the restricted zone related to the rear reflection from the screen ($HD_{\text{reflection}}$); also taking into account a 1 meter lateral separation.

The $HD_{\text{reflection}}$ distance equals 25% of the difference between the determined HD distance and the projection distance to the rear projection screen. To determine the HD distance for the used lens and projector model see graphs in chapter “HD in function of modifying optics”, page 23.

$$HD_{\text{reflection}} = 25\% (HD - PD)$$

The light emitted from the screen within the observation shall never exceed the RG2 exposure limit, determined at 10 cm. The HD_{diffuse} can be neglected if the measured light at the screen surface is below 5000 cd/m² or 15000 LUX.

2.7 HD in function of modifying optics

Hazard Distance

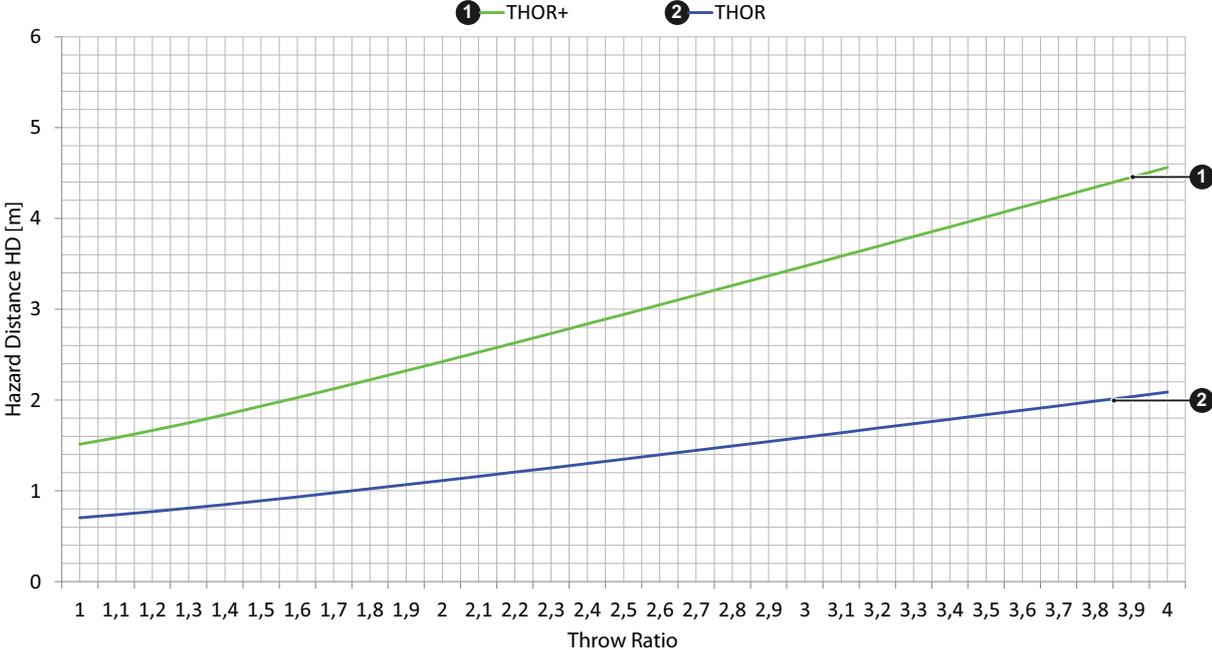


Image 2-4

System overview

3

About this chapter

This chapter briefly describes all different components of the complete projection system based on the Thor. For more detailed information related to the projector we refer to other chapters in this document. For the other components in the system we refer to its own documentation set of the component. Note that the latest version of this document and all other related documentation sets are available on the Barco website.

Different components of the projection system.

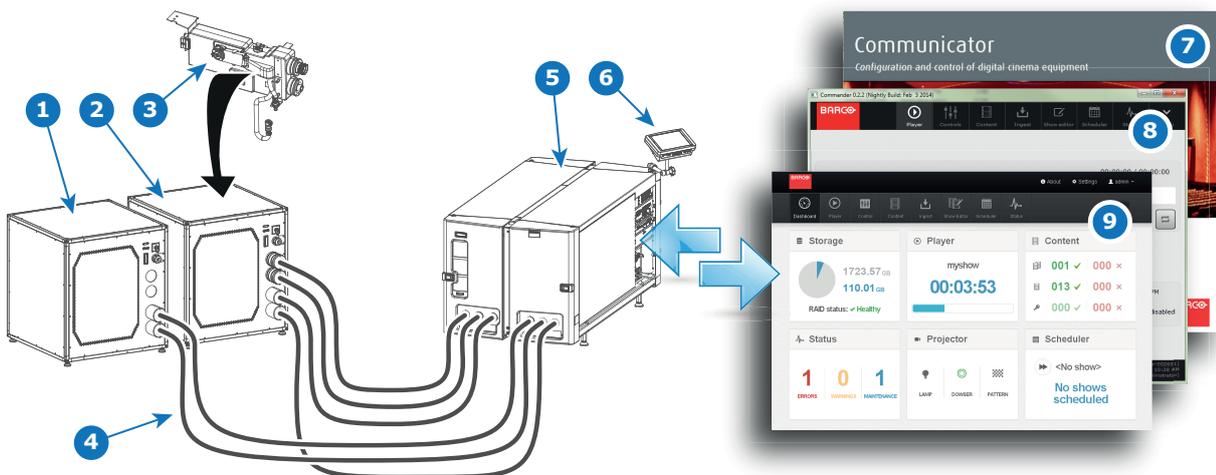


Image 3-1

- | | |
|--|----------------------------------|
| 1 Chiller unit without expansion for DMD cooling (not used for Thor). | 6 Touch Panel (optional). |
| 2 Chiller unit equipped with expansion for DMD cooling. | 7 Communicator (PC). |
| 3 Chiller cooling circuit expansion for DMD cooling. | 8 Commander (ICMP). |
| 4 Hoses. | 9 Web Commander (ICMP). |
| 5 Projector (with or without external safety interlocks). | |

Overview

- Thor
- Chillers and hoses
- Safety system
- Communicator Touch Panel
- Communicator PC version



System overview

- Commander & Web Commander

3.1 Thor

Introduction

The Thor series projector is a RGB laser-illuminated projector. This high-brightness laser projector is capable of showing 4K content at 60 fps and 3D movies in full 4K resolution. The Thor series projector has an integrated color 3D system, with 6-Primary (6P) color laser modules. This Barco Laser3D system maximizes 3D efficiency from a single projector, delivering constant and uniform images in excellent contrast, without lamp flicker.

For functionality and reliability, the projector requires accurate temperature control and cooling below ambient. Therefore a liquid cooling system is provided consisting of liquid circuits inside the projector which are connected via hoses to external chillers. Only chiller models and hoses exclusively developed for this application and approved by Barco are allowed to be used. Barco approved chillers models are listed on the Barco website.

Depending on the projector model one or two chillers are required!

Convention projector orientation

This manual refers to the left side of the projector as the side at your left hand when standing behind the projector and looking at the projection screen in front of the projector.

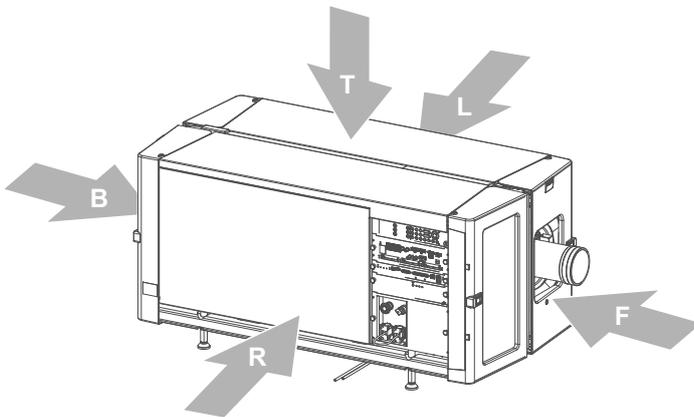


Image 3-2

- | | |
|---|--|
| T Top of the projector. | R Right side of the projector (Input side). |
| L Left side of the projector (Light Processor side). | B Back side of the projector. |
| F Front of the projector. | |

Component location

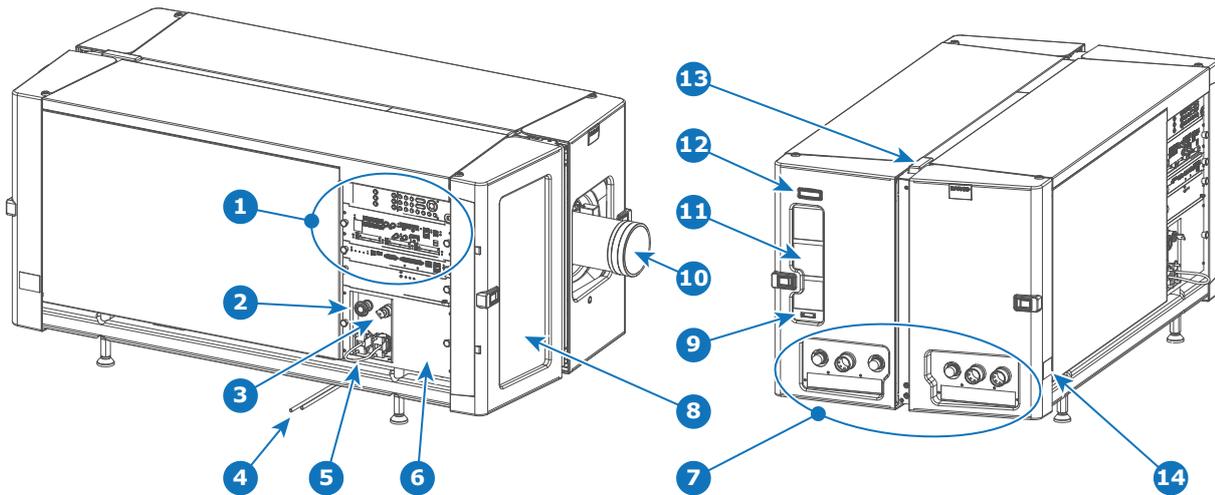


Image 3-3

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Input & Communication interface. 2 Beam stop button. 3 Beam enable key. 4 Condensed water drain tubes. 5 UPS sockets. 6 Cover mains compartment. 7 Valve coupling to connect with external chiller(s). | <ul style="list-style-type: none"> 8 Air inlet filter. 9 Communication port with chillers. 10 Lens. 11 Air outlet. 12 Projector status light. 13 Laser status light. 14 Projector ID label. |
|---|---|

Air flow

The Thor series projector has two air flow channels (reference A & B) to cool the projector electronics. The air intake is at the front side of the projector, the air outlet is at the back side.

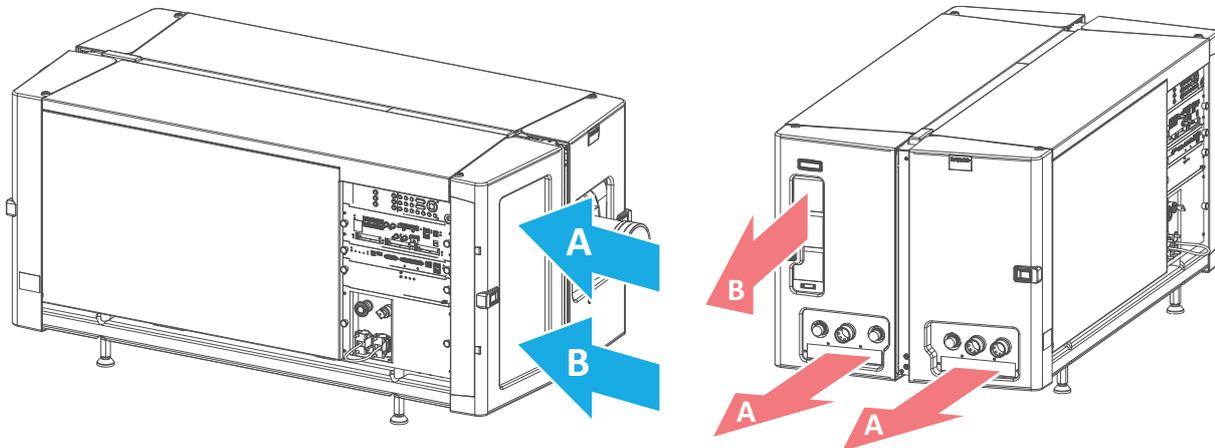


Image 3-4

3.2 Chillers and hoses



DMD

A digital micromirror device, or DMD, is an optical semiconductor that is the core of DLP projection technology.

Introduction

The chillers are specially designed for the Thor series projector. The chillers are controlled by the projector and ensure that the ambient temperature of the lasers and DMDs is within specs. Without these chillers the projector will not operate.

Depending on the projector model one or two chillers are required! For the Thor series projector one chiller has to be installed. The Thor+ series needs two chillers.

One chiller must be equipped with a cooling circuit expansion unit to cool the DMDs. This chiller can be recognized by the extra coupling for the hoses at the front (reference 1 Image 3-5). The expansion unit has to be installed on site.

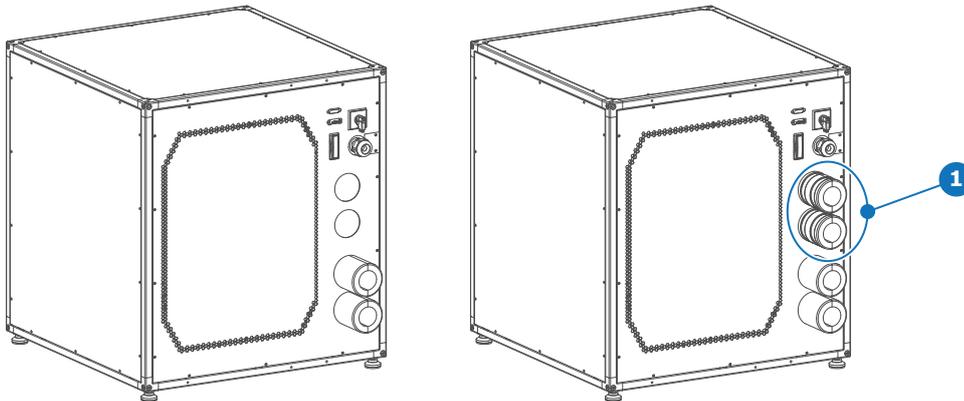


Image 3-5



For installation instructions see documentation of the chiller. All latest documentation files are available on the Barco website. How to connect the chiller(s) with the projector is described in this document.

Chiller cooling circuit expansion for DMD cooling

The valve coupling of this expansion unit is of the same type and size as the standard installed coupling on the chiller. However, the hoses of the DMD cooling which have to be connect with the coupling of this expansion unit has a smaller diameter than the hoses for the Red, Green and Blue laser cooling. Note that the cooling circuit expansion unit for the DMD cooling has to be installed on site.

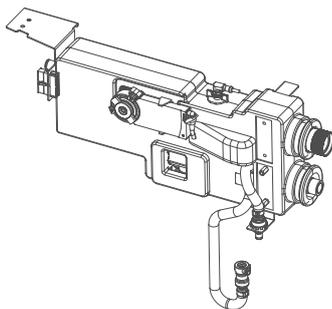


Image 3-6

The chiller cooling circuit expansion for DMD cooling may only be installed by trained technicians. Installation instructions are included in the service documentation of the chiller.

Hoses

Only hoses specified by Barco can be used to couple the cooling liquid of the chiller with the cooling circuit of the projector. The hoses specified are specially designed for this purpose. Using other hoses than those will have impact on the cooling capacity of the system and may make the system fail!

The hoses are available in different lengths up to 10 meter which is also the maximum distance allowed between chiller and projector. The chiller side of the hose has a straight coupling, the projector side has a 90 degree tube elbow with coupling. The flow direction at the coupling is always from female towards male. The hoses are isolated and reinforced for optimal performance.

The hoses for the RED, GREEN and BLUE laser cluster cooling have a larger diameter size than the hoses for the DMD cooling. However, take into account that the couplings are of the same type and size. So, ensure to connect the right hose with the right cooling channel.

See Barco website for available kits of hoses and corresponding ordering information.



Image 3-7: Hose with 90° angle female coupling.



Image 3-8: Hose with 90° angle male coupling.



For chillers and hoses ordering information see Barco website.

3.3 Safety system

Safety controller

The projector is equipped with a safety controller which is located inside the mains compartment. This safety controller operates independent from the projector electronics and has its own power supply. The safety controller is connected with the beam stop button (reference 1 Image 3-9) and the beam enable key (reference 2 Image 3-9) of the projector. In case the beam stop button is pushed or the beam enable key is switched off the safety controller immediately triggers the relay to disconnect the power from all Power Supply Units (PSU) of the lasers.

Beam enable key

The beam enable key (reference 2 Image 3-9) must be in the “on” position to be able to activate the lasers. In case the safety controller is triggered by an interlock event (internal or external) then, after restoring the interlock, the beam enable key must be switched off and on to reset the safety controller. Otherwise, the lasers can not be activated.

External beam enable key

The beam enable key is built-in but there is also a connection available for an additional, external switch which is connected in series with the internal beam enable key. This means that both keys must be switched on to power the PSUs of the lasers.

Beam stop button

The beam stop button (reference 1 Image 3-9) is easy accessible by the operator. Pushing the beam stop button will result in disconnecting the power from all Power Supply Units (PSU) of the lasers. The beam stop button requires a quarter turn to restore its normal operating position. After restoring the beam stop button the beam enable key must be switched off and on to reset the safety controller.

External safety interlocks

Two external safety interlocks can be connected with the safety controller (e.g. to connect an infrared field scanning device for the restricted HD area). In case an external safety interlock switch opens the safety controller immediately opens relays to disconnect the power from all Power Supply Units (PSU) of the lasers.

The safety controller requires per interlock a double pole switch. It is not sufficient to break only one of the two interconnections. Both contacts should be opened and closed simultaneously. If only one contact is opened without the second one, the projector will not start up again after the contact is closed. To recover from such an error, open and close the external interlock with both contacts simultaneously, then turn the beam enable key off and on.

Both switch inputs should not be electrically interconnected in any way. An electrical connection between the switches will be seen as an interlock open situation.

The connector (reference 3 Image 3-9) for the external interlocks can be found behind the mains input compartment door. It is in the form of a 10 pole screw type removable terminal block (reference 5 Image 3-9). There are three cable glands (reference 4 Image 3-9) at the base of the mains compartment for the cabling of the external interlock devices.

The projector is shipped with a connector of which the external beam enable key and the 2 external interlocks are bypassed. Before connecting an external interlock the appropriate shunt wires (reference 6 Image 3-9) should be removed and replaced by the interlock wiring.

Component location

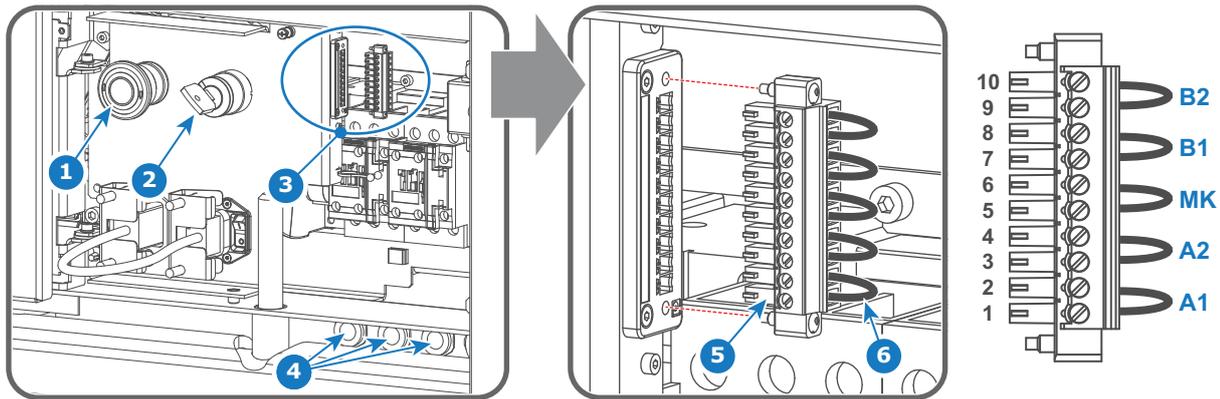


Image 3-9

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Beam stop button. 2 Beam enable key. 3 Socket and connector for external safety interlocks. 4 Three cable glands (M20 D7-13). 5 10 pins connector. 6 Shunt wire. | <ul style="list-style-type: none"> A1 External safety interlock A contact No 1. A2 External safety interlock A contact No 2. MK External beam enable key. B1 External safety interlock B contact No 1. B2 External safety interlock B contact No 2. |
|---|--|



CAUTION: The need for installing external safety interlocks is the responsibility of the Safety Officer and depends on the installed application and local regulations.



WARNING: The connector with shunt wires is delivered with the projector but not installed. The Safety Officer of the boot area must decide either if the connector with shunt wires can be installed or if external safety interlocks must be installed.



The external safety interlocks used must be of the type 'micro load' and must be approved interlocks for safety applications. In order to achieve the highest reliability level of safety; employ only SIL level 4 (according IEC 62061) dual normal open contact or performance level Ple (according IEC 13849-1) dual normal open contact devices.

3.4 Communicator Touch Panel

Communicator Touch Panel for digital cinema projectors

The Communicator Touch Panel is designed for multi-user command and control. The Communicator enables users to learn quickly and operate efficiently - using an elegant and flexible Touch Panel interface. The interface's commonality means that operators can intuitively use any model in the product line, without restriction, and its user-friendly nature translates directly into a short and enjoyable learning curve.



Image 3-10

Flexible Touch Panel interface

The Touch Panel interface can be mounted upon a swivel arm which easily fits on top of the Thor series. One central locking mechanism of the swivel arm allows instant fixation of the Touch Panel interface in any position.

The Touch Panel interface can also be installed further away from the Thor series. For this purpose an Ethernet cable up to 50 meter can be used to realize a direct data communication between the Thor series and the Communicator Touch Panel.

The Touch Panel interface can also be connected via a Local Area Network (LAN) in the same way as the Thor series. In this configuration both devices can communicate with each other as well.

The Touch Panel interface requires a voltage supply +12 VDC and 1,5 ampere. Note that the Thor series has a 12 VDC output which can be used to power up the Touch Panel interface. Nevertheless, the use of a separate +12 VDC adaptor (1,5 ampere minimum) is required in case the Touch Panel interface is installed more then a few meters away from the Thor series.

Parts location of the Touch Panel interface

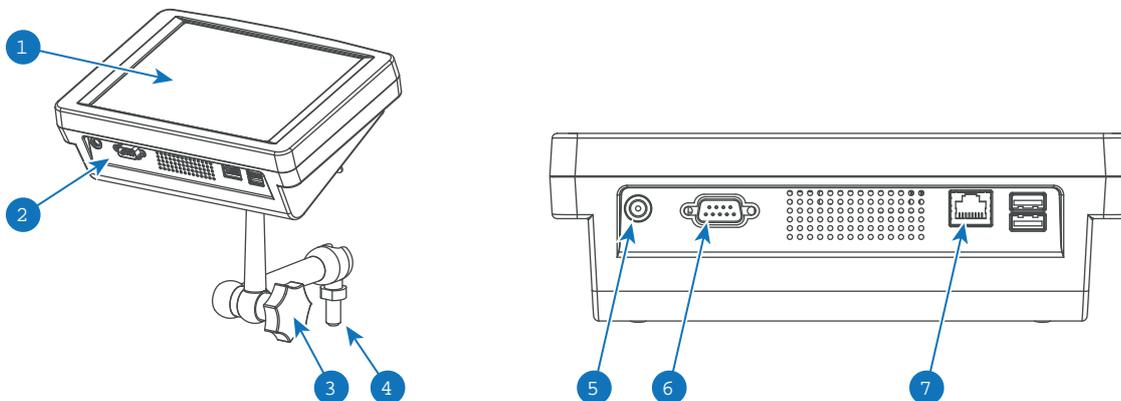


Image 3-11

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Touch screen 2 Communication panel 3 Knob to operate central swivel clamp 4 Base of swivel arm | <ul style="list-style-type: none"> 5 Power input 12 VDC, 1.5A 6 RS232 port (sub-D) 7 Ethernet port (RJ45) |
|---|---|

Touch Panel power/data customized cable



Image 3-12: Customized cable to connect Touch Panel interface with the Barco projector.



The Communicator Touch Panel has its own user guide which latest version is available on the Barco website.

3.5 Communicator PC version

Configuration tool

A uniquely powerful and easy to use configuration tool for the Barco cinema projector. This Communicator software for PC provides all the necessary tools and only those tool necessary for the connected projector to setup and control this projector. A comprehensive array of easy to access menu pages provide the projectors digital input, output and screen display via a combination of simple buttons and displays.

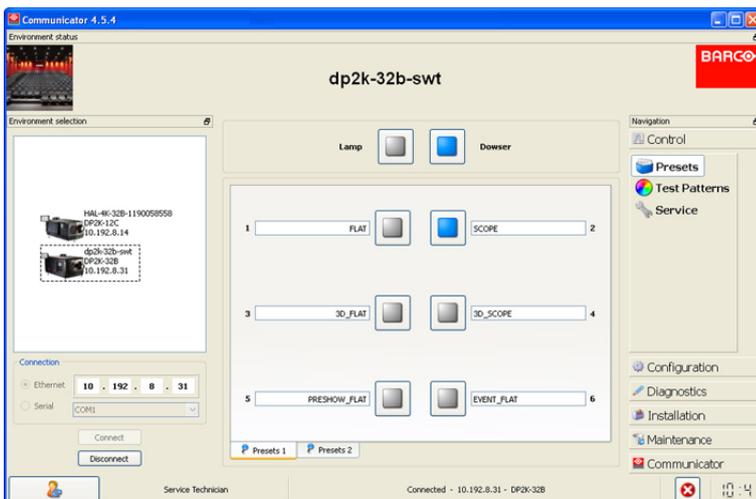


Image 3-13

Quick and Easy configuration

Clearly indicated tab pages allow the control of Projector connection, configuration, test, color calibration and configuration with an existing automation system. All actions can be activated by a simple click. Depending on the user level, functions are enabled or disabled in the software. The enabled functions are only accessible via a password entry and that prevents misalignment once everything is correctly aligned.



The Communicator PC version has its own user guide which latest version is available on the Barco website.

3.6 Commander & Web Commander

Commander

All Barco Alchemy projectors come with the 'Barco Commander' software that runs from a touch panel controller or PC.

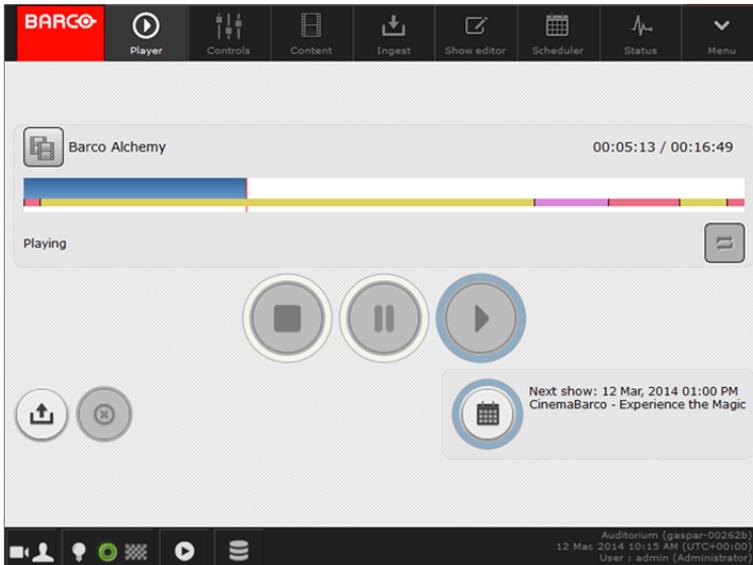


Image 3-14

Web Commander

All Barco Alchemy projectors come with the 'Barco Web Commander' screen management system featuring an intuitive user interface for simple operation.

The Barco Alchemy projectors have been carefully designed to greatly increase the level of operational efficiency. Projectionists can now enjoy a streamlined and intuitive user interface that seamlessly blends projector control with a full-fledged screen management system. The 'Barco Web Commander' user interface is readily available on the projector without any additional software installation. It is accessed via a web browser and is also fully supported on iOS and Android tablets thanks to the free 'Barco CineMate' iOS and Android app.

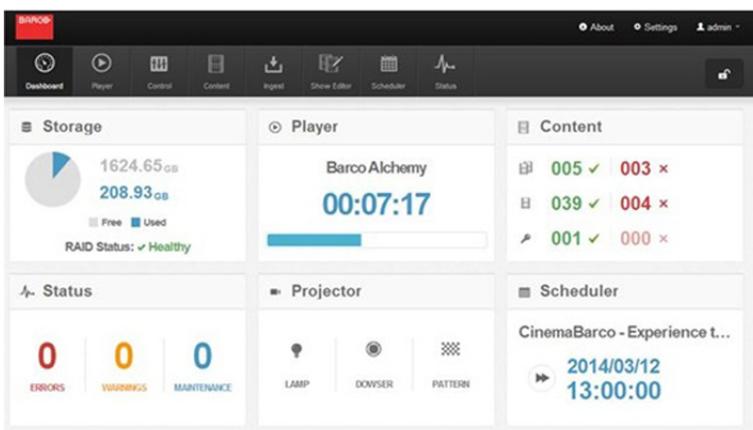


Image 3-15



The Commander and Web Commander have their own user guide which latest version is available on the Barco website.

Getting started

4

About this chapter

Read this chapter before installing your Thor series projector. It contains important information concerning installation requirements for the Thor series projector, such as minimum and maximum allowed ambient temperature, humidity conditions, required safety area around the installed projector, required power net, etc.

Furthermore, careful consideration of things such as image size, ambient light level, projector placement and type of screen to use are critical to the optimum use of the projection system.



Barco provides a guarantee relating to perfect manufacturing as part of the legally stipulated terms of guarantee. Observing the specification mentioned in this chapter is critical for projector performance. Neglecting this can result in loss of warranty.

Overview

- Installation requirements
- Unpacking the projector
- Initial inspection

4.1 Installation requirements

Environment conditions

Table below summarizes the physical environment in which the Thor series projector may be safely operated or stored.

Environment	Operating	Non-Operating
Ambient Temperature	10°C (50°F) to 30°C (86°F)	-15°C (5°F) to 60°C (140°F)
Air cleanliness	Clean office environment (equivalent with cleanroom standard ISO 14644-1 ISO Class 9)	n.a.
Humidity	0% RH to 80% RH non-condensed	5% to 95% RH Non-Condensed
Altitude	-60 m (-197 Ft) to 3000 m (9843 Ft) Automatic decrease of brightness possible for altitudes above 1000 m.	-60 m (-197 Ft) to 10 000 m (3 2810 Ft)



Let the projector acclimatize after unpacking. Neglecting this may result in a startup failure of the Light Processor Unit.

Measures to resolve radio interference

Operation of this equipment in a residential area may cause radio interference. Possible interference shall be solved by one of the following non limitative product installation measures:

- Create more separation distance between projector and interfered device.
- Change direction of the interfered device.
- Electromagnetic shielding of the projection booth.



No interference to radio communication in neighbor buildings possible if a separation distance of 30 m (32.8 yards) is provided.

Cooling requirements

For functionality and reliability, the projector requires accurate temperature control and cooling below ambient. Therefore a liquid cooling system is provided consisting of liquid circuits inside the projector which are connected via hoses to external chillers. Only chiller models and hoses exclusively developed for this application and approved by Barco are allowed to be used. Barco approved chillers models are listed on the Barco website.

The chiller must be installed in the same environmental conditions as the projector (ambient temperature and humidity must be the same on both projector and chiller locations). The chiller must be installed in upright position (not tilted) conform all the installation instructions of the chiller. Maximum 3 meter height differences is allowed between projector coupling and chiller coupling.

Sensors measure the temperature and relative humidity (RH) inside the sealed compartments of the projector. From these measured values the dew point is calculated and compared with the temperature of the liquid cooling in the chiller.

The dew point inside the sealed compartments of the projector must be lower than the temperature of the cooling liquid coming from the chiller. If not, the projector will fail to startup. This to prevent drops of moisture deposit on the electronic boards.

In case the projector fails to startup due to a dew point inside the projector that is too high, the projector and chiller need more time to acclimatize to the environment. For a first install the time needed to acclimatize depends on the environmental storage conditions of the projector and chiller. In extreme conditions the acclimatization time may take several hours.

Note that the lower the relative humidity of the boot area the shorter the acclimatization time needed for the projector and chiller.

The electronics of the projector are fan cooled. For that the projector must be installed with sufficient space around the projector, minimum 20 cm (8 inch) to ensure sufficient air flow. It should be used in an area where the ambient temperature, as measured at the projector air inlet, does not exceed 30°C (86°F).

Projection rooms must be well ventilated or cooled in order to avoid build up of heat. It is necessary to vent hot exhaust air from projector and cooling system (chiller unit) to the outside of the building. The minimum flow rate of the air extraction system depends on the ambient temperature:

Thor+	
Ambient temperature	Minimum airflow per system
30°C (86°F)	370 l/s (790 CFM)
25°C (77°F)	280 l/s (590 CFM)
20°C (68°F)	225 l/s (475 CFM)

Thor	
Ambient temperature	Minimum airflow per system
30°C (86°F)	280 l/s (590 CFM)
25°C (77°F)	210 l/s (440 CFM)
20°C (68°F)	166 l/s (350 CFM)

Where two projectors or more are installed close to each other, ensure that the projectors do not thermally affect each other.

Dew point



The dew point is the saturation temperature for water in air. The dew point is associated with relative humidity. A high relative humidity implies that the dew point is closer to the current air temperature. Relative humidity of 100% indicates the dew point is equal to the current temperature and that the air is maximally saturated with water. When the moisture content remains constant and temperature increases, relative humidity decreases.

Condensed water drain requirements

The projector is equipped with air dryers to remove moisture from the sealed compartments. The condensed water collected by the air dryers is removed from the projector through small drain tubes at the bottom of the projector. It's most efficient and recommended to guide the small drain tubes directly to a water drain.

- A vertical air gap fitting must be installed between the small drain tubes and the building drain! Note that the end of the small drain tubes must be in free air (not airtight taped off) to prevent back flow.
- The minimum downwards slope over the whole length of the small drain tubes is 15 cm per meter (1.8 inch per foot). It's recommended to guide the small drain tubes vertically for optimal flow. Clogging is often the result of improper slope (sloping uphill).
- The maximum allowed length of the small drain tubes (Ø8 mm) before ending into the water drain is 2.5 meter (8 feet).
- If no water drain is available then an 'open' water container can be installed to capture the condensed water coming out of the small drain tubes. The volume of the water container depends on the humidity level of the operation environment. In most applications a water container with a volume of 5 liter should be sufficient if emptied regularly.

Main Power requirements

The Thor series projector operates from a nominal 3W+N+PE or 3W+PE power net. The projector must be switched internally between a star connection to a delta connection or vice versa. See installation instructions.

- **Electrical ratings for Star system (3W+N+PE):**
 - The cross-sectional area of the conductors in the power supply cord shall be 4mm² to 6mm², 10AWG to 8AWG.
 - The electrical rating of the Thor+ projector is 200-240V/346-415V 3W+N+PE 16A 50-60Hz (Y connection) (Y connection).
 - The electrical rating of the Thor projector is 200-240V/346-415V 3W+N+PE 10A 50-60Hz (Y connection) (Y connection).
 - The building installation has to be provided with a circuit breaker of range 25A to 40A to protect the complete unit.

• **Electrical ratings for Delta system (3W+PE):**

- The cross-sectional area of the conductors in the power supply cord shall be 6mm², 8AWG.
- The electrical rating of the Thor+ projector is 200-240V 3W+PE 28A 50-60Hz (Δ connection) (Δ connection).
- The electrical rating of the Thor projector is 200-240V 3W+PE 15A 50-60Hz (Δ connection) (Δ connection).
- The building installation has to be provided with a circuit breaker of 40A to protect the complete unit.

The power cord required to connect the projector with the power net is not delivered with the projector. It is the responsibility of the customer to provide the correct type of power cord. Take into account that the cable gland allows a cable diameter from 11 to 21 mm.

To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. In no event shall this projector be operated without an adequate cabinet ground connection.

The AC supply must be installed by a qualified electrician in conformance to local codes. Hardware, wire sizes and conduit types must comply with local codes.

A readily accessible disconnect device shall be incorporated externally to the equipment for removal of the power to the equipment mains terminals.



WARNING: Disconnect the power to the unit mains terminals and unplug power cord at UPS inlet for removal of all power from the unit

UPS requirements

The Uninterruptible Power Supply (UPS), also known as a Continuous Power Supply (CPS), must have an output voltage of 200-240V at 50-60Hz and must be capable of delivering an output current of 5,5 amperes. This UPS provides only power for the electronics in the Card Cage.

The connection between the UPS unit and the UPS inlet of the projector must be done with a certified AC power supply cord of minimum 0,75 mm² or 18 AWG and minimum 300V.



CAUTION: The 200–240V power outlet (UPS OUTLET) of the projector may not be used to provide the UPS unit with power! The UPS OUTLET of the projector may only be used for connection to the UPS INLET of the projector.



The Thor series projector does not have a built in UPS unit.

Projection screen

The Thor series projector performs best when the image is projected on white screen with minimum gain (between 1 and 1.8). Very high gain screens (e.g. silver screens with gain 2.4) are not recommended.

Projector weight

Do not underestimate the weight of the Thor series projector. The Thor + projector weight approximately ±240 kg (±529 lbs) without lens. The Thor projector weight approximately ±200 kg (±440 pounds) without lens. Ensure that the pedestal on which the projector is installed is capable of supporting the complete load of the system. To prevent personal injury a hoisting tool should be used to lift the projector.



CAUTION: An external frame must be used to stack projectors.

4.2 Unpacking the projector

What you need to do?

Upon delivery, your projector is packed into a carton box upon a wooden/plastic pallet and secured with banding and fastening clips. Furthermore, to provide protection during transportation, the projector is

surrounded by foam. Once the projector has arrived at the installation site, it needs to be removed from its carton box and wooden/plastic pallet in a safe manner without damaging the projector.

Required tools

10 mm Allen wrench.

How to unpack the projector?

1. Loosen the banding (reference 1 Image 4-1) by pulling the free end of the banding loop in the clip.
2. Take off the box cover (reference 2 Image 4-1).
3. Remove the carton plate (reference 3 Image 4-1) from the top of the projector.
4. Take out the small box between the outer and inner box. This box contains the product documentation (manuals etc.).

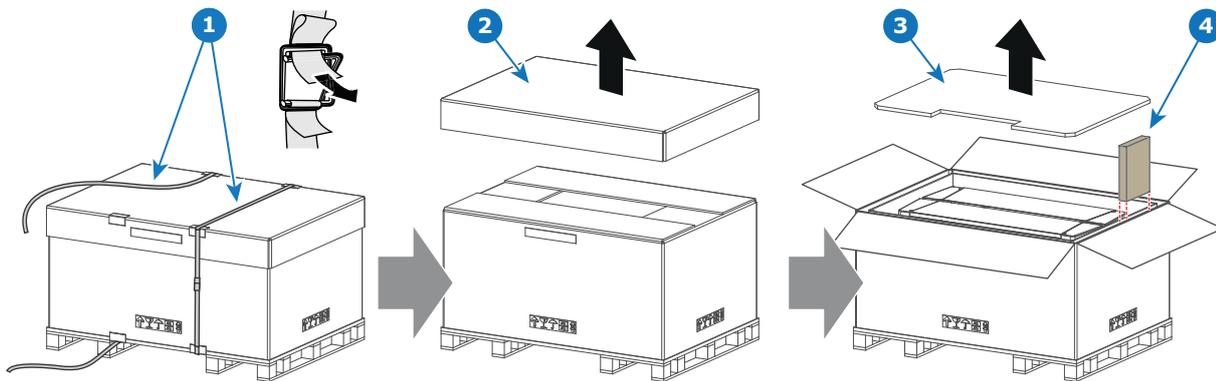


Image 4-1

5. Lift up the outer carton box (reference 5 Image 4-2) as a whole and remove it away from the projector package.
6. Lift up the inner carton box (reference 6 Image 4-2) as a whole and remove it away from the projector package.
7. Remove the screw (reference 7 Image 4-2) in the centre of both transport fixation bars (front and rear of the projector). Use a 10 mm Allen wrench.
8. Now the projector can be lifted up and put in place.



Warning: Do not underestimate the weight of the projector. The projector weights ± 240 kg (± 529 lbs). To prevent personal injury a hoisting tool should be used to lift the projector.



Note: The top side of the projector is foreseen with four threaded holes M10 (25 mm depth), one in each corner. These holes can be used to insert eyebolts to connect the shackles of the lifting equipment.

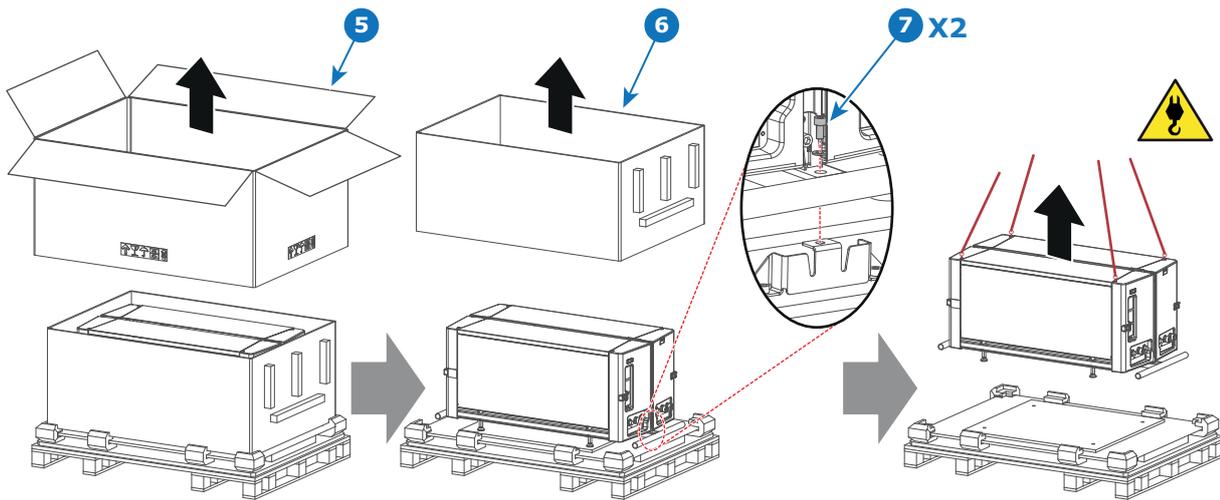


Image 4-2

Caution: Ensure that the pedestal is capable to carry the weight of the projector.

After unpacking, allow the projector to acclimatize to a room temperature ranging from 10°C (50°F) to 30°C (86°F) MAX. Neglecting this may result in a start up failure of the Light Processor Unit.

4.3 Initial inspection

General

Before shipment, the projector was inspected and found to be free of mechanical and electrical defects. As soon as the projector is unpacked, inspect for any damage that may have occurred in transit. Save all packing material until the inspection is completed. If damage is found, file claim with carrier immediately. The Barco Sales and Service office should be notified as soon as possible.

The packaging of the Thor series projector is provided with a **shock-watch** label. If this shock-watch label was triggered (red colored at arrival) during transport may indicate rough handling by the transport company. In this case, the instructions mentioned on the label, should be followed, which are: adding a note on the “bill of lading” and informing the transport company and the Barco sales and service office as soon as possible.

Box content

- Projector.
- User and installation manual (this document).
- Safety manual.

The projector lens is not included in the package of the projector.

Mechanical check

This check should confirm that there are no broken knobs or connectors, that the cabinet and panel surfaces are free of dents and scratches, and that the operating panel is not scratched or cracked. The Barco Sales and Service office should be notified as soon as possible if this is not the case.

5

Installation process

About this chapter

After you have unpacked and checked the projector, you can start with the installation process of your Thor series projector. This chapter gives an overview of all the different stages in the installation process which you have to be followed to set your Thor series projector up and running. Each stage is briefly described and refers to more detailed step by step procedures in this manual.

Use this overview as a checklist to ensure that all stages have been followed in the setup process of the Thor series projector.



After unpacking, allow the projector and chiller(s) to acclimatize to a room temperature ranging from 10°C (50°F) to 30°C (86°F) MAX. Neglecting this may result in a start up failure of the Light Processor Unit.

Overview

- Installation process overview

5.1 Installation process overview

Installation process from A to Z

1. **Check if all installation requirements are fulfilled** such as the environment conditions of the installation area, electrical facilities, etc. Note that a solid pedestal is required to support the projector. For more info see topic "Installation requirements", page 36.
 -  *Tip:* Barco offers a pedestal for the Thor series series projector. This pedestal allows for a solid and easy setup of the projector and chillers that fit underneath the pedestal.
2. **Physical installation of the chiller.** One chiller has to be installed. Follow precisely the installation instructions delivered with the chiller. Only by Barco approved chillers may be used. Ensure that the distance between the chiller and projector can be bridged with the hoses delivered with the system. Take into account that the height difference between chiller coupling and projector coupling should be less than 3 meter.
 -  *Note:* The chiller must be equipped with the cooling circuit expansion unit for the projector DMD cooling. See chapter chapter "Chillers and hoses", page 28. This expansion unit has be installed on site. See installation instructions delivered with the chiller.
 -  *Note:* Ensure to install the correct address plug for the chiller. The chiller which is equipped with the cooling circuit expansion unit has a different address plug installed. See installation instructions delivered with the chiller.
3. **Physical installation of the projector** upon its pedestal. Position the projector correctly on its pedestal and then remove the transport protection bars at the front and at the rear side of the projector. See chapter "Physical installation", page 45.
4. **Capture condensed water.** Guide the small drain tubes at the bottom of the projector directly to a water drain. If no water drain is available then an 'open' water container must be installed to capture the condensed water coming out of the small drain tubes. See chapter "Installation requirements", page 36.
5. **Installing the hoses and communication cables between chiller and projector.** Note that only by Barco approved hoses may be used. See chapter "Connecting the hoses with projector and chillers", page 49, and chapter "Connecting the data cable with projector and chillers", page 51.
6. **Installing the isolation shells** at both ends of the hoses. An accessory kit containing the isolation shells is delivered separately. For precise installation instructions see documentation included in the accessory kit.
7. **Installing the external safety interlocks** if needed. It's up to the Laser Safety Officer to investigate the need of external safety interlocks and to ensure a correct installation of the external safety interlocks when needed. For more info about external safety interlocks see chapter "Safety system", page 30. For installation instructions see chapter "Connecting the external safety interlocks", page 53.
8. **Power input set up and electrical connection with the mains electricity.** First check if the three phase configuration (Y-Δ) of the projector matches with the voltage of the mains electricity. To adapt the configuration see chapter "Three phase power input configuration of the projector", page 54. Then connect the projector with the mains electricity. See chapter "Connecting the projector with the mains electricity", page 55.
9. **Installation of a suitable UPS unit or bypass** the power in and outlet for the projector electronics. See chapters "Connecting a UPS to the projector electronics", page 57 or "Power loop through to the projector electronics", page 56.
10. **Installation of the Communicator Touch Panel.** See chapter "Installing the Communicator Touch Panel ", page 58.
11. **Installation of the lens.** First select a lens with appropriate throw ratio covering the screen size and the projector - screen distance. Then install the lens in the lens holder of the projector. For more information about available lenses, lens selection and lens installation see chapter "Lenses & Lens selection", page 61.
 -  *Caution:* The projector is delivered with a protective cover inside the Lens Holder. Remove the cover prior to installing the lens.
12. **Installation of the ICMP or IMB.** (only in case no ICMP or IMB is factory installed).
13. **Installation of the HDDs.** In case the HDDs of the ICMP are delivered separated from the projector remove the protection tape from the HDD input slots and install all three HDDs as described in the procedure

“Installing a HDD into the ICMP”, page 103. Make sure that all HDDs in the ICMP HDD set have the same storage capacity. See label on top of the HDD to know the storage capacity.

14. **Acclimatization of the complete system.** Let the projector, chillers and hoses acclimatize to the ambient conditions of the projection room. Ensure that all environmental requirements are fulfilled. See chapter “Installation requirements”, page 36.

Note: For a first install the time needed to acclimatize depends on the environmental storage conditions of the projector and chillers. In extreme conditions the acclimatization time may take several hours. Note that the lower the relative humidity of the boot area the shorter the acclimatization time needed for the projector and chillers.
15. **Fence off the HD restriction zone if needed.** See chapter “High Brightness precautions: Hazard Distance (HD)”, page 19.
16. **Switch on the chiller.** See documentation of the chiller.
17. **Switch on the projector.** The projector can now be switched on. Place the **ON/OFF** switch of the projector in the “I” position. As a result the projector starts to initialize. The status lights of the projector lights up GREEN once the projector is initialized. In case the status lights up RED may indicate a tamper event during transport. If so, contact Barco customer service.
18. **Note:** The projector always boots up in the same mode (E.g. Standby or Operation) as it was switched off. In case the projector starts up in Standby mode, press the Standby button for three seconds to bring the projector in Operation mode. For detailed information about starting up the projector see chapter “Starting up”, page 105.
19. **Select the corresponding lens parameters for the installed lens.** See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*.
20. **Alignment of the projected image on the screen.** The image can be aligned with the screen size of the application. Follow the next steps to achieve that:
 1. Press the **LIGHT** button on the Local Keypad to activate the lasers.
 2. Press the **DOWSER** button on the Local Keypad to open the mechanical dowser of the projector. The dowser is open if the color of the DOWSER button is GREEN.
 3. Press the **TEST PATTERN** button on the Local Keypad to project one of the internal test patterns of the projector on the screen.
 4. Perform a “**Lens Homing**”. See user guide of the Communicator.
 5. Use the lens **ZOOM**, **SHIFT** and **FOCUS** buttons on the Local Keypad to match the projected image with the screen. Tilt the projector in case you can not SHIFT the image completely upon the screen. See “Positioning the projector at port window”, page 46
See chapter “Local Keypad”, page 72, for detailed description of the Local Keypad buttons.
21. **Adjusting the light path.** Normally the convergence and Scheimpflug of the projector are perfectly adjusted at the factory. Nevertheless, some applications require a readjustment of the lens holder, convergence or both. See procedure “Scheimpflug”, page 111 and “Convergence”, page 123.
22. **Calibration** of luminance, white point and color gamut. See chapter “Calibration”, page 131.
23. **SCC calibration.**

Note: A Spatial Color Calibration (SCC) has to be execute in case of a first install or in case a High Brightness lens is swapped with a High Contrast lens or vice versa. See user guide of the Communicator for detail SCC calibration instructions.
24. **Creating screen files, lens files, light sensor calibration (LSC) files, and macro files for FLAT and for SCOPE.** See user guide of the Communicator.
25. **Backup of all projector configuration files.** See user guide of the Communicator.
26. **Registration of the projector.** The Thor series projector is DCI compliant and should be registered.
27. **Projection of a digital cinema movie.**
 - In case the projector is equipped with an ICMP, download the ICMP device certificate, request KDM and DCP from the content supplier, ingest KDM and DCP, and play out the movie. for detailed instructions see chapter “ICMP”, page 77, and user guide of the Communicator and/or (Web) Commander.
 - In case the projector is equipped with an Integrated Media Block (IMB) see user guide of the IMB.

Physical installation

6

About this chapter

This chapter describes how the mechanical and electrical set up of your Thor series projector has to be done.

Overview

- Removing the transport protection bars
- Positioning the projector at port window
- Connecting the hoses with projector and chillers
- Connecting the data cable with projector and chillers
- Accessing the mains compartment
- Connecting the external safety interlocks
- Three phase power input configuration of the projector
- Connecting the projector with the mains electricity
- Power loop through to the projector electronics
- Connecting a UPS to the projector electronics
- Installing the Communicator Touch Panel

6.1 Removing the transport protection bars

What needs to be done?

After the projector is unpacked and placed on its pedestal the transport protection bars at the front and at the rear of the projector have to be removed.



The transport protection bars need to be removed to connect the hoses of the cooling system with the projector and to have easy access to the dust filter at the front side.

Required tools

Allen wrench 10 mm

How to remove the transport protection bars?

1. Remove the two fixation screws (reference 1 Image 6-1) in the center of the transport protection bar. Use a 10 mm Allen wrench.

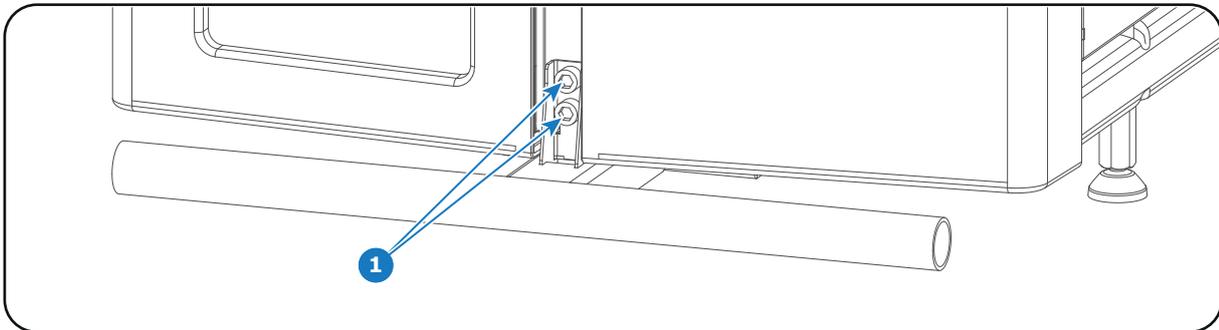


Image 6-1

2. Pull the transport protection bar out of its slot.

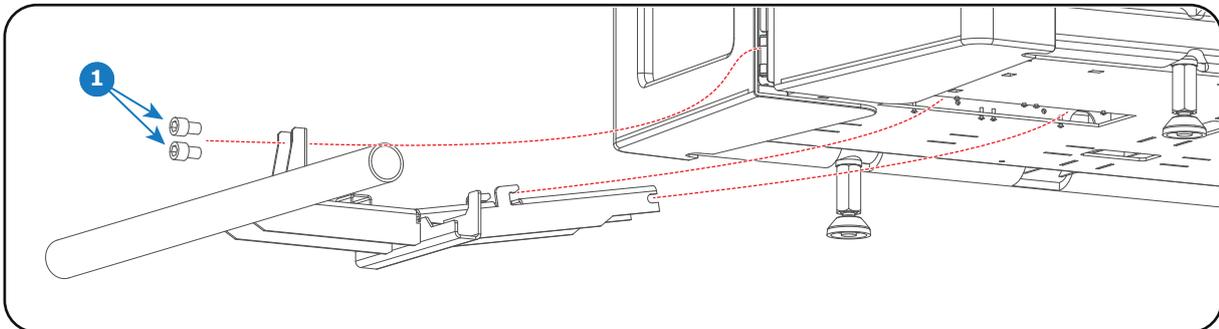


Image 6-2

3. Repeat these steps to remove the other transport protection bar as well.

6.2 Positioning the projector at port window

General guidelines

- Use a solid pedestal to mount the Thor series projector on to. Ensure that the pedestal can support the weight of the projector and that all feet of the projector are captured.
- The pedestal should be placed in front of the port window wall in a manner such that the projector lens is at a minimum distance of 20 centimeters from the port window.

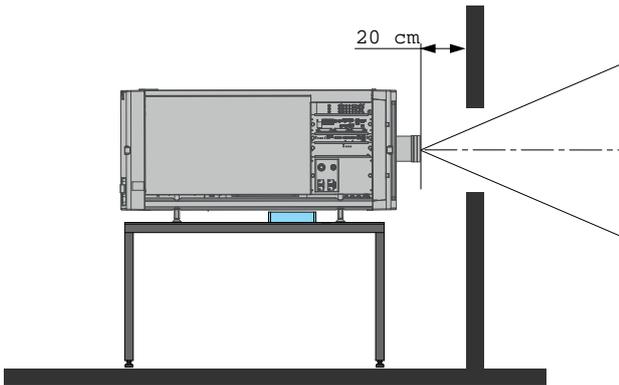


Image 6-3: Positioning at port window



Barco offers a pedestal for the Thor series series projector. This pedestal allows for a solid and easy setup of the projector and chillers that fit underneath the pedestal.

Required tools

- 17 mm open end wrench
- 24 mm open end wrench

Projector centering

1. If the projector is standalone in front of the port window, center the projector with the theatre screen (see reference A Image 6-4).
2. If another film projector is already present (projector will be off-center), try to optimize aim (see reference B Image 6-4).



Note: Unlike analog film projectors, it is best to keep the projector lens surface as parallel as possible to the screen, even if it is significantly above the screen center.



Note: All feet have an adjustment range of 10 cm. The minimum feet height is 8 cm below the bottom of the projector, the maximum feet height is 18 cm.

The off-center position slightly increases side keystone, but will minimize horizontal lens offset required.

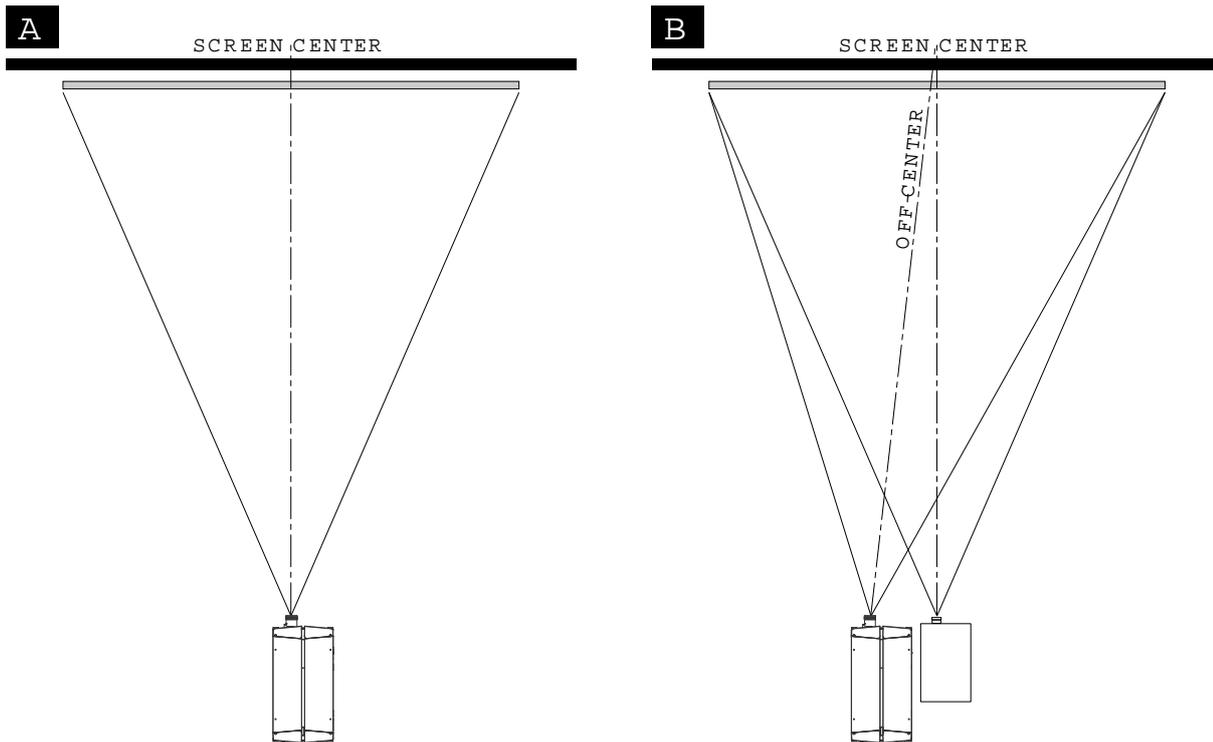


Image 6-4

3. Proceed to level the projector by adjusting the feet of the projector as follows:

- Loosen the long nut (reference 1 Image 6-5) on the threaded rod of the four projector feet. Use a 24 mm open end wrench.
- Adjust the height of the four legs to level the projector. Use a 17 mm open end wrench to adjust the height as illustrated (reference 2 Image 6-5).
- Secure the leg height by tightening the long nuts (reference 1 Image 6-5) of each projector foot against the projector chassis.

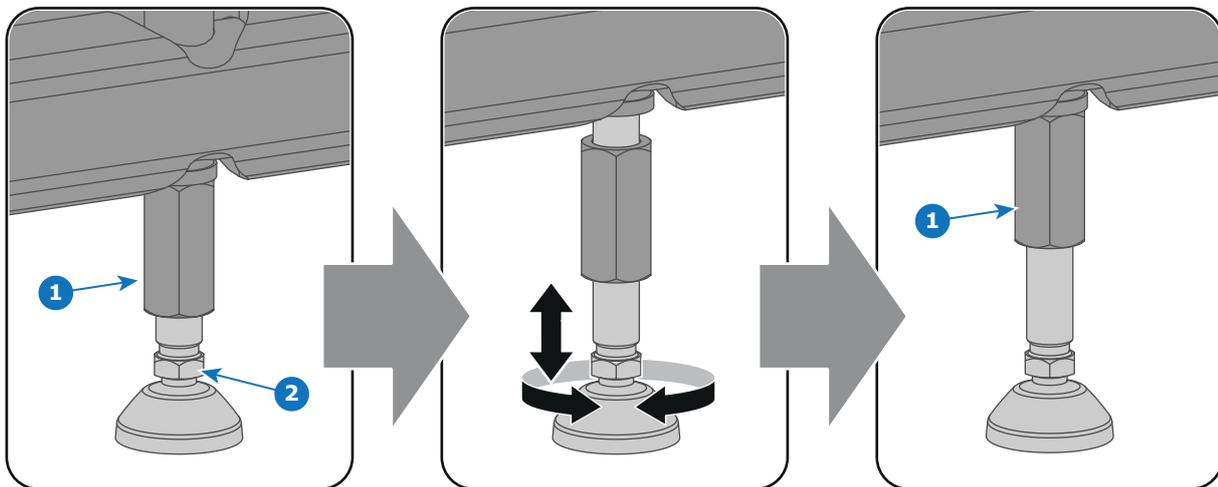


Image 6-5

4. Later, when the projector is up-and-running, adjust precise image geometry and placement.

Projector tilting

In an ideal installation, the Thor series projector lens surface is **centered with** and **parallel to** the screen. This orientation helps to ensure optimized lens performance with minimal offset. If this position is not possible (such as when the projector is significantly higher than the center of the screen), it is better to rely on **offset** rather than extra **tilt**. In other words, use the SHIFT functionality of the Lens Holder prior to tilt the projector.

1. Before adjusting tilt, make sure the projector is as well-centered with the theatre screen as possible for the installation area.
2. Check the degree of screen tilt, or measure this incline with a protractor at the screen.
3. Tilt the projector to closely match this screen tilt angle as follows:
 - Loosen the nut (reference 1 Image 6-5) on the threaded rod of the four projector feet. Use a 24 mm open end wrench.
 - Adjust the height of the four legs until the projected image matches the projection port window and the screen tilt. Use a 17 mm open wrench to adjust the height as illustrated (reference 2 Image 6-5).
 - Secure the leg height by tightening the long nuts (reference 1 Image 6-5) of each projector foot.

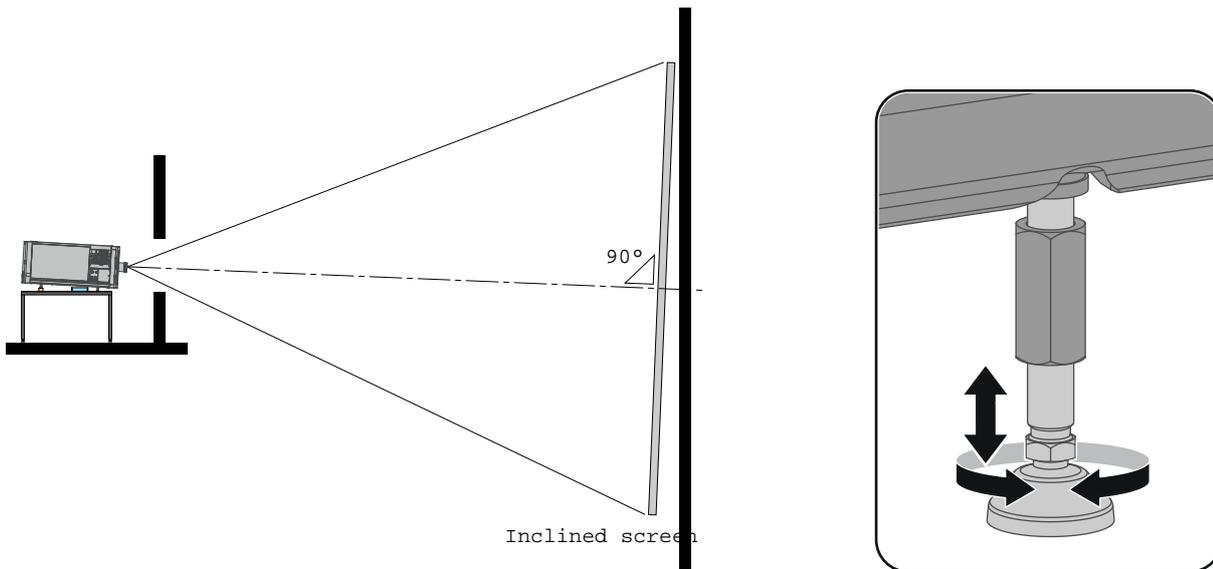


Image 6-6



CAUTION: The Thor series may tilt maximum 20° forward and maximum 5° backwards. No tilt is allowed sideways.



All feet have an adjustment range of 10 cm. The minimum feet height is 8 cm below the bottom of the projector, the maximum feet height is 18 cm. This correspond with a forward tilt of 6.7° if the front feet are completely turned in and the back feet turned out.



Barco offers a pedestal for the Thor series projector. This pedestal has height adjustment blocks which allows extra tilt of 3.3°/block (one block has a height of 5 cm). Maximum stack additional blocks four high.

6.3 Connecting the hoses with projector and chillers

What has to be done?

The cooling circuit of the chiller(s) has to be connected with the cooling circuit of the projector. For that hoses are needed. The length of the hoses depend on the position of the chillers in relation to the projector. The maximum length is 10 meter!

Depending on the projector model one or two chillers are required! For the Thor series projector one chiller has to be installed. The Thor+ series needs two chillers.



This procedure assumes that the chiller(s) and projector are already installed. It is also advised to use the Thor series accessory kit and install the support frames before you connect the hoses and use the hose shells after connecting the hoses. See the Accessory kit installation manual for more details.

Hoses IN/OUT connection scheme

The labels on the projector and on the chiller indicating the three different cooling circuits: (R/B, G and DMD) and the direction of the liquid flow: **OUT** and **IN**. 'OUT' means liquid flows out of the chiller or projector, 'IN' means liquid flows into the chiller or projector. Both sides of all hoses are also labeled.

Chiller without DMD cooling unit (not for Thor)	Chiller with DMD cooling unit	Projector
	DMD OUT	DMD IN
	DMD IN	DMD OUT
	R/B OUT	R/B IN
G OUT		G IN
G IN		G OUT
	R/B IN	R/B OUT



The Thor series projector requires only one chiller. The circuits G-IN and G-OUT are omitted.

How to connect the hoses?

1. Ensure that all connectors of the hoses, chillers and projector are clean. Wipe away any dust before attaching.
2. Connect the hoses one by one with the chiller and projector as illustrated below. (see also 'IN/OUT connection scheme' above)

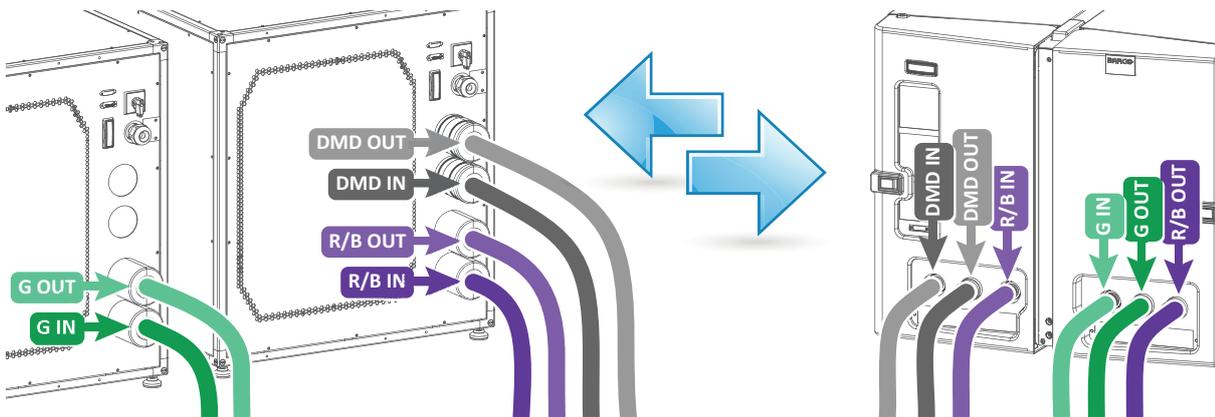


Image 6-7



Note: The circuit is pressurized which makes it sometimes difficult to insert the hoses.



Tip: First move the latch (reference 1 Image 6-8) away from the connection while coupling the hose. Then release the latch and push the hose further until the latch locks.

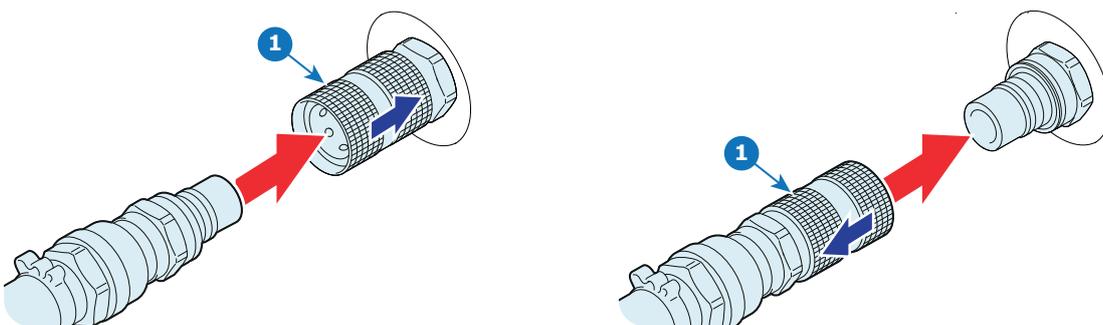


Image 6-8: Left: Male hose connection, right: Female hose connection



CAUTION: Do not interchange the different cooling circuits with each other! Otherwise the system will fail.



CAUTION: The minimum bend radius of the hoses is 30 centimeter.

6.4 Connecting the data cable with projector and chillers

What has to be done?

Next to connecting the hoses, the communication port of the chillers has to be connected with each other and with the projector.

Depending on the projector model one or two chillers are required! For the Thor series projector one chiller has to be installed. The Thor+ series needs two chillers.

Required parts

- One long (10 meter) communication cable with SUBD Male/Female 15 pins plugs.
- One short (5 meter) communication cable with SUBD Male/Female 15 pins plugs (only if two chillers are required).

How to connect the communication ports of the chillers with the projector?

1. Does the system contain two chillers?
 - ▶ **If yes**, connect the output port of one chiller (reference 1 Image 6-9) with the input port of the other chiller (reference 2 Image 6-9). Use for this a short communication cable.
 - ▶ **If no**, proceed with the next step.
2. Connect the output port of the chiller (reference 3 Image 6-9) with the communication port of the projector (reference 4 Image 6-9). Use for this a long communication cable.



Tip: Guide the long communication cable together with the hoses.

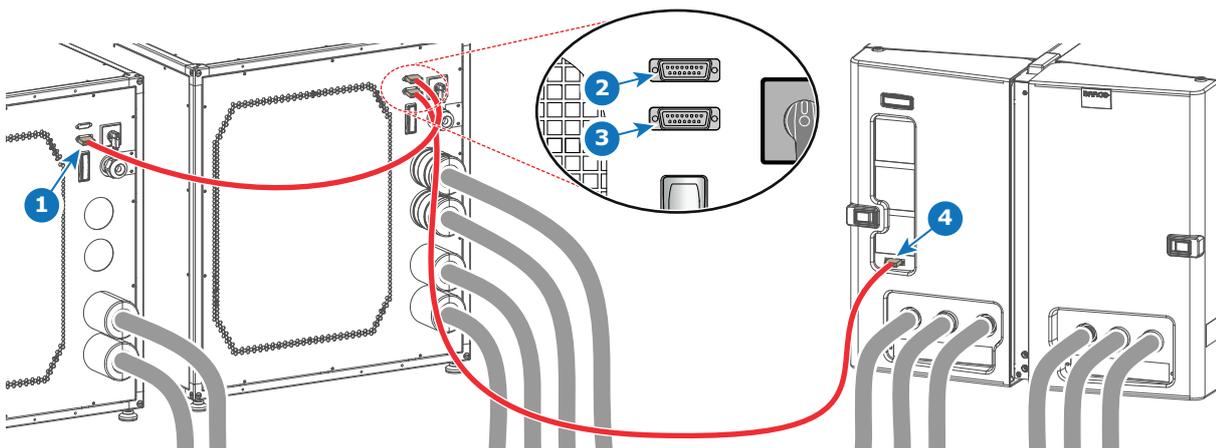


Image 6-9

6.5 Accessing the mains compartment

Required tools

- Phillips screwdriver PH1
- Allen wrench 3 mm

How to access the mains compartment?

1. Loosen the four retaining screws (reference 1 Image 6-10) of the mains cover. Use a PH1 Phillips screwdriver.
2. Remove the mains cover.

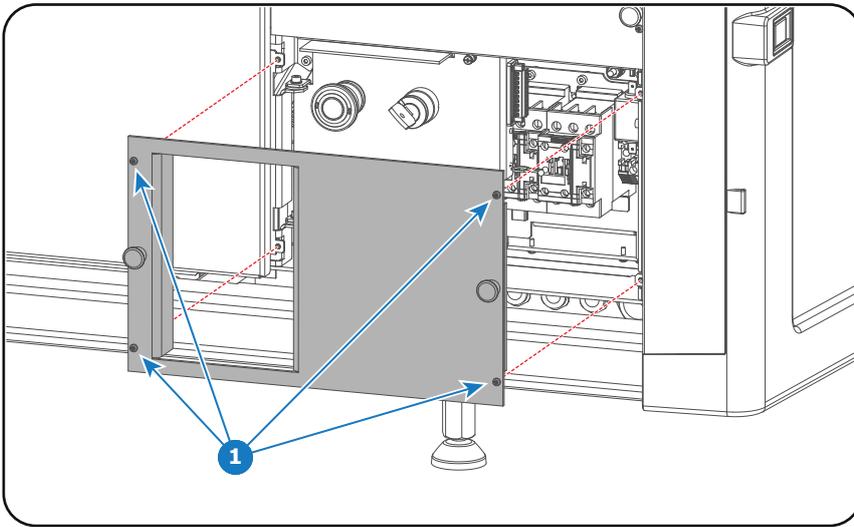


Image 6-10

3. Unlatch and pivot the right front plastic cover door (door which contains the dust filters).
4. Loosen the retaining screw (reference 2 Image 6-11) of the inner door. Use a PH1 Phillips screwdriver.
5. Pivot the inner door to access the mains compartment from the side.

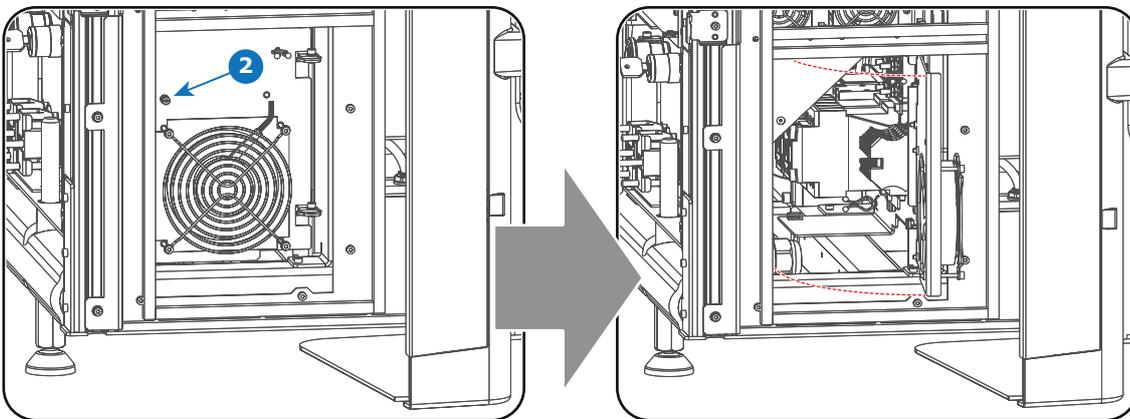


Image 6-11

6. Loosen the retaining screw (reference 3 Image 6-12) of the inner front door (door with the Stop button). Use a 3 mm Allen wrench.
7. Pivot the inner front door to have full access the mains compartment parts.

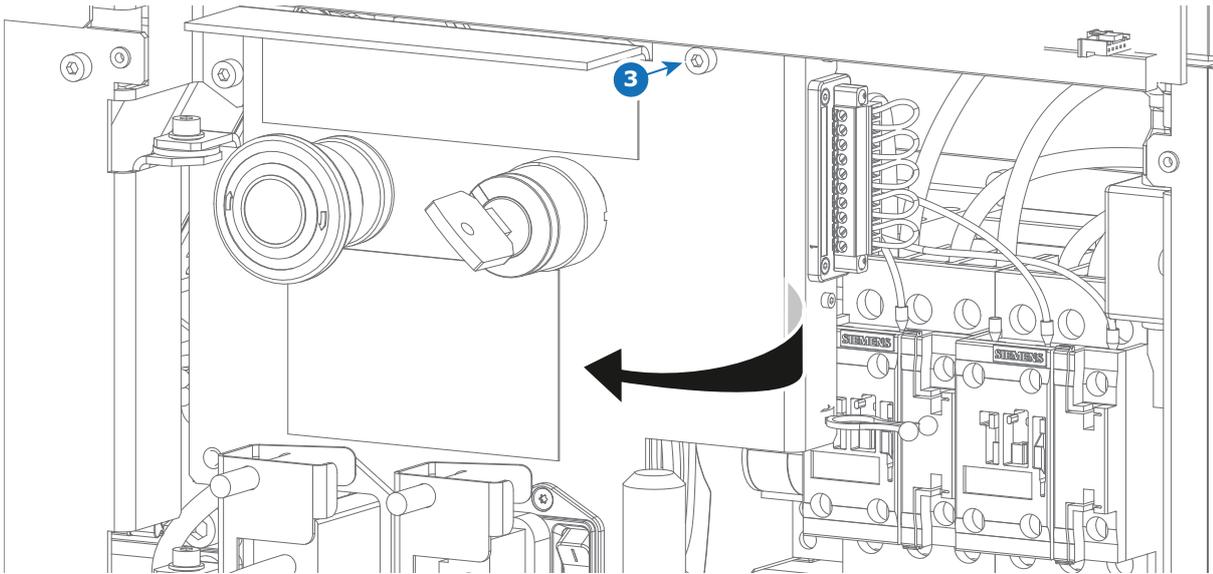


Image 6-12

6.6 Connecting the external safety interlocks



The terminal for the external safety interlocks is located inside the mains compartment. This procedure assumes that the cover of the mains compartment is already removed. See chapter "Accessing the mains compartment", page 51.

Required tools

Flat screwdriver (small)

How to connect the external safety interlocks with the projector?

1. Remove the 10 pole terminal block from its socket (reference 3 Image 6-13). Use a small screw driver.
2. Guide the cable(s) coming from the external interlock device(s) through the cable gland(s) located at the base of the mains compartment (reference 4 Image 6-13).
3. Remove the shunt wire(s) from the 10 pole terminal block and connect the cable(s) according the schematic in Image 6-13.



Note: Only remove the shunt wires from these pins which have to be connected with an external safety interlock device. All other shunt wires must remain in place.



Note: Maximum two external safety interlock devices can be connected. These interlock devices must have double pole normal open contacts. So, for normal operation of the projector the normal open contacts are pushed into the closed state to close the circuit and thus enabling the activation of the PSU of the lasers.

The internal master key can be extended with a single pole external master key (MK).

4. Insert the 10 pole terminal block back in its socket. Use a small screw driver to fixate the terminal block.
5. Insert the cable(s) in the cable tie located below the terminal block (reference 5 Image 6-13).

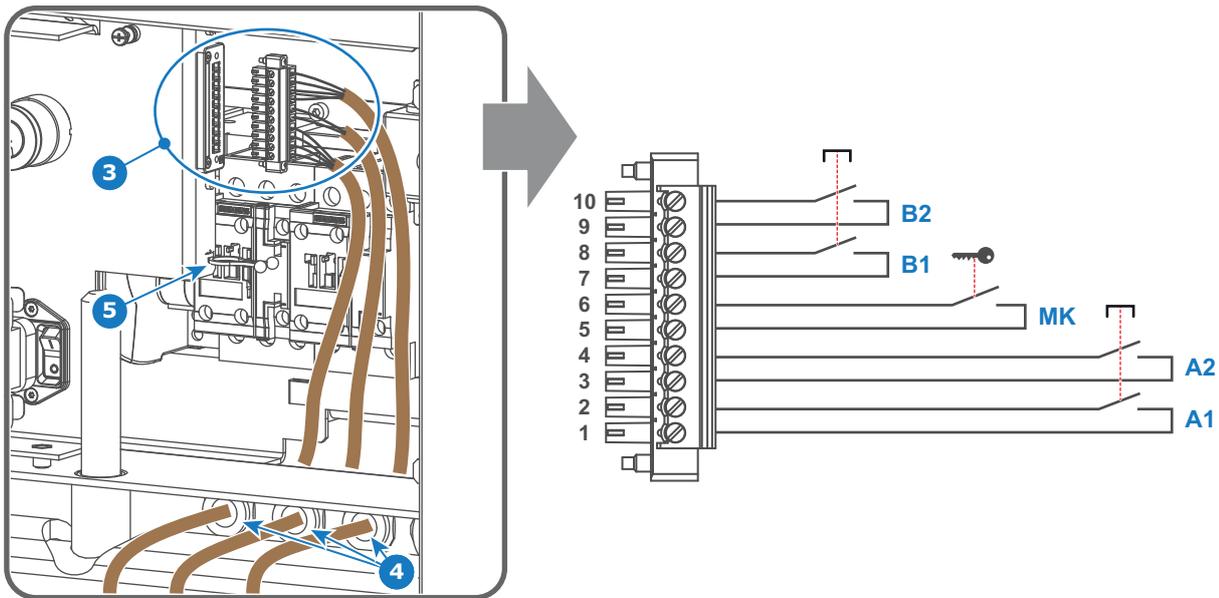


Image 6-13

6. Install the cover of the mains compartment.

6.7 Three phase power input configuration of the projector

About the power input

The projector power input can be configured for a power supply of 200-240V / 346-415V in a Y configuration (3W+N+PE) or for 200-240V in a Δ configuration (3W+PE). Before operating the projector, place the links in the correct position depending on the local power supply.

For a 3W+N+PE system, 346-415V is measured between the lines, 200-240V is measured between the lines and the neutral.

For a 3W+PE system, 200-240V is measured between the lines.

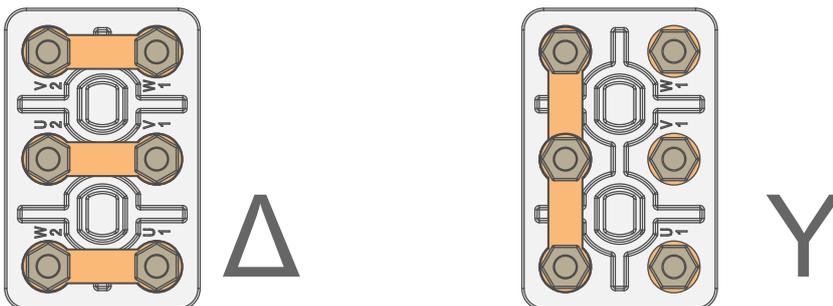


Image 6-14: Y/ Δ configuration block (left: delta, right: star)



WARNING: Ensure that the mains is disconnected from the projector prior to start with this procedure.



The Y/ Δ configuration block is located inside the mains compartment. This procedure assumes that the cover of the mains compartment is already removed. See chapter "Accessing the mains compartment", page 51.

Required tools

- Nut driver 10 mm

- Torque wrench with 10 mm hexagon socket

How to switch from a Y-connection to Δ -connection

1. Loosen the 6 top nuts on the Y/ Δ configuration block. (1 to 6)

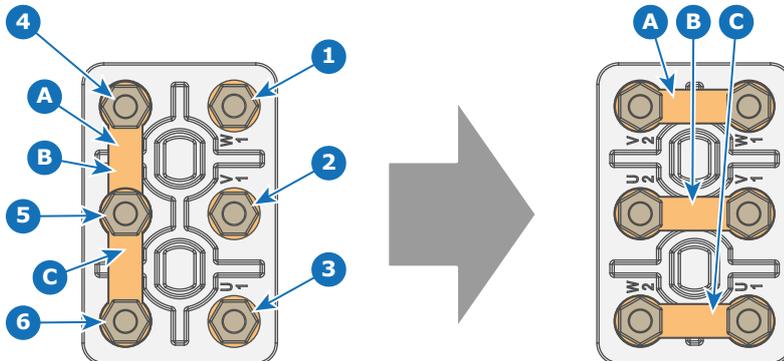


Image 6-15

2. Take off the mounted links (A, B and C). Two links above each other or mounted between the upper and middle pin (A, B) and one link between the middle pin and lower pin (C).
3. Mount the links horizontally on the pins.
4. Turn a nut on each pin and secure with a torque wrench set to **7.5 Nm**.

How to switch from a Δ -connection to Y-connection

1. Loosen the top nuts on the Y/ Δ configuration block (1 to 6).

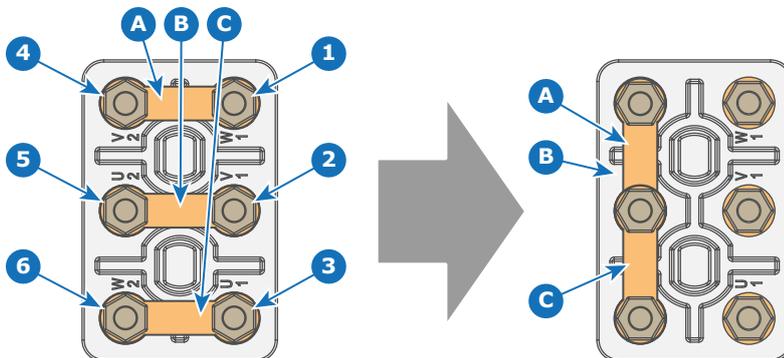


Image 6-16

2. Take off the mounted links (A, B and C).
3. Connect the left pins together. Place 2 links between the upper pin and the middle pin (A, B) and 1 link between the middle pin and the lower pin (C).

6.8 Connecting the projector with the mains electricity



WARNING: The total electrical installation should be protected by an appropriate rated and readily accessible disconnect switch, circuit breakers and ground fault current interrupters. The installation shall be done according to the local electrical installation codes.



CAUTION: The cross-sectional area of the conductors in the AC power supply cord shall be not less than 4mm² to 6mm², 10AWG to 8AWG in case of a star (Y) configuration and not less than 6mm², 8AWG in case of a delta (Δ) configuration.

Required tools

- Flat screw driver 4 x 100 mm
- Torque wrench with flat-head socket (medium size)

Required parts

Certified AC power supply cord, min. 500V. Take into account that the cable gland of the projector allows a cable diameter from 11 to 21 mm.

How to connect the projector with the mains electricity?

1. Remove the cover of the mains compartment. See procedure “Accessing the mains compartment”, page 51.
2. Push the stripped AC power supply cord through the cable gland (reference 2 Image 6-17).
3. Connect the wires to the 5-terminal strip (reference 1 Image 6-17) as illustrated. Use a torque screw driver to fasten the screws of the 5-terminal strip with a torque of **1.7Nm** (1.25 lbf*ft).

Always connect the ground wire (PE) with the connector indicated with PE on the terminal barrier strip.

If a neutral conductor is available, connect always to the connector indicated with N on the terminal barrier strip.

 **Warning:** Connect first the PE wire, then the other wires.

 **Caution:** When using a flexible AC power supply cord, make sure that each conductor end is provided with an end sleeve.

 **Tip:** Check for good fixation by pulling on each wire.

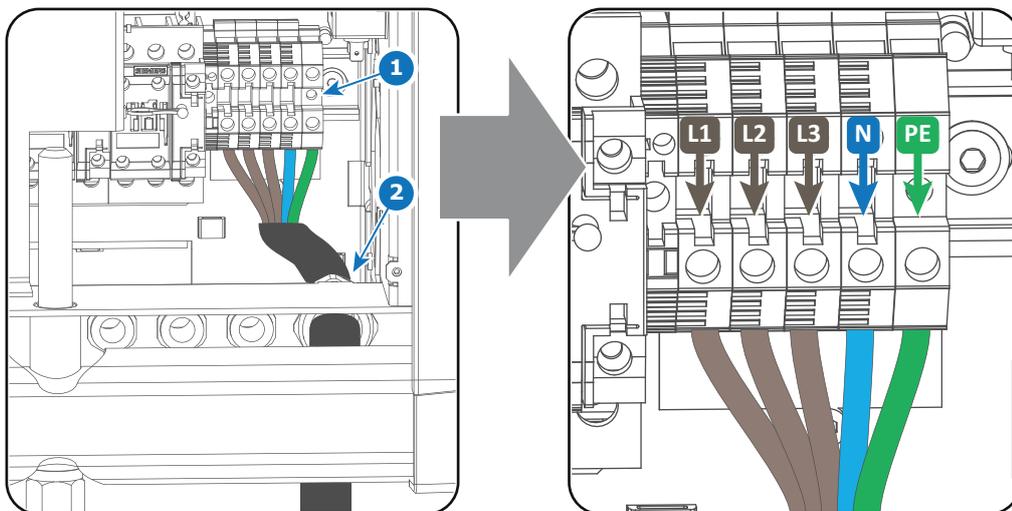


Image 6-17

4. Secure the AC power supply cord by fastening the cable gland (reference 2 Image 6-17).
5. Install the cover of the mains compartment.

6.9 Power loop through to the projector electronics



This procedure explains how to provide the projector electronics with power in case no UPS unit is used. Note that the projector is by default configured for use without UPS. So, the short power link cable is already installed.

Required tools

No tools required.

Required parts

Short power link cable with plug type C13/C14

How to loop through the power?

1. Plug in the short power cable (reference 1 Image 6-18) which was delivered with the projector.
 -  **Warning:** Always use the Barco short power cable which is delivered with the projector.
2. Secure both plugs of the short cable with a fixation spring (reference 2 Image 6-18). Handle as follow:
 - Squeeze the fixation spring together.
 - Slide the fixation spring on the fixation pins (reference 3 Image 6-18) while squeezing together and push it against the power plug.
 - Release the fixation spring.

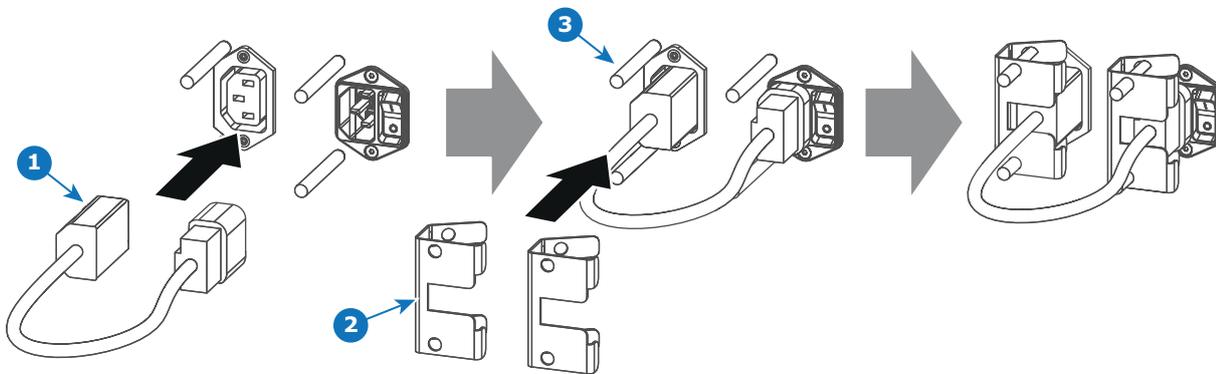


Image 6-18

6.10 Connecting a UPS to the projector electronics



WARNING: Only use UPS units which are suitable for the Thor series series projector. See chapter "Installation requirements" for more information about the requirements of the UPS.

Required tools

No tools required.

How to connect the UPS

1. Install the UPS according to the instructions of the manufacturer and the local regulations.
2. Connect the power output cord from the UPS unit to the UPS inlet socket of the projector (right socket).

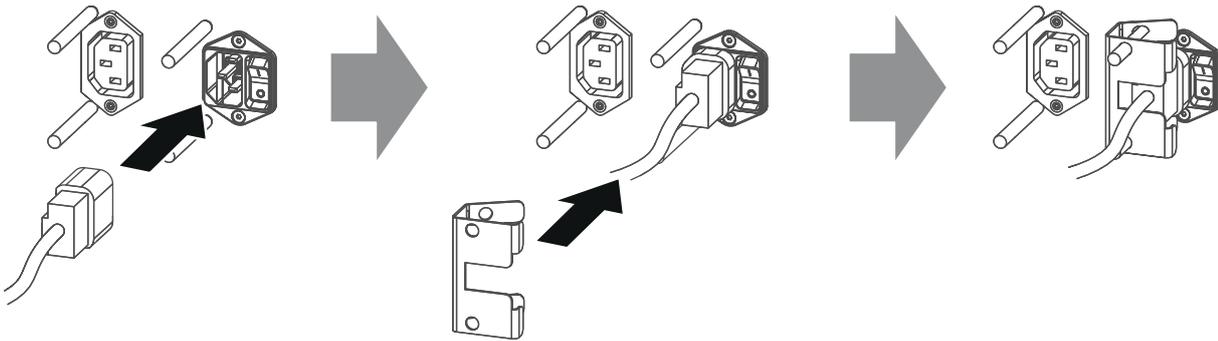


Image 6-19

3. Secure the UPS inlet socket with a fixation spring. Handle as follow:
 - Squeeze the fixation spring together.
 - Slide the fixation spring on the fixation pins while squeezing together and push it against the power plug.
 - Release the fixation spring.
4. Install on the power outlet the second fixation spring to prevent losing it.

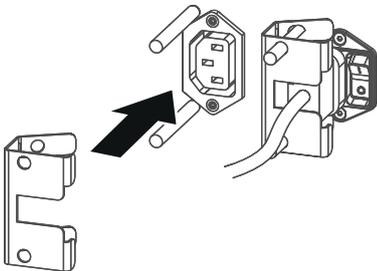


Image 6-20



CAUTION: The electrical connection with the UPS INLET socket of the projector must be done with a certified AC power supply cord (minimum 0,75 mm² or 18 AWG and minimum 300V)



CAUTION: Do not use the power OUTLET socket of the projector to provide power to other equipment!

6.11 Installing the Communicator Touch Panel

Required tools

- 17mm open wrench.
- 10mm open wrench.

How to install the Touch Panel interface onto the top of the projector?

1. Assemble the mounting plate and the swivel arm together as illustrated. First place the nut (reference 1 Image 6-21) upon the rod of the mounting plate, then add the lock washer (reference 2 Image 6-21), then fasten the mounting plate and the swivel arm together. When the arm is mounted, turn the nut (reference 1 Image 6-21) against the arm to secure the position.

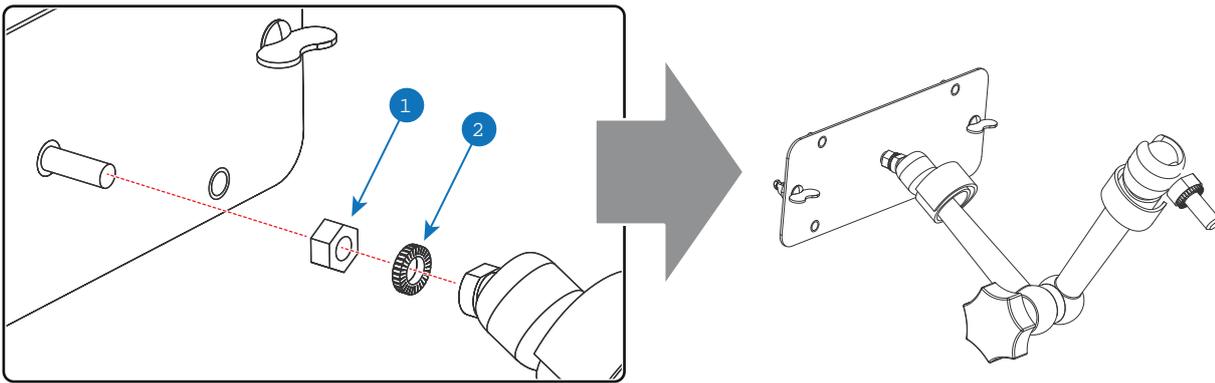


Image 6-21

- Slide a washer (reference 4 Image 6-22) over the base of the swivel arm (reference 3 Image 6-22) and insert the base of the swivel arm into one of the four possible mounting holes (reference 1 & 2 Image 6-22) at the top of the projector.

 **Note:** Which mounting hole to use depends on the operator preferences. In the illustration below the swivel arm is installed into the mounting hole nearest by the Local Keypad of the projector.

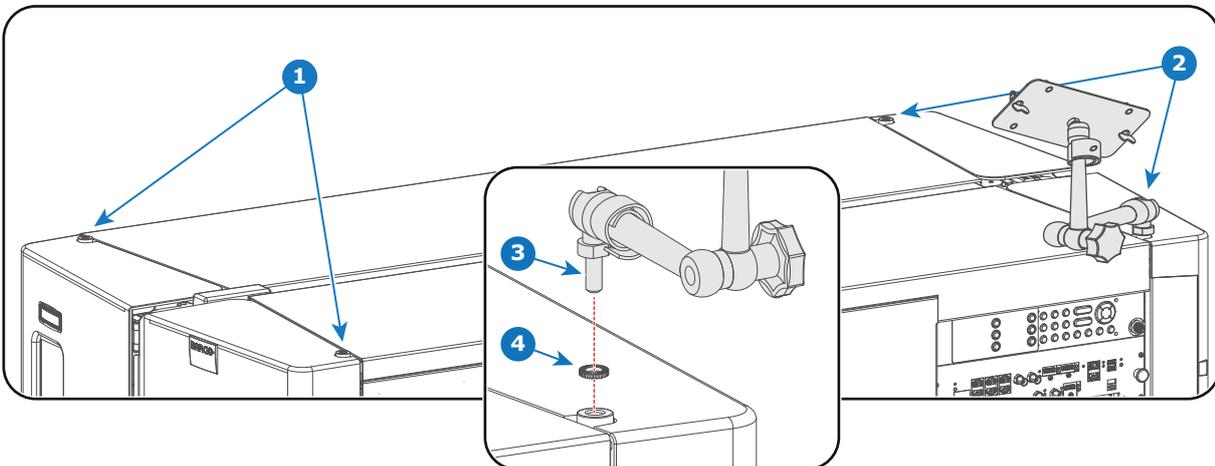


Image 6-22

- Place the Touch Panel interface upon the mounting plate of the swivel arm and fasten the two wing nuts (reference 5 Image 6-23) as illustrated.

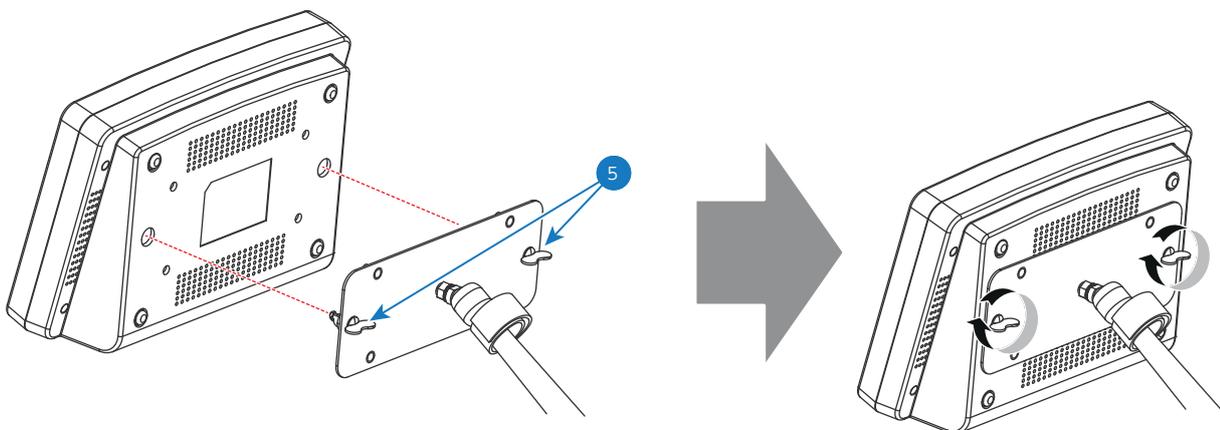


Image 6-23

- Connect the DC plug, the RJ45 Ethernet plug and the D-SUB plug of the customized cable into their respective sockets on the Touch Panel interface.

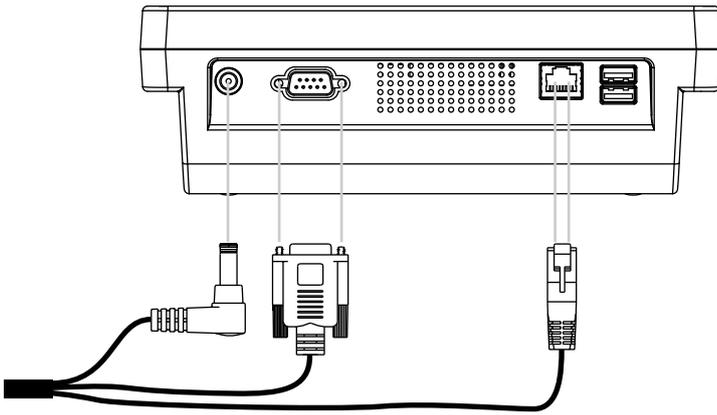


Image 6-24

5. Connect the circular plug of the customized cable with the circular socket (reference 6 Image 6-25) at the right side of the Local Keypad of the projector.

! *Caution:* To avoid connector damage, align the pins before you connect the customized cable.

📄 *Note:* Ensure to tighten the locking nut on the connector.

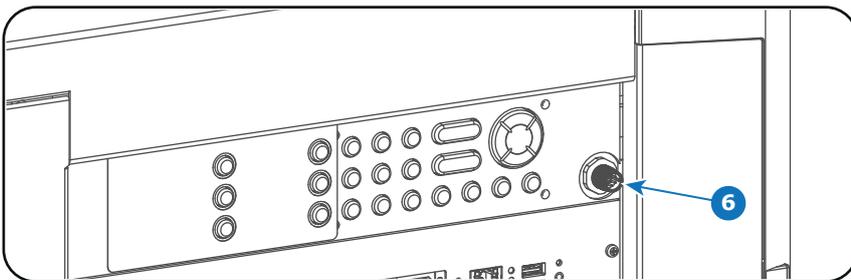


Image 6-25

6. Attach the multi cable to the swivel arm using the two Velcro strips.
7. Position the Touch Panel interface in the desired location. Hold the Touch Panel interface with one hand, release the swivel lock (reference 7 Image 6-26), reposition the Touch Panel interface in the desired location, and fasten the swivel lock.

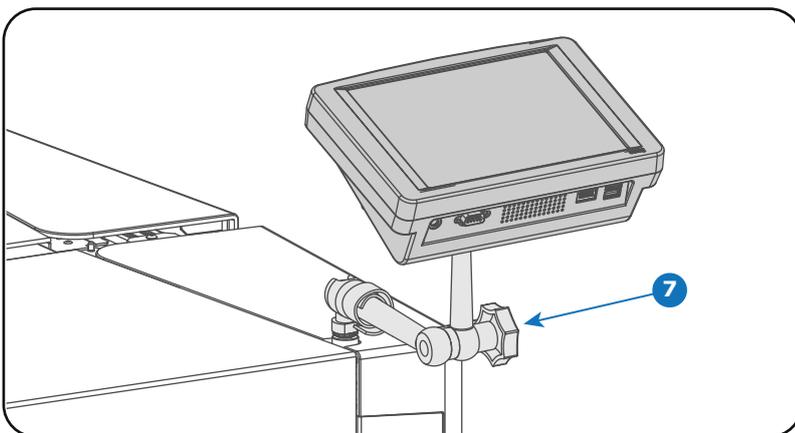


Image 6-26

! *Caution:* Never release the central swivel lock without supporting the Touch Panel interface.

Lenses & Lens selection

7

About this chapter

This chapter gives an overview of available lenses for your Thor series and explains how to select the best suited lens for a specific situation using the lens calculator. Also, it is explained how to install and remove a lens from the projector Lens Holder and how to shift, zoom and focus the lens.



CAUTION: Never transport the projector with a Lens mounted in the Lens Holder. Always remove the Lens before transporting the projector. Neglecting this can damage the Lens Holder and Prism.



CAUTION: Caution when removing or installing the lens! Fragile parts at the inner side of the Lens Holder.



Each time a lens is manipulated (e.g. removed and installed in a projector), it needs to be homed and returned.

Overview

- Available lenses
- Lens selection
- Lens installation
- Lens removal
- Lens shift, zoom & focus

7.1 Available lenses

Which lenses are available for my projector?



The table below is subject to changes and was last updated on 22/12/2017. Consult Barco's web site for the most recent information about available lenses.

Order No	Type	Throw Range		Projector series		
		2K	4K	DP2K-B DP4K-B DP2K-BLP DP4K-BLP DP4K-L	DP4K-P Prometheus I Prometheus II	DP4K-LHC DP4K-BLPHC Thor Prometheus III
R9856504	HB	1.25-1.90	1.13-1.72	X		
R9856506	HB	1.25-1.91	1.13-1.72	X		
R9856294	HB	1.49-2.05	1.35-1.86	X		
R9856297	HB	1.61-2.31	1.46-2.10	X		
R9856300	HB	1.82-2.86	1.65-2.60	X		
R9856303	HB	2.21-3.70	2.00-3.35	X		
R9855947	HB	2.8-5.5	2.53-4.98	X		
R98565042	HC		1.13-1.72	X	X	
R98562942	HC		1.35-1.86	X	X	
R98562972	HC		1.46-2.10	X	X	
R98563002	HC		1.65-2.60	X	X	
R98563032	HC		2.00-3.35	X	X	
R98565043	VHC		1.13-1.72			X
R98562943	VHC		1.35-1.86			X
R98562973	VHC		1.46-2.10			X
R98563003	VHC		1.65-2.60			X
R98563033	VHC		2.00-3.35			X

7.2 Lens selection

Which lens do I need?

1. Go to Barco's website on www.barco.com and click on myBarco

2. Login on.

If you are not yet registered create a login and password. With the created login and password, it is possible to enter myBarco.

When your login is correct, the start page is displayed.

3. Click the **Support** tab, then **Digital cinema calculator** (on the left of the screen) and select the appropriate lens calculator.

The lens calculator (see screenshot, Image 7-1) will be displayed.

The lens calculator allows you to have an overview of which lenses are suitable for your specific projector setup. Just make your selection of parameters and all possible configurations are displayed.

Digital cinema Lens calculator - Series 2

Barco.com | Digital Cinema Calculator - Series 2 - Beta

Make your selection

Resolution only 4k only 2k

Projection 2D projection 3D projection

Masking Side Masking Top Masking

Screen Width m

Screen Height m

Projector Distance m

Screen gain

Optical losses %

Lamp life %

Foot-Lambert fL

units: m ft Legal Disclaimer

Required lens ratios
scope: 2.32 flat: 3
scope 4K: 2.57 flat 4K: 3.32

Possible configurations

DP4K-32B
Ultra-bright Enhanced 4K
DLP Cinema@ projector
Lamp
6.5kW High Performance Bulb

Available lenses

Lens	Zoom Range	Required Ratio
1.38" DC4K (1.13-1.31)	1.13 - 1.31	2.32
1.38" DC4K (1.27-1.86)	1.27 - 1.86	2.32
1.38" DC4K (1.45-2.13)	1.45 - 2.13	2.32
1.38" DC4K (1.63-2.53)	1.63 - 2.53	2.32
1.38" DC4K (1.95-3.26)	1.95 - 3.26	2.32
1.38" DC4K (2.53-4.98)	2.53 - 4.98	2.32

Required lens ratios: scope: 2.32 flat: 3

DP2K-19B
Ultra-bright DLP Cinema@
projector for screens up to
19m (62ft)
Lamp
3kW Standard short-arc Bulb

Available lenses

Lens	Zoom Range	Required Ratio
1.2" DC2K (1.25-1.45)	1.25 - 1.45	2.32
1.2" DC2K (1.4-2.05)	1.4 - 2.05	2.32
1.2" DC2K (1.6-2.35)	1.6 - 2.35	2.32
1.2" DC2K (1.8-2.8)	1.8 - 2.8	2.32
1.2" DC2K (2.15-3.6)	2.15 - 3.6	2.32
1.2" DC2K (2.8-5.5)	2.8 - 5.5	2.32

Required lens ratios: scope: 2.32 scope 4K: 2.57 flat: 3 flat 4K: 3.32

DP2K-12C

Available lenses

Lens	Zoom Range	Required Ratio
0.98" DC2K (1.2-1.8)	1.2 - 1.8	2.32

Image 7-1: Digital cinema lens calculator



Take into account that when the projector is **tilted** the **Screen Width** you have to fill in should be **larger** than the physical screen width due to the keystone distortion of the projected image. How much larger depends on the amount of tilt.



Due to production tolerances the real distances can differ by 2% from the calculated values. For critical situations (fixed installs that use the lens at one of its extreme zoom positions) this should be taken into account.

7.3 Lens installation



If no lens is installed the lasers of the Thor series projector can not be powered. The Standby button or Light button will light up red. The Projector Toolset will also show the error message that there is no lens installed.

How to install a lens into the Lens Holder?

1. Remove the plastic cover in the opening of the Lens Holder if not removed yet. Place the Lens Holder in the "unlocked" position by moving the lens lock handle (reference 1 Image 7-2) to the right. Then, take away the plastic cover.

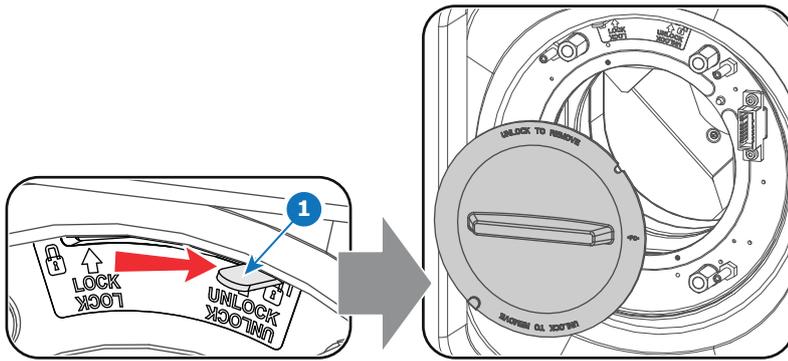


Image 7-2

2. Take the lens assembly out of its packing material and remove the lens caps on both sides.

! *Caution:* Do not touch the glass of the lens!

3. Ensure that the Lens Holder stands in the On-Axis position (horizontal and vertical mid position). As best as possible.
4. Place the Lens Holder in the “locked” position by moving the lens lock handle (reference 1 Image 7-3) to the left, away from the lens power supply socket (reference 2 Image 7-3).
5. Gently insert the lens in such a way that the lens connector matches the socket. To prevent collision of the lens ensure you centre the lens and keep it on-axis while approaching.

! *Warning:* Do not release the Lens yet, as the Lens may fall out of the Lens Holder.

6. **Push** the lens completely against the Lens Holder front plate. An **audible click** should be noticed. Once seated, there may be no airgap between lens flange and Lens Holder front plate.

! *Caution:* Ensure that the lock handle remains in the “locked” position.

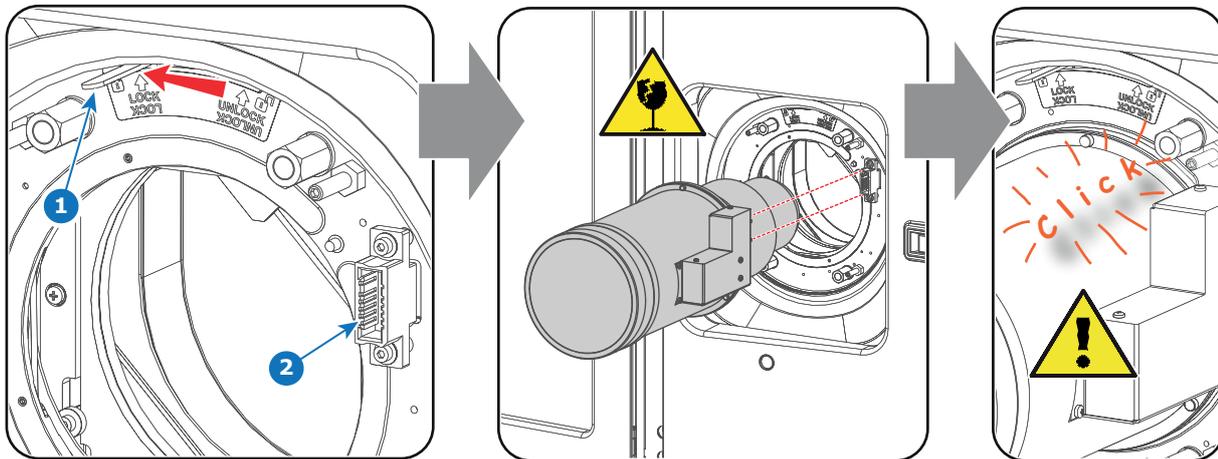


Image 7-3

Note: For frequent installation and removal of the lens it is recommended to install the lens while the lock handle is in “open” position (to the right) and put the lock handle in “locked” position once the lens is inserted. Then check if the lens is properly installed by trying to pull the lens out of the Lens Holder. (this alternative procedure result in less wear of the Lens Holder and avoids the risk of moving and misaligning the projector while pushing the lens inwards).

7. Check if the lens is really secured by trying to pull the lens out of the Lens Holder.
8. Activate the corresponding lens parameters for the installed lens. (See user guide of the “Projector Toolset” chapter *Installation > Advanced > Lens parameters*)

! **Caution:** Not using the correct lens parameters could result in lens damage.

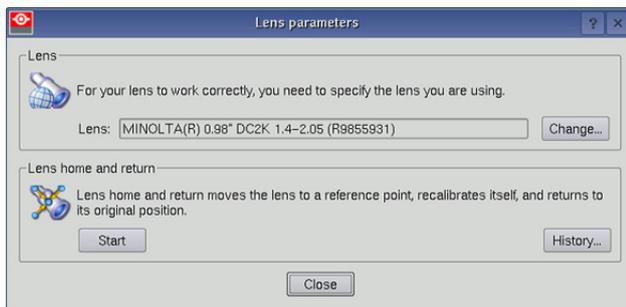


Image 7-4

9. Perform a lens **HOME & RETURN** operation. (See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*)

Note: The HOME & RETURN operation enables the projector to determine the reference positions of the motorized ZOOM and FOCUS barrels of the installed lens.



A Spatial Color Calibration (SCC) has to be executed in case of a first install or in case a High Brightness lens is swapped with a High Contrast lens or vice versa. See user guide of the Communicator for detail SCC calibration instructions.



CAUTION: Never transport the projector with a Lens mounted in the Lens Holder. Always remove the Lens before transporting the projector. Neglecting this can damage the Lens Holder and Prism.

7.4 Lens removal

How to remove a lens from the Lens Holder?

1. Support the lens with one hand while you unlock the lens holder by sliding the lock handle (reference 1 Image 7-5) towards the “unlocked” position as illustrated.
2. Gently pull the lens out of the lens holder, maintaining its coaxial direction.

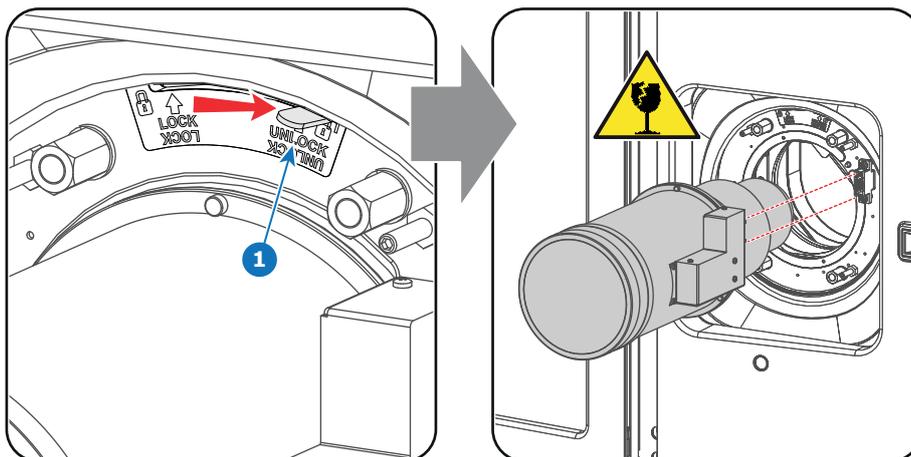


Image 7-5



It's recommended to place the Lens caps of the original Lens packaging, back on both sides of the removed Lens to protect the optics of the Lens.



It's recommended to place the plastic cover of the original projector packaging, back into the lens opening to prevent intrusion of dust. This plastic cover prevents that dust is entering the projector.



If no lens is installed the lasers of the Thor series projector can not be powered. The Standby button and Light button will light up red. The Projector Toolset will also show the error message that there is no lens installed.

7.5 Lens shift, zoom & focus

Motorized lens adjustment

The Thor series is equipped with a motorized lens shift and zoom & focus functionality.

Maximum shift range

The lens can be shifted with respect to the internal optics of the projector (DMD) which results in a shifted image on the screen (Off-Axis). A 100% shift means that the centre point of the projected image is shifted by half the screen size. In other words, the centre point of the projected image falls together with the outline of the image in an On-Axis projection. Due to mechanical and optical limitations the shift range is limited as well.

All DC4K lenses have a shift range of 50% up, 50% down, 17% left, and 17% right. This range is valid for all throw ratios. Within these shift ranges the projector and lens perform excellently. Configuring the projector outside these shift ranges will result in a slight decline of image quality.

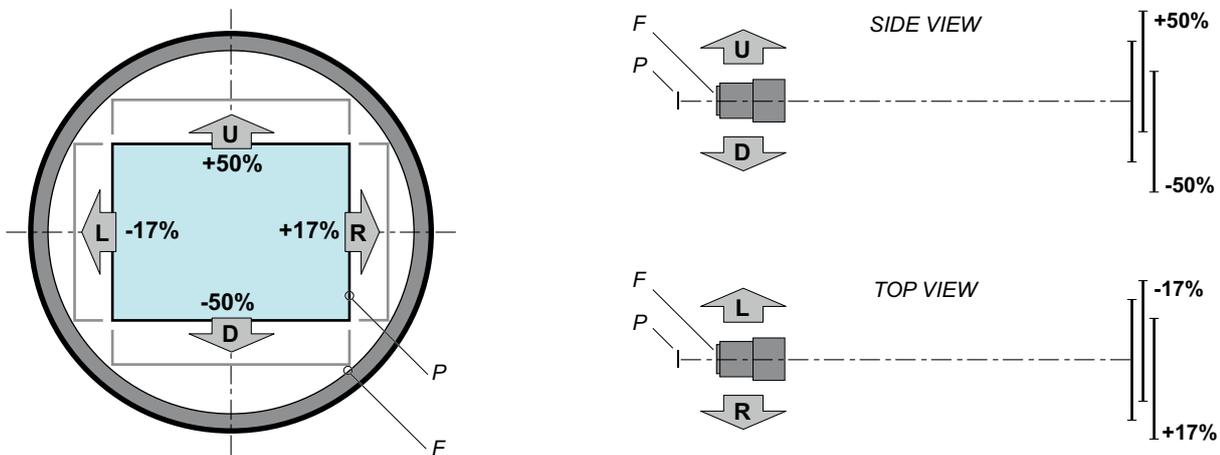


Image 7-6

- P** DMD.
- F** Field of view.



It's mechanical possible to shift outside the recommended field of view, but this will result in a decline of image quality depending on the used lens and the zoom position of the used lens. Furthermore, shifting too much in both directions will result in a blurred image corner.

How to shift the lens of the Thor series ?

1. Use the **up and down** arrow buttons on the Local Keypad to shift the lens **vertically** and use the **left and right** arrow buttons on the Local Keypad to shift the lens **horizontally**.



Image 7-7

How to zoom in or out?

1. Use the **“+”** and **“-”** **zoom buttons** on the Local Keypad to zoom in or out.



Image 7-8

How to focus?

1. Use the “+” and “-” **focus buttons** on the Local Keypad to focus the image on the screen.



Image 7-9



Take into account that the lens focus may slightly drift while the lens is warming up from cold to operation temperature. This is a typical phenomenon for projection lenses used with high brightness projectors. The operation temperature of the lens is reached after approximately 30 minutes projection of average video.

Button backlight colors

- **WHITE** : The default backlight color of the Shift, Zoom and Focus buttons is white which indicates that the button is enabled.
- **PURPLE** : When pushing the Shift, Zoom or Focus button the backlight color is purple of the part of the button that is pushed. This indicates that the requested action is ongoing.
- **RED** : The backlight color of the Shift, Zoom and Focus buttons is red in case of end of range.

Input & Communication

8

About this chapter

This chapter describes the functionality of the Local Keypad, the projector Status Light (tail light) and the different input and communication ports of your Thor series projector.

Note that all information about the ICMP is gathered into one separated chapter: "ICMP", page 77.

Overview

- Introduction
- Projector Status
- Laser Status
- Local Keypad
- Cinema Controller

8.1 Introduction

General

The Input & Communication side of the Thor series projector consists of a Local Keypad integrated into the projector housing and a card cage with three slots. The rear side of the projector is equipped with a tail light which reflects the status of the projector. The laser status light is located on the top side of the projector.

The projector card cage is equipped with an ICMP. See illustration below. Note that all information about the ICMP is gathered into one separated chapter: “ICMP”, page 77.

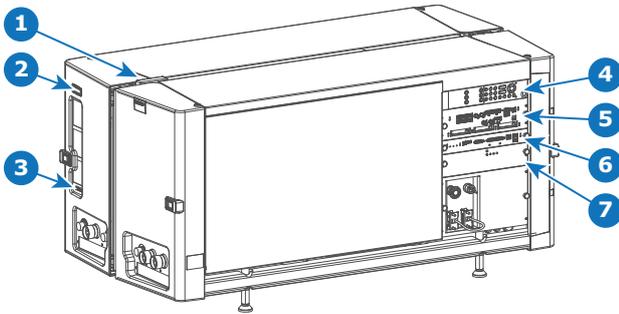


Image 8-1

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Lasers status light. 2 Projector status light. 3 Communication port with Chillers. 4 Local keypad. | <ul style="list-style-type: none"> 5 ICMP. 6 Barco Cinema Controller. 7 Switch Mode Power Supply (SMPS) for projector electronics (not lasers) |
|---|---|



CAUTION: A unit may only be removed from the card cage by qualified service personnel. Removing one of the boards (except for the Cinema Controller or SMPS) will result in an authorization request upon starting.

8.2 Projector Status

About the projector Status Light

The projector Status Light is located at the rear side of the projector (reference 1 Image 8-2). The projector Status Light is a real time indicator of the projector condition.

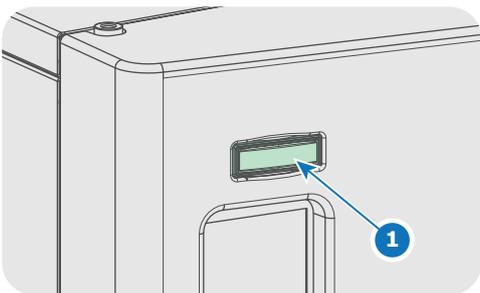


Image 8-2

Status overview

Depending on the condition of the projector the status light may have 4 colors: Green, Yellow, Red or Blue. Each color represent a different state:

Blinking Green

Projector is booting up.

Green

Projector is running normally.

Yellow

Projector is running with warnings. Event can go on but a technical intervention might be needed in the future to prevent a complete stop of the projector.

Red

Projector is in error state. Problem could prevent normal operation. Solve the problem before the projector.

Blue

Projector runs in notification state. Maintenance action required.

Operational mode

In Operational mode the lasers of the projector are switched OFF but all the electronics of the projector remain fully operational. The projector is ready to activate the lasers and project the image. The status light is not different between Operational mode and Light ON mode.

Standby mode

If the projector is in **Standby** mode then the **status light flashes** every ten seconds. The color of the flash depends on the state of the projector. In other words, the color of the flash will be green in normal state (no warnings, no errors, no notifications).

In Standby mode the total power consumption of the projector is less than 15W. All electronics are switched off (including PSUs for the lasers) except for Cinema Controller board and Local Keypad. Only the following functionalities of the projector remains active:

- Local Keypad
- Router LAN and WAN port fully functional
- USB IN port type "B" (Virtual comport RS232)
- USB OUT port type "A" (To power handheld devices [500mA MAX]. No other functionality supported)
- GPIO port on the Cinema Controller

Pressing the Standby button in Operational mode for 3 seconds puts the projector in Standby mode. After de-conditioning then the projector goes in Standby mode.

Pressing the Standby button in Standby mode for 3 seconds will awake the projector towards operational mode. The status light will blink for a few seconds (booting up all inactive boards) and then lights up continuously.

Enter or leave Standby mode can also be done via two dedicated projector commands (USB/Ethernet), or via two predefined Macros (not editable) with GPIO of the Cinema Controller (not the GPIO of the ICMP), or via the Communicator.



The projector always boots up in the same mode (E.g. Standby or Operational) as it was powered OFF.

8.3 Laser Status

About the Laser Status Light

The Laser Status Light is located at the rear top of the projector (reference 2 Image 8-3). The Laser Status Light is a real time indicator of the laser condition.

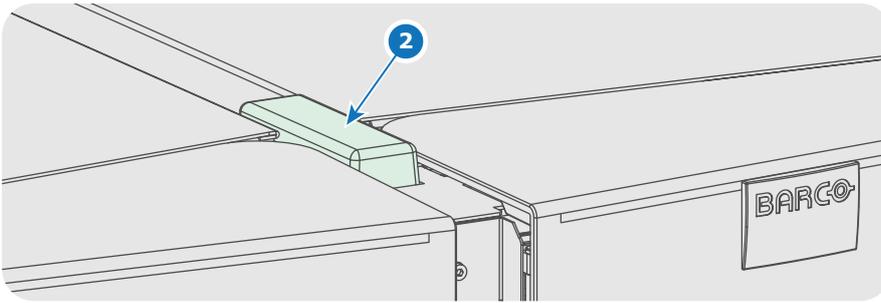


Image 8-3

Status overview

The Laser Status light has only one color: white. The combination of the Laser Status light and the backlight of the Power On/Off button on the Local Keypad indicates a certain condition of the projector. See table below.

Status Light	Light Button	Meaning
Off	Continuous white or off	Sealed compartments are DECONDITIONED. Lasers are not safe to open (service personnel to open the compartments).
Blinking (6 seconds)	Blinking green	Indicates the start of the CONDITIONING process. After six seconds the light will light up continuously.
On	Blinking green	Ongoing CONDITIONING process. Lasers are tested
	Continuous green	Sealed compartments are fully CONDITIONED. Lasers are safe to open for projection.
	Blinking white	Ongoing DECONDITIONING process. Lasers can be active
Slow blinking	Continuous white or red	Not safe to open the sealed compartments due to risk of condensation. Dew point of the boot area is too high. Wait until the status light turns off and remains off.

8.4 Local Keypad

Identification of the buttons

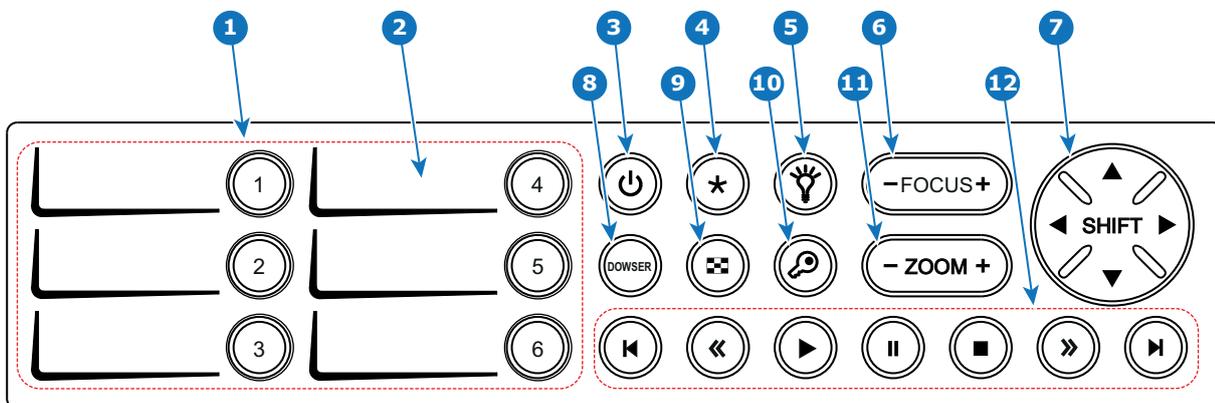


Image 8-4

Functionality of the buttons

1 Numeric buttons (No.1 - 6)

Each Numeric button (reference **1** Image 8-4) can be linked to a macro which allows you to setup the projector to your requirements with one push of a button. The backlight of the Numeric button is white if a macro is associated with the Numeric button. The backlight is green if the macro associated with the Numeric button is activated. The backlight is red in case one of the actions of the macro failed. Inactive Numeric buttons have no backlight.

When the authorization process is activated with the (security) Key button, the backlight of the Numeric buttons changes to yellow.

2 Marker area

Each Numeric button has a marker area (reference **2** Image 8-4) where you can write down the name of the Macro.

3 Standby button

Pushing the Standby button (reference **3** Image 8-4) for 3 seconds changes the projector mode from Standby mode (energy saving) to Operational mode or vice versa. The backlight of the Standby button is blinking white or green, depending on the requested mode. Once the requested mode is reached the backlight will be continuously lit up green in Operational mode or white in Standby mode.

Enter or leave Standby mode can also be done via a 2 dedicated projector command (USB/Ethernet), or via two predefined Macros (not editable) with GPIO, or via the Communicator.

During projector initialization the backlight of the Standby button is blinking blue.

In case the Light button and the Standby button continuous lights up red indicates that no lens is installed or that the ambient temperature inside the Light Processor compartment is exceeded or that the DMD FRONT or DMD BACK temperature is exceeded.

4 Star button

Star button (reference **4** Image 8-4). Pressing the Star button a few seconds will activate the ICMP reset process.

5 Light button

Light button (reference **5** Image 8-4) switches the lasers ON or OFF.

Pushing the Light button (reference **5** Image 8-4) for 3 seconds will activate or deactivate the lasers of the projector. The backlight of the Light button is blinking white or green, depending on the requested mode. Once the requested mode is reached the backlight will be continuously lit up green when the lasers are activated or white when the lasers are deactivated.

In case the Light button and the Standby button continuous lights up red indicates that no lens is installed or that the ambient temperature inside the Light Processor compartment is exceeded or that the DMD FRONT or DMD BACK temperature is exceeded.

6 Focus button

The Focus button (reference **6** Image 8-4) allows you to focus the projected image on the screen. The backlight of the Focus button is red in case the end of range is reached.

In case no lens (file) is selected the Focus button remains inactive. No backlight.

7 Shift button

The Shift button (reference **7** Image 8-4) allows you to shift the lens up/down or left/right. The backlight of the Shift button is red in case the end of range is reached.

In case no lens (file) is selected the Shift button remains inactive. No backlight.

8 Dowser button

The Dowser button (reference **8** Image 8-4) opens or closes the dowser. The backlight of the Dowser button is green when the dowser is requested to open and white when the dowser is closed. Red indicates an error.

9 Test Pattern button

The Test Pattern button (reference **9** Image 8-4) gives direct access to a limited set of the internal test patterns of the projector. This is a toggle button. To exit the Test Pattern mode toggle through all test patterns. Note that the convergence test pattern is not included in this set. The backlight of the Test Pattern button is blinking green if one of the test patterns is activated and lit up continuous green if none is activated. In case of failure the button lights up in red.

10 Key button

The (security) Key button (reference **10** Image 8-4) is used for the authorization procedure to clear tamper errors etc. (service purposes, see procedure “Authorization to clear security warning on the projector”, page 147). Pin codes can be added/changed with the Communicator. The backlight of the Key button is normally green. If the DCI security is tampered then the backlight of the Key button is red.

11 Zoom button

The Zoom button (reference **11** Image 8-4) allows you to zoom in or out the projected image on the screen. The backlight of the Zoom button is red in case the end of range is reached. In case no lens (file) is selected the Zoom button remains inactive. No backlight.

12 Media control buttons

Buttons (reference **12** Image 8-4) allowing you to navigate through the content on the integrated media server. (this feature is not yet implemented in the software, future expansion).

8.5 Cinema Controller

Location of the communication ports

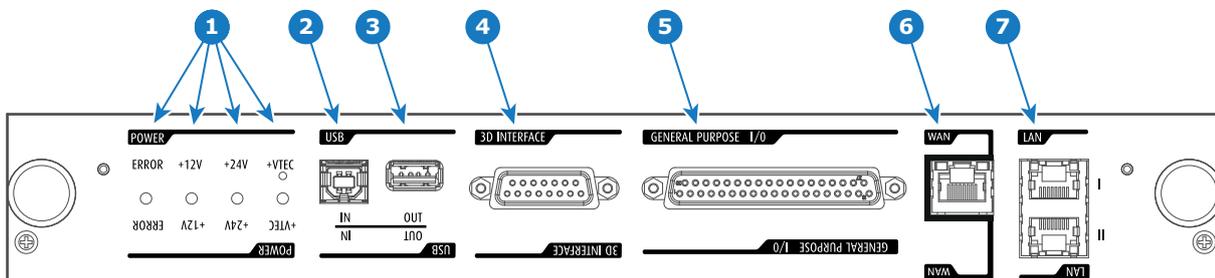


Image 8-5

Functionality

1 Diagnostic LEDs

The front plate of the Cinema Controller contains 4 diagnostic LEDs to display the status of the power supply (reference **1** Image 8-5):

- +VTEC supply.
- +24V supply.
- +12V supply.
- general power supply (ERROR).

2 USB IN port

The Cinema Controller is equipped with a USB port, type “B” connector, (reference **2** Image 8-5) to connect upstream devices (E.g. PC). This USB port is used to communicate with the projector via RS232 commands (Virtual comport). The USB IN port remains operational in Standby mode.

3 USB OUT port

The Cinema Controller is equipped with a USB port, type "A" connector, (reference **3** Image 8-5) which can be used to power handheld devices within USB spec (MAX 500mA/5V). No other functionality supported (Future expansion). The USB OUT port remains operational in Standby mode.

4 3D INTERFACE

3D interface port (reference **4** Image 8-5). Can be used to connect external 3D devices to the projector. All signals necessary for 3D projection can be provided via this connector. The 3D interface port is disabled if the projector is in Standby mode.

5 GENERAL PURPOSE INPUT/OUTPUT (GPIO)

This 37 pin connector (reference **5** Image 8-5) can be used to send or receive trigger signals from other devices. These input/output pins can be programmed by macros created with the Communicator software. See user's guide of the Communicator, section Macro editor, for more information about this functionality. Note that the General Purpose Inputs accept 24 volt maximum. The GPIO remains operational when the projector is in Standby mode. So, if the factory predefined macro to wake up the projector is assigned to one of the free GPI input pins the projector can be awakened via GPIO. Enter or leave Standby mode can also be done with GPIO via two predefined Macros (not editable).

6 Wide Area Network (WAN)

Wide Area Network (WAN: 10/100/1000 base-T). Use this Ethernet port (reference **6** Image 8-5) to connect the network which contains the DHCP server.

The Thor series can be connected to a WAN (Wide area network) (reference **6** Image 8-5). Once connected to the WAN, users can access the projector from any location, inside or outside (if allowed) their company network using the Communicator software. This software locates the projector on the network if there is a DHCP server or the user can insert the correct IP-address to access the projector. Once accessed, it is possible to check and manipulate all the projector settings. Remote diagnostics, control and monitoring of the projector can then become a daily and very simple operation. The network connectivity allows detection of potential errors and consequently improves service time.

7 Local Area Network (LAN: 10/100/1000 base-T)

Local Area Network (LAN: 10/100/1000 base-T) with built-in Ethernet switch (port 1 and port 2). Use for projector control and automation. E.g. Touch Panel, content server, ... (not for content streaming!)

As there is a need to daisy chain projectors when they are on an Ethernet network, an Ethernet switch is built in. the incoming network is hereby available for the internal PC and for the next device in the chain. In this way a 'star' network interconnection can be avoided. The switch used is a stand alone 10/100/1000Mbit Ethernet switch. This assures no influence on the network speed. Furthermore, this Ethernet switch remains operational when the projector is in Standby mode.

The connectors used for these Ethernet ports are of the type RJ45, which is compatible with standard RJ45 cable connector. Straight (most common) as well as cross linked network cables can be used. The 2 ports are functionally identical. Both ports are connected via the projector switch (Auto sensing enabled).

Cinema Controller functions:

- Ethernet Communication to ICMP.
- Virtual COM port (RS232) to BARCO Controller on the USB-IN port.
- Standardized 3D interface on board.
- GPIO controls
- Lensholder motors (stepper motors)
- Stores lens files and lens type / Controls lens
- Lens motor drivers (DC motors)
- Controls lamp power supply
- Stores SNMP key
- Stores Barco IP address and host name
- Handles reporting of errors, version info & Barco logs to Communicator

- Controls and monitors keypad (Button module)
- Controls and monitors status lights
- Stores Macro files, Input files, Lens files, 3D files and Light Sensor Calibration file (LSC)

Virtual comport (RS232 serial communication)

The USB-IN port of the communication interface supports RS232 serial communication. You can use the RS232 input port to connect a local PC to your Thor series projector. This way you can configure and control your Thor series projector from your local PC via RS232 (serial) communication protocol.



Do not forget to set the projector's baud rate (default = 115200) to match that of the computer.

Advantages of using RS232 serial communication:

- easy adjustment of the projector via PC (or MAC).
- wide range of control possibilities.
- copying data from the projector (backup).

RS232



An Electronic Industries Association (EIA) serial digital interface standard specifying the characteristics of the communication path between two devices using either D-SUB 9 pins or D-SUB 25 pins connectors. This standard is used for relatively short-range communications and does not specify balanced control lines. RS-232 is a serial control standard with a set number of conductors, data rate, word length and type of connector to be used. The standard specifies component connection standards with regard to computer interface. It is also called RS-232-C, which is the third version of the RS-232 standard, and is functionally identical to the CCITT V.24 standard. Logical '0' is > + 3V, Logical '1' is < - 3V. The range between -3V and +3V is the transition zone.

About this chapter

This chapter describes the ICMP in general, the HDDs, the input ports and the communication ports. Furthermore, the status LEDs are described and the importance of the device certificate is illustrated.



Image 9-1

Overview

- ICMP introduction
- ICMP HDD
- ICMP communication ports
- ICMP source input ports
- ICMP DisplayPort specifications
- ICMP SDI specifications
- ICMP HDMI 2.0 specifications
- ICMP HDMI 1.4 specifications
- ICMP status LEDs
- ICMP HDD status LEDs
- ICMP device certificate
- ICMP configuration via Communicator
- ICMP reset
- Obtaining the Barco ICMP certificate
- Removing a HDD from the ICMP

- Installing a HDD into the ICMP

9.1 ICMP introduction

About ICMP

The ICMP is a removable electronic assembly situated in the Card Cage of the projector. The ICMP stores, decrypts and decodes DCI cinema content and delivers it to the projector in a usable format, all integrated into a single assembly placed directly in the projector. ICMP is a fully integrated assembly so expected by the operators to facilitate their daily business.

The standard Integrated Cinema Processor functionality from Texas Instruments® is fully integrated into the ICMP. So, the ICMP replaces the ICP board as well.

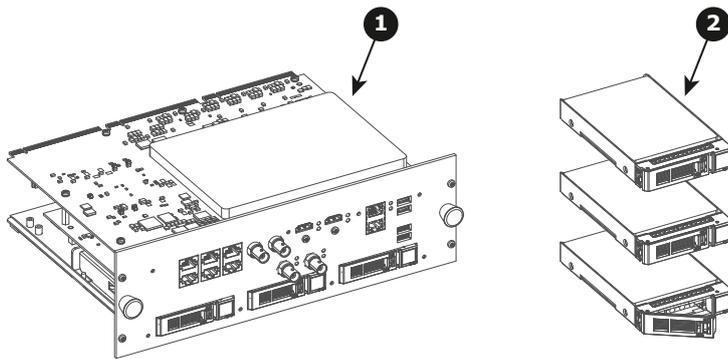


Image 9-2

- 1 ICMP
- 2 HDDs for ICMP

As an integrated component of the projector, installation and maintenance of the ICMP requires the same skills and the same precautions as an intervention on the projector itself.

For order info see www.barco.com.

Front face of the ICMP

The last produced model is equipped with two HDMI 2.0 as video source.

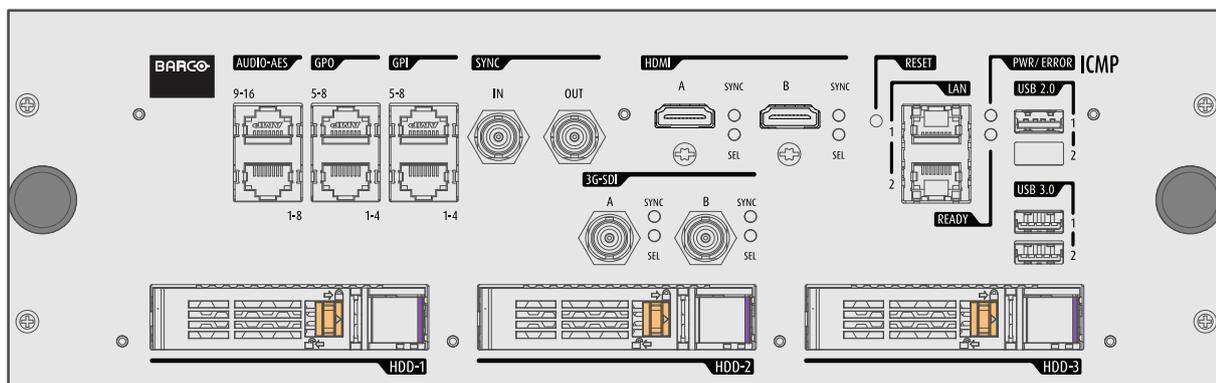


Image 9-3: Front face ICMP (with HDMI 2.0).

Some models with DisplayPorts and one HDMI 1.4 (mezzanine) are still present on the field.

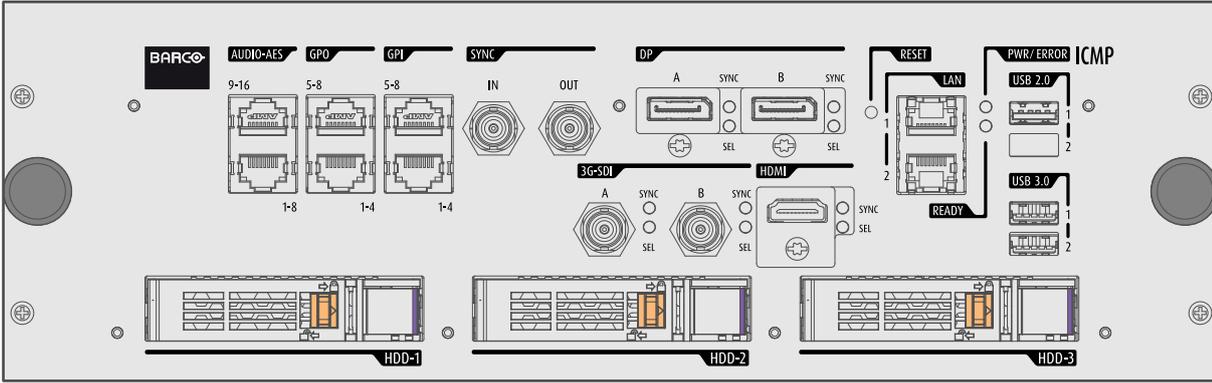


Image 9-4: Front face ICMP (with DisplayPort and HDMI 1.4).

Card Cage slot location

The Card Cage can be different depending the projector type but it always consists of a button module and several removable units. The ICMP (reference 1) is inserted into the former ICP slot and IMB slot above the Barco Cinema Controller (reference 2).

ICMP location in the Card Cage of a L-series projector.

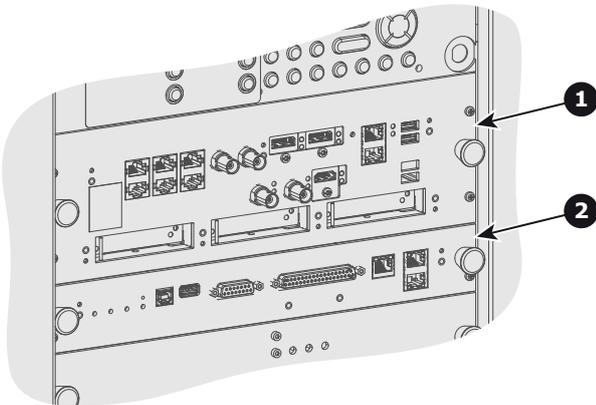


Image 9-5

9.2 ICMP HDD

About ICMP HDD

The three HDDs (local storage) in the ICMP, are set up in a RAID 5 configuration. This storage technique, that combines multiple HDD components into a logical unit, manages enough redundancy information to continue to operate properly after the loss of one HDD.

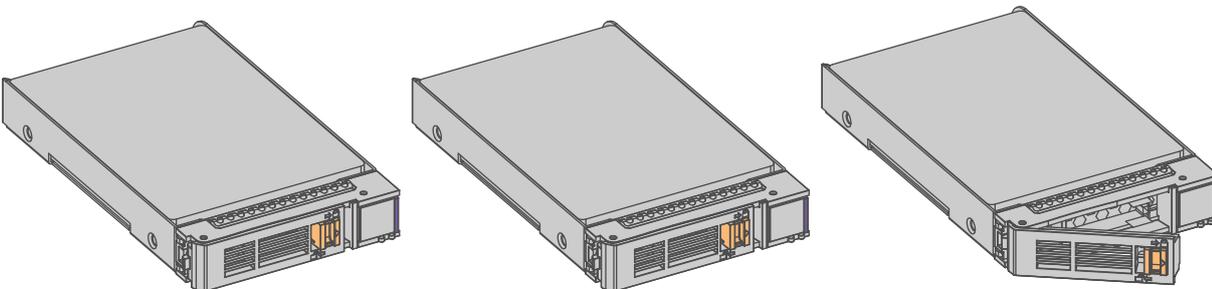


Image 9-6

CAUTION: A RAID 5 configuration with three HDDs allows a maximum loss of one disk. With the simultaneous loss of more than one HDDs, data is lost and the RAID must be completely initialized again after replacement of the defect HDDs with new HDDs!

About degraded mode

When a RAID array experiences the failure of one disk, it enters in degraded mode. Content storage and playback remains available on the ICMP.



CAUTION: The loss of one disk causes no serious consequences on the ICMP. But action must be taken quickly because the loss of a second disk will make the RAID system broken. The main cause of the total loss of RAID is due in most cases to the loss of the second disk while the first has not been rebuilt!



A failed drive should be replaced as soon as possible.

About “RAID recovery” process

The restoration from degraded to normal condition of the RAID 5 system is done automatically. When the RAID controller detects a new HDD to replace the failed disk the recovery procedure starts automatically.



CAUTION: The automatic process does not work if more than one disk is lost. In that case the RAID must be completely initialized again!

About RAID broken

When more than one HDD is out of order, the RAID is considered as 'broken' and the content is lost. The failed HDDs must be changed and a new RAID must be created.

Exchange or re-use of a disk set

It's possible to have several sets of disks with one ICMP or to reuse a complete set of disks coming from another projector with ICMP. It is sufficient to insert the three HDDs, from a valid RAID array, and let the system explore the new RAID. The mounting order of the HDDs and the HDD slots do not matter. Of course, when using HDDs from another ICMP it is necessary to retrieve from the content distributor the KDMs corresponding to the content and the new ICMP.

HDD storage capacity

Make sure that all HDDs in the ICMP HDD set have the same storage capacity. See label on top of the HDD to know the storage capacity.

HDD storage

The maximum recommended storage period for the drive in a non-operational environment is 90 days. Drives should be stored in the original unopened shipping packaging whenever possible. Once the drive is removed from the original packaging the recommended maximum period between drive operation cycles is 30 days. During any storage period the drive non-operational temperature, humidity, wet bulb, atmospheric conditions, shock, vibration, magnetic and electrical field specifications should be followed.

HDD models validated by Barco

Only the original HDD spare parts provided by Barco or models validated by Barco (see list below) can be used in the ICMP. All deviations from this rule void warranty.

List of validated models:

- 1TB: HGST – Western Digital (order code: HCC541010A9E630)
- 2TB: Seagate (order code : ST2000NX0253)

9.3 ICMP communication ports

Location of the communication ports

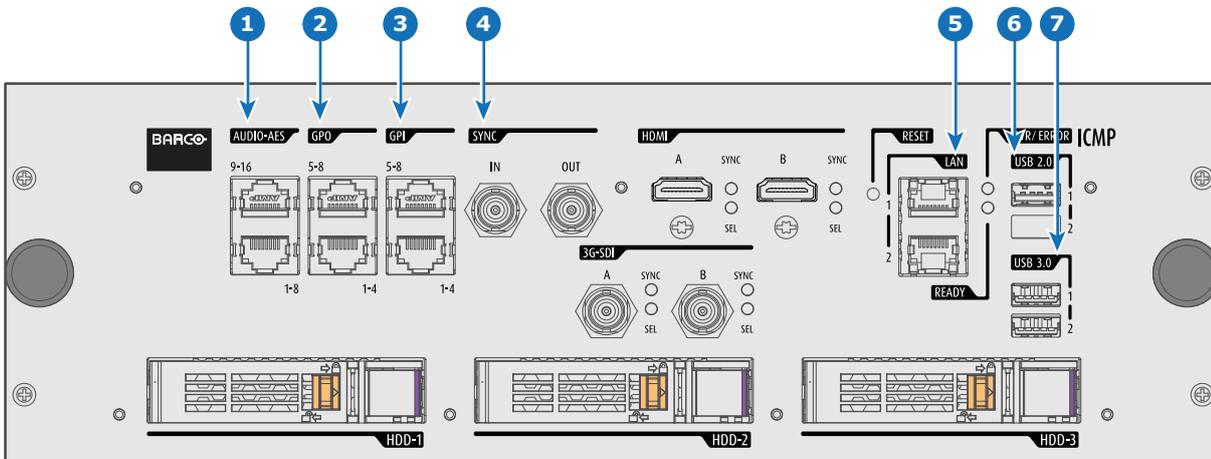


Image 9-7: ICMP (with HDMI 2.0).

Functionality

1 AUDIO-AES 1-8 (9-16)

ICMP outputs sixteen audio signals equitably distributed over these two RJ45 connectors, which can be configured independently. The mapping of audio channels (content) on each audio output (AES outputs of the ICMP) is performed by configuring the ICMP via the Communicator software. Please refer to the Communicator user guide for further information.

2 GPO 1-4 (5-8)

These RJ45 connectors can be used to send trigger signals to other devices. The mapping of user Cues (output Cues) on each General Purpose Output (GPO) is configured via the Communicator software. Please refer to the Communicator user guide for further information.

3 GPI 1-4 (5-8)

These RJ45 connectors can be used to receive trigger signals from other devices. The mapping of the General Purpose Input (GPI) on each input Cues is configured via the Communicator software. Please refer to the Communicator user guide for further information.

4 SYNC IN / OUT

Synchronization signal IN and OUT: Reserved for multiple-projector projection. Use a 50 Ohm coaxial cable to connect the sync signal from projector to projector.

5 LAN 1 (2)

The ICMP can be connected to a LAN (local area network) using one of the Ethernet ports. These LAN port are used for 'content' transfer.

NOTE: These ports are optionally used to connect to external content storage sources. Control of the ICMP is done via the same IP address as the projector.

6 USB 2.0

The ICMP can be connected to a USB 2.0 Media to load content. The USB port can be used to load content (DCP) or keys (KDM).

NOTE: It is recommended to use the USB 3.0 ports for faster ingest.

7 USB 3.0

The ICMP can be connected to a USB 3.0 Media to load content. The USB port can be used to load content (DCP), or keys (KDM), or software update.

NOTE: These ports are recommended for fast ingest when connected to an appropriate USB 3.0 source.

USB



Universal Serial Bus (USB) is an industry standard developed in the mid-1990s that defines the cables, connectors and communications protocols used in a bus for connection, communication, and power supply between computers and electronic devices. **USB 2.0** (also called "Hi-Speed"), adding higher maximum signaling rate of 480 Mbit/s (effective throughput up to 35 MB/s or 280 Mbit/s), in addition to the "USB 1.x Full Speed" signaling rate of 12 Mbit/s.[16] USB 2.0 connectors are usually colored black. **USB 3.0** defines a new SuperSpeed mode with a signaling speed of 5 Gbit/s and a usable data rate of up to 4 Gbit/s (500 MB/s). A USB 3.0 port is usually colored blue, and is backwards compatible with USB 2.0.

9.4 ICMP source input ports

Location of the source input ports

The last produced model is equipped with two HDMI 2.0 (Reference 8, Image 9-8) as video source.

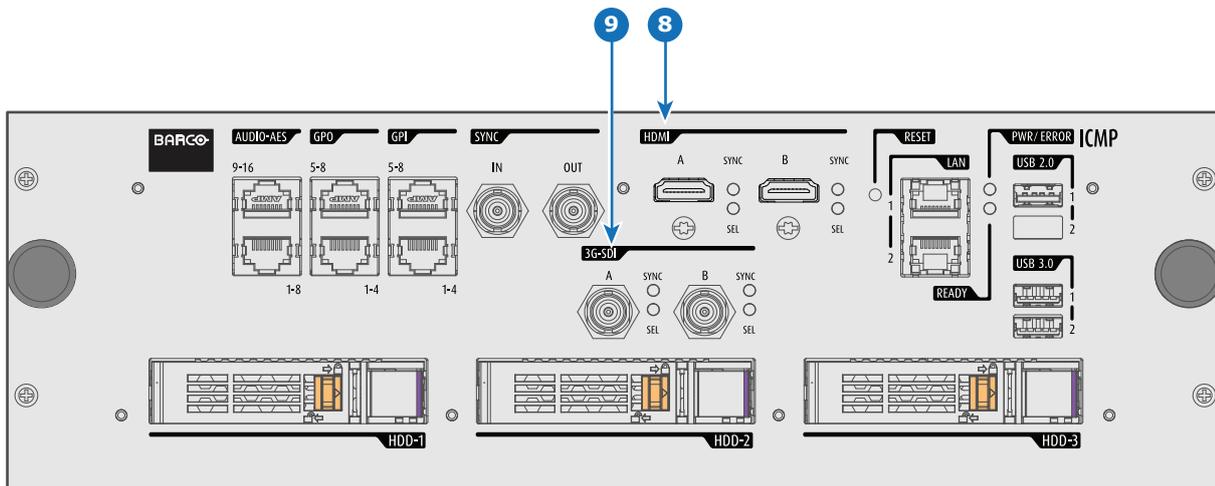


Image 9-8: ICMP (with HDMI 2.0).

Some models with DisplayPorts (Reference 11, Image 9-9) and HDMI 1.4 (Reference 10, Image 9-9) are still present on the field.

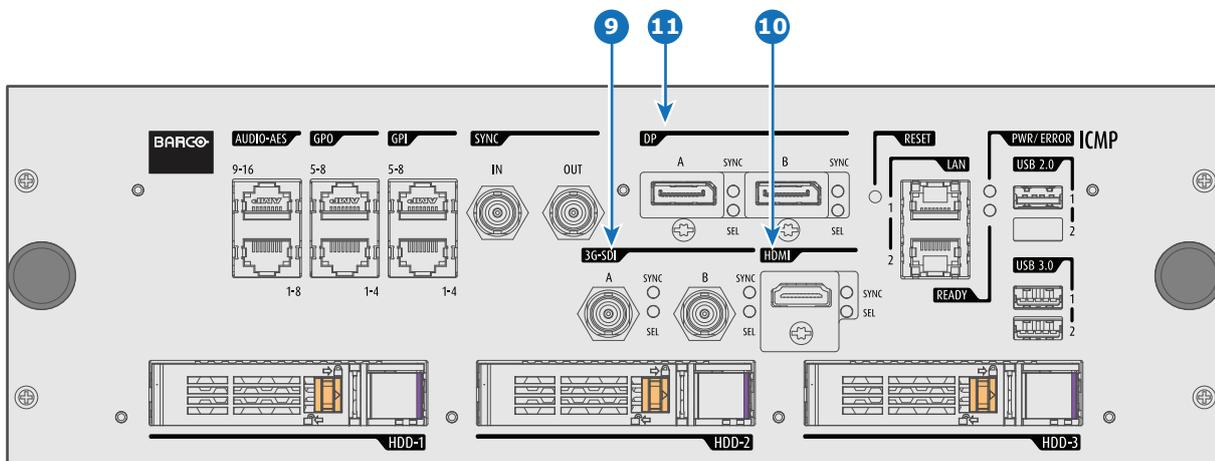


Image 9-9: ICMP (with DisplayPort and HDMI 1.4).

Functionality

8 HDMI A (B)

HDMI 2.0 connector to connect a video source.

NOTE: It is recommended to use the HDMI 2.0 ports for faster transfer of video and audio data.

9 3G-SDI A (B)

SDI connector to connect a video source.

10 HDMI

HDMI 1.4 connector to connect a video source.

11 DisplayPort A (B)

DisplayPort connector to connect a video source.

9.5 ICMP DisplayPort specifications

DisplayPort



Digital display interface developed by the Video Electronics Standards Association (VESA). This royalty-free interface is primarily used to connect a video source to a display device such as a computer monitor, though it can also be used to transmit audio, USB, and other forms of data. VESA designed it to replace VGA, DVI, and FPD-Link. Backward compatibility to VGA and DVI by using active adapter dongles enables users to use DisplayPort fitted video sources without replacing existing display devices.

HDCP



High-bandwidth Digital Content Protection is a form of digital copy protection developed by Intel Corporation to prevent copying of digital audio and video content as it travels across DisplayPort, Digital Visual Interface (DVI), High-Definition Multimedia Interface (HDMI), Gigabit Video Interface (GVIF), or Unified Display Interface (UDI) connections, even if such copying would be permitted by fair use laws. The specification is proprietary, and implementing HDCP requires a license.

DisplayPort specifications

Supported Modes:

- DP1.1a, 4-lanes RBR/HBR
- Audio : yes
- Content Protection : HDCP1.4
- Color Depth : 8 bit/component and 10 bit/component.
- 3D-stereo mode : frame sequential (embedded stereosync on DP required from the source)

DisplayPort A and DisplayPort B accept the following video-timings:

2D Formats / Single DP	Color depth	Port	Display Mode
640 x 480 @ 60 fps	8 bpc, 10 bpc	Single	2D
800 x 600 @ 60 fps	8 bpc, 10 bpc	Single	2D
1600 x 1200 @ 60 fps	8 bpc, 10 bpc	Single	2D
1280 x 800 @ 60 fps	8 bpc, 10 bpc	Single	2D
1280 x 720 @ 60 fps	8 bpc, 10 bpc	Single	2D
1680 x 1050 @ 60 fps	8 bpc, 10 bpc	Single	2D

2D Formats / Single DP	Color depth	Port	Display Mode
1920 x 1080 @ 60 fps	8 bpc, 10 bpc	Single	2D
1920 x 1200 @ 60 fps	8 bpc, 10 bpc	Single	2D
2048 x 1080 @ 48, 60 fps	8 bpc, 10 bpc	Single	2D
2048 x 1536 @ 60 fps	8 bpc, 10 bpc	Single	2D
2048 x 2160 @ 30, 48, 50, 60 fps	8 bpc, 10 bpc	Single	2D
3840 x 2160 @ 24 fps	8 bpc, 10 bpc	Single	2D
3D Formats / Single DP	Color depth	Port	Display Mode
1920 x 1080 @ 60 fps	8 bpc, 10 bpc	Single	3D
2048 x 1080 @ 60 fps	8 bpc, 10 bpc	Single	3D
4K Horizontal SPAN 2D - Full	Color depth	Port	Display Mode
2048 x 2160 @ 30, 48, 50, 60 fps	8 bpc, 10 bpc	A+B span	2D
4K Horizontal SPAN 2D - Flat	Color depth	Port	Display Mode
1920 x 2160 @ 30, 48, 50, 60 fps	8 bpc, 10 bpc	A+B span	2D
4K Horizontal SPAN 3D	Color depth	Port	Display Mode
2048 x 2160 @ 60 fps	8 bpc, 10 bpc	A+B span	3D

Audio formats

- 2 channels / LPCM / 16 bits / 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz
- 5.1 format / LPCM / 24 bits / 48 kHz
- 7.1 format / LPCM / 20 bits / 48 kHz

Notes:

- DisplayMode = Single : is applicable to both DisplayPort A, and DisplayPort B input, separately.
- DisplayMode = A+B : inputs DisplayPort A and DisplayPort B are combined to 1 larger image; in this case the 2 DisplayPort links need to be genlocked (= synchronous and in phase).
- In all cases :
 - Color Space - Color Sampling:
 - YCbCr - 4:4:4
 - YCbCr - 4:2:2
 - RGB - 4:4:4
 - Scan Type = progressive.
- Both Nvidia and AMD GPU's will not support color depths of 10 bits/color while in 3D-stereo mode.
- Some Graphical Cards may not permit 10 bits/color at all video timings, because of bandwidth restrictions.
- DisplayPort A and DisplayPort B automatically detect:
 - Active Pixels, and Active Lines
 - Vertical Refresh
 - 8 bits/color - 10 bits/color
 - Frame locked
- All input resolutions are scaled towards the desired resolution specified in the screen presentation file.
- Fractional frame rates = (Hz*1000)/1001

9.6 ICMP SDI specifications

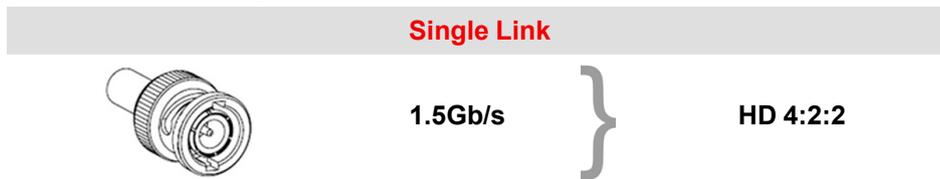
3G-SDI



Serial Digital Interface (SDI) is a serial link standardized by ITU-R BT.656 and the Society of Motion Picture and Television Engineers (SMPTE). SDI transmits uncompressed digital video over 75-ohm coaxial cable within studios, and is seen on most professional video infrastructure equipment. The first revision of the standard, SMPTE 259M, was defined to carry digital representation of analog video such as NTSC and PAL over a serial interface and is more popularly known as standard-definition (SD) SDI. The data rate required to transmit SD SDI is 270 Mbps. With the advent of high-definition (HD) video standards such as 1080i and 720p, the interface was scaled to handle higher data rates of 1.485 Gbps. The 1.485-Gbps serial interface is commonly called the HD SDI interface and is defined by SMPTE 292M, using the same 75-ohm coaxial cable. Studios and other video production facilities have invested heavily on the hardware infrastructure for coaxial cable and have a vested interest in extending the life of their infrastructure. Fortunately, SMPTE recently ratified a new standard called SMPTE 424M that doubles the SDI data rates to 2.97 Gbps using the same 75-ohm coaxial cable. This new standard, also called 3-Gbps (3G)-SDI, enables higher resolution of picture quality required for 1080p and digital cinema.

SDI terminology

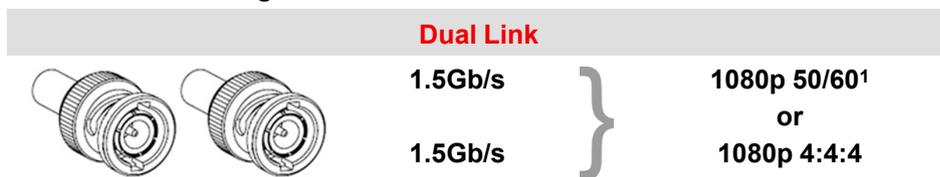
Standard HD-SDI signal



Standard HD-SDI allows for a single 4:2:2 image to be carried on one cable at 1.485 Gb/s. The image uses the Y Cb Cr colorspace and uses a bit depth of 10 bit per color component.

Due to the data rate limitations only 23.976, 24, 25, 29.970 and 30 fps streams are achievable.

Dual-Link HD-SDI signal

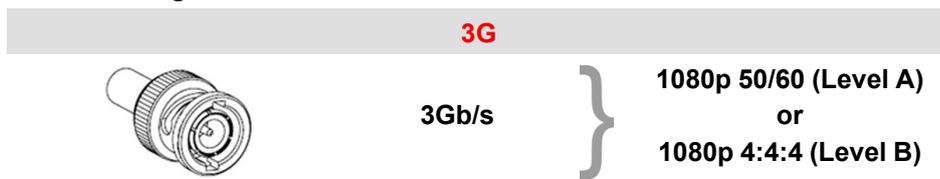


Dual-Link HD-SDI is mainly two standard HD-SDI signals carrying a single image stream split between the two cables. The main advantage is that color subsampling is no longer required, and the image can be transmitted in 4:4:4 quality, which then also allows the RGB (or XYZ) color space to be used.

The main link will contain a standard HD-SDI signal, the second (enhancement) link contains the missing Cb and Cr samples.

Depending on the implementation the enhancement link could also contain extra information to increase the bit depth.

3G HD-SDI signal

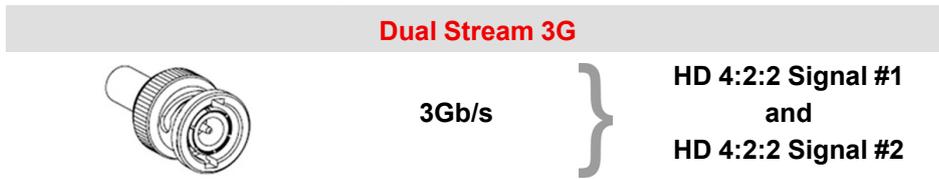


3G HD-SDI uses a higher data rate (2.97 Gb/s). This allows a single cable interface to achieve the same capabilities of a Dual-Link HD-SDI implementation.

1: Not supported in Alchemy

In direct mapping (level A) this is used to achieve higher frame rates. (50, 59.940 and 60 fps streams are supported).

Dual Stream 3G HD-SDI signal



Dual Stream 3G is a specific variant of the 3G signal which combines two completely separate 4:2:2 image streams into a single 3G signal. This can be used to transmit stereoscopic streams by keeping the left and right eye signals together.

SMPTE 292M STANDARD 1.485 Gb/s HD-SDI SIGNALS

Standard HD-SDI (SMPTE 292M) formats

SMPTE Standard	Source Resolution	Frame Rate	Display Rate	Scan Type			
SMPTE 296M	1280 x 720	23.976	23.976	Progressive Y Cb Cr 4:2:2 10-Bit			
		24	24				
		25	25				
		29.970	29.970				
		30	30				
		50	50				
		59.940	59.940				
SMPTE 274M SMPTE 428-8	1920 x 1080 2048 x 1080	23.976	23.976	Progressive Y Cb Cr 4:2:2 10-Bit			
		24	24				
		25	25				
		29.97	29.97				
		30	30				
		SMPTE 274M SMPTE 428-9 (SMPTE RP211)	1920 x 1080 2048 x 1080		23.976	23.976	Segmented frame Y Cb Cr 4:2:2 10-Bit
					24	24	
25	25						
29.97	29.97						
30	30						
SMPTE 274M	1920 x 1080	25	50	Interlaced Y Cb Cr 4:2:2 10-Bit			
		29.970	59.940				
		30	60				

Dual-Link HD-SDI (SMPTE 372M) formats

SMPTE Standard	Source Resolution	Frame Rate	Display Rate	Scan Type
SMPTE 274M	1920 x 1080	23.976	23.976	Progressive
SMPTE 428-8	2048 x 1080	24	24	Y Cb Cr 4:2:2 12-Bit only
		25	25	Y Cb Cr 4:4:4 10 or 12-Bit
		29.970	29.970	RGB (XYZ) 4:4:4 10 or 12-Bit
		30	30	
SMPTE 274M	1920 x 1080	23.976	23.976	Segmented frame
SMPTE 428-9 (SMPTE RP211)	2048 x 1080	24	24	Y Cb Cr 4:2:2 12-Bit only
		25	25	Y Cb Cr 4:4:4 10 or 12-Bit
		29.970	29.970	RGB (XYZ) 4:4:4 10 or 12-Bit
		30	30	
SMPTE 274M	1920 x 1080	25	50	Interlaced
		29.970	59.940	Y Cb Cr 4:2:2 12-Bit only
		30	60	Y Cb Cr 4:4:4 10 or 12-Bit RGB (XYZ) 4:4:4 10 or 12-Bit

Standard HD-SDI (2 × SMPTE 292M) formats²

SMPTE Standard	Source Resolution	Frame Rate	Display Rate	Scan Type
SMPTE 292M	1920 x 1080	23.976	47.952	Progressive
SMPTE 428-8	2048 x 1080	24	48	Y Cb Cr 4:2:2 10-Bit
		25	50	
		29.97	59.940	
		30	60	
SMPTE 292M	1920 x 1080	23.976	47.952	Segmented frame
SMPTE 428-9 (SMPTE RP211)	2048 x 1080	24	48	Y Cb Cr 4:2:2 10-Bit
		25	50	
		29.97	59.940	
		30	60	

The standard HD-SDI interfaces support the Y Cb Cr colorspace (both legal and full range) using 4:2:2 color subsampling.

The Dual-Link HD-SDI interface can be used to carry a single 4:4:4 image, having a color depth of 10 or 12 bit per component. Both RGB (XYZ) and Y Cb Cr color spaces are supported.

SMPTE 424M 3G HD-SDI 2.970 Gb/s SIGNALS

3G HD-SDI (SMPTE 425) formats

²: mainly used to carry stereoscopic images.

SMPTE Standard	Source Resolution	Frame Rate	Display Rate	Scan Type
SMPTE 296M	1280 x 720	23.976	23.976	Progressive
		24	24	Y Cb Cr 4:4:4 10-Bit
		25	25	RGB (XYZ) 4:4:4 10-Bit
		29.970	29.970	
		30	30	
		50	50	
		59.940	59.940	
SMPTE 274M ³	1920 x 1080	50	50	Progressive
		59.940	59.940	Y Cb Cr 4:2:2 10-Bit
		60	60	
SMPTE 274M	1920 x 1080	23.976	23.976	Progressive
		24	24	Y Cb Cr 4:2:2 12-Bit only
		25	25	Y Cb Cr 4:4:4 10 or 12-Bit
		29.97	29.97	RGB (XYZ) 4:4:4 10 or 12-Bit
		30	30	
SMPTE 274M	1920 x 1080	50	50	Interlaced
		59.940	59.940	Y Cb Cr 4:2:2 12-Bit only
		60	60	Y Cb Cr 4:4:4 10 or 12-Bit RGB (XYZ) 4:4:4 10 or 12-Bit
SMPTE 428-9	2048 x 1080	23.976	23.976	Progressive
		24	24	Y Cb Cr 4:4:4 12-Bit RGB (XYZ) 4:4:4 12-Bit

Dual Stream 3G HD-SDI (SMPTE 425) formats

SMPTE Standard	Source Resolution	Frame Rate	Display Rate	Scan Type
SMPTE 292M	1920 x 1080	23.976	47.952	Progressive
SMPTE 428-9	2048 x 1080	24	48	Y Cb Cr 4:2:2 10-Bit
		25	50	
		29.970	59.940	
		30	60	

9.7 ICMP HDMI 2.0 specifications

HDMI



HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from a HDMI-compliant device ("the source device") to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for existing analog video standards.

HDMI 2.0 specifications

HDMI

Both HDMI 2.0 inputs are fully compliant with the HDMI 1.4, 1.4a, 1.4b, 2.0 and 2.0a revisions of the HDMI specification.

3: only supported in 3G level A mapping, others formats are supported in both level A and level B mapping.

Full Range and Limited Range Quantization are supported for all specified formats.

BT.709 and DCI-P3 are supported for all formats. For HDR content (UHD and 4K only) the BT.2020 color coding is supported.

All video streams should have a progressive scan order, with the exception of 1920x1080i 60 fps (interlaced scan).

HDCP

Both HDMI 2.0 inputs are HDCP 1.4 & HDCP 2.2 compliant.

HDR (SMPTE ST 2084)

HDR (High Dynamic Range) is supported on all UHD and 4K formats.

This includes SMPTE ST 2084 (static metadata) and BT.2020 color coding. Requires a license!

HDMI 2.0 Cable requirements

All HDMI cables should work with HDMI 2.0 receivers. There is no such thing as a “4K HDMI cable” even though this is sometimes sold this way. But of course there are quality differences. The “high-speed” cables would be preferred over the “standard-speed” cables. They usually work at higher cable lengths than the standard-speed ones.



The “Premium Certified HDMI” cables are tested to work with high bandwidth as is the case with 4K HDR content. These can be more expensive though. When using active and/or optical cables you should verify if the integrated receiver and sender are HDMI certified to guarantee to work compliant with the HDMI protocol. You can request the HDMI certificate to the manufacturer of the cable.



The ICMP is not supporting Ethernet-over-HDMI and such specific cables are thus not required.

HDMI 2.0 Supported 2D Formats

Format	Frame Rate	Color coding	Bit depth
1280x720	23.976	RGB	8
	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		
1280x720	100	RGB	8
	119.88	YCbCr 4:4:4	
	120	YCbCr 4:2:2	
1920x1080	23.976	RGB	8
2048x1080	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		

Format	Frame Rate	Color coding	Bit depth
	60		
1920x1080	100	RGB	8
2048x1080	119.88	YCbCr 4:4:4	
	120	YCbCr 4:2:2	
3840x2160	23.976	RGB	8
4096x2160	24 25	YCbCr 4:4:4	10
	29.97	YCbCr 4:2:2	12
	30		
3840x2160	50	RGB	8
4096x2160	59.94	YCbCr 4:4:4	
	60	YCbCr 4:2:2	

HDMI 2.0 Supported 3D (Frame Packing) Formats

Format	Frame Rate	Color coding	Bit depth
1920x1080	23.976	RGB	8
2048x1080	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
1920x1080	50	RGB	8
2048x1080	59.94	YCbCr 4:4:4	
	60	YCbCr 4:2:2	
3840x2160	23.976	RGB	8
4096x2160	24 25	YCbCr 4:4:4	10
	29.97, 30	YCbCr 4:2:2	12
3840x2160	50	RGB	8
4096x2160	59.94	YCbCr 4:4:4	
	60	YCbCr 4:2:2	

HDMI 2.0 Supported Audio Formats

Format	Sample Rate	Sample coding	Bit depth
2.0	32	L-PCM	16
2.1	44.1		20
5.1	48		24
7.1	88.2		
	96		

HDMI 2.0 Supported Dual (Twin) Link Formats (2D formats only)

Format	Frame Rate	Color coding	Bit depth
1920x1080	23.976	RGB	8
2048x1080	24	YCbCr 4:4:4	
	25	YCbCr 4:2:2	
	29.97		
	30		
	50		
	59.94		
3840x2160	23.976	RGB	
	24	YCbCr 4:4:4	
	25	YCbCr 4:2:2	
	29.97		
	30		
	59.94		
4096x2160	23.976	RGB	8
	24	YCbCr 4:4:4	
	25	YCbCr 4:2:2	
	29.97		
	30		
	59.94		
4096x2160	23.976	RGB	
	24	YCbCr 4:4:4	
	25	YCbCr 4:2:2	
	29.97		
	30		
	59.94		



In Dual (Twin) Link both HDMI2 inputs (port A & port B) should have to same Format, Frame Rate and Color coding.



Port A should contain the 8 most significant bits of the pixel data, where port B should contain the 8 least significant bits of the pixel data. The pixel data will be reconstructed using the all 8 bits of port A and using the 4 most significant bits of port B.

HDMI 2.0 Supported Passive 3D Formats (3D formats only)

Format	Frame Rate	Color coding	Bit depth
1920x1080	24	RGB	8
2048x1080	30	YCbCr 4:4:4	10
		YCbCr 4:2:2	12
1920x1080	60	RGB	8
		YCbCr 4:4:4	
2048x1080	60	YCbCr 4:2:2	
3840x2160	24	RGB	8
4096x2160	30	YCbCr 4:4:4	
		YCbCr 4:2:2	



In Passive 3D HDMI2 input port A should contain the pixel data of Left Eye and HDMI2 input port B should contain the pixel data for Right Eye.

9.8 ICMP HDMI 1.4 specifications

HDMI



HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from a HDMI-compliant device ("the source device") to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for existing analog video standards.

HDMI 1.4 specifications

HDMI1.4a, including HDCP1.4

HDMI 1.4 Supported 2D Formats (progressive)

Format	Frame Rate	Color coding	Bit depth
720x480	60	RGB	(8)
		YCbCr 4:4:4	10
		YCbCr 4:2:2	12
720x576	50	RGB	(8)
		YCbCr 4:4:4	10
		YCbCr 4:2:2	12
1280x720	23.976	RGB	8
	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		
	60		
	100		
	119.88		
	120		
1680x720	23.976	RGB	8
	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		
	60		
	100		
	119.88		
	120		
1920x1080	23.976	RGB	8
2048x1080	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		
	60		
1920x1080	100	RGB	8
2048x1080	119.88	YCbCr 4:4:4	
	120	YCbCr 4:2:2	

Format	Frame Rate	Color coding	Bit depth
2560x1080	23.976	RGB	8
	24	YCbCr 4:4:4	10
	25	YCbCr 4:2:2	12
	29.97		
	30		
	50		
	59.94		
3840x2160	23.976	RGB	8
	24	YCbCr 4:4:4	10
4096x2160	25	YCbCr 4:2:2	12
	29.97		
	30		

HDMI 1.4 Supported 2D (Interlaced) Formats

Format	Frame Rate	Color coding	Bit depth
720x576	25		
	50		
	100		
1920x1080	25		
	29.97		
	30		
	50		
	59.94		
60			

HDMI 1.4 Supported 3D (Frame Packing) Formats

Format	Frame Rate	Color coding	Bit depth
1280x720	50		
	59.94		
	60		
1920x1080	23.98		
	24		

HDMI 1.4 Supported 3D (Top Bottom) Formats

Format	Frame Rate	Color coding	Bit depth
1280x720	50		
	59.94		
	60		
1920x1080	23.98		
	24		

HDMI 1.4 Supported Audio Formats

Format	Sample Rate	Sample coding	Bit depth
2 channels	32	L-PCM	16
	44		
	48		
	88		
	96		
5.1 channels	24	L-PCM	48
7.1 channels	20	L-PCM	48

9.9 ICMP status LEDs

ICMP status LEDs and Reset button

LEDs on ICMP front panel give information on the status of the device.

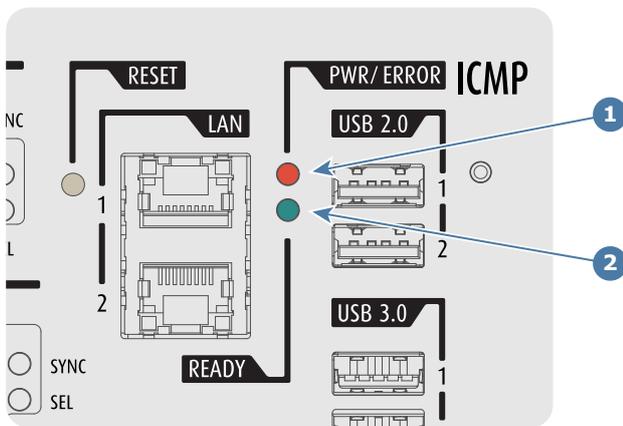


Image 9-10

Status overview PWR/ERROR and READY LEDs:

1 PWR/ERROR	2 READY	ICMP Status
Off	Off	Turned off
Red	Off	Board reset or FIPS error
Blinking Green	Off	Boot loader
Blinking Green	Blinking Orange	Operating System start up
Blinking Green	Orange	Security Manager - Image Integrity tests
Blinking Green	Blinking Yellow	Security Manager - Self Test
Blinking Green	Yellow	Security Manager - FPGA self-test

1	2	
PWR/ERROR	READY	ICMP Status
Green	Blinking Green	Starting Applications
Green	Green	Applications started in normal mode
Green	Orange	Applications started in degraded mode
Blinking Red	Off	FIPS error
Green	Blinking Orange	Update ongoing
Orange	Orange	Update done

9.10 ICMP HDD status LEDs

ICMP HDD status LEDs

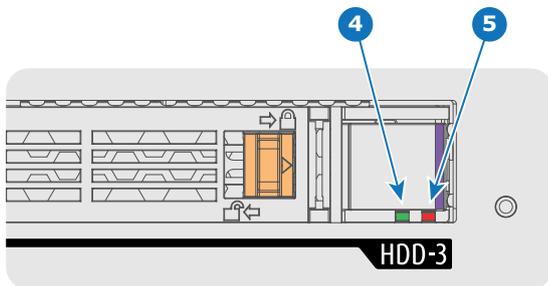


Image 9-11

Status overview PWR/ERROR and READY LEDs:

4	5	
HDD I/O	RAID	ICMP HDD Status
Off	Off	HDD idle / Disk in RAID OK.
Blinking Green	Off	HDD I/O activity / Disk in RAID OK.
Blinking Green	Blinking Red	HDD I/O activity / RAID rebuilding.
Off	Red	HDD idle / Disk error. See troubleshooting table below for curative act

Troubleshooting

Situation

One disk failed (red LED) + **RAID degraded**.

The ongoing event is not interrupted.

Note: The disk status (RAID degraded) can be retrieved via the (Web) Commander. See user guide of the (Web) Commander.

One disk failed (red LED) + Error 10580 “**local storage not available**”.

Note: The disk status (Error code) can be retrieved via the (Web) Commander. See user guide of the (Web) Commander.

Multiple disks failed (multiple red LEDs) + **RAID broken**.

Note: The disk status (RAID broken) can be retrieved via the (Web) Commander. See user guide of the (Web) Commander.

All HDD LEDs remain off + Error 10580 “**local storage not available**”.

Note: The disk status (Error code) can be retrieved via the (Web) Commander. See user guide of the (Web) Commander.

Solution

1. Switch off the power.
2. Replace the defect HDD with approved model of the same storage capacity. See procedure “Removing a HDD from the ICMP”, page 102, and “Installing a HDD into the ICMP”, page 103. Ensure to insert the HDD firmly.
3. Switch on the power.

Result: As soon the new HDD is detected by the ICMP the rebuild of the RAID is started (Blinking red LED).

1. Switch off the power.
2. Replace the defect HDD with approved model of the same storage capacity. See procedure “Removing a HDD from the ICMP”, page 102, and “Installing a HDD into the ICMP”, page 103. Ensure to insert the HDD firmly.
3. Switch on the power.

Result: As soon the new HDD is detected by the ICMP the rebuild of the RAID is started (Blinking red LED).

1. Switch off the power.
2. Replace all defect HDDs with approved models of the same storage capacity. See procedure “Removing a HDD from the ICMP”, page 102, and “Installing a HDD into the ICMP”, page 103. Ensure to insert the HDDs firmly.
3. Switch on the power.
4. Start “RAID Initialize”. See user guide of the Communicator.

Result: a new empty RAID is created.

1. Switch off the power.
2. Reseat all HDDs. See procedure “Removing a HDD from the ICMP”, page 102, and “Installing a HDD into the ICMP”, page 103. Ensure to insert the HDDs firmly.
3. If problem remains try “RAID Initialize”. See user guide of the Communicator. Note that all content will be lost!
4. If problem remains contact Service for further instructions.



In case the ICMP has to be returned to factory (e.g. for repair) the non defective HDDs should be removed and kept.

9.11 ICMP device certificate

Purpose of the Barco ICMP device certificate

The device certificate (*.pem) of the Barco ICMP is a digital certificate signed by Barco which is required when ordering the KDM to play a DCP that is ingested on the ICMP. The device certificate is stored inside the ICMP and on a web server.

The (WEB) Commander or Communicator can be used to retrieve the device certificate directly from the ICMP. To retrieve the device certificate from the website the QR (Quick Response) code can be used. See procedure “Obtaining the Barco ICMP certificate”, page 101.

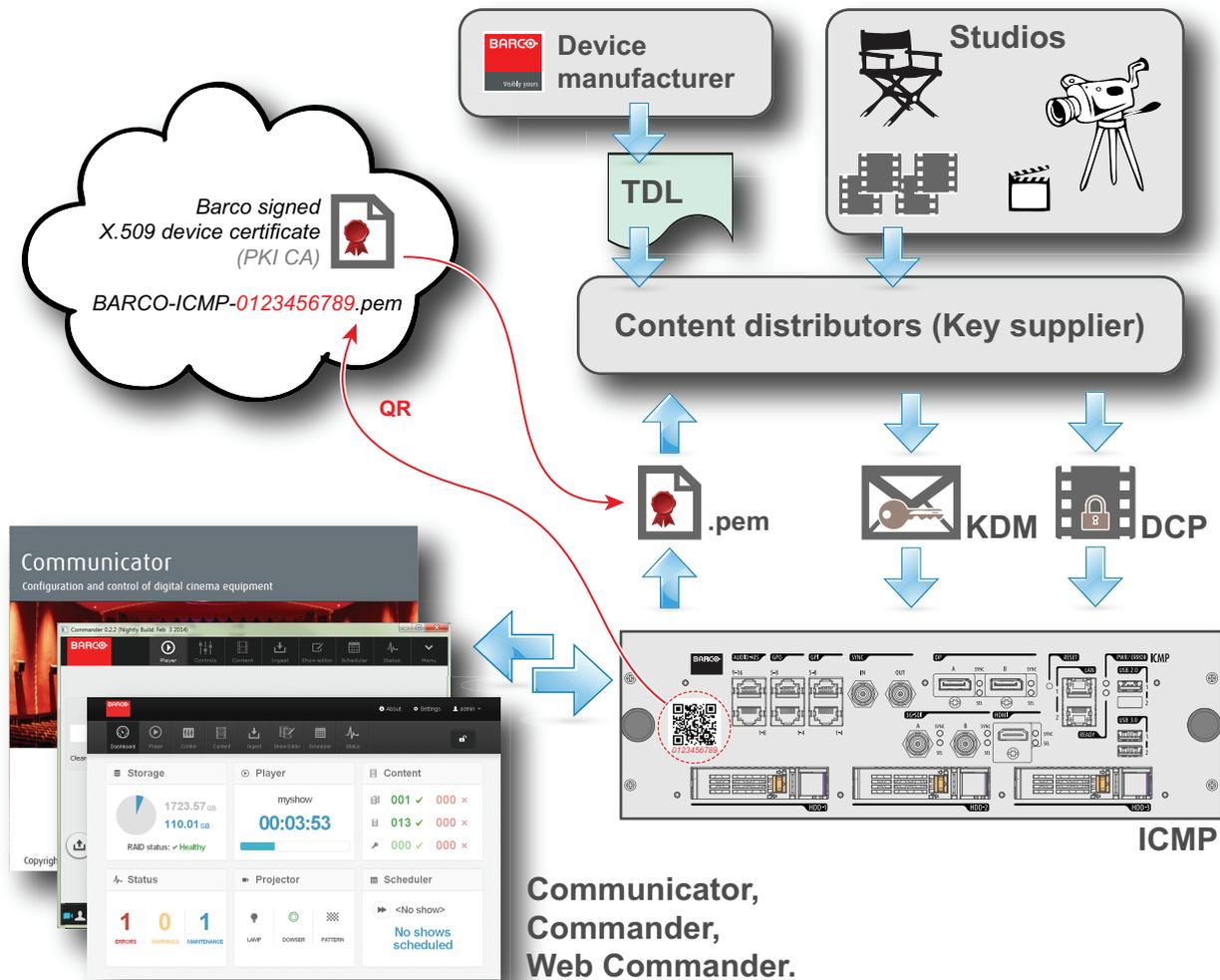


Image 9-12

Trusted Device List (TDL)



The Goal of the TDL is to maintain timely and accurate information on participating auditoriums so that participating subscribers can obtain information needed to issue KDMs. The TDL has several data sources: Device manufacturers, Exhibitors, Deployment Entities, Integrators, Service Providers (interacting with Exhibitors), regional authorities and Support.

Public Key Infrastructure (PKI)



PKI is a framework for creating a secure method for exchanging information based on public key cryptography. The foundation of a PKI is the certificate authority (CA), which issues digital certificates that authenticate the identity of organizations and individuals over a public system such as the Internet. The certificates are also used to sign messages, which ensures that messages have not been tampered with.

***.pem**



Privacy-enhanced Electronic Mail. File format used to distribute digital signed certificates. Base64 encoded DER certificate, enclosed between "-----BEGIN CERTIFICATE-----" and "-----END CERTIFICATE-----"

Key Delivery Message (KDM)

The security key for each movie is delivered in a unique KDM for each digital cinema server. The security key is encrypted within the KDM, which means that the delivery of a KDM to the wrong server or wrong location will not work, and thus such errors cannot compromise the security of the movie. The KDM is a small file, and is typically emailed to the exhibitor. To create the correct set of KDMs for a site requires knowledge of the digital certificate in the projection system's media block.

Digital Cinema Package (DCP)

A Digital Cinema Package (DCP) is a collection of digital files used to store and convey Digital Cinema (DC) audio, image, and data streams. The term has been defined by Digital Cinema Initiatives (DCI). General practice adopts a file structure that is organized into a number of usually multi-gigabyte size Material eXchange Format (MXF) files, which are separately used to store audio and video streams, and auxiliary index files in XML format. The MXF files contain streams that are compressed, encoded, and encrypted, in order to reduce the huge amount of required storage and to protect from unauthorized use. The image part is JPEG 2000 compressed, whereas the audio part is linear PCM. The adopted (optional) encryption standard is AES 128 bit in CBC mode. The newer SMPTE standards are used to conform the recommendations among different tool vendors and producers. Interop, the legacy DCP standard, is still required to be supported by DCP players.

Digital Cinema Initiatives (DCI)

DCI is a joint venture of Disney, Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios. DCI's primary purpose is to establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of technical performance, reliability and quality control. Note that the DCI specification is not a standard. Standards for digital cinema are the domain of the Society of Motion Picture and Television Engineers (SMPTE). "DCI compliant" is a term used to describe products that conform to the DCI specification. Products that have been tested per the DCI Compliance Test Plan (CTP) are posted at the DCI compliance web site. Notably, DCI compliance does not require compliance to the full set of SMPTE DCP standards. A copy of the most recent DCI specification can be downloaded from the DCI website (<http://dcimovies.com>).

9.12 ICMP configuration via Communicator

About ICMP configuration

Following parameters are available to configure the ICMP:

- Global settings: allows defining name of the ICMP, host name (network identifier) and IP address which can be used for communication with external content devices.
- User settings: definition of all users allowed on the ICMP.
- Server settings: definition of access to servers and storage libraries of content (movies, KDM, etc.).
- Player settings: Audio delay and audio output frequency.
- Audio channel: allows defining the mapping of audio channels (content) on each audio output (AES outputs of the ICMP).
- Scheduler setting: Enable/Disable scheduler at startup, delays allowed in scheduler mode and length of schedule history.
- Devices: allows defining communication ports settings, to access external devices controlled by the automation.
- Automation Cues: event cues that are triggered from different sources and to which can be assigned actions to be executed by the automation engine.
- Verify internal clock of the ICMP.



All installation and maintenance operations on the ICMP are performed via Communicator, the Barco configuration software. Please refer to the Communicator user guide for further information.

About Default settings

The restore of factory setting is a feature that allows removing all settings performed on the ICMP and replaces them with the default values set at the factory. Please refer to the Communicator user guide for further information.

About the ICMP internal clock

The crystal on the ICMP board that manages the clock shows a certain drift (all crystals do). With the Communicator the internal clock can be adjusted. This maintenance action should be repeated every 3 months. When neglected the system will lock up.

From ICMP software version 1.2.1 onwards it is possible to enable NTP (Network Time Protocol). You have to configure (at installation) an IP address where the ICMP can find a sync signal. From then on, and as long as the connection is active, the ICMP will automatically keep its clock correct. For detailed instructions see user guide of the Communicator.

9.13 ICMP reset



This procedure requires that ICMP version 1.2.4 or later is installed.

ICMP reset possibilities

- The Star button on the local keypad (Not for C- and B-series)
- The ICMP reset button in the GUI of the Communicator.
- The ICMP reset button in the GUI of the Commander.
- The ICMP reset button in the GUI of the Web Commander.
- The ICMP hardware reset button located on the front panel of the ICMP (Not recommended, use only when all other reset possibilities are exhausted!)

How to reset the ICMP?

1. Click on the ICMP **reset button** in the GUI of the **Web Commander**

or

Click on the ICMP **reset button** in the GUI of the **Commander**



Note: It can be that the Commander or WEB-Commander is not able to send the reset command.

or

click on the ICMP **reset button** in the GUI of the **Communicator** (recommended)

or

press the **Star button** on the **local keypad** for a few seconds (Not for C- and B-series)

As a result the projector is safely prepared for the ICMP reboot. All ongoing events on the ICMP (e.g. ingest) are requested to end. After a few seconds the ICMP is requested to restart. The READY LED on the front panel of the ICMP starts to blink orange.

In case the ICMP is installed in DP4K-L series projector the lasers are switched off and the projector remains in the same mode (e.g. Conditioned). The Star button on the local keypad starts blinking green. After the reset of the ICMP the lasers are switched on again.

Once the READY LED lit continuous green the ICMP is up and running.

2. Did the reset of the ICMP fail?

► **If yes**, perform a hardware reset as follows:

1. switch off the lasers of the projector or switch of the projector lamp.
2. press the ICMP **hardware reset button** a few seconds (reference 3 Image 9-13) .



Warning: Resetting the ICMP with the hardware reset button may cause damage to the content on the HDDs. A re-configuration of the whole system may be required!

As a result the projector is safely prepared for the ICMP reboot. All ongoing events on the ICMP (e.g. ingest) are stopped immediately and the ICMP restarts.

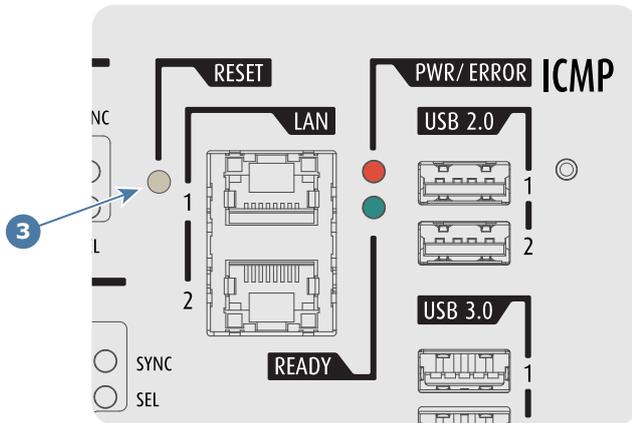


Image 9-13



WARNING: Resetting the ICMP with the hardware reset button may cause damage to the content on the HDDs. A re-configuration of the whole system may be required!

9.14 Obtaining the Barco ICMP certificate

Required tools

Smartphone (with auto-focus) or control software (e.g. Communicator, Commander or WEB Commander)

Using the CertID label to download the ICMP certificate

1. Scan the QR code (reference 1) on the front face of the ICMP with a smartphone. It's recommended to use a smartphone with auto-focus. The QR reader will automatically redirect to the ICMP certificate download page on the web server.



Note: Instead of downloading the ICMP certificate you can use the CertID number (reference 2), located below the QR code, in communication with your KDM supplier. Certified KDM suppliers can use this CertID number to retrieve the ICMP certificate directly.

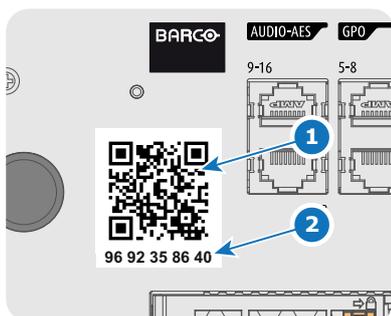


Image 9-14

Using control software to obtain the ICMP certificate

1. Use the **WEB Commander** to download the ICMP certificate from the ICMP main board. For detailed instructions see user guide of the WEB Commander.

or

use the **Commander** to download the ICMP certificate from the ICMP main board. For detailed instructions see user guide of the Commander.

or

use the **Communicator** to download the ICMP certificate from the ICMP main board. For detailed instructions see user guide of the Communicator.

9.15 Removing a HDD from the ICMP



In case the ICMP has to be returned to factory (e.g. for repair) the non defective HDDs should be removed and kept.

How to remove a HDD ?

1. Switch off the projector.
2. Moving the latch towards the left.

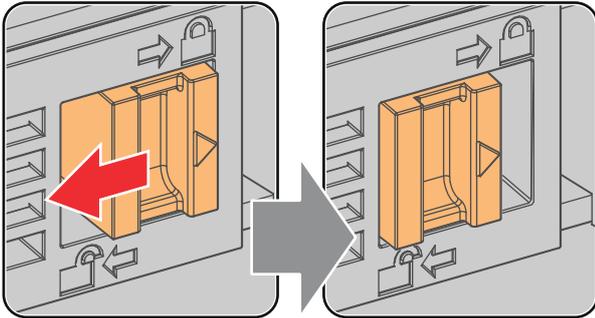


Image 9-15

3. Push the unlock button to open the handle.

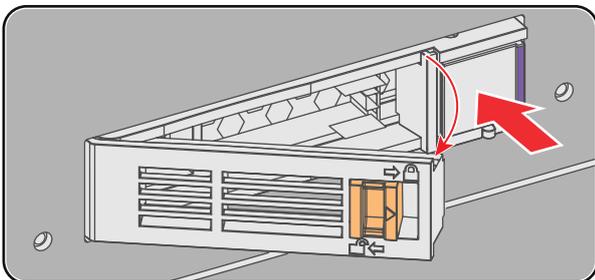


Image 9-16

4. Pull the HDD out of its slot.

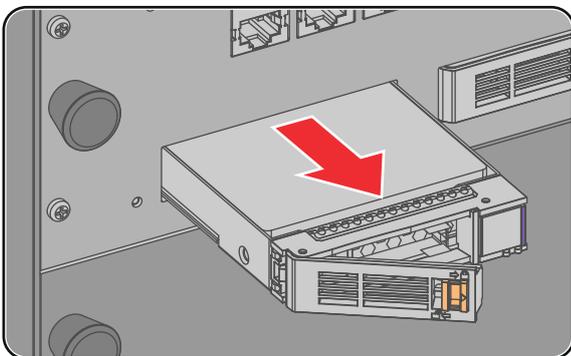


Image 9-17



To install the HDD see procedure “Installing a HDD into the ICMP”, page 103.

9.16 Installing a HDD into the ICMP



This procedure assumes that the HDD slot of the ICMP is empty. If not, see procedure “Removing a HDD from the ICMP”, page 102.



CAUTION: Always use a new empty spare part HDD approved by Barco to replace a malfunction HDD. Do not use a HDD from another ICMP HDD set.



CAUTION: Always make sure that all HDDs in the ICMP HDD set have the same storage capacity. See label on top of the HDD to know the storage capacity.

How to install a HDD ?

1. Ensure that the projector is switched off.
2. Prepare the HDD for insertion by moving the latch towards the left and push the unlock button to open the handle.

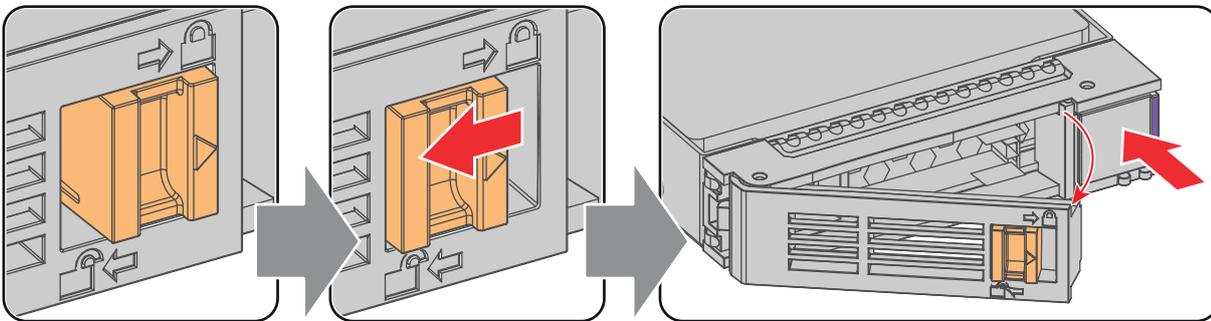


Image 9-18

3. Insert the HDD into the HDD slot. Ensure that the handle is sufficiently open so that the hook (reference 1) of the handle can pass the front plate of the ICMP.

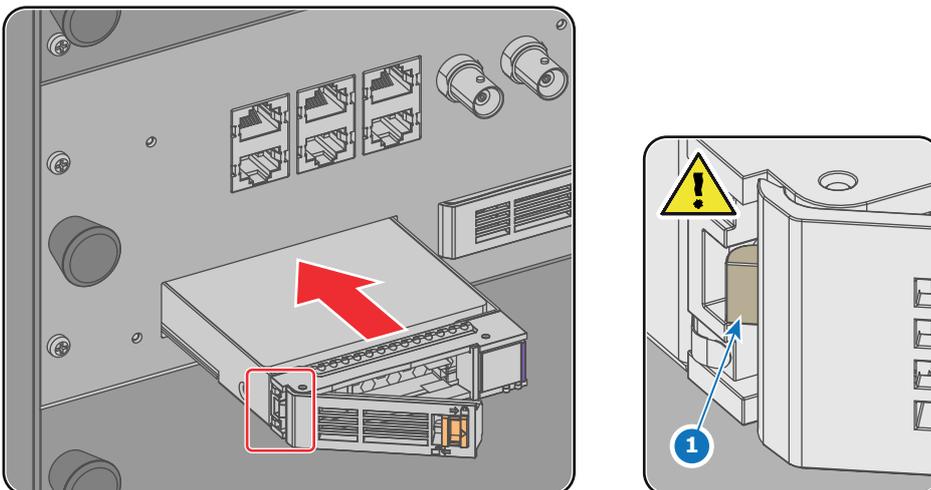


Image 9-19

4. Push the HDD completely and firmly inside its slot, close the handle, and move the latch towards the right.

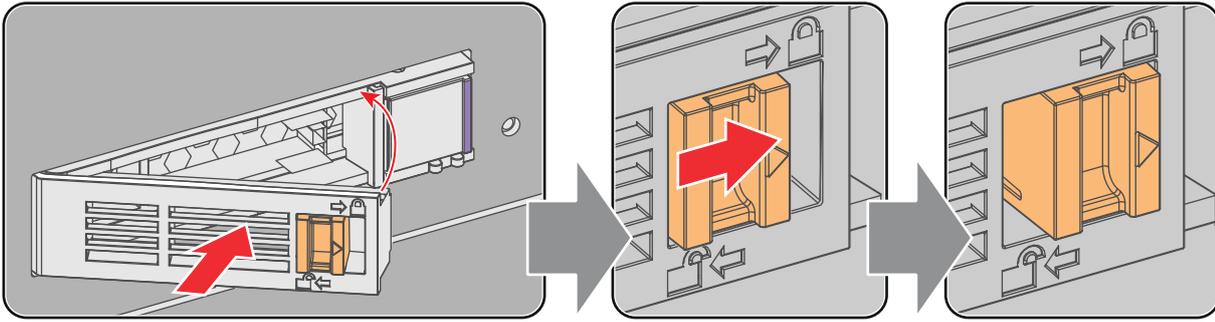


Image 9-20

5. Switch on the projector.



In case you replace one HDD (e.g. degraded mode) the ICMP automatically starts with the RAID recovery process. The red LED of the HDD which has to be rebuilt is blinking. This process takes about 200 GB per hour. Once the RAID is completed the red LED turns off.



CAUTION: It's strongly recommended to complete the RAID recovery process prior to starting a show. This to ensure that the content integrity is preserved and that the show is not interrupted.

Starting up

10

About this chapter

This chapter contains the switch ON and switch OFF procedures of your Thor series projector. These procedures highlight all important points to be checked prior to switching the projector ON. This is to ensure a safe startup of the projector.

Overview

- Switching the Thor series projector ON
- Switching the Thor series projector OFF
- Projector ON/OFF cycle explained

10.1 Switching the Thor series projector ON

About the start up process

To start up the Thor series projector the sealed compartment of the Light Processor and the sealed compartment of the Laser Clusters must be brought into a 'condition' which is safe for the electronics to operate (avoid moisture due to extreme cooling). In other words, the temperature and humidity inside these compartments must be brought within specs prior to activating the lasers and Light Processor. The time needed to bring the projector from a **deconditioned** state into a **conditioned** state depends on the ambient conditions and can take several minutes. This process is called **conditioning**.

Start up checklist

1. Check if all chillers are correctly installed. See documentation set of the chillers.
2. Check if one chiller is equipped with the expansion unit for DMD cooling.
3. Check if the Thor series projector is installed onto a stable platform and all covers are installed. See chapter "Positioning the projector at port window", page 46.
4. Check if all hoses are properly connected with the chiller(s) and projector. See chapter "Connecting the hoses with projector and chillers", page 49.
5. Check if the data cables between chiller(s) and projector are correctly installed. See chapter "Connecting the data cable with projector and chillers", page 51..
6. Check if the projector is connected with the mains electricity. See chapter "Connecting the projector with the mains electricity", page 55.
7. Check if the ambient temperature and humidity are within specifications. See chapter "Installation requirements", page 36.
8. Check if the chiller(s), hoses and projector are completely acclimatized to the same ambient temperature.
9. Check if the correct lens is installed for the application and the lens cap is removed from the lens. See chapter "Lens installation", page 63.
10. Check if the small drain tubes at the bottom of the projector leads to a water drain or to an open reservoir to capture the condensed water. See chapter "Installation requirements", page 36.



Keep in mind that it can take up to 10 minutes to start the lasers again after they were switched off. If there are only 30 to 45 minutes between the shows it's advisable to keep the lasers on with dowsers closed. When the dowsers are closed the lasers are automatically dimmed.

Start up procedure

1. Switch on the chiller(s). The status light of the chiller(s) should light up white. See documentation set of the chiller.
2. Press the **Power Switch** to switch the projector **ON**.

As a result the Controller of the projector starts up. All other electronics remain off. The booting process is indicated by the **blue blinking backlight** of the Standby button on the local keypad. Once the Controller is up and running the backlight of the Standby button is changed to continuous white. This is the projector Standby mode. The status light of the projector also flashes green.



Note: The projector always boots up in the same mode (E.g. Standby or Operation) as it was switched off. This procedure assumes that the projector was switched off in Standby mode.

3. Press the **STANDBY** button on the Local Keypad for three seconds or use the Communicator to put the projector in **OPERATIONAL** mode.

As a result the backlight of the Standby button starts blinking green indicating the start up of all other projector electronics. Once this initializing process is done the backlight of the Standby button is changed to continuous green. This is the projector Operational mode. The status light of the projector also lights up green (not flashing).

4. Press the **LIGHT** button on the Local Keypad for three seconds or use the Communicator to activate the lasers.

As a result the backlight of the Light button starts blinking green indicating the projector is in CONDITIONING mode. The laser status light on the top of the projector flashes a few times and then lights up continuously white.

Once the projector is conditioned the backlight of the Standby button is changed to continuous green. Now the lasers are active and light can come out of the projector. The status light of the projector remains green and the status light of the lasers remains white.

5. Press the **DOWSER** button on the Local Keypad or use the Communicator to open the dowser.



Note: The state of the dowser (open or closed) when starting up the projector will be the same as when the projector was switched off. This procedure assumes that the dowser was closed .



CAUTION: See user's guide of the Communicator Touch Panel to operate and control the Thor series.



When for any reason a restart of the projector is required, the content server should be restarted also.

10.2 Switching the Thor series projector OFF

About the switch off process

To switch off the Thor series projector in a safe manner to protect the internal electronics (avoid moisture due to warming up) the temperature inside the sealed compartments has to be brought back to ambient in a controlled manner. This process is called **deconditioning**.

How to switch the Thor series OFF?

1. Press the Standby button for three seconds on the Local Keypad or use the Communicator Touch Panel to switch the projector from OPERATIONAL mode to STANDBY mode. As a result the lasers are deactivated (if activated) and the projector starts to deconditioning the sealed compartments.
 -  **Caution:** Do not switch off the power from the projector until the laser status light is off. Also make sure not to power off the chiller(s). The chiller(s) should remain on as long as the projector is powered on.
2. Switch the projector OFF with the power switch.



Keep in mind that it can take up to 10 minutes to start the lasers again after they were switched off. If there are only 30 to 45 minutes between the shows it's advisable to keep the lasers on with dowser closed. When the dowser is closed the lasers are automatically dimmed.

10.3 Projector ON/OFF cycle explained

Projector ON/OFF cycle

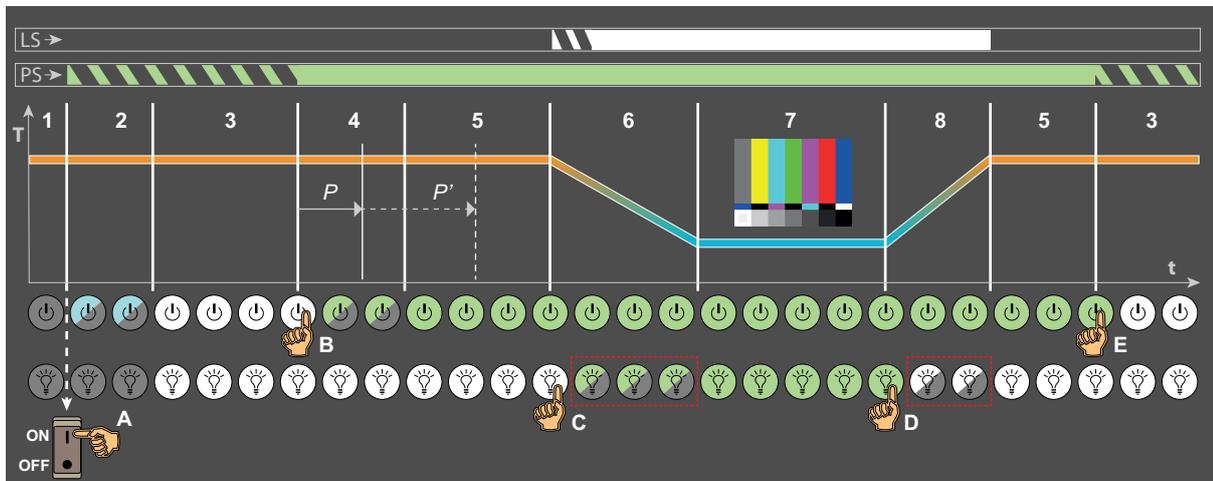


Image 10-1

LS Laser Status light.

PS Projector Status light (tail light).

T Temperature inside sealed compartments.

t time.

A.. Operator manipulations.

E

1..8 Different process stages.

Stage description:

Stage 1 : Projector is **switched off**. Local Keypad is not active. The projector status light (PS) and the laser status light (LS) are off.

Stage 2 : Cinema Controller of the projector is **booting**. This process starts as soon as the power switch is switched on (reference A Image 10-1). This process takes several seconds and during this process the backlight of the Standby button is blinking blue. The projector status light is blinking green (in normal condition, no errors and no warnings). The laser status light remains off.

Stage 3 : Projector is in **Standby** mode. The Cinema Controller is up and running. Only the Standby button and Light button on the Local Keypad are active: The backlight of both buttons is white. The projector status light is blinking green (in normal condition, no errors and no warnings). The laser status light remains off.

Stage 4 : **Initialization** and **PRECONDITIONING**. These two processes start simultaneous as soon as the Standby button is pressed for 3 seconds when the projector is in Standby mode (reference B Image 10-1).

The initialization of all electronic boards takes approximately two minutes and during this process the backlight of the Standby button is blinking green. The projector status light remains blinking green (in normal condition, no errors and no warnings). The laser status light remains off. Note that the projector always boots up in the same mode (E.g. Standby or Operation) as it was switched off.

The PRECONDITIONING process verifies if it's safe to turn on the pump of the cooling circuit and to extract humidity from the sealed compartments without having the risk of condensation. The temperature inside the sealed compartments is kept on ambient level. Following sub-stages take place during PRECONDITIONING:

Stage 4.1 : Checking ambient and internal conditions.

Stage 4.2 : Turning pump on. Reaching liquid flow target.

Stage 4.3 : Flow target reached. Conditioning humidity in the projector.

Stage 4.4 : Cooling started.

Stage 4.5 : Reaching liquid temperature target.

Depending on the environmental circumstances (temperature and humidity) the PRECONDITIONING process will reach its target before (reference P Image 10-1) or after (reference P' Image 10-1) the initialization process is completed. In optimal circumstances it will be before.

Stage 5 : Projector is **Operational** and **PRECONDITIONED**. All electronic boards are up and running. All buttons on the Local Keypad are active. The backlight of the Standby button is green while the backlight of the

Light button is white. The projector status light is continuous green (in normal condition, no errors and no warnings). The laser status light remains off.

In PRECONDITIONED mode the chillers are operational and the heat dissipation of the DMDs is under control. Heat dissipated by the active formatter boards is removed. Ingesting of content, creating playlist, etc. is already possible on the ICMP. Also the creation of macros etc. is possible if that is feasible without projecting an image (lasers are not active).

Stage 6 : Projector is **Operational** and in **CONDITIONING** mode. This process starts as soon as the Light button is pressed for 3 seconds (reference C Image 10-1). The laser status light on the top of the projector flashes a few times and then lights up continuously white. The sealed compartments are cooling down from ambient to operating temperature and humidity is extracted. The conditioning process takes approximately 3 to 15 minutes (depends on the environmental conditions). Following sub-stages take place during CONDITIONING:

Stage 6.1 : Checking ambient and internal conditions.

Stage 6.2 : Turning pump on. Reaching liquid flow target.

Stage 6.3 : Flow target reached. Conditioning humidity in the projector.

Stage 6.4 : Cooling started.

Stage 6.5 : Reaching liquid temperature target.

During CONDITIONING the backlight of the Light button is blinking green. The projector status light is continuous green (in normal condition, no errors and no warnings).

Stage 7 : Projector is **Operational** and **CONDITIONED**. Temperature and humidity inside the sealed compartments are within specifications and the lasers are activated. Image is projected on the screen in case the dowser is open and a source or test pattern is selected. The projector status light is continuous green (in normal condition, no errors and no warnings) and the laser status light on the top of the projector lights up continuously white.

Stage 8 : Projector is in **Operational** and in **DECONDITIONING** mode. This process starts as soon as the Standby button or Light button is pressed for 3 seconds (reference D Image 10-1) while the projector is in conditioning or conditioned mode. The DECONDITIONING mode brings the system back to the PRECONDITIONED state. The laser status light on the top of the projector remains lighting up white. The sealed compartments are brought back to ambient temperature and humidity extraction is stopped. The deconditioning process takes a few minutes and during this process the backlight of the Light button is blinking white. The projector status light is continuous green (in normal condition, no errors and no warnings).

Scheimpflug

11

About this chapter

This chapter explains the Scheimpflug principle and when to apply Scheimpflug correction upon the projector. In addition to the procedure for Scheimpflug adjustment the procedure to adjust the Back Focal Length is also included in this chapter.

Scheimpflug principle



The "plane of sharp focus" can be changed so that any plane can be brought into sharp focus. When the DMD plane and lens plane are parallel, the plane of sharp focus will also be parallel to these two planes. If, however, the lens plane is tilted with respect to the DMD plane, the plane of sharp focus will also be tilted according to geometrical and optical properties. The DMD plane, the principal lens plane and the sharp focus plane will intersect in a line below the projector for downward lens tilt.

Overview

- Scheimpflug introduction
- Scheimpflug adjustment
- Fixation of the Lens Holder front plate
- Back Focal Length adjustment

11.1 Scheimpflug introduction

What is Scheimpflug?

The lens holder has to be adjusted so that the "sharp focus plane" of the projected image falls together with the plane of the screen ($Fp1 \rightarrow Fp2$). This is achieved by changing the distance between the DMD plane and the lens plane ($Lp1 \rightarrow Lp2$). The closer the lens plane comes to the DMD plane the further the sharp focus plane will be. It can occur that you won't be able to get a complete focused image on the screen due to a tilt (or swing) of the lens plane with respect to the DMD plane. This is also known as Scheimpflug's law. To solve this the lens plane must be placed parallel with the DMD plane. This can be achieved by turning the lens holder to remove the tilt (or swing) between lens plane and DMD plane ($Lp3 \rightarrow Lp4$).

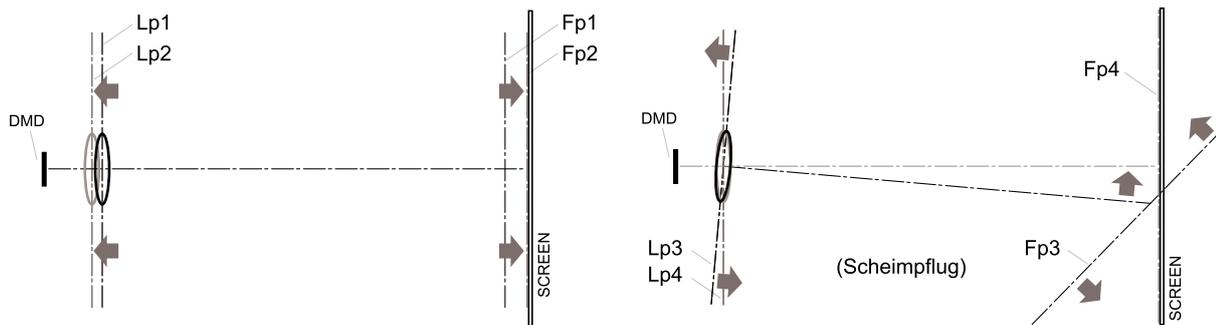


Image 11-1: Scheimpflug principle

Scheimpflug principle



The "plane of sharp focus" can be changed so that any plane can be brought into sharp focus. When the DMD plane and lens plane are parallel, the plane of sharp focus will also be parallel to these two planes. If, however, the lens plane is tilted with respect to the DMD plane, the plane of sharp focus will also be tilted according to geometrical and optical properties. The DMD plane, the principal lens plane and the sharp focus plane will intersect in a line below the projector for downward lens tilt.

Scheimpflug adjustment points

The front plate of the Lens holder is equipped with four bronze (Scheimpflug) nuts and four set screws with lock nut. These screws and nuts are used for Scheimpflug adjustment.

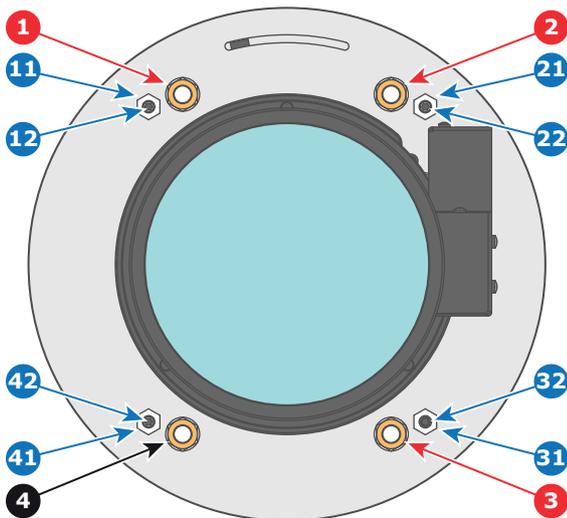


Image 11-2

- | | |
|---|--|
| <p>1 Scheimpflug adjustment nuts No1: Influences the sharp focus plane in the lower left corner of the projected image.</p> <p>2 Scheimpflug adjustment nuts No2: Influences the sharp focus plane in the lower right corner of the projected image.</p> <p>3 Scheimpflug adjustment nuts No3: Influences the sharp focus plane in the upper right corner of the projected image.</p> <p>4 Scheimpflug nut No 4: without adjustment functionality.</p> <p>11 Lock nut.</p> <p>12 Set screw for nut No1.</p> | <p>21 Lock nut.</p> <p>22 Set screw for nut No2.</p> <p>31 Lock nut.</p> <p>32 Set screw for nut No3.</p> <p>41 Lock nut.</p> <p>42 Set screw for nut No4.</p> |
|---|--|



Reference 1, 2 and 3 are adjustment points. Reference 4 is a locking point and NOT used during Scheimpflug adjustment.

When to apply Scheimpflug?

Only apply a Scheimpflug correction in case the overall focus of the projected image is not equally sharp (can be caused if the projector is **NOT in parallel** with the screen or a previous misaligned Scheimpflug) . Take into account that the consequence of applying Scheimpflug correction upon a screen not in parallel with the projector is that the projected image differs from the rectangle shaped image. In other words “**distortion**” of the projected image occurs. **Masking** will be required to solve the distortion.

The disadvantage of Masking is loss of content. Therefore it is strongly **recommended** to place the projector **in parallel** with the projection screen and use the **SHIFT** functionality of the Lens Holder to match the projected image with the projection screen. In case the SHIFT range is not sufficient then the projector can be tilted and Scheimpflug can be applied.

11.2 Scheimpflug adjustment

Required tools

- Allen wrench 3 mm
- Nut driver 13 mm
- Nut driver 10 mm

Preparation steps:

1. Ensure that the throw ratio of the installed lens matches the requirements of the application (projection distance and screen size).

2. Ensure that the correct lens parameters are activated. (See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*)

 **Note:** Selecting the wrong lens parameters will result in an unexpected behavior of the lens when using macros for switching between FLAT and SCOPE (change in picture size and focus).

3. Perform a lens **HOME & RETURN** operation. (See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*)
4. Project the green focus test pattern.

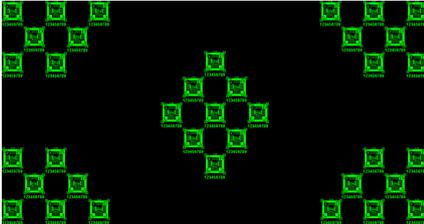


Image 11-3

5. Zoom the lens for maximum image on the screen (**WIDE**).
6. Is it possible to focus the center of the projected image?
 - ▶ If **yes**, the Back Focal Length is OK. Proceed with the next step.
 - ▶ If **no**, the Back Focal Length needs realignment. Proceed with the procedure “Back Focal Length adjustment”, page 117.
7. Unlock and turn out the 4 set screws (reference 11 Image 11-4) of the Lens Holder by 1 centimeter. Use a 10mm nut driver for the lock nuts (reference 21 Image 11-4) and use a 3 mm Allen wrench for the set screws.

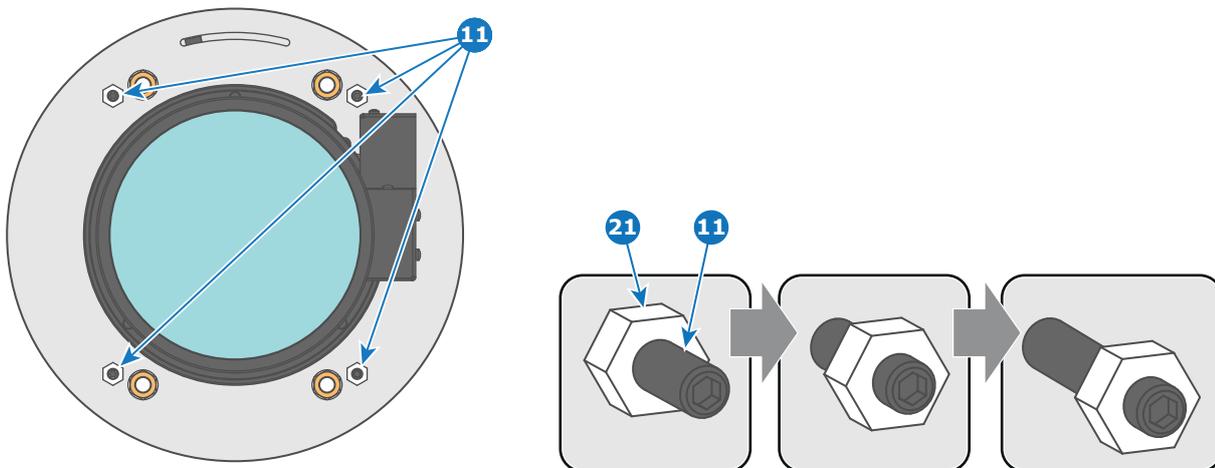


Image 11-4

8. Fully loosen the Scheimpflug nut at the lower left of the Lens Holder (reference 4 “”, page 115). Use a 13 mm nut driver.
9. Optimize the focus of the projected image in the center of the screen (F) using the motorized focus control (Local Keypad).

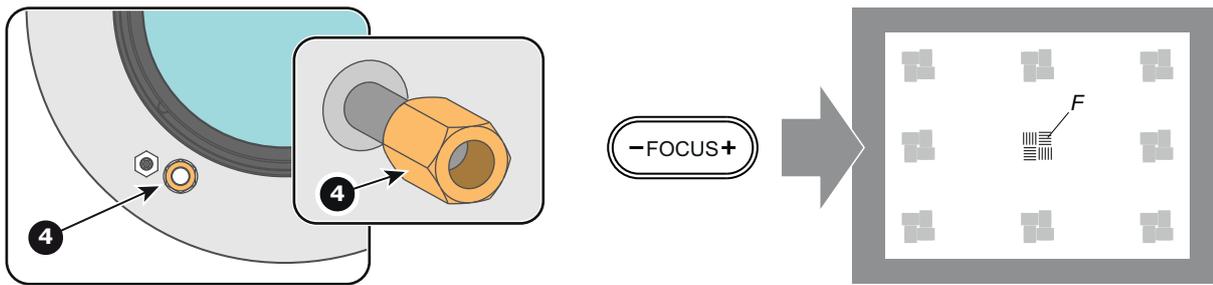


Image 11-5

Scheimpflug adjustment steps:

1. Sharpen the image at the bottom left corner of the screen by turning the upper left Scheimpflug adjustment nut (reference 1 Image 11-6). As a result the focus in the center will fade a bit but that's normal.

! Caution: Do not remove any of the Scheimpflug adjustment nuts completely from the threaded rod. Otherwise the lens holder front plate with lens will fall off.

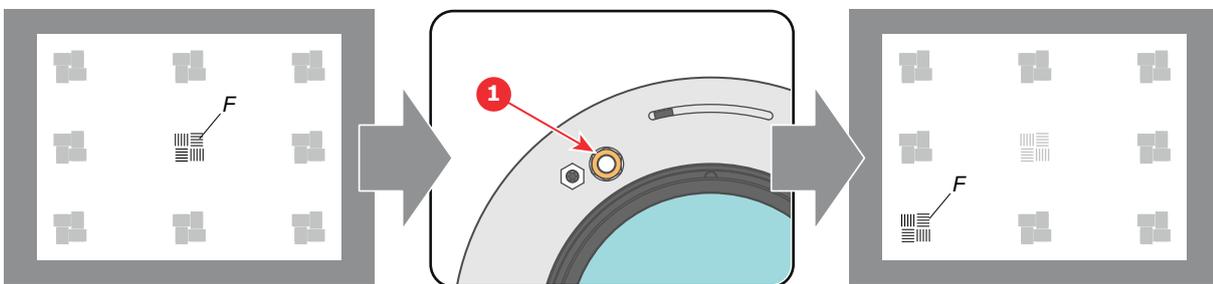


Image 11-6

2. Sharpen the image at the top right corner of the screen by turning the lower right Scheimpflug adjustment nut (reference 3 Image 11-7).

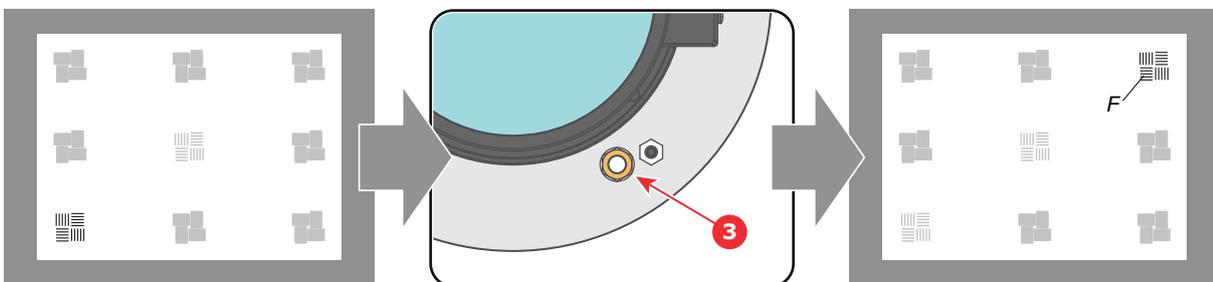


Image 11-7

3. Sharpen the image at the bottom right corner of the screen by turning the upper right Scheimpflug adjustment nut (reference 2 Image 11-8).

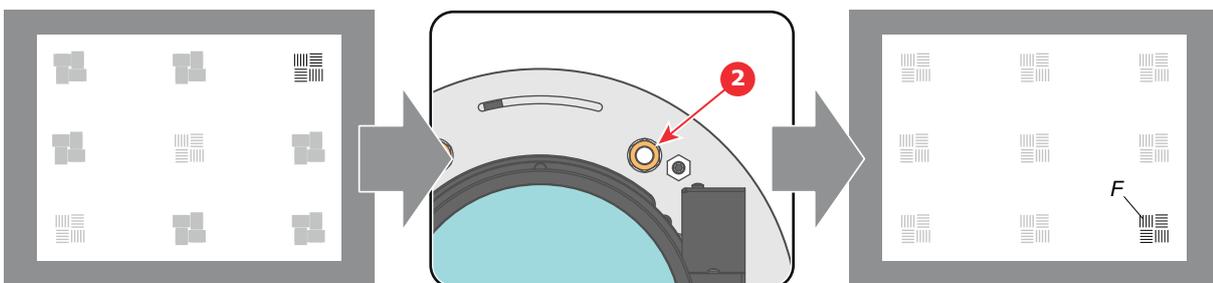


Image 11-8

4. Optimize the focus of the projected image in the center of the screen using the motorized focus control (Local Keypad).

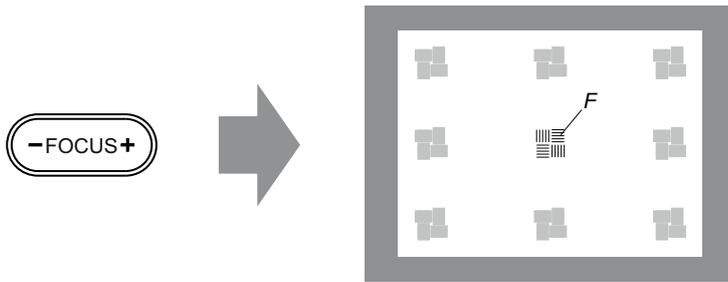


Image 11-9

5. Repeat from step 1 until the projected focus pattern is as sharp as possible in the center, left, right, top and bottom of the screen.
6. Proceed with the procedure “Fixation of the Lens Holder front plate”, page 116.

11.3 Fixation of the Lens Holder front plate

When fixing the Lens Holder front plate

After performing the procedure for Scheimpflug adjustment or Back Focal Length adjustment the Lens Holder front plate must be secured in such a way that it doesn't disturb the result of the adjustment.

Required tools

- Allen wrench 3 mm
- Nut driver 10 mm
- Nut driver 13 mm

How to fix the Lens Holder front plate?

Start the fixation as follows (steps must be followed strictly) :

1. Project the **Outline / Aspect** test pattern (depending on projector type).
2. Zoom the projected image until the edges of the projected test pattern matches with the edges of the projection screen.

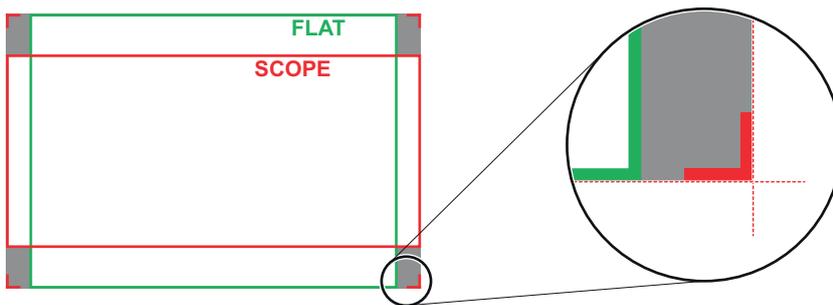


Image 11-10

3. Turn in the three set screws indicated with reference 11 Image 11-11 without disturbing the projected image. Tighten lightly . Do not turn in the set screw at the lower left of the Lens Holder!



Note: Ensure that the edges of the projected test pattern remain in place on the screen. Any movement of the image will affect the Scheimpflug adjustment.

4. Fasten the lock nut (reference 21 Image 11-11) of the three set screws. Use a 10 mm nut driver. Ensure the image doesn't move.

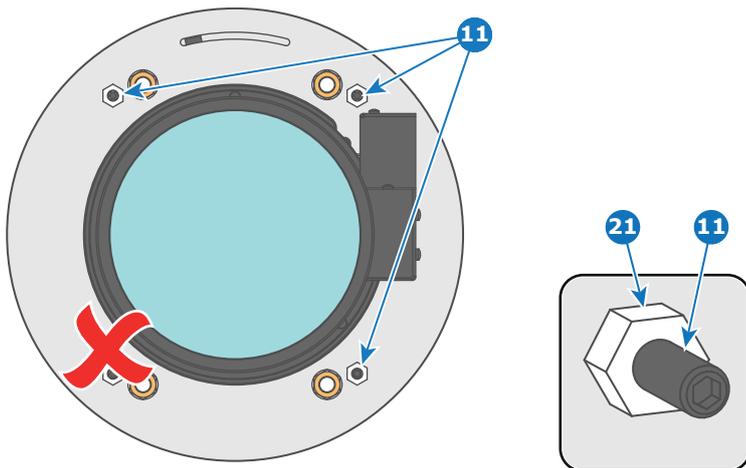


Image 11-11

5. Gently turn (by hand) the Scheimpflug adjustment nut at the lower left of the Lens Holder (reference 4 Image 11-12) against the Lens Holder front plate without disturbing the projected image.
6. Turn in the set screw at the lower left of the Lens Holder (reference 14 Image 11-12) without disturbing the projected image. Use a 3 mm Allen wrench.

 **Note:** Ensure that the edges of the projected test pattern remain in place on the screen. Any movement of the image will affect the Scheimpflug adjustment.

 **Tip:** Fasten the set screw and the Scheimpflug nut alternately, without disturbing the projected image, until the Scheimpflug nut and set screw are completely tightened.

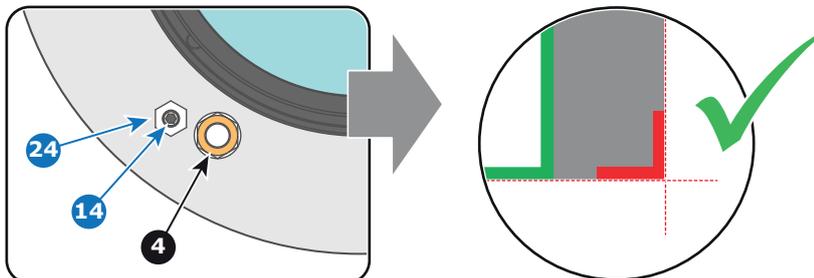


Image 11-12

7. Fasten the lock nut at the lower left of the Lens Holder. Use a 10 mm nut driver.

11.4 Back Focal Length adjustment

When to adjust the Back Focal Length?

If a lens is used with a throw ratio suited for the application, (lens selection depends on projection distance and screen size) typically one would NEVER need to adjust the Back Focal Length of the projector.

A Back Focal Length adjustment is only required in case the Focus range of the installed lens does not capture the projection screen either for FLAT and/or for SCOPE. In other words, when it is impossible to focus the image on the screen for FLAT and/or for SCOPE. Note that the lenses for the Thor series series projector are varifocal. So, switching between FLAT and SCOPE (zoom action) requires a readjustment of the focus.

What is Back Focal Length adjustment?

Back Focal Length adjustment means moving the lens plane (Lp), thus the Lens Holder front plate, closer to or further from the DMD plane. The closer the lens plane to the DMD plane the further the focus range (Fr) of the lens will be.

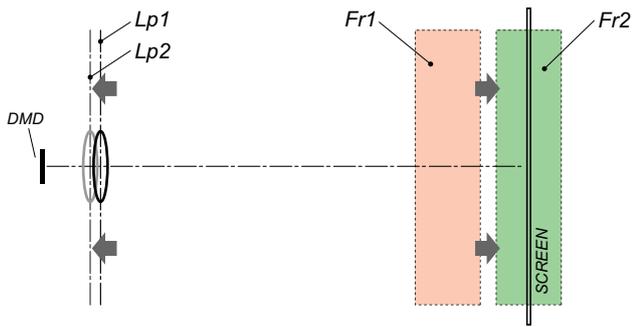


Image 11-13



Do not abuse the Back Focal Length adjustment of the Lens Holder. Neglecting this will result in loss of image quality because of the lens design. Cases requiring Back Focal Length adjustment normally indicate incorrect lens choice (throw ratio).

Required tools

- 10mm nut driver.
- 3mm Allen wrench.
- 13mm nut driver.

How to check the Back Focal Length?

1. Ensure that the throw ratio of the installed lens matches with the requirements of the application (projection distance and screen size).
2. Ensure that the correct lens parameters are activated. (See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*)



Caution: Not using the correct lens parameters could result in lens damage.

3. Perform a lens **HOME & RETURN** operation. (See user guide of the “Communicator” chapter *Installation > Advanced > Lens parameters*)
4. Project the green focus test pattern. (screen file “no masking” or “no “crop”)

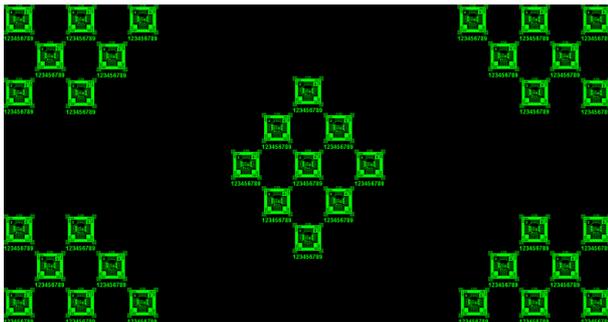


Image 11-14

5. Zoom the lens for maximum image on the screen (**WIDE**).
6. Is it possible to focus the center of the projected image?
 - ▶ If **yes**, the Back Focal Length is OK.
 - ▶ If **no**, the Back Focal Length needs realignment. Proceed with the next procedure.

How to adjust the Back Focal Length?

1. Unlock and loosen the 4 set screws (reference 11 Image 11-15) of the Lens Holder by 1 centimeter. Use a 10mm nut driver for the lock nuts (reference 21 Image 11-15) and use a 3mm Allen wrench for the set screws.

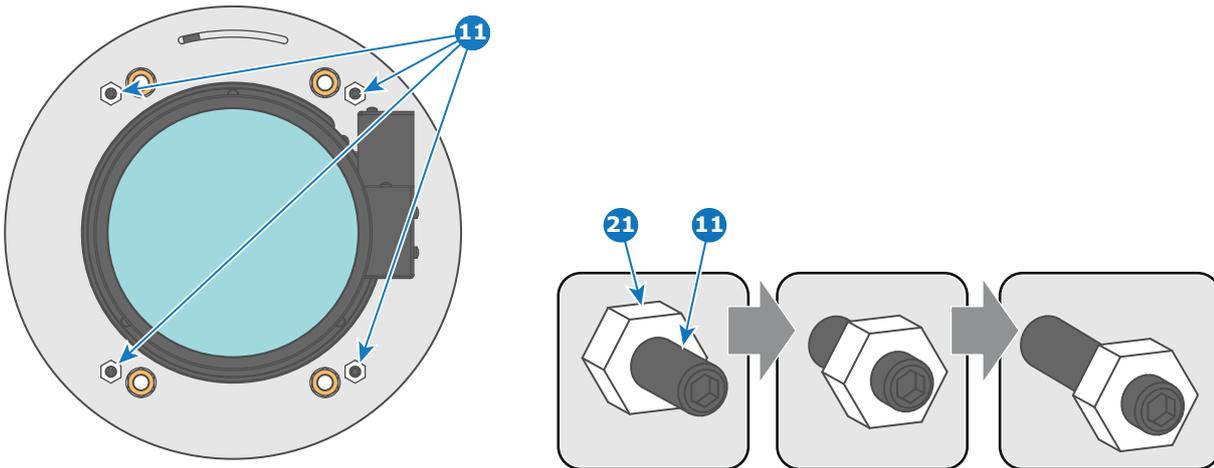


Image 11-15

2. Fully loosen the Scheimpflug nut at the lower left of the Lens Holder (reference 4 Image 11-16). Use a 13mm nut driver.

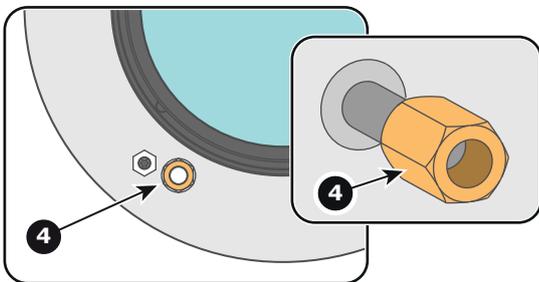


Image 11-16

3. Turn the three Scheimpflug adjustment nuts, reference 1, 2 and 3 Image 11-17, until the front of the nut (reference 5 Image 11-17) is equally aligned with the front of the threaded rod (reference 6 Image 11-17). Use a 13mm nut driver.

 **Note:** This is the nominal position of the Lens Holder.

 **Caution:** Do not remove any of the Scheimpflug adjustment nuts completely from the threaded rod. Otherwise the lens holder front plate with lens will fall off.

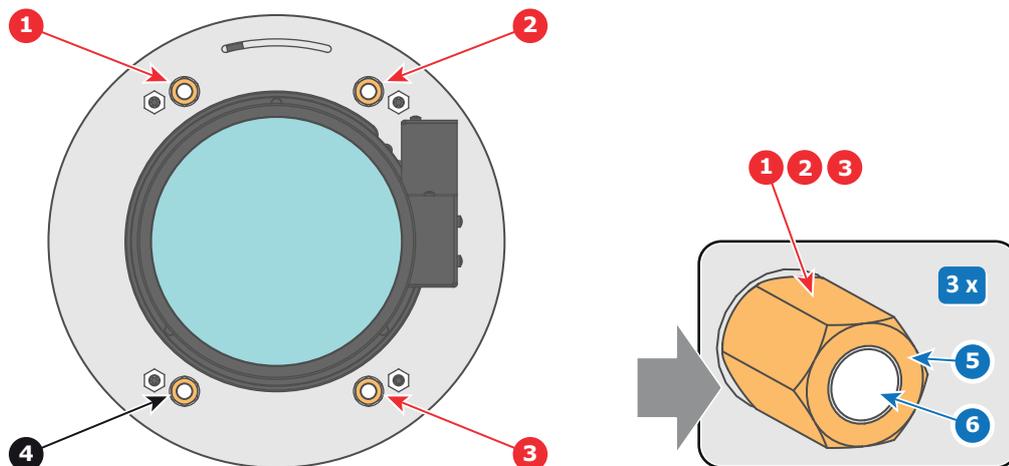


Image 11-17

4. Zoom the lens for maximum image on the screen (**WIDE**) and focus the center of the projected image using the motorized focus control (Local Keypad).

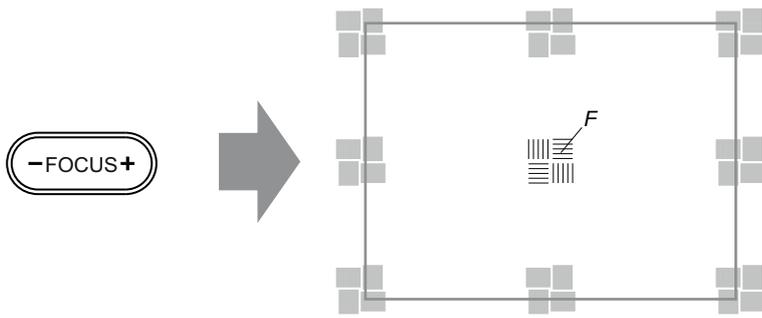


Image 11-18

5. Is it possible to focus the center of the projected image using the motorized focus control (Local Keypad) ? Ensure that the lens is zoomed for maximum image on the screen (**WIDE**).
 - ▶ If yes, nominal position is good for sharp focus in the middle of the projected image. Proceed with step 6.
 - ▶ If no, obtain the best possible focus in the center of the projected image using the motorized focus control and then turn the three Scheimpflug adjustment nuts, reference 1, 2 and 3 Image 11-19, equally in or out until the center of the projected image is sharp. **Attention:** Keep in mind the turning direction of the Scheimpflug adjustment nuts for further adjustment instructions in this procedure.

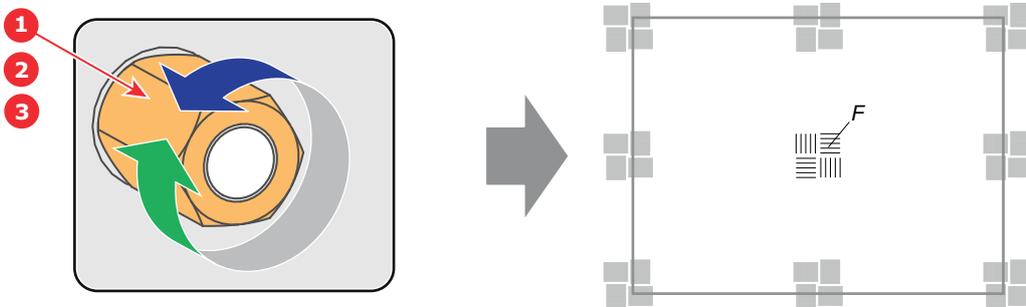


Image 11-19

6. Zoom the lens for minimum image on the screen (**TELE**) and focus the center of the projected image using the motorized focus control (Local Keypad).

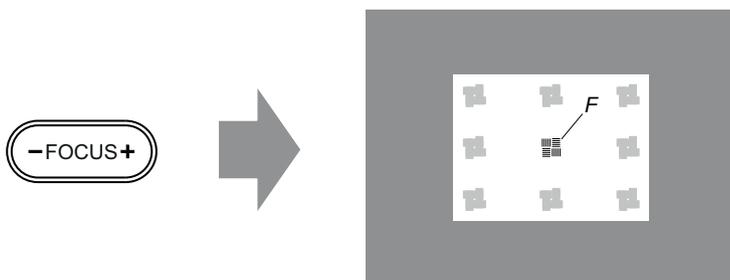


Image 11-20

7. Is it possible to focus the center of the projected image using the motorized focus control (Local Keypad) ? Ensure that the lens is zoomed for minimum image on the screen (**TELE**).
 - ▶ If yes, no further adjustment actions required. Proceed with step 8.
 - ▶ If no, obtain the best possible focus in the center of the projected image using the motorized focus control and then turn the three Scheimpflug adjustment nuts, reference 1, 2 and 3 Image 11-21, equally in or out until the center of the projected image is sharp. **Note:** the same turning direction as in step 4 is applicable.

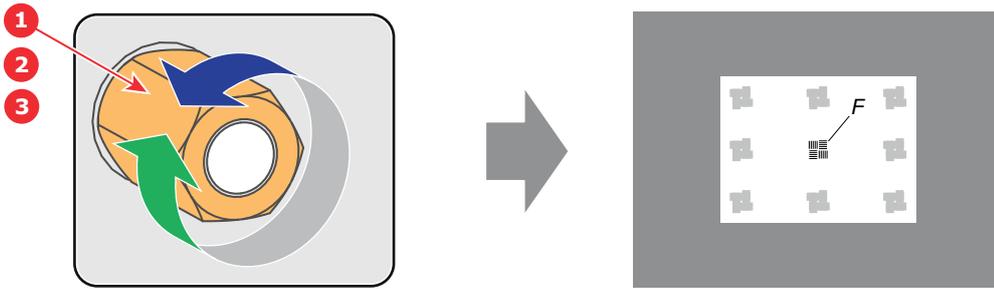


Image 11-21

8. Check if it is possible to focus the center of the projected image using the motorized focus control (Local Keypad) for **WIDE** and for **TELE**.
 - ▶ If **yes**, the Back Focal Length is correctly adjusted.
 - ▶ If **no**, repeat with step 4.
9. Is the projected image in the corners as sharp as in the middle?
 - ▶ If **yes**, proceed with the procedure “Fixation of the Lens Holder front plate”, page 116.
 - ▶ If **no**, Scheimpflug adjustment is required. See procedure “Scheimpflug adjustment”, page 113, prior to fixate the Lens Holder front plate. **CAUTION**: Skip the action, in the Scheimpflug adjustment procedure, to turn the three Scheimpflug adjustment nuts until the front of the nut is equally aligned with the front of the threaded rod!

Convergence

12

About this chapter

This chapter describes how to prepare the projector for convergence adjustment and how to adjust the convergence.

Overview

- Convergence controls
- Preparing for convergence adjustment
- Converging the red pattern onto the blue pattern
- Converging the green pattern onto the blue pattern

12.1 Convergence controls

Extended control knobs

As the DMD of the blue channel is not accessible in the projector, it remains fixed. Therefore the image of this DMD will be taken as reference. Red and green may be aligned onto blue when a small convergence drift is recognized. The red and green channels have pivot plates equipped with three extended control knobs for convergence adjustment. The control knobs are numbered from 1 to 6 and have the same color as the channel which they affect.

To access the control knobs the left side cover of the projector and a small cover plate in front of the control knobs have to be removed.

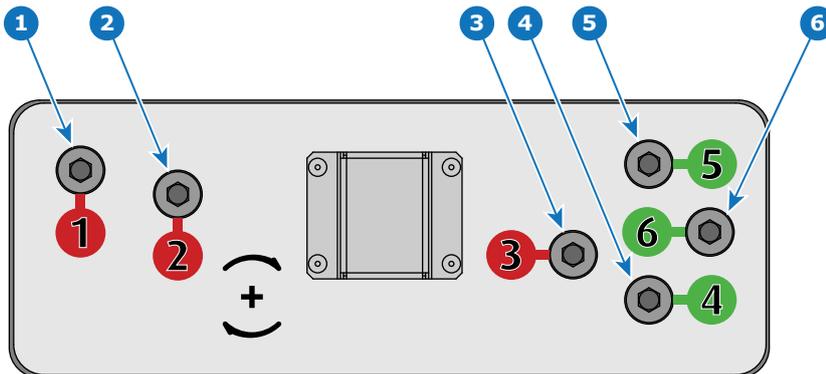


Image 12-1

- | | | | |
|---|-------------------------------------|---|---------------------------------------|
| 1 | Red channel, control knob number 1. | 4 | Green channel, control knob number 4. |
| 2 | Red channel, control knob number 2. | 5 | Green channel, control knob number 5. |
| 3 | Red channel, control knob number 3. | 6 | Green channel, control knob number 6. |

Convergence test pattern

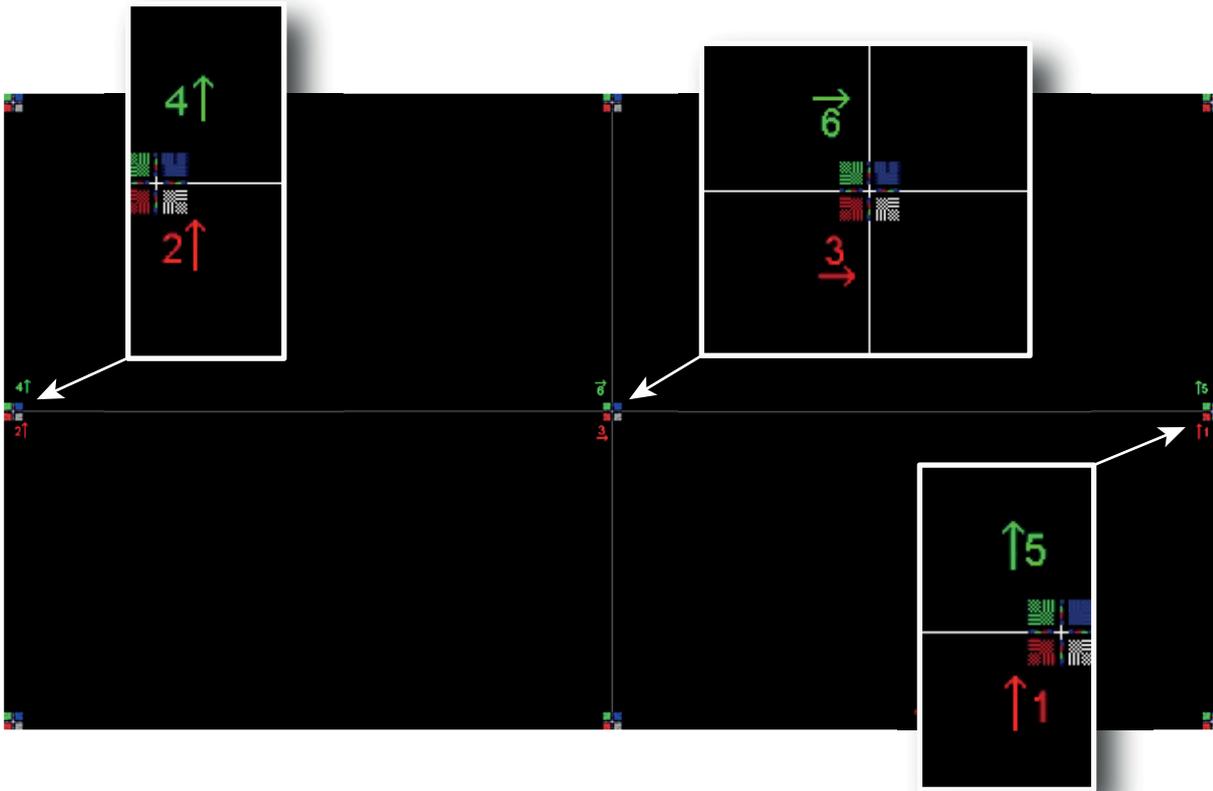


Image 12-2

The test pattern illustrated above is specifically designed for convergence purposes. The test pattern has three red arrows numbered from 1 to 3 and three green arrows numbered from 4 to 6. These numbers and colors correspond to those of the control knobs. Turning the control knob clockwise corresponds to the direction indicated on the screen.

Adjustment Range

Prevent damage to the system by limiting the amount/number of adjustment (s) made. Typically the convergence adjustments serve to correct a convergence fault of a few pixels at the most. Any convergence fault beyond this is considered grossly abnormal and likely indicates abuse or rough handling.

- Each adjustment allows for approximately 20 pixels (for 4K projectors) maximum displacement to either side of the nominal BLUE position.
- Rotation is limited to approximately +/- 10 pixels on the left screen flank and +/- 10 pixels on the right screen flank.
- One turn of a control knob relates to an approximately 10 pixels displacement on the screen.



CAUTION: The system does not have an end of travel in either direction, but using excessive force may cause damage. Please handle gently.

Troubleshooting 'dead zone' of control knob

In rare cases it can happen that a control knob is loose in the perfect convergence position. This means that the nominal DMD position falls within a **dead zone**, where the mechanism changes from a pushing to a pulling function. This dead zone is due to inherent tolerances within the mechanism. If it so happens that the nominal position of an adjustment falls within this dead zone, it is preferable to continue screwing through the dead zone for another 2 turns. Then return to the required nominal position. The dead zone should now be displaced away from the required end position. The DMD is now securely held in the nominal position.

12.2 Preparing for convergence adjustment

What needs to be done?

To adjust the convergence of the projected image the control knobs of the convergence adjustment mechanism has to be made accessible and the projector must project the convergence test pattern.

Required tools

- Flat screwdriver 7 mm
- Allen wrench 3 mm

How to set up the projector for convergence adjustment?

1. Remove the left side cover of the projector.
2. Release the six screws (reference 1 Image 12-3) of the control knobs cover plate. Use a 3 mm Allen wrench.
3. Remove the cover plate from the control knobs.

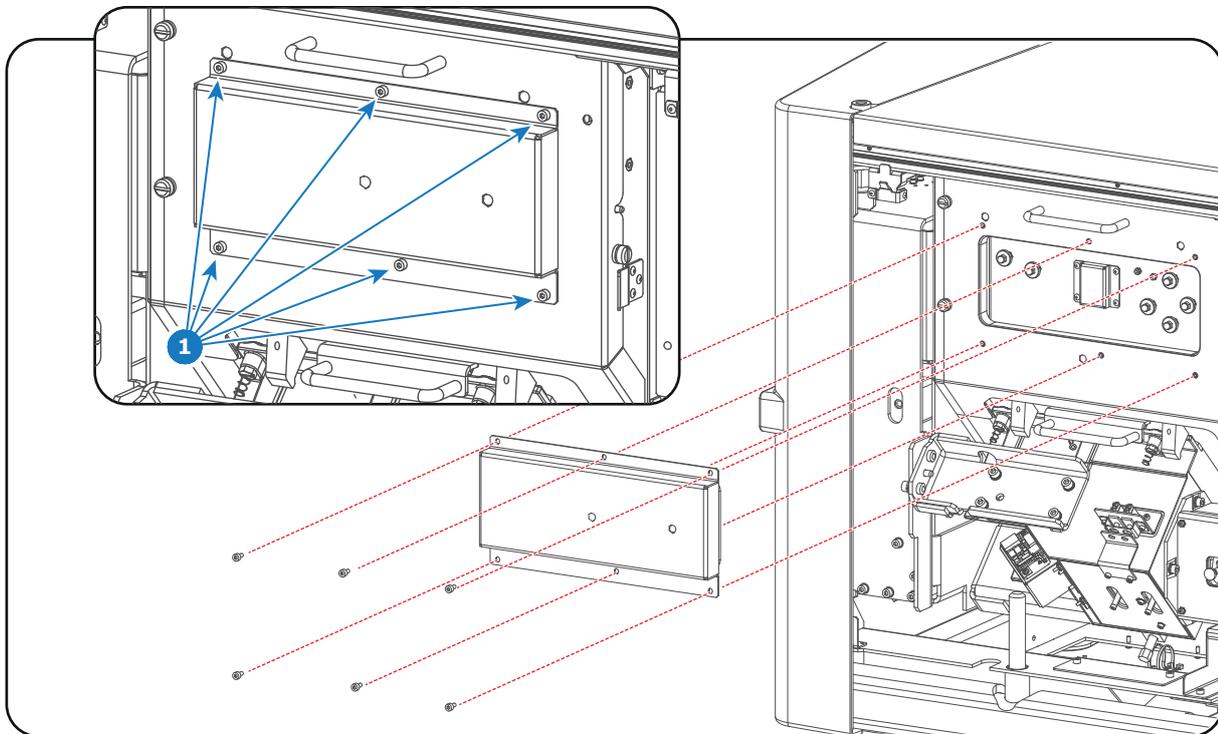


Image 12-3

4. Switch on the projector, activate the lasers and open the dower.
5. Select the convergence test pattern, which is illustrated below (Image 12-4). Use the communicator to activate the convergence test pattern.



Note: The convergence test pattern can NOT be activated via the **PATTERN** button on the Local Keypad.

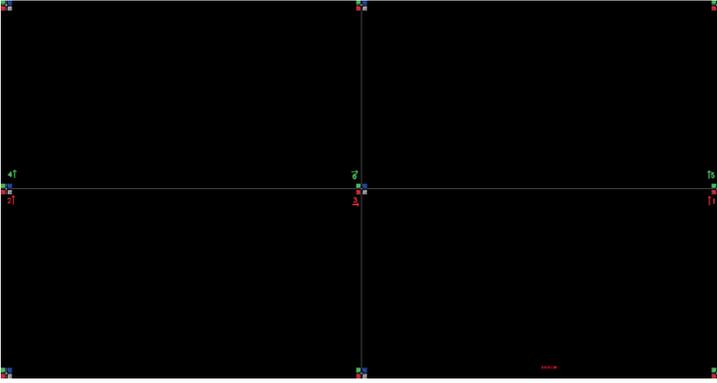


Image 12-4

- Let the projector warming up for 30 minutes before starting to adjust the convergence.

12.3 Converging the red pattern onto the blue pattern



This adjustment procedure assumes that the projector is prepared for convergence adjustment. See chapter “Preparing for convergence adjustment”, page 126.

Required tools

5.5 mm nut driver or open-end wrench.

Converging the RED pattern onto the BLUE pattern

Start with aligning the RED pattern in the vertical direction (control knob 1 and 2) and then proceed with the horizontal direction (control knob 3)

- To translate the RED pattern **vertically**, slightly turn the red control knobs number 1 and 2. Turn both control knobs in equal increments.



Note: Note that a turn of a few degrees corresponds with one full pixel. Turning the control knob clockwise corresponds to the direction of the arrow of the test pattern.

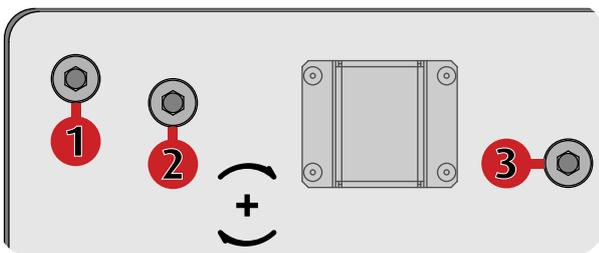


Image 12-5

- To translate the RED pattern **horizontally**, slightly turn the red control knob number 3.
- To **rotate** the RED pattern, slightly turn the red control knob number 1. If much rotation is required, slightly turn the red control knob number 2 in the opposite direction.



Note: Slight corrections of the RED pattern in vertical direction may be required after rotation.

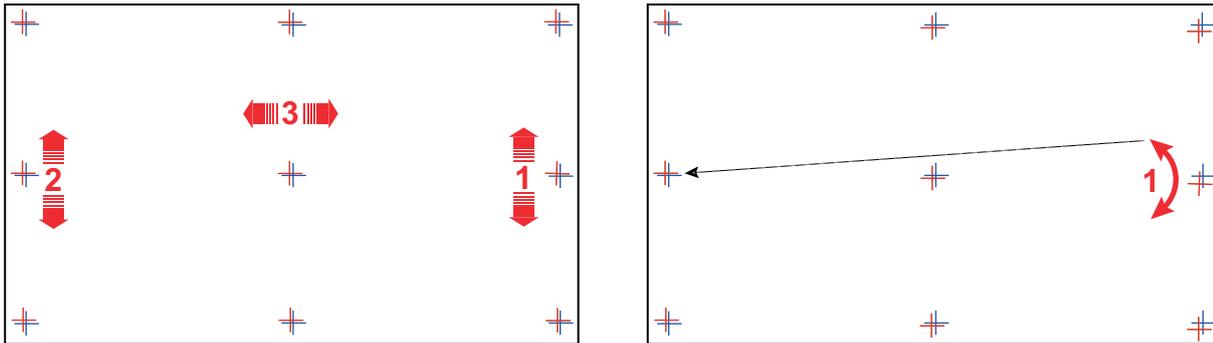


Image 12-6

4. Repeat from step 1 until **full coincidence** is obtained of the RED pattern in the **center, left and right** of the projected image.
5. To adjust the green pattern. See procedure “Converging the green pattern onto the blue pattern”, page 128.
6. When the red and green pattern are overall aligned with the blue reference pattern install the cover plate of the convergence control knobs and the projector left side cover.

12.4 Converging the green pattern onto the blue pattern



This adjustment procedure assumes that the projector is prepared for convergence adjustment. See chapter “Preparing for convergence adjustment”, page 126.

Required tools

5.5 mm nut driver or open-end wrench.

Converging the GREEN pattern onto the BLUE pattern

Start with aligning the GREEN pattern in the vertical direction (control knob 4 and 5) and then proceed with the horizontal direction (control knob 6)

1. To translate the GREEN pattern **vertically**, slightly turn the green control knobs number 4 and 5. Turn both control knobs in equal increments.



Note: Note that a turn of a few degrees corresponds with one full pixel. Turning the control knob clockwise corresponds to the direction of the arrow of the test pattern.

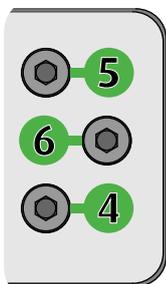


Image 12-7

2. To translate the GREEN pattern **horizontally**, slightly turn the green control knob number 6.
3. To **rotate** the GREEN pattern, slightly turn the green control knob number 4. If much rotation is required, slightly turn the green control knob number 5 in the opposite direction.



Note: Slight corrections of the GREEN pattern in vertical direction may be required after rotation.

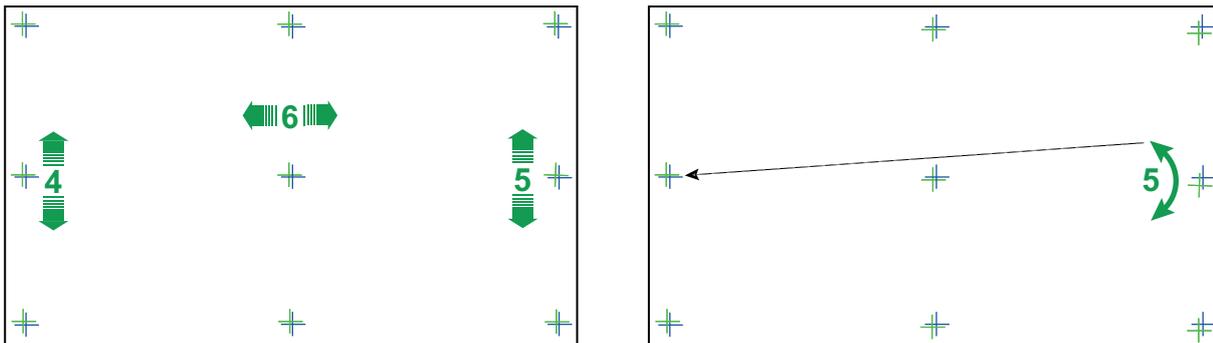


Image 12-8

4. Repeat from step 1 until **full coincidence** is obtained of the GREEN pattern in the **center, left and right** of the projected image.
5. To adjust the red pattern. See procedure “Converging the red pattern onto the blue pattern”, page 127.
6. When the red and green pattern are overall aligned with the blue reference pattern install the cover plate of the convergence control knobs and the projector left side cover.

Calibration

13

About this chapter

This chapter describes the luminance and color calibration process for the Thor series. Where applicable references are made to the user guide of the Communicator for detailed menu navigation instructions. The first chapter describes the complete calibration process in chronological order.

Overview

- Calibration process
- White point calibration
- Color gamut calibration
- Luminance calibration

13.1 Calibration process

Calibration process overview

1. Set the projector in the desired projection mode (laser mode):
 - **2D**
 - **2D Rec. 2020**
 - **Active Laser 3D (6P)**
 - **External 3D**
 - **External 3D Rec. 2020**
 - **Passive Laser3D (Left eye)**
 - **Passive Laser3D (Right eye)**
2. Select desired aspect ratio by activating the correct lens file.
 - **SCOPE** format
 - **FLAT** format
3. Activate the uncorrected full white **test pattern**. Note that a test pattern does not have a format. It's always full screen. That's why the test pattern has to be activated after the format is chosen.
4. **Adjust projector light output** slightly above the desired screen brightness. (screen brightness will slightly drop after calibration).
5. **White point calibration** (Laser power calibration). Needs to be done per projection mode:

- **2D**
- **Laser3D** : measure values for left eye and for right eye separately.
 - with laser power **Luminance balancing** between left and right eye.
- **External 3D** : measure left and right together through the external 3D system.

For more info about white point calibration see chapter "White point calibration", page 133. The Communicator contains a wizard for white point calibration. See user guide of the Communicator for detailed menu navigation instructions.

6. **Color gamut calibration.** (electronic P7 correction). Measured values are saved in the Measured Color Gamut Data (MCGD) file. Needs to be done per format and per projection mode.
 - **FLAT:**
 - **2D** → One MCGD file.
 - **Laser3D**
 - Left eye → One MCGD file.
 - Right eye → One MCGD file.
 - **External 3D**
 - Left eye → One MCGD file.
 - Right eye → One MCGD file.
 - **SCOPE:**
 - **2D** → One MCGD file.
 - **Laser3D**
 - Left eye → One MCGD file.
 - Right eye → One MCGD file.
 - **External 3D**
 - Left eye → One MCGD file.
 - Right eye → One MCGD file.

For more info about color gamut calibration see chapter "Color gamut calibration", page 135. The Communicator contains a wizard for color gamut calibration. See user guide of the Communicator for detailed menu navigation instructions.

7. **Select target colors.** The target colors are stored in the Target Color Gamut Data (TCGD) file. Several TCGD files are already available in the file system of the projector. Depending on the projector setup (2D, 3D, ...) the right TCGD file has to be activated. In case of luminance balancing (e.g. for 3D) a second TCGD file is derived from the selected TCGD file. Only the Y component in the second TCGD is modified to apply luminance balancing.
 - **2D** : → one TCGD file.
 - **Laser3D**
 - without electronic luminance balancing.
 - Same TCGD for left and right eye.

- with electronic **luminance balancing**.
 - Left eye → One TCGD file.
 - Right eye → One TCGD file.
- **External 3D**
 - without electronic luminance balancing.
 - Same TCGD for left and right eye
 - with electronic **luminance balancing**.
 - Left eye → One TCGD file.
 - Right eye → One TCGD file.

For detailed instructions on how to select target colors and how to apply luminance balancing see user guide of the Communicator.

8. Verify corrected colors.

For detailed instructions on how to verify corrected colors see user guide of the Communicator.

9. Luminance calibration.

For more info about luminance calibration see chapter “Luminance calibration”, page 137.

10. Arrange calibration files in macro.

To apply correct color calibration it is important that the MCGD file(s) and matching TCGD file(s) are activated after that the INPUT file and PCF file are activated. For that it's recommended to create a macro where the files are loaded one by one in the right order:

- a) First activate the **INPUT** file. Ensure that in case of 3D projection with the **ICMP media player** the color correction “**Dual (separate eyes)**” is selected in the INPUT file.
- b) then activate the **PCF** file (PCF already contains plane 1 information),
- c) then activate the **MCGD** and **TCGD** files of **plane 1**.
- d) and in case of 3D activate the **MCGD** and **TCGD** files of **plane 2**.

For detailed instructions on how to create a macro see user guide of the Communicator.

13.2 White point calibration

What has to be done?

The projector uncorrected white point (W_n) has to be shifted towards the DCI white point (W_t). The coordinates of the DCI white point ($x_w=0.314$; $y_w=0.351$) are embedded in the projector software and cannot be changed. The coordinates of the projector uncorrected white point has to be measured and entered.

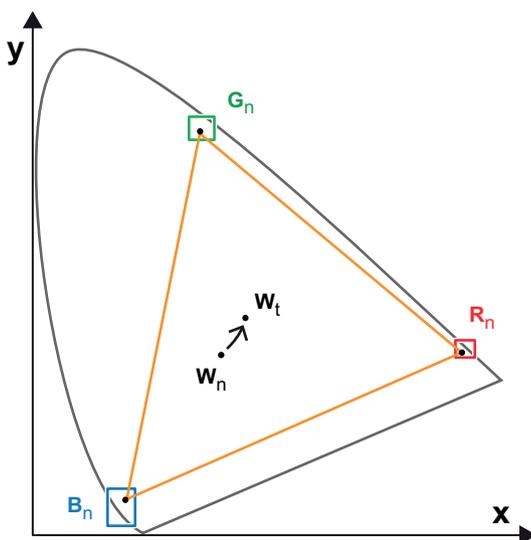


Image 13-1: Shifting projector 'white point' towards desired white point (laser power calibration)

The projector uncorrected white point can be defined by measuring the xy coordinates of the uncorrected primary colors (red, green, blue) and uncorrected full white separately.

The initial set of xy values stored in the projector for the uncorrected white point are the same as for DCI white point. After white point calibration, the initial values are overwritten with the measured values.

Laser RGB correction

Based on the measured values the projector can balance the power of the lasers for Red Green and Blue to move the projector uncorrected white point towards the desired white point. This adjustment is called 'Laser RGB correction' or 'Laser power calibration'.

2D and 3D projector mode

The projector uncorrected white point is different for 2D projection, Laser3D projection and External 3D projection. Therefore, the projector uncorrected white point has to be measured and entered for each projection mode separately. Per projection mode one set of measured values are stored. Depending on the projection mode, the corresponding set is used for white point correction.

In case of 3D projection, the xy coordinates of uncorrected white has to be measured twice. Once through the left eye glass of the 3D goggles and once through the right eye glass.

Luminance balancing

In case of Laser3D projection, it is possible to correct difference in luminance between left and right. Scaling is applied from the strongest eye towards the weakest eye. Note that this is not possible for External 3D systems.

Required tools

- Spectroradiometer.
- Communicator.

White point calibration procedure:

1. **Setup the ambient light conditions** as it should be during the play out of the movie. (e.g. only the stairs and emergency exit lighting is switched on).
 -  **Note:** In an optimal setup less than 1% of light from any other source than the light from the projector should illuminate the screen.
2. Set the projector in the desired projection mode 2D, Laser3D or External 3D. For detailed instructions see user guide of the Communicator.
3. Configure the desired aspect ratio: e.g. FLAT or SCOPE (use most common aspect ratio). Do this by activating the correct LENS file. For detailed instructions see user guide of the Communicator.
4. **Project a none calibrated full white** test pattern. For detailed instructions see user guide of the Communicator.
5. **Measure the reflected light** from the center of the screen with a spectroradiometer. Position the spectroradiometer perpendicular to the screen in the auditorium sweet spot.
 -  **Caution:** Do not measure the light through the port window of the boot area!
6. **Adjust the light output** of the projector slightly above the desired screen brightness. (screen brightness will slightly drop after calibration). Use the Communicator software to achieve that. Go to *Installation > Illumination > Light output*. For detailed instructions see user guide of the Communicator.
7. **Sequentially measure and enter the xy coordinates** of the three primary colors (red, green, blue) and full white. Use therefor the "Laser white calibration" wizard in the Communicator. Go to *Installation > Color calibration > Laser white calibration*. For detailed instructions see user guide of the Communicator.
 -  **Caution:** Ensure that the correct projection mode is selected: 2D, Laser3D or External 3D.
 -  **Caution:** In case of 3D measure the xy coordinates once through the left eye glass of the 3D goggles and once through the right eye glass.

The wizard will reset previous xy values of power calibration and automatically start with projecting uncorrected primary red. Once you have measured and entered the xy values for red, click on "next" and

repeat the measurement for green, blue and white. When finished the laser power levels are automatically corrected according to the entered xy values.

8. **In case of Laser3D apply Luminance balancing** for the left and right eye. Do this by measuring the Y coordinates of full white through the left eye glass and through the right eye glass. Enter the measured values in Communicator to apply luminance balancing. For detailed instructions see user guide of the Communicator.



After white point calibration proceed immediately with color gamut calibration.

13.3 Color gamut calibration

Color Gamut

Color Gamut is the entire range of reproducible colors by a particular device such as a projector. The entire range of reproducible colors are typically defined so that horizontal and vertical directions describe saturation and luminance changes, respectively. When a color is "out of gamut," it is not possible to reach that color by the device.

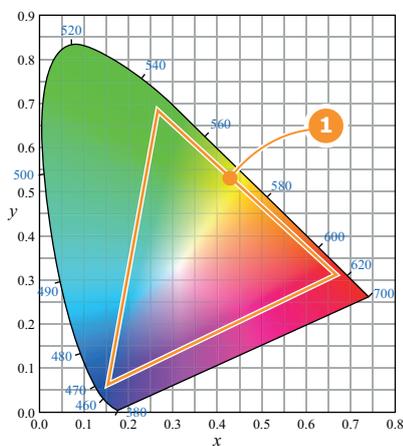


Image 13-2: Sample Chromaticity Diagram with Color Gamut of target device (1).

Why apply color correction?

During the post-production process of a film, a specific color space is applied. This color space is the Target Color Gamut Data (TCGD). All movie content operates under that gamut. To ensure that in the cinema theater the film is projected within the same color space as intended by the film industry, the color space of the projector has to be corrected accordingly.

What has to be done?

The color coordinates for the projected primary colors must be measured on the screen. The values can be different than those originally inside the projector due to reflection on the screen or due to the influence of the glass between the projection booth and the theatre and even the projected colors are different from setup to setup.

These measured color coordinates are references for the projector and will be entered so that the projector knows how its colors are projected on the screen. This reference measurement (MCGD), together with the delivered gamut file (TCGD) of the film will introduce a color correction so that the film will be projected with the desired color target.

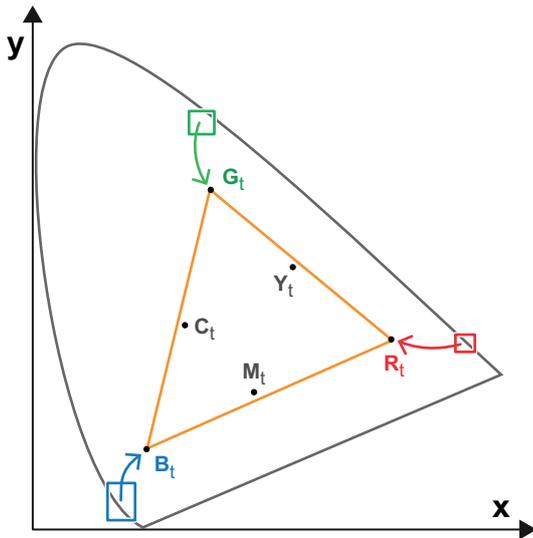


Image 13-3: Correction of native color gamut towards desired color gamut (electronic correction)

Electronic correction

The electronic correction adapts the native color gamut towards the desired (target) color gamut (e.g. DC28_DCI_Xenon.TCGD). This correction is introduced by the DMD drivers and is also called 'P7 correction'. The electronic correction takes place once the MCGD file of the projector is mapped with the TCGD file of the film.

Influence of aspect ratio

The aspect ratio of the projected image could have a small influence upon the measured xy coordinates. Therefore, it's recommended to save the xy coordinates per aspect ratio in separate MCGD files.

3D color calibration

In case of 3D projection the uncorrected (native) Red, Green, Blue and White color coordinates of the projector has to be measured twice. Once through the left eye glass of the 3D goggles and once through the right eye glass.



CAUTION: Prior to start with color gamut calibration ensure that the white point calibration for the same projection mode (2D, Laser3D or External 3D) is finalized successfully. See chapter "White point calibration", page 133.

Required tools

- Spectroradiometer.
- Communicator.

Color gamut calibration procedure:

1. Check if the white point calibration for the projection mode (2D, Laser3D or External 3D) of which you want to apply color gamut correction is done. If not see chapter "White point calibration", page 133.
2. **Setup the ambient light conditions** as it should be during the play out of the movie. (e.g. only the stairs and emergency exit lighting is switched on).



Note: In an optimal setup less than 1% of light from any other source than the light from the projector should illuminate the screen.

3. **Sequentially measure and enter the xy coordinates** of the three primary colors (red, green, blue) and full white. Use therefore the Communicator. Go to *Installation > Color calibration > Measure native colors*. For detailed instructions see user guide of the Communicator.



Caution: Ensure that the correct projection mode is selected: 2D, Laser3D or External 3D.

 **Caution:** In case of 3D, measure the xy coordinates once through the left eye glass of the 3D goggles and once through the right eye glass.

 **Tip:** When using the wizard for white point calibration you can immediately proceed with the electronic correction.

4. Once all xy coordinates are measured and entered proceed by saving all measured values into a MCGD file.

 **Tip:** Put in the MCGD file name the type of projection mode (2D, Laser3D, External 3D,...) and the aspect ratio (FLAT, SCOPE).

5. Map the MCGD file with the TCGD file. Use for that the Communicator. Go to *Installation > Color calibration > Select target colors*. For detailed instructions see user guide of the Communicator.

6. In addition you can check if the corrected colors complies. Use therefore the Communicator. Go to *Installation > Color calibration > Verify corrected colors*. For detailed instructions see user guide of the Communicator.

13.4 Luminance calibration

Screen Brightness



Screen Brightness, or how bright a screen will look, involves measuring the light reflected from its surface to our eyes. It takes into account the luminous flux (lumens) falling over its entire area (lux) and how reflective the surface of the screen is. It literally is a measure of the light bouncing off the screen. Luminance is measured in foot-lamberts. One foot-Lambert of luminance is equal to one lumen per square foot.

Why calibrating the Light Sensor?

The purpose of luminance calibration is to make a reference between the light measured by the projector built-in light sensor and the light reflected by the screen. This to tell the projector how much power the RGB lasers require to get the desired screen brightness (e.g. 14 ft-L).

Required tools

- Spectroradiometer.
- Communicator.

Light Sensor Calibration process

1. **Setup the ambient light conditions** as it should be during the play out of the movie. (e.g. only the stairs and emergency exit lighting is switched on).

 **Note:** In an optimal setup less than 1% of light from any other source than the light from the projector should illuminate the screen.

2. **Project a none calibrated full white** test pattern with the desired aspect ratio (e.g. FLAT).

 **Note:** Per aspect ratio (FLAT, SCOPE, ...) the light sensor needs to be calibrated for optimal result.

3. **Measure the reflected light** from the center of the screen with a spectroradiometer. Position the spectroradiometer perpendicular to the screen in the auditorium sweet spot.

 **Caution:** Do not measure the light through the port window of the boot area!

4. **Adjust the light output** of the projector with the Communicator to obtain the desired screen brightness (e.g. 14 ft-L). Ssee user guide of the Communicator for detailed instructions.

5. **Create a Light Sensor Calibration file** (LSC-file) based on the adjusted light output and projected aspect ratio. For detailed instructions see user guide of the Communicator.



Tip: Put the name of the aspect ratio in the file name. This will make it easier to recognize the file when needed. The LSC-file can be included in a 'macro' which execute several commands sequentially to setup the projector (and environment) to play a movie.

6. Repeat this measurement process for other aspect ratios if applicable (e.g. SCOPE).



The US unit of luminance is the Foot-lambert or ft-L whereas the SI unit is Candela per Square Meter or cd/m^2 . 1 ft-L equals $3.426 \text{ cd}/\text{m}^2$. Nit (nt) is a non-SI name also used for this unit. 1 nt equals $1 \text{ cd}/\text{m}^2$. The US unit Foot-lambert is the one typically used in cinema theater design and calibration.

Preventative maintenance actions

14

Maintenance program

The maintenance program is subdivided in time frames. The maintenance actions described in this chapter can be done by a trained projectionist. Note that there are also annually and 4 yearly maintenance actions (not included in this manual) which must be done by certified service personnel who are familiar with potential hazards of the product and all product safety checks. Contact your service partner for more information about maintenance services.

Overview

- 1 month maintenance actions
- 3 month maintenance actions

14.1 1 month maintenance actions

MAINTENANCE TYPE A (perform every month)



The 1 month maintenance actions, listed below, may be performed by a trained projectionist who is familiar with potential hazards associated with the product.

N- o.	Maintenance action	Remarks
1	<p>Check dust filters of the projector for dust and grease. Grease on the filter can build up after several months in an environment contaminated with greasy air. Note that areas where popcorn is consumed are subject to greasy air.</p> <ul style="list-style-type: none"> • If the filters are contaminated with dust than cleaning the filters with a vacuum cleaner should be sufficient. • In case the filters feel greasy than the filters must be washed. <p>Take into account that the time needed to dry the dust filters may be 24 hours or more. For that, it's recommended to have a second set of dust filters which can be used while cleaning the first set.</p>	<p>Replace damaged filters immediately. See procedures "Vacuum cleaning of the dust filters", page 145, and "Washing and drying the dust filters", page 145. To speed-up drying, allow the filter(s) to dry at 50°C max in a well ventilated room.</p>
2	<p>Check the surface of the lens output side for dust. (it is not needed to remove the lens from the projector). Only clean if necessary.</p>	<p>Clean the lens output side in case dust is clearly visible upon the surface. Note: if the lens was removed from the projector, a manual "Lens Home & Return" action must be executed to calibrate the position of the lens in relation to the Lens Holder. This way the references of the existing 'lens files' remain valid. See user guide of the Communicator software.</p>
3	<p>Check the porthole (both sides) for dust.</p>	<p>Clean the porthole in case dust is clearly visible upon the surface. Use an optical cloth.</p>
4	<p>Check the good working condition of the external safety interlock system (if installed).</p>	<p>Ensure that all safety signs are still in place. .</p>
5	<p>Check dust filters of the chillers for dust and grease.</p>	<p>To access the filters and cleaning instructions see documentation set of the chillers.</p>

14.2 3 month maintenance actions

MAINTENANCE TYPE B (perform every three months)



The 3 month maintenance actions, listed below, may be performed by a trained projectionist who is familiar with potential hazards associated with the product.

No.	Maintenance action	Remarks
1	Clean the housing of the projector.	Removal overall dust accumulation on projector covers. See cleaning instructions in this manual.
2	Clean the housing of the chillers.	Removal overall dust accumulation on chiller covers. See documentation set of the chillers.
3	Verify the internal clock of the ICMP with real time clock. Correct if needed.	ICMP version 1.2.1 is required. Communicator version 5.0 is required. See user guide of Communicator for detailed instructions.

Maintenance procedures

15

About this chapter

This chapter describes several maintenance procedures for the projector.



WARNING: All procedures described in this chapter may only be performed by TRAINED PROJECTIONISTS or qualified SERVICE PERSONNEL.

Overview

- Check the dust filters
- Vacuum cleaning of the dust filters
- Washing and drying the dust filters
- Cleaning the lens
- Cleaning the exterior of the projector
- Authorization to clear security warning on the projector

15.1 Check the dust filters

How to check the large dust filter?

1. Unlatch and pivot the front cover door which contains the dust filters.



Note: In case there is insufficient space to pivot the front cover door 90 degrees pull out the small side panel from the front cover door assembly as illustrated below.

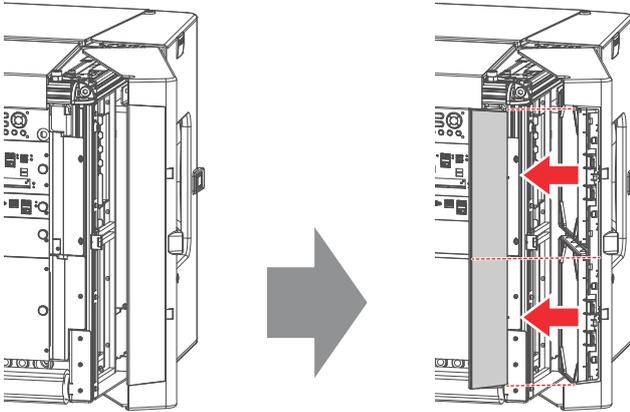


Image 15-1

2. Detach the dust filters from the inner side of the front cover door. Do this by pushing the two latches (reference 1 Image 15-2) of the dust filter inwards.

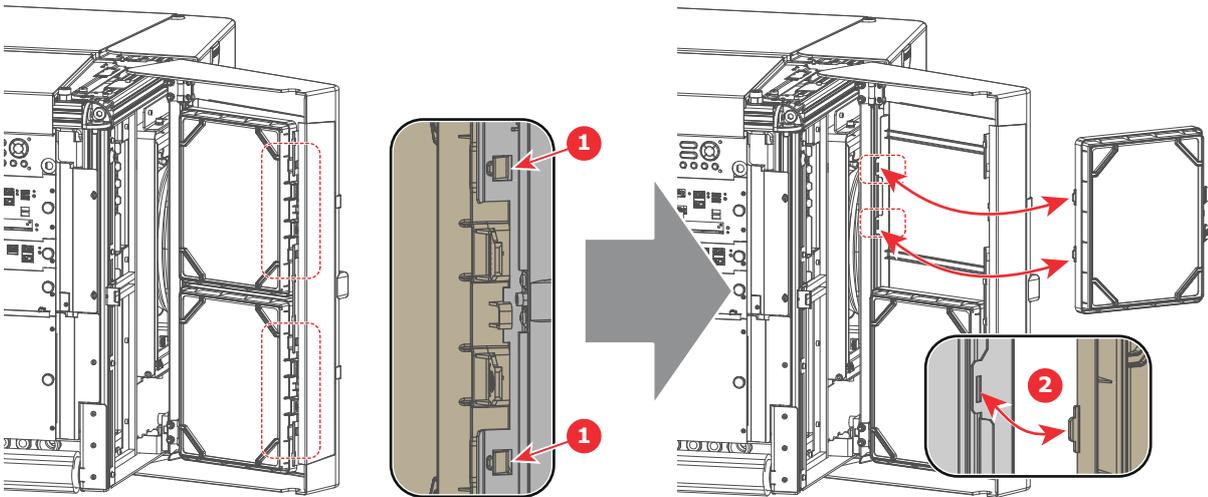


Image 15-2

3. Check the “air in” side of the dust filter for **dust** and/or **grease**.

In case the filter is contaminated with grease wash and dry the dust filter. See cleaning procedure “Washing and drying the dust filters”, page 145.

In case the filter contains dust but doesn't feel greasy then vacuum clean the dust filter. See procedure “Vacuum cleaning of the dust filters”, page 145.



Note: Grease on the filter can build up after several months in an environment contaminated with greasy air. Note that areas where popcorn is consumed are subject to greasy air.



Tip: Take into account that the time needed to dry the dust filters may be 24 hours or more. For that, it's recommended to have a second set of dust filters which can be used while cleaning the first set.

- Attach the clean dust filters to the inner side of the front cover door. Ensure that both latches and both mounting lips (reference 1 and 2 Image 15-2) of the dust filters are engaged.



Caution: UNDER NO CIRCUMSTANCES SHOULD WET FILTERS BE INSTALLED BACK INTO THE PROJECTOR. THIS CAN HAVE SERIOUS SAFETY CONSEQUENCES AS WELL AS JEOPARDIZE INTERNAL COMPONENTS OF THE SYSTEM.

- Reinstall the small side panel (if removed, see Image 15-1) and close the front cover door.



The dust filter is cleanable. See cleaning procedure for correct cleaning and drying instructions.

15.2 Vacuum cleaning of the dust filters

When to vacuum clean the dust filters?

The dust filters of the projector should be checked every month. If the filters are contaminated with dust then cleaning the filters with a vacuum cleaner should be sufficient. In case the filters feel greasy these must be washed. See cleaning procedure “Vacuum cleaning of the dust filters”, page 145.



Grease on the filter can build up after several months in an environment contaminated with greasy air. Note that areas where popcorn is consumed are subject to greasy air.



This procedure assumes that the dust filters are removed from the projector.

Required tools

Vacuum cleaner with soft brush suction nozzle.

How to vacuum-clean the dust filter?

- Carefully vacuum the air inlet side of the dust filter. Use a vacuum cleaner with a soft brush suction nozzle. The air inlet side of the dust filter is the side which is surrounded with a glue edge.
 - Tip:** Lightly tap the filter on its dusty side to expel heavy dust contamination.
 - Tip:** Compressed air is also permitted to clean the filters but take care not to damage them.
 - Caution:** Do not use compressed air inside the booth area. Bring the dust filters outside the building to blow off the dust.
 - Caution:** Do not damage the dust filter. Replace damaged dust filters immediately.

15.3 Washing and drying the dust filters

About filter washing and drying

For environments where popcorn grease and such can contaminate the filters, Barco advises the client to purchase one extra set of filters to cover drying time, as well as taking following extra precautions and instructions pertaining to filter cleaning and drying.

Cleansing agent

To clean sticky, greasy dust filters we suggest usage of **Sodium carbonate** crystals (Na_2CO_3). Sodium carbonate (Often called **washing soda**, **soda crystals**, or **sal soda** in the detergent section of stores) is widely used to effectively remove oil, grease, alcohol stains ... The product itself is relatively safe, sodium

carbonate is used in toothpastes and as a food additive (E500). Potential Hazards are described in the section “Hazards”, page 170.

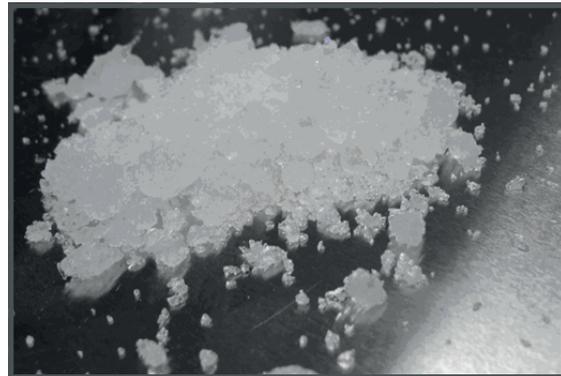


Image 15-3: Sodium carbonate crystals.



This cleaning procedure assumes that the filters are already removed from their slots.



Take into account that the time needed to dry the dust filters may be 24 hours or more. For that, it's recommended to have a second set of dust filters which can be used while cleaning the first set.

Required tools

- Bucket with hot water.
- Sodium carbonate, 30 gram (handful) per liter hot water.

How to wash and dry the dust filters?

1. Make a solution with a ratio of 30 gram (a handful) sodium carbonate to 1 liter **hot water**.
2. Soak the dust filters in the solution for **30 to 60 minutes**. The grease should be dissolved after 1 hour.
3. If the dust filter is still clogged repeat this procedure from step 1.
4. Rinse the dust filters with clean water to flush all grease residue away.
5. Shake out all excess liquid by repeatedly swinging the filter to-and-fro in a centrifugal action.
6. Then allow the filters to **dry thoroughly**.



Note: Drying time of the dust filters can be up to 24h or more. Drying time can be shorter when being done in a well-ventilated area.



Tip: To speed-up drying, allow the filter(s) to dry at 50°C max in a well ventilated room.



CAUTION: UNDER NO CIRCUMSTANCES SHOULD WET FILTERS BE INSTALLED BACK INTO THE PROJECTOR. THIS CAN HAVE SERIOUS SAFETY CONSEQUENCES AS WELL AS JEOPARDIZE THE INTERNAL OPTICS OF THE SYSTEM.



CAUTION: Do not install/use damaged dust filters. Replace damaged dust filters immediately with new dust filters of the same type. See <https://my.barco.com> for the correct replacement part.

15.4 Cleaning the lens



WARNING: Make sure that the lasers are switched OFF before performing this procedure



To minimize the possibility of damage to optical coatings, or scratches to lens surfaces follow the cleaning procedure as described here precisely.

Required tools

- Compressed air.
- Clean Toraysee® cloth or any micro fiber lens cleaning cloth.
- Clean cotton cloth.

Required parts

Lens cleaner (e.g. Carl Zeiss lens cleaner or Purasol® or any water-based lens cleaner)

How to clean the lens?

1. Blow off dust with clean compressed air (or pressurized air cans⁴).
2. Clean with lens cleaner together with a clean lens cleaning cloth to remove the dust and contamination. Use big wipes in one single direction.
 -  **Warning:** Do not wipe back and forwards across the lens surface as this tends to grind dirt into the coating.
3. Use a dry lens cleaning cloth to remove left liquid or stripes. Polish with small circles.
4. If there are still fingerprints on the surface, wipe them off with lens cleaner together with a clean lens cleaning cloth. Polish again with a dry one.



If smears occur when cleaning lenses, replace the cloth. Smears are the first indication of a dirty cloth.

15.5 Cleaning the exterior of the projector

How to clean the exterior of the projector ?

1. Switch off the projector and unplug the projector from the mains power net.
2. Clean the housing of the projector with a damp cloth. Stubborn stains may be removed with a cloth lightly dampened with a mild detergent solution.

15.6 Authorization to clear security warning on the projector

When is an authorization required to clear the security warning?

If a module has been removed or if the sealed compartment has been opened, an authorization will be required to clear the security warning.

Required tools

Authorization pin code.

Authorization procedure to clear security warning

1. Ensure that all modules are properly installed.
2. Start up the projector (Operational mode).

⁴: Pressurized air cans are not efficient if there is too much dust on the surface, the pressure is too low

3. Initiate authorization by pushing the Key button on the Local Keypad:



The color of the backlight of the Numeric keys 1 to 6 of the Local Keypad changes to yellow.

4. Enter pin code within 5 seconds.
 - In case no keys are pressed, the color of the backlight of the Numeric keys 1 to 6 changes back to its original color. Authorization procedure is aborted.
 - When code is entered then the backlight of the Key button lit up:
 - **white** in case of a service door tamper. (check if all covers are correctly installed)
 - **red** in case of an insertion tamper. (check if the ICMP is correctly installed)
 - **green** in case all tamper events are cleared.



Each attempt to clear the security warning and its result (successfully or unsuccessfully) is logged inside the projector.

Removal and installation of the projector covers

16



WARNING: Switch off the projector prior to opening or removing the projector covers, unless otherwise specified in the procedure.

Overview

- Opening the front and rear cover doors
- Removal of the top cover
- Removal of the side covers

16.1 Opening the front and rear cover doors



This procedure assumes that the lens is removed and that the hoses are disconnected from the projector. This procedure is applicable for all four cover doors.



To access the thumbscrews of the top cover it is sufficient to open the cover doors a few centimeters. In this case it's not needed to remove the lens and to disconnect the hoses.

Required tools

No tools required.

Open cover doors

1. Unlatch (reference 1 Image 16-1) and pivot the plastic cover door.

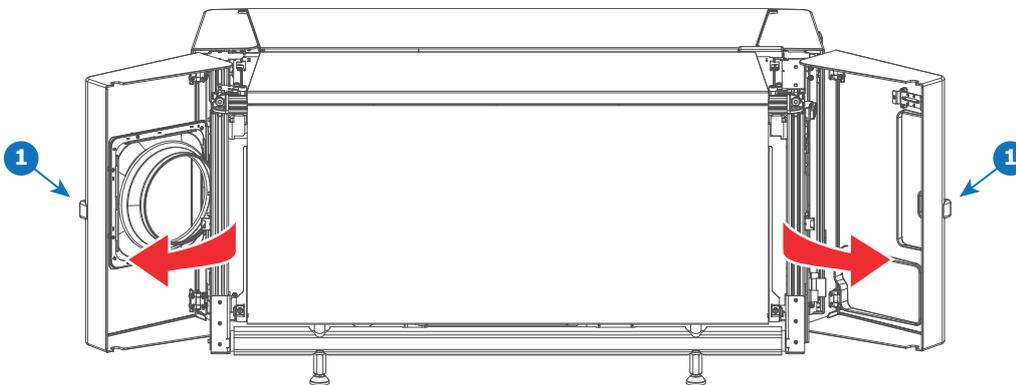


Image 16-1

16.2 Removal of the top cover



The illustrations in this procedure are based on the top-left cover. Nevertheless, the same procedure is applicable for the top-right cover as well.

Required tools

Flat screwdriver 7 mm

How to remove a top cover?

1. Unlatch and pivot the front and rear plastic cover doors a few centimeters. This is to gain access to the two thumbscrews of the top cover. See procedure "Opening the front and rear cover doors", page 150.
2. Loosen the two captive thumbscrews of the top cover (reference 2 Image 16-2).

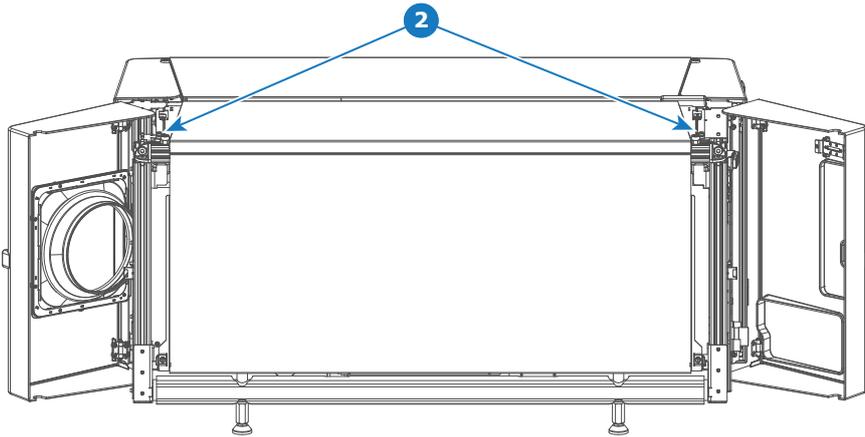


Image 16-2

3. Slide the top cover in horizontal direction a few centimeters away from the center of the projector (this to unhook), then remove it from the projector.

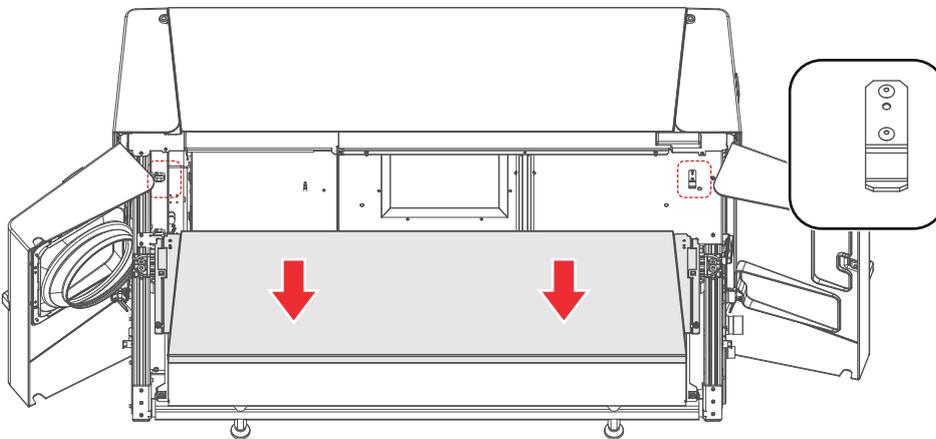


Image 16-3

16.3 Removal of the side covers



The illustrations in this procedure are based on the left-side cover. Nevertheless, the same procedure is applicable for the right-side cover as well.

Required tools

- Flat screwdriver 7 mm
- Allen wrench 3 mm

How to remove a side cover?

1. Unlatch and pivot the front and rear plastic cover doors a few centimeters. This to gain access to the two thumbscrews of the top cover and the side cover. See procedure “Opening the front and rear cover doors”, page 150.
 -  **Note:** The side cover is partially captured by the top cover and the front and rear plastic cover doors. For that, both cover doors have to be (partially) opened first.
2. Remove the top cover or at least loosen the two captive thumbscrews of the top cover. See procedure “Removal of the top cover”, page 150.
 -  **Tip:** It's not needed to remove the top cover completely away from the projector to remove the side cover.

Removal and installation of the projector covers

3. Loosen the two captive thumbscrews of the side cover (reference 3 Image 16-4).
4. Remove the two screws located at the middle bottom of the side cover (reference 4 Image 16-4). Use a 3 mm Allen wrench.
5. Lift up the side cover about two centimeters and then remove it from the projector.

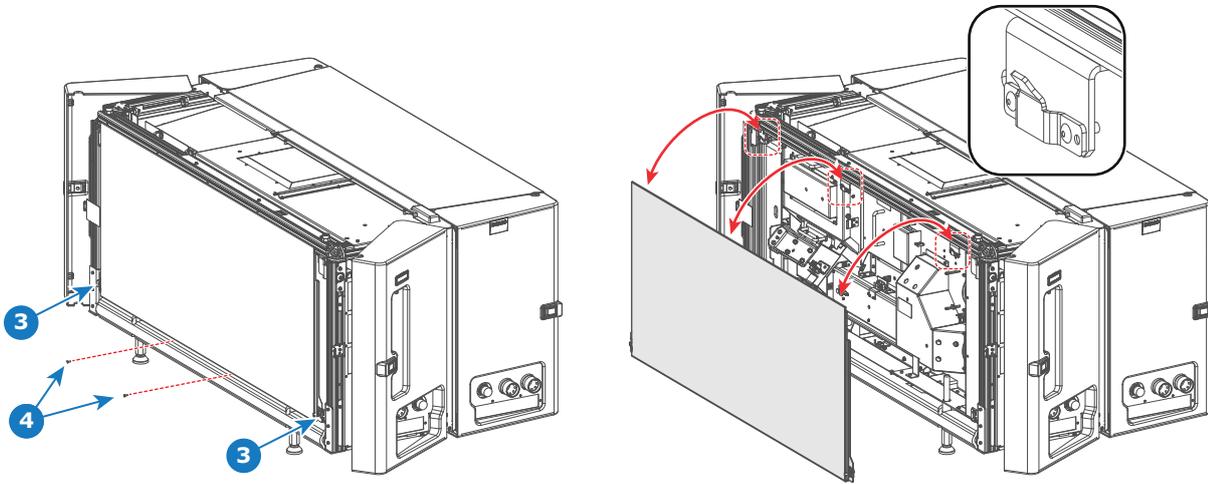
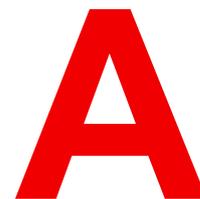


Image 16-4

Specifications



About this chapter

This chapter gives an overview of the specification of your Thor series projector as well as the dimensions and the center of gravity.

Overview

- Specifications of the Thor
- Specifications of the Thor+
- Specifications of the ICMP
- Dimensions of the Thor series projector
- Technical Regulations

A.1 Specifications of the Thor

Specifications

Resolution	4,096 x 2,160
Display technology	three chip 4K 6P RGB Laser DLP
Housing	Sealed DMDs and optical assembly
Input resolution range	up to 4K (4,096 x 2,160)
Light output	Up to 15000 ANSI lumens
Contrast	1,100 : 1 ANSI Contrast (w/WHC Lens) / 6,000 :1 On/Off contrast
Light source	6P RGB Laser
Light source lifetime	30,000 hours or more, replaceable illumination
Lenses	1.13 - 1.72 : 1 4K-VHC LNS Only 1.35 - 1.86 : 1 4K-VHC LNS or DC4K HC 1.46 - 2.10 : 1 4K-VHC LNS or DC4K HC 1.65 - 2.60 : 1 4K-VHC LNS or DC4K HC 2.00 - 3.35 : 1 4K-VHC LNS or DC4K HC
Lens Shift	adjustable: vertical and horizontal, depending on lenses
Inputs	Barco Alchemy ICMP included in the projector: 2x HDMI2.0a (up to 4K 2D 60fps) JPEG2000 2K & 4K DCI play-out High Frame Rates 3D up to 120fps (60fps per eye) 2x 3G-SDI inputs 16x AES/EBU audio channels (2x RJ45)
3D	Color3D (Barco Laser3D): Native 6-primary color-3D system. Only requires color filter glasses (Dolby3D glasses cannot be reused) Active glasses systems Polarization recuperation systems
Control	TCP/IP, 8 x GPIO, RS232
Dimensions	Projector: 744 x 1,445 x 706 mm / 29.3 x 56.9 x 27.8 inches (with feet, no lens) Chiller with the following dimensions: 701 x 701 x 800 mm / 27.6 x 27.6 x 31.5 inches
Weight	Projector: 200kg (~440lb), Chiller: ~115kg (~250lb)
Power requirements	<ul style="list-style-type: none"> • Projector: 200 - 240 / 346 - 415 V 50 - 60 Hz 16A 3W+N+PE (Y connection) • Power cord size range: 4 sq mm to 6 sq mm, 10AWG to 8AWG • Circuit breaker range: 25A to 40A • Chiller: 230 / 400V 3W+N+PE 16A 2.5 sq mm (Y connection) or 208V / 3W+PE (delta connection) Max. 16A per phase
Power consumption	<ul style="list-style-type: none"> • Projector @ full laser power: 3.5 kW (2D or Polarization D) / 2.0 kW (Barco Laser3D - 6P) • Chiller @ full laser power: 2.0 kW (2D or Polarization 3D) / 1.6 kW (Barco Laser3D - 6P)
BTU per hour	18,500 BTU

Noise level (typical at 25°C/ 77°F)	TBD
Operating temperature	30°C (86°F) Max. (projector and chillers)
Operating humidity	75% Max. (projector and chillers)
DCI	Desktop front
Warranty	Limited 2 years parts and labor.
Certifications	CE, ETL/UL/FCC

A.2 Specifications of the Thor+

Specifications

Resolution	4,096 x 2,160
Display technology	three chip 4K 6P RGB Laser DLP
Housing	Sealed DMDs and optical assembly
Input resolution range	up to 4K (4,096 x 2,160)
Light output	Up to 32,000 ANSI lumens
Contrast	1,100 : 1 ANSI Contrast (w/WHC Lens) / 6,000 :1 On/Off contrast
Light source	6P RGB Laser
Light source lifetime	30,000 hours or more, replaceable illumination
Lenses	1.13 - 1.72 : 1 4K-VHC LNS Only 1.35 - 1.86 : 1 4K-VHC LNS or DC4K HC 1.46 - 2.10 : 1 4K-VHC LNS or DC4K HC 1.65 - 2.60 : 1 4K-VHC LNS or DC4K HC 2.00 - 3.35 : 1 4K-VHC LNS or DC4K HC
Lens Shift	adjustable: vertical and horizontal, depending on lenses
Inputs	Barco Alchemy ICMP included in the projector: 2x HDMI2.0a (up to 4K 2D 60fps) JPEG2000 2K & 4K DCI play-out High Frame Rates 3D up to 120fps (60fps per eye) 2x 3G-SDI inputs 16x AES/EBU audio channels (2x RJ45)
3D	Color3D (Barco Laser3D): Native 6-primary color-3D system. Only requires color filter glasses (Dolby3D glasses cannot be reused) Active glasses systems Polarization recuperation systems
Control	TCP/IP, 8 x GPIO, RS232
Dimensions	Projector: 744 x 1,445 x 706 mm / 29.3 x 56.9 x 27.8 inches (with feet, no lens) Two chillers, each with the following dimensions: 701 x 701 x 800 mm / 27.6 x 27.6 x 31.5 inches
Weight	Projector: 235kg (~520lb) Chillers: ~115kg (~250lb) per chiller (two chillers needed)
Power requirements	<ul style="list-style-type: none"> Projector: 200-240/346-415V 50-60Hz 16A 3W+N+PE (Y connection)

	<ul style="list-style-type: none"> • Power cord size range: 4 sq mm to 6 sq mm, 10AWG to 8AWG • Circuit breaker range: 25A to 40A 200-240V 3W+PE 28A 50-60Hz (delta connection) • Power cord size: 6 sq mm, 8AWG • Circuit breaker: 40A • Chillers: 230/400V 3W+N+PE 16A, 2.5 sq mm (Y connection) or 208V / 3W+PE (delta connection) / Max. 16A per phase
Power consumption	<ul style="list-style-type: none"> • Projector @ full laser power: 6.7 kW (2D or Polarization 3D) / 3.6 kW (Barco Laser3D -6P) • Chillers @ full laser power: 3.0 kW (2D or Polarization 3D) / 2.5 kW (Barco Laser3D -6P)
BTU per hour	32,150 BTU
Noise level (typical at 25°C/ 77°F)	Loud
Operating temperature	30°C (86°F) Max. (projector and chillers)
Operating humidity	75% Max. (projector and chillers)
DCI	Desktop front
Warranty	Limited 2 years parts and labor.
Certifications	CE, ETL/UL/FCC
*	Example

A.3 Specifications of the ICMP

Specifications

Integrated Cinema Media Processor	<p>DCI 4K 2D up to 60fps*</p> <p>DCI 4K 3D (24 or 30 fps per eye)*</p> <p>DCI High Frame Rates 2K 3D up to 120fps (60fps per eye)</p> <p>JPEG 2000 bit-rates up to 625Mbps</p> <p>Dual-channel color-correction</p> <p>MPEG-2 (4:2:0 and 4:2:2 up to 60fps)</p> <p>2x HDMI2.0a (up to 4K 2D 60fps)</p> <p>2x 3G-SDI inputs</p> <p>16x AES/EBU audio channels (2x RJ45)</p> <p>8x GPI, 8x GPO (4x RJ45)</p> <p>2x Gbe for content connectivity & ingest</p> <p>2x front-accessible USB 3.0 for fast ingest</p> <p>2x front-accessible USB 2.0</p> <p>Video and audio watermarking: Civolution NexGuard</p> <p>Closed captioning devices: Support for SMPTE 430-10</p> <p>* 4K 24fps is standard. For 4K 60 fps / 4K 3D on ICMP upgrade modules a license is required. Newly-built 4K Barco Alchemy projectors have the license standard included.</p>
Barco Web Commander	<p>Projector dashboard</p> <p>Projector control board</p> <p>Show player/editor/scheduler</p> <p>Automation, 3D, Ingest</p> <p>Smart projector status</p> <p>Via HTML5 web browsers including iOS & Android tablets</p>

	Compatible with free Barco CineMate iOS & Android app
Barco Commander (for touch panel controller)	Projector control board Show Player/Editor/Scheduler Automation, 3D, ingest Dynamic DCP playlists & intermission Smart projector status
Barco Communicator	Projector installation & configuration Projector update & maintenance Barco CineMate App (iOS & Android) - free
Integrated storage	2TB effective storage (RAID-5) / 3x 1TB Hot-swappable 2.5" hard-drives 4TB effective storage (RAID-5) / 3x 2TB Hot-swappable 2.5" hard-drives
Options	ICMP License for 4K 3D/4K 60p - Upgrade Kit ICMP License for HDMI2.0 HDR Licence for Dual Projector
TMS support	Barco Alchemy is supported by the following Theater Management System (TMS) brands: AAM Screenwriter, Ymagis Melody, CFG-Barco, Unique RosettaBridge, ADDE, CinéDigital Manager, GDC, Proyecson, Real Image, Sony, Hollywoodsoftware/Comscore TCC, Kinoton

A.4 Dimensions of the Thor series projector

Dimensions

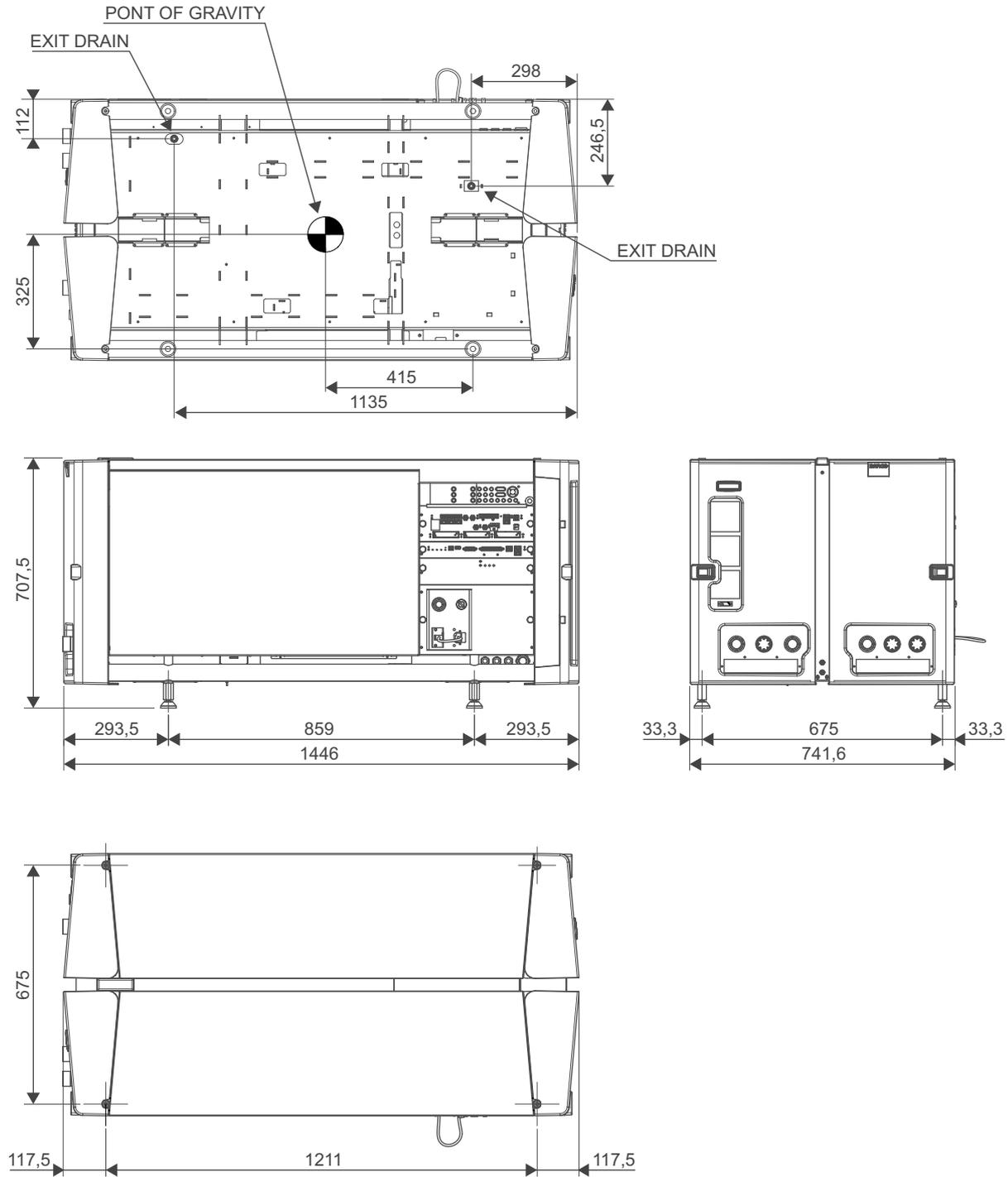


Image A-1: Dimensions given in millimeters.

A.5 Technical Regulations

Certificates



Image A-2:
EAC mark



Image A-3: CE mark



Image A-4: ETL mark



Image A-5: FCC label



Image A-6: RCM mark

Pin configurations

B

Overview

- About General Purpose Inputs & Outputs (GPIO)
- Pin configurations of the Cinema Controller communication ports
- Pin configurations of the ICMP communication ports

B.1 About General Purpose Inputs & Outputs (GPIO)



The Barco Cinema Controller and the Barco ICMP are equipped with GPIO ports. The electrical specifications described in this chapter are the same for both GPIO ports.

General Purpose inputs

The Barco Cinema Controller and the Barco ICMP have each eight (8) opto-isolated general purpose inputs available. These inputs are used to trigger the execution of macro files. For more explanation about the association of a macro to a GPI, consult the user guide of the Communicator.

Input voltage

The inputs can be directly driven from a TTL or CMOS output.

- The shape of the pulse must be rectangular.
- The duration of the pulse must be at least 50 milliseconds (shorter pulses are considered as a switch bounce)
- Minimum voltage : $V_{\min} = 3,3 \text{ V}$
- Maximum voltage : $V_{\max} = 24 \text{ V}$

External power supply

When interfacing with contact closure outputs, an external power supply needs to be provided. Depending upon the configuration a suitable pull-up resistor needs to be added as well.

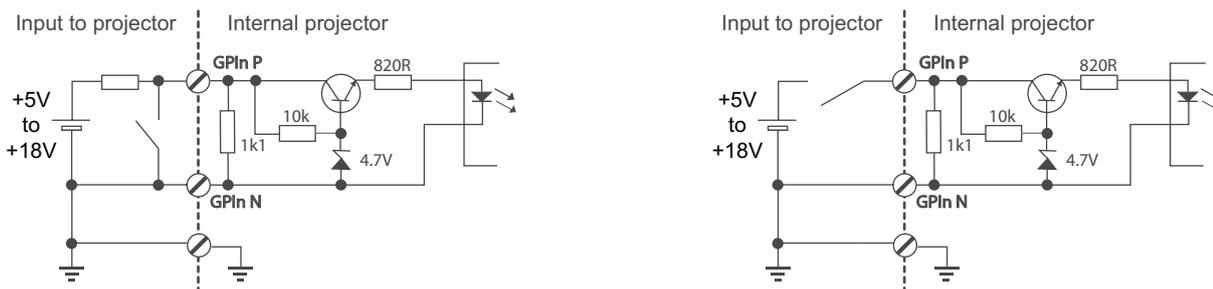


Image B-1

Cables

When long cable connections are required the use of shielded cables with twisted pairs is recommended. One twisted pair is to be assigned to each GP Input pair.

How to make the connection

When the power supply used to provide the DC voltage is isolated from ground (for example in the case of an AC adapter) it is recommended that the minus pole of that power supply is connected to ground (or to the projector chassis). This will avoid high common mode voltages at the projector GP Inputs. If that same power supply is used for other parts of the system, take care not to create ground loops. In any case when shielded cables are used that shield should be connected to the projector chassis.

General Purpose outputs

The Barco Cinema Controller and the Barco ICMP have each eight (8) opto-isolated outputs available. Four (4) of the outputs on the Cinema Controller are dedicated for TI. The other general purpose outputs can be controlled via software.

About an output

The output can generate a falling edge, rising edge, toggle or continuous toggle.

- **Generate Falling Edge** – generate a falling edge on the external GPO port if the present state of the output is high. If the present state of the external GPO is low, no edge will be generated.

- **Generate Rising Edge** – generate a rising edge on the external GPO port if the present state of the output is low. If the present state of the external GPO is high, no edge will be generated.
- **Generate Toggle** – generate a toggle on the external GPO port. If the present state of the output is low, a rising edge will be generated, followed by a falling edge. If the present state of the output is high, a falling edge will be generated, followed by a rising edge. Pulse width = 20 milliseconds.
- **Generate Continuous Toggle** - This command will generate a continuous toggle of the external GPO port. This toggle will continue until a *Generate Falling Edge*, *Generate Rising Edge*, or *Generate Toggle* command is received. The rate of toggle is 24Hz. .

Output transistor

- Maximum output driving voltage : $V_{\max} = 70 \text{ V}$
- Maximum current : $I_{\max} = 30 \text{ mA}$
- Maximum power dissipation : 120 mW

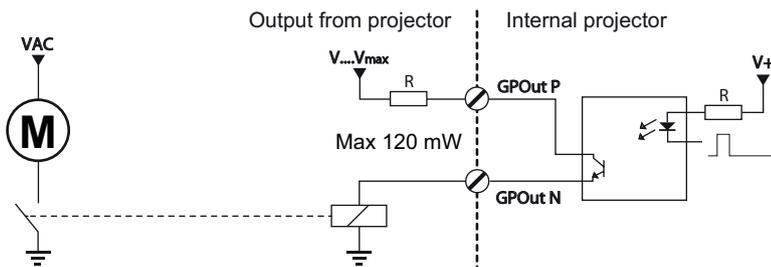


Image B-2



When the GPO driver inside the projector becomes powerless the GPO state changes to the default state. The default GPO state depends on the external system connected with the GPO port (pull-up or pull-down circuitry).

GPIO and projector Standby mode

Enter or leave the Standby mode can be done with GPIO of the Cinema Controller via two predefined Macros (not editable). Not with the GPIO of the ICMP.

The GPO signals of the ICMP will return to their default output level when the projector is switched to Standby mode. This could generate unexpected "Falling Edge" triggers at the output pins. Also when awakening the projector (from Standby mode to Operational mode) the GPO signals of the ICMP may generate unexpected "Rising Edge" events.

GPO and projector switching On or Off

The GPO signals of the Cinema Controller and ICMP will return to their default output level when the projector is switched to power-off. This could generate unexpected "Falling Edge" triggers at the output pins. Also during power-on the GPO signals may generate unexpected "Rising Edge" events.

B.2 Pin configurations of the Cinema Controller communication ports

General purpose input/output (GPIO) of the Cinema Controller

General Purpose In/Out			
1	3D Input Reference P	20	3D Input Reference N
2	3D Display Reference P	21	3D Display Reference N
3	GPIN 3 P (reserved)	22	GPIN 3 N (reserved)
4	GPIN 4 P (reserved)	23	GPIN 4 N (reserved)
5	GPIN 5 P	24	GPIN 5 N
6	GPIN 6 P	25	GPIN 6 N

General Purpose In/Out			
7	GPIN 7 P	26	GPIN 7 N
8	GPIN 8 P	27	GPIN 8 N
9	3D Output Reference P	28	3D Output Reference N
10	GPOUT 2 P (reserved)	29	GPOUT 2 N (reserved)
11	GPOUT 3 P (reserved)	30	GPOUT 3 N (reserved)
12	GPOUT 4 P	31	GPOUT 4 N
13	GPOUT 5 P	32	GPOUT 5 N
14	GPOUT 6 P	33	GPOUT 6 N
15	GPOUT 7 P	34	GPOUT 7 N
16	GPOUT 8 P	35	GPOUT 8 N
17	reserved	36	reserved
18	reserved	37	reserved
19	reserved		

Ethernet port

			10/100 Base-T – RJ45 port	1000 Base-T – RJ45 port
Pin	Pair	Color	Description	Description
1	3	white/green	TXD+	TX0+
2	3	green	TXD-	TX0-
3	2	white/orange	RXD+	RX0+
4	1	blue	–	TX1+
5	1	white/blue	–	TX1-
6	2	orange	RXD-	RX0-
7	4	white/brown	–	Rx1+
8	4	brown	–	RX1-

3D interface

Pin	Name	Pin	Name
1	+12V	9	+12V
2	Grnd	10	3D Input Reference -
3	Grnd	11	3D Display Reference +
4	RS232 RX	12	3D Display Reference -
5	RS232 TX	13	CONN_3D MODE -
6	CONN_3D_MODE +	14	CONN_SYNC -
7	CONN_SYNC +	15	-
8	3D Input Reference +		

B.3 Pin configurations of the ICMP communication ports

RJ-45 pin configuration

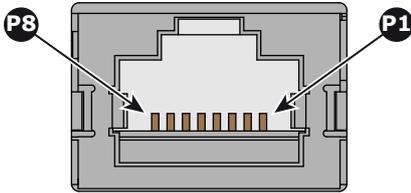


Image B-3

Audio Channels:

AUDIO-AES 1-8		
Audio channel	AES pair	RJ-45 pin
1, 2	1 +	1
	1 -	2
3, 4	2 +	3
	2 -	6
5, 6	3 +	4
	3 -	5
7, 8	4 +	7
	4 -	8

AUDIO-AES 9-16		
Audio channel	AES pair	RJ-45 pin
9, 10	5 +	1
	5 -	2
11, 12	6 +	3
	6 -	6
13, 14	7 +	4
	7 -	5
15, 16	8 +	7
	8 -	8

General Purpose Output:

GPO 1-4	
Definition	RJ-45 pin
EXT_GPOUT_1_P	1
EXT_GPOUT_1_N	2
EXT_GPOUT_2_P	3
EXT_GPOUT_2_N	4

GPO 1-4	
Definition	RJ-45 pin
EXT_GPOUT_3_P	5
EXT_GPOUT_3_N	6
EXT_GPOUT_4_P	7
EXT_GPOUT_4_N	8

GPO 5-8	
Definition	RJ-45 pin
EXT_GPOUT_5_P	1
EXT_GPOUT_5_N	2
EXT_GPOUT_6_P	3
EXT_GPOUT_6_N	4
EXT_GPOUT_7_P	5
EXT_GPOUT_7_N	6
EXT_GPOUT_8_P	7
EXT_GPOUT_8_N	8

General Purpose Input:

GPI 1-4	
Definition	RJ-45 pin
EXT_GPIN_1_P	1
EXT_GPIN_1_N	2
EXT_GPIN_2_P	3
EXT_GPIN_2_N	4
EXT_GPIN_3_P	5
EXT_GPIN_3_N	6
EXT_GPIN_4_P	7
EXT_GPIN_4_N	8

GPI 5-8	
Definition	RJ-45 pin
EXT_GPIN_5_P	1
EXT_GPIN_5_N	2
EXT_GPIN_6_P	3
EXT_GPIN_6_N	4
EXT_GPIN_7_P	5
EXT_GPIN_7_N	6

GPI 5-8	
Definition	RJ-45 pin
EXT_GPIN_8_P	7
EXT_GPIN_8_N	8

About 568A and 568B on an Ethernet connector RJ-45

TIA/EIA-568A and -568B are two standards for connecting Category 3 and Category 5 wire to connectors. Both are appropriate for high speed data, though 568B is somewhat more common for installed wiring and 568A is more common in jumpers. There is no performance advantage either way. The only real difference between the two is the order in which the pairs are used (orange and green).

Hold a cable as if to plug it into a wall jack, the locking tab down (contacts facing you). The contacts are numbered 1-8 from left to right. Here's what you will see:

RJ-45 Pin Number (Left > Right copper side)	568A		568B		AES -1-8
1	White/Green			White/Orange	AES 1&2 +plus
2	Green			Orange	AES 1&2 +minus
3	White/Orange			White/Green	AES 3&4 +plus
4	Blue			Blue	AES 5&6 +minus
5	White/Blue			White/Blue	AES 5&6 +plus
6	Orange			Green	AES 3&4 +minus
7	White/Brown			White/Brown	AES 7&8 +plus
8	Brown			Brown	AES 7&8 +minus

568A and 568B may be used interchangeably in a system SO LONG AS both ends of a given cable are terminated the same way.

568A + 568B wiring is a crossover cable.

568A + 568A wiring is a straight cable.

568B + 568B wiring is a straight cable.

The mapping of the channels is done according to the Ethernet wiring scheme and gives us 100 Ohm per pair.

Environmental information



Overview

- [Disposal information](#)
- [Turkey RoHS compliance](#)
- [Hazards](#)
- [Contact information](#)
- [Production address](#)
- [Download Product Manual](#)

C.1 Disposal information

Disposal Information

Waste Electrical and Electronic Equipment



■ This symbol on the product indicates that, under the European Directive (EU) 2015/863 governing waste from electrical and electronic equipment, this product must not be disposed of with other municipal waste. Please dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

For more information about recycling of this product, please contact your local city office or your municipal waste disposal service.

For details, please visit the Barco website at: <http://www.barco.com/en/AboutBarco/weee>

Disposal of batteries in the product



■ This product contains batteries covered by the Directive 2006/66/EC which must be collected and disposed of separately from municipal waste.

If the battery contains more than the specified values of lead (Pb), mercury (Hg) or cadmium (Cd), these chemical symbols will appear below the crossed-out wheeled bin symbol.

By participating in separate collection of batteries, you will help to ensure proper disposal and to prevent potential negative effects on the environment and human health.

WEEE Information

This product conforms to all requirements of the EU Directive on waste electrical and electronic equipment (WEEE). This product shall be recycled properly. It can be disassembled to facilitate proper recycling of its individual parts.

Consult your dealer or relevant public authority regarding drop-off points for collection of WEEE. For details, please visit the Barco website at: <http://www.barco.com/en/aboutBarco/weee>.

C.2 Turkey RoHS compliance

Turkey RoHS compliance



■ Türkiye Cumhuriyeti: AEEE Yönetmeliğine Uygundur.

[Republic of Turkey: In conformity with the WEEE Regulation]

C.3 Hazards

Safety notice Sodium Carbonate (Na₂CO₃)

According to the Material Safety Data Sheet (MSDS), Sodium Carbonate could cause the following hazards:

- Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation (lung irritant).
- Potential Chronic Health Effects: Slightly hazardous in case of skin contact (sensitizer). The substance may be toxic to upper respiratory tract, skin, eyes. Repeated or prolonged exposure to the substance can produce target organ damage.

C.4 Contact information

Barco contact information

Registered office address: President Kennedypark 35, 8500 Kortrijk, Belgium

Contact address: Beneluxpark 21, 8500 Kortrijk, Belgium

Importers contact information

To find your local importer, contact Barco directly or one of Barco's regional offices via the contact information given on Barco's web site, www.barco.com.

C.5 Production address

Factories

Barco NV (BELGIUM)

President Kennedypark 35, B-8500 Kortrijk

CFG Barco (Beijing) Electronics Co. Ltd.

中影巴可 (北京) 电子有限公司

3rd Floor, Barco Factory, No.16 Changsheng Road, Changping District, 102200, Beijing, P.R.C.

北京市昌平区中关村科技园区昌平园昌盛路16号巴可工厂第3层 邮政编码：102200

Barco Visual (Beijing) Electronics Co. Ltd.

巴可伟视 (北京) 电子有限公司

No.16 Changsheng Road, Changping District, 102200, Beijing, P.R.C.

北京市昌平区中关村科技园区昌平园昌盛路16号 邮政编码：102200

Made in information

The made in country is indicated on the product ID label on the product itself.

Production date

The month and year of production is indicated on the product ID label on the product itself.

C.6 Download Product Manual

Download Product Manual

Product manuals and documentation are available online at www.barco.com/td.

Registration may be required; follow the instructions given on the website.

IMPORTANT! Read Installation Instructions before connecting equipment to the mains power supply.

Glossary

HD

Hazard Distance (HD) is the distance measured from the projection lens at which the intensity or the energy per surface unit becomes lower than the applicable exposure limit on the cornea or on the skin. The light beam is considered (to be) unsafe for exposure if the distance from a person to the light source is less than the HD.

HD

Hazard Distance (HD) is the distance measured from the projection lens at which the intensity or the energy per surface unit becomes lower than the applicable exposure limit on the cornea or on the skin. The light beam is considered (to be) unsafe for exposure if the distance from a person to the light source is less than the HD.

DMD

A digital micromirror device, or DMD, is an optical semiconductor that is the core of DLP projection technology.

Dew point

The dew point is the saturation temperature for water in air. The dew point is associated with relative humidity. A high relative humidity implies that the dew point is closer to the current air temperature. Relative humidity of 100% indicates the dew point is equal to the current temperature and that the air is maximally saturated with water. When the moisture content remains constant and temperature increases, relative humidity decreases.

RS232

An Electronic Industries Association (EIA) serial digital interface standard specifying the characteristics of the communication path between two devices using either D-SUB 9 pins or D-SUB 25 pins connectors. This standard is used for relatively short-range communications and does not specify balanced control lines. RS-232 is a serial control standard with a set number of conductors, data rate, word length and type of connector to be used. The standard specifies component connection standards with regard to computer interface. It is also called RS-232-C, which is the third version of the RS-232 standard, and is functionally identical to the CCITT V.24 standard. Logical '0' is $> +3V$, Logical '1' is $< -3V$. The range between $-3V$ and $+3V$ is the transition zone.

USB

Universal Serial Bus (USB) is an industry standard developed in the mid-1990s that defines the cables, connectors and communications protocols used in a bus for connection, communication, and power supply between computers and electronic devices. **USB 2.0** (also called "Hi-Speed"), adding higher maximum signaling rate of 480 Mbit/s (effective throughput up to 35 MB/s or 280 Mbit/s), in addition to the "USB 1.x Full Speed" signaling rate of 12 Mbit/s.[16] USB 2.0 connectors are usually colored black. **USB 3.0** defines a new SuperSpeed mode with a signaling speed of 5 Gbit/s and a usable data rate of up to 4 Gbit/s (500 MB/s). A USB 3.0 port is usually colored blue, and is backwards compatible with USB 2.0.

DisplayPort

Digital display interface developed by the Video Electronics Standards Association (VESA). This royalty-free interface is primarily used to connect a video source to a display device such as a computer monitor, though it can also be used to transmit audio, USB, and other forms of data. VESA designed it to replace VGA, DVI, and

FPD-Link. Backward compatibility to VGA and DVI by using active adapter dongles enables users to use DisplayPort fitted video sources without replacing existing display devices.

HDCP

High-bandwidth Digital Content Protection is a form of digital copy protection developed by Intel Corporation to prevent copying of digital audio and video content as it travels across DisplayPort, Digital Visual Interface (DVI), High-Definition Multimedia Interface (HDMI), Gigabit Video Interface (GVIF), or Unified Display Interface (UDI) connections, even if such copying would be permitted by fair use laws. The specification is proprietary, and implementing HDCP requires a license.

3G-SDI

Serial Digital Interface (SDI) is a serial link standardized by ITU-R BT.656 and the Society of Motion Picture and Television Engineers (SMPTE). SDI transmits uncompressed digital video over 75-ohm coaxial cable within studios, and is seen on most professional video infrastructure equipment. The first revision of the standard, SMPTE 259M, was defined to carry digital representation of analog video such as NTSC and PAL over a serial interface and is more popularly known as standard-definition (SD) SDI. The data rate required to transmit SD SDI is 270 Mbps. With the advent of high-definition (HD) video standards such as 1080i and 720p, the interface was scaled to handle higher data rates of 1.485 Gbps. The 1.485-Gbps serial interface is commonly called the HD SDI interface and is defined by SMPTE 292M, using the same 75-ohm coaxial cable. Studios and other video production facilities have invested heavily on the hardware infrastructure for coaxial cable and have a vested interest in extending the life of their infrastructure. Fortunately, SMPTE recently ratified a new standard called SMPTE 424M that doubles the SDI data rates to 2.97 Gbps using the same 75-ohm coaxial cable. This new standard, also called 3-Gbps (3G)-SDI, enables higher resolution of picture quality required for 1080p and digital cinema.

HDMI

HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from a HDMI-compliant device ("the source device") to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for existing analog video standards.

HDMI

HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from a HDMI-compliant device ("the source device") to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for existing analog video standards.

Trusted Device List (TDL)

The Goal of the TDL is to maintain timely and accurate information on participating auditoriums so that participating subscribers can obtain information needed to issue KDMs. The TDL has several data sources: Device manufacturers, Exhibitors, Deployment Entities, Integrators, Service Providers (interacting with Exhibitors), regional authorities and Support.

Public Key Infrastructure (PKI)

PKI is a framework for creating a secure method for exchanging information based on public key cryptography. The foundation of a PKI is the certificate authority (**CA**), which issues digital certificates that authenticate the identity of organizations and individuals over a public system such as the Internet. The certificates are also used to sign messages, which ensures that messages have not been tampered with.

***.pem**

Privacy-enhanced Electronic Mail. File format used to distribute digital signed certificates. Base64 encoded DER certificate, enclosed between "-----BEGIN CERTIFICATE-----" and "-----END CERTIFICATE-----"

Key Delivery Message (KDM)

The security key for each movie is delivered in a unique KDM for each digital cinema server. The security key is encrypted within the KDM, which means that the delivery of a KDM to the wrong server or wrong location will not work, and thus such errors cannot compromise the security of the movie. The KDM is a small file, and is typically emailed to the exhibitor. To create the correct set of KDMs for a site requires knowledge of the digital certificate in the projection system's media block.

Digital Cinema Package (DCP)

A Digital Cinema Package (DCP) is a collection of digital files used to store and convey Digital Cinema (DC) audio, image, and data streams. The term has been defined by Digital Cinema Initiatives (DCI). General practice adopts a file structure that is organized into a number of usually multi-gigabyte size Material eXchange Format (MXF) files, which are separately used to store audio and video streams, and auxiliary index files in XML format. The MXF files contain streams that are compressed, encoded, and encrypted, in order to reduce the huge amount of required storage and to protect from unauthorized use. The image part is JPEG 2000 compressed, whereas the audio part is linear PCM. The adopted (optional) encryption standard is AES 128 bit in CBC mode. The newer SMPTE standards are used to conform the recommendations among different tool vendors and producers. Interop, the legacy DCP standard, is still required to be supported by DCP players.

Digital Cinema Initiatives (DCI)

DCI is a joint venture of Disney, Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios. DCI's primary purpose is to establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of technical performance, reliability and quality control. Note that the DCI specification is not a standard. Standards for digital cinema are the domain of the Society of Motion Picture and Television Engineers (SMPTE). "DCI compliant" is a term used to describe products that conform to the DCI specification. Products that have been tested per the DCI Compliance Test Plan (CTP) are posted at the DCI compliance web site. Notably, DCI compliance does not require compliance to the full set of SMPTE DCP standards. A copy of the most recent DCI specification can be downloaded from the DCI website (<http://dcimovies.com>).

Scheimpflug principle

The "plane of sharp focus" can be changed so that any plane can be brought into sharp focus. When the DMD plane and lens plane are parallel, the plane of sharp focus will also be parallel to these two planes. If, however, the lens plane is tilted with respect to the DMD plane, the plane of sharp focus will also be tilted according to geometrical and optical properties. The DMD plane, the principal lens plane and the sharp focus plane will intersect in a line below the projector for downward lens tilt.

Scheimpflug principle

The "plane of sharp focus" can be changed so that any plane can be brought into sharp focus. When the DMD plane and lens plane are parallel, the plane of sharp focus will also be parallel to these two planes. If, however, the lens plane is tilted with respect to the DMD plane, the plane of sharp focus will also be tilted according to geometrical and optical properties. The DMD plane, the principal lens plane and the sharp focus plane will intersect in a line below the projector for downward lens tilt.

Screen Brightness

Screen Brightness, or how bright a screen will look, involves measuring the light reflected from its surface to our eyes. It takes into account the luminous flux (lumens) falling over its entire area (lux) and how reflective the surface of the screen is. It literally is a measure of the light bouncing off the screen. Luminance is measured in foot-lamberts. One foot-Lambert of luminance is equal to one lumen per square foot.

Index

Numbers/Symbols

3G-SDI 84

A

About this manual 10
Access
 Mains compartment 51
Address 171
Adjust
 Convergence
 Green 128
 Red 127
Air flow
 Projector 28
AUDIO-AES 82
Authorization
 Security warning
 Clear 147
Awake 71

B

Back Focal Length 111
 Adjustment 117
Backlight
 Color 67

C

Calibration 131
 Color 135
 Luminance 137
 Process 132
 White point 133
CertID 97
Check
 Dust filter 144
Chiller
 Communication port 51
Chillers and hoses 28
Cinema Controller 74
Cleaning
 Exterior 147

Filters 145
Filters (wet) 145
Lens 146
Color
 Backlight 67
 Calibration 135
Commander 34
Communication 69
 AUDIO-AES 82
 GPI 82
 GPO 82
 Introduction 70
 LAN 82
 SYNC 82
 USB 2.0 82
 USB 3.0 83
 USB port 74
Communication port
 Chiller 51
 Projector 51
Communication ports 74, 82
Communicator 33
 Touch Panel 58
Component
 Location 28
Configuration 99
Connect
 Communication port 51
 Mains 55
 Safety interlocks 53
Convention
 Orientation 27
Convergence 123
 Control knobs 124
 Controls
 Extenders 124
 Green onto blue 128
 Prepare 126
 Red onto blue 127
 Test pattern 125
Cover
 Mains compartment 51
 Side 151
 Top 150
Covers
 Install 149
 Remove 149

D

- Delta (Δ) configuration 54
- Device certificate 97
 - Download 101
 - ICMP 101
- Dimensions
 - Thor series projector 158
- DisplayPort 84
 - Specifications 84
- DMD cooling 29
- Download
 - Device certificate 101
 - Product manual 171
- Drying
 - Filters 145
- Dust filter
 - Large
 - Replace 144

E

- Enclosed projection 22
- Environmental information 169
 - Disposal information 170
 - RoHS compliance
 - Turkey 170
- Expected
 - From you 10
- Exterior
 - Cleaning 147
- External safety interlocks 30

F

- Filters
 - Cleaning 145
 - Cleaning (wet) 145
- Fixate
 - Lens Holder front plate 116
- Focus 66

G

- General considerations 12
- General Purpose I/O 162
- Getting started 35
- GPI 82
- GPIO 162
- GPO 82

H

- Hazard Distance 19, 22
 - Modifying optics 23
- Hazardous Chemicals 17
- Hazards 170
- HDD 80
 - About 80
 - Degrade mode 81
 - RAID broken 81

- RAID recovery 81
- Remove 102–103
- Storage 81
- Storage capacity 81
- Validated list 81
- HDMI 84
- HDMI 1.4
 - Specifications 92
- HDMI 2.0 84
 - Specifications 89
- High Brightness precautions 19
- Hoses 29
 - Install 49

I

- ICMP 77
- ICMP HDD
 - Status LEDs 96
 - Troubleshooting 96
- ICMP reset 100
- ICMP introduction 79
- Important safety instructions 13
- Importer 171
- Initial inspection 40
- Input 69
 - Introduction 70
- Input & communication
 - Communication ports 74
- Input & Communication
 - Local Keypad 72
- Install
 - Covers 149
 - Hoses 49
 - Lens 63
 - Power loop through 56
 - Safety interlocks 53
 - Touch Panel 58
 - UPS connection 57
- Installation
 - Overview 42
 - Power input configuration 54
- Installation process 41
- Installation requirements 36
- Internal clock 100
- Introduction
 - Communication 70
 - Input 70

K

- KDM 97
- Keypad
 - Backlight
 - Color 67

L

- LAN 82
- Large dust filter
 - Replace 144
- Laser status 71–72

- Lens
 - Cleaning 146
 - Focus 66
 - Installation 63
 - Removal 65
 - Scheimpflug 112–113
 - Shift 66
 - Zoom 66
- Lens Holder
 - Front plate 116
 - Lenses 61
- lens selection 62
- Lenses
 - Available 62
 - Lens Holder 61
- Local Keypad 72
- Location
 - Component 28
- Luminance
 - Calibration 137

M

- Mains
 - Connect 55
- Mains compartment
 - Access 51
 - Cover 51
- Maintenance 143
 - 3 month 140
- Maintenance program 139
 - 1 Month 140
- Manual
 - Use 10
- Mechanical check 40

N

- Network Time Protocol 100
- Notice on optical radiation
 - Optical radiation 12
- Notice on safety 12

O

- Obtain
 - Device certificate 101
- ON/OFF 108
- Open
 - Cover door 150
- Orientation
 - Convention 27
- Owner's record 12

P

- Physical installation 45–46
- Pin configuration
 - Communication ports 163
- Pin configurations 161
 - ICMP 165

- Power input setup 54
- Power loop through
 - Installation 56
- Product safety labels 17
- Production 171
- Projection screen 38
- Projector
 - Air flow 28
 - Communication port 51
- Projector ON/OFF explained 108
- Projector status 70

R

- Rear projection 22
- Remove
 - Covers 149
 - HDD 102–103
 - Lens 65
 - Protection bars 46
 - Side cover 151
 - Top cover 150
- Replace
 - Dust filter
 - Large 144
- Requirements
 - Condensed water 37
 - Cooling 36
 - Power 37
 - Projection screen 38
 - Projector weight 38
 - UPS 38
- Reset button 100
- RS232 76

S

- Safety 11
 - Battery explosion 15
 - Electrical shock 13
 - Fire hazard 14
 - Hazard Distance 19, 22
 - Hazardous Chemicals 17
 - Personal injury 15
 - Projector damage 16
 - Safety Data Sheet (SDS) 17
 - Servicing 16
- Safety Data Sheet (SDS) 17
- Safety interlocks
 - Connect 53
- Safety system 30
- Safety training 12
- Scheimpflug 111–113
 - Adjustment points 112
- Scheimpflug's law 112
- SDI
 - Specifications 86
- Serial communication 76
- Shift 66
- Side cover
 - Remove 151
- Source input

- 3G-SDI 84
- DisplayPort 84
- HDMI 84
- HDMI 2.0 84
- Source input ports 83
- Specification
 - ICMP 156
- Specifications 153
 - DisplayPort 84
 - HDMI 1.4 92
 - HDMI 2.0 89
 - SDI 86
 - Thor 154
 - Thor+ 155
- Stacking 38
- Standby mode 71
- Star (Y) configuration 54
- Starting up 105
 - Switching on 106
- Status LEDs 95
 - ICMP HDD 96
- Status light 70, 72
- Status light lasers 71
- Switching OFF 107
- Switching on 106
- SYNC 82
- System overview 25
 - Chillers and hoses 28
 - Commander 34
 - Communicator software 33
 - Thor 27

T

- Tail light 70
- TDL 97
- Technical Regulations 159
- Test Pattern
 - Convergence 125
- This manual 9
- Thor 27
- Three phase
 - Configuration 54
- Top cover
 - Remove 150
- Touch Panel
 - Install 58
 - Introduction 31

U

- Unpacking 38
- UPS 38
- UPS connection
 - Installation 57
- USB 2.0 82
- USB 3.0 83
- USB port 74
- User definition 13

V

- Vacuum
 - Filters 145

W

- Washing
 - Filters 145
- Welcome 9
- White point
 - Calibration 133

Z

- Zoom 66

