Corona II + LED-Control Unit XLC4-1
Manual

Version R05
(CD40069)
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Contents

1 Before you start

The Corona II illumination unit and the LED-Control Unit XLC4 have been thoroughly tested and been shipped in perfect operating condition.

- Carefully check the shipping box for damage that may have occurred during shipping. Damages must be immediately reported to the shipping company and to Chromasens.
- Make sure you have received all parts listed in the packing list.
- Keep the original packaging for a possible return of the equipment! To prevent damage, the Corona II illumination unit and the LED-Control Unit XLC4 unit have to be returned correctly packed and in the original packaging material.
- Read this document carefully and take account to the instructions and notes listed in this document.

2 Highlights

The Corona II illumination unit is a LED line scan illumination device for industrial applications. It provides bright, homogeneous and stable lighting, which is the only way to get high quality images. The Corona II illumination unit can be controlled by the Chromasens XLC4 controller as well as with third party current sources or flash controllers.

- Highly-focused LED light

  The Corona II illumination focuses the emitted LED light by means of a special and a patented reflector technology. This reflector allows for perfect light shaping and is the technological base for the outstanding homogeneity of the focused light. Due to the usage of a mirror, the light focusing of the Corona does not - contrary to lenses – lead to chromatic aberrations. Corona II provides a perfect and focused spectral homogeneity without aberrations.

- High illuminance

  With a focus length of 60 mm and adequate heat dissipation, illuminance values up to 3.500.000 lx can be achieved.

- High homogeneity

  Due to the patented Chromasens technology, different number segments (170 mm each) LED modules can be lined up without any loss in homogeneity.

- Highly efficient passive cooling

  The Corona II illumination comes with a very effective passive cooling system. The cooling capacity of the lighting modules can be adapted to the installation conditions and the requirements in light output by selecting a suitable heat sink. A liquid cooling system is also available as fan cooling option.

- Flexible configuration

  The Corona II illumination module is available with overall lengths from 180 mm to 1360 mm in steps by 170 mm. All relevant colors are available: Red, green, blue and white as well as different focus lengths: 60 mm, 95 mm, 190 mm and parallel.

- Compact design and sturdy housing

  Minimum size for installation is required, because the Corona II is controlled by an external control unit. Due to its sturdy and dust-proof design, the Corona II can be used in rough industrial environments, where lots of dust and abrasive materials are present.

- External controllers

  The Corona II units are designed for use with the Chromasens XLC4 LED Control Unit but can also easily be adapted to a variety of other commercially available LED control units by means of wire end ferrules.

  Operation with the XLC4 controller allows the use of enhanced features of the Corona II modules such as automatic current limitation, temperature sensing and LED functional test.

  The controller can run several Corona II modules.

- Easy installation

  The Corona II housing has pre-drilled mounting holes which allow for quick mounting.

3 Safety information

3.1 Presentation of safety information

Safety relevant information is presented as follows in this manual:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation or task, which, if not avoided, could result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation or task, which, if not avoided, may result in minor or moderate injury.

NOTICE Indicates a potentially hazardous situation or task, which, if not avoided, could result in damage to the product or the surrounding environment.

3.2 Basic safety rules

Ensure the following:

- The illumination unit shall always be in perfectly safe condition. If there is a malfunction of the unit or if any parts of the unit are defective, operation must be stopped immediately and the person in charge must be notified.
- National and local standards, directives and regulations on health, safety and accident prevention shall be followed.
- Make sure you have read and understood this manual.
- Only authorized specialist personnel may install, maintain or repair the illumination.
- The personnel must be instructed at regular intervals about potential hazards.

3.3 Specific hazards

DANGER

To prevent or reduce the risk of electrical shock or fire, do not expose this unit to rain or moisture.

WARNING

This unit may cause severe eye damage. Avoid looking directly into the light source at all times.

Electrostatic discharge / electro-statically sensitive parts

Some components of the illumination are sensitive to electrostatic discharge. Always observe the applicable ESD standards. Avoid the proximity of electromagnetic fields or electro-static charge-up.

NOTICE Make sure that the device, the tools and the persons handling the device have the same electrical potential.

3.4 Alert labels on the equipment

Risks from hot surfaces

The housing of the illumination unit heats up during operation.

Do not touch hot surfaces without suitable protective gloves. Always allow hot surfaces to cool down before carrying out any work on the unit.

Risks from optical radiation

Contact with optical radiation may result in injury.

Direct and long-term exposure of eyes and skin to light radiation must be avoided because it could be hazardous to health.

Do not stare into the beam.

3.5 Purpose / applications

- The Corona II and the controller XLC4 are designed for installation in machines and systems which are used for commercial and industrial applications.
- The owner of the machine or system in which the Corona II and the controller XLC4 are installed is responsible for compliance with relevant safety regulations, standards and directives. Commissioning of the Corona II and the controller XLC4 is not permitted until it has been verified that the machine or system in which the Corona II and the controller XLC4 are installed complies with the safety regulations and standards of the country in which the Corona II and the controller XLC4 are run.
- The owner of the machine or system in which the Corona II and the controller XLC4 are installed must verify the suitability of the Corona II and the XLC4 controller for its intended use.
- The safety regulations of the country in which the device is used must be complied with.
- The Corona II and the controller XLC4 may only be connected or used as described in this manual.
- The Corona II and the controller XLC4 must be set up and installed in compliance with the instructions contained in this manual.

3.6 Information on optical radiation

Due to the withdrawal of the LED from IEC 60825, the assessment of eye safety is done according to CIE S009/E:2002 “Photo Biological Safety of Lamps and Lamp Systems”.

Within the risk assessment system of CIE S009/E:2002 (DIN EN 62471) the LEDs used in the Corona II illumination unit are depending on the LED color, the focus and the intensity might be in this risk classes:

LED	Dark Field			
	A	B	C	D
White	Up to Class 2 „Medium risk “	Up to Class 2 „Medium risk “	Up to Class 1 „Low risk “	Up to Class 1 „Low risk “
Red, Green	Up to Class 1 „Low risk “	Up to Class 1 „Low risk “	Up to Class 1 „Low risk “	Up to Class 1 „Low risk “
Blue, IR (850 nm / 940 nm)	Up to Class 2 „Medium risk “	Up to Class 2 „Medium risk “	Up to Class 2 „Medium risk “	Up to Class 2 „Medium risk “
UV (365 and 395 nm)	Up to Class 3 „High risk “	Up to Class 3 „High risk “	Up to Class 3 „High risk “	Up to Class 3 „High risk “

LED	Bright Field (H)
White, Red, Green	Up to Class 1 „Low risk “
Blue, IR (850 nm and 940 nm)	Up to Class 2 „Medium risk “
UV (365 and 395 nm)	Not available

LED	Tube Light (T+U)
White, Red, Green	Up to Class 1 „Low risk “
Blue, IR (850 nm and 940 nm)	Up to Class 2 „Medium risk “
UV (365 and 395 nm)	Not available

It is assumed that these devices for Class 1 do not normally present a hazard.

These classes are at full power operation; at lower current rates, the safety class for white, red, green, blue and IR might be lower.

Caution:
For UV version it is strongly recommended to protect the user from radiation, e.g. with a special housing and safety switches at the housing. For setup and service, it is strongly recommended to use eye protection glasses.

Take notice, however, that intense light sources have a high secondary hazard potential, due to their blinding effect. If you view intense light sources, temporary reduction in visual acuity and afterimages can occur, leading to irritation, annoyance, visual impairment, and even accidents.

Ensure the following:

- Do not stare into the beam.
- Check the Corona II illumination unit before every use.
- Do not open the Corona II illumination unit.
- Repairs which require that the equipment is opened may only be performed by Chromasens.
- Do not remove warning signs on the lighting module.
- Protect the user with a housing from radiation.
- Instruct maintainence staff about risk from optical radiation.
- Add safety instructions to the manual of your machine or installation.

3.7 Information on thermal risks

Caution:

Operation temperature might be higher than 65° C. This will cause skin irritation at once.

Ensure the following:

- Protect staff to get in contact with the hot parts by using extra housings or covers.
- Switch off the device and let it cool down for maintainance and cleaning.
- Instruct maintainence staff about risk from hot parts.
- Add safety instructions to the manual of your machine or installation.
- Refer for further information to DIN EN ISO 13732-1.

3.8 Personal requirements

- The system owner must ensure that all persons working on the system are trained for the required work and have read and understood this manual. This applies in particular to personnel that only work occasionally with the Corona II and the controller XLC4, for example during commissioning and maintenance work.

- Work on the electrical installations of the system may only be carried out by a qualified electrician or persons who have undergone electrotechnical training under the supervision of a qualified electrician in compliance with applicable electrotechnical regulations.

- Only suitably trained and qualified persons are permitted to work with the Corona II and the XLC4 controller. Such persons are qualified to work with the Corona II and the controller XLC4 device if they are familiar with its assembly, installation and care as well as all necessary precautionary measures.

- The assignments and responsibilities of personnel charged with operation, commissioning, maintenance and repair must be clearly defined. This definition must be specified by the owner of the machine or system in which the Corona II and the XLC4 controller is installed.

3.9 Organisational measures

- The operating manual must always be kept in the vicinity of the Corona II and the XLC4 controller while it is in operation.

- The information contained in this manual must be integrated into the documentation of the machine or system in which the Corona II and the controller XLC4 are installed.

- The Corona II, the XLC4 controller and all connected periphery must be checked regularly for visible external damage.

3.10 Safety instructions for transport, mounting and maintenance

- All personnel working on the system must be informed before service or maintenance work is carried out.
- Deadlines and intervals for regular inspection work must be complied with.
- Before starting maintenance work, the Corona II and the Controller XLC4 must be isolated from the power supply.
- Corona II and the XLC4 controller must first be allowed to cool down after switching off, because there is the risk of burns.
- Only technicians of Chromasens GmbH are permitted to open or slacken screws or housing sections of the Corona II and the controller XLC4.
- Repair work may only be carried out by Chromasens GmbH.
- Clean the device with a soft, lint-free cloth and Isopropanol (optional).
- To prevent damage to the Corona II and the XLC4 controller, it may only be transported in its original packaging.

WARNING

Use of Isopropanol:

- **Isopropanol is a burnable liquid.**
- **The safety data sheet of the manufacturer for Isopropanol alcohol must be kept at the installation. The staff for cleaning must be instructed about the use of Isopropanol alcohol and about the proceeds in case of emergency.**

WARNING

Corona modules do have a weight up to 10 kg.

For mounting and transport the staff must wear their personal safety equipment like safety boots.

4 Enviromental conditions

4.1 General

The device is not designed for use in explosive environment.

For operation of the Corona II modules, the environmental conditions according to

DIN EN 60721-3-3 (International IEC 721-3-3): IE33

are admissible.

4.2 IP protection class

The XLC4 unit should be kept free from moisture liquids and fire because this could seriously damage the device.

The IP protection class of the standard XLC4 is:	**IP40**
The IP protection class of the standard Corona II is:	**IP54**
The IP protection class of the fan cooling Corona II is:	**IP30**

The module itself is IP54 – it is limited due the fans.

The IP protection class of the tube light (Parameter ID2= “T” and “U”) is: **IP20**

4.3 Enviromental conditions for operation

Item	Description	Min.	Nominal	Max.	Unit
$T_{Ambient}$	Ambient temperature	5		50	[°C]
RH_{Air}	Relative humidity	20		90	[%]
AH_{Air}	Absolute humidity	3		25	[g/m³]
$dT_{Ambient}$	Temperature rise			0.5	[°C/min]

Cooling and current settings of the Corona II systems must be designed so that temperature at the heat sink does not exceed maximum operating temperature:

T_{max} = 75 °C

If the Corona II system is used with a Chromasens XLC 4 Controller, the temperature inside the illumination module can be monitored. If the threshold value is exceeded, a cooling system can be activated, or the illumination can be switched off.

Note that the LED temperature has a strong influence on the degradation of the LEDs light output.

The Corona II modules are available with several heat sink options to adapt the illumination to the environmental and operational conditions in the scan system.

It is strongly recommended to mount the Corona II illuminations in a way that free air flow can provide optimal convection cooling.

4.4 Enviromental conditions for storage and transport

For storage of the Corona II modules, the environmental conditions according to

DIN EN 60721-3-1 (International IEC 721-3-1): IE11

are admissible.

For transport of the Corona II modules, the environmental conditions according to

DIN EN 60721-3-2 (International IEC 721-3-2): IE21

are admissible.

Item	Description	Min Value	Nominal	Max Value	Unit
$T_{Ambient,\ continuous}$	Ambient temperature	-25		55	[°C]
$T_{Ambient,\ for\ 24\ hrs}$	Ambient temperature 24h	-25		70	[°C]
RH_{Air}	Relative humidity	5		95	[%]
AH_{Air}	Absolute humidity	0.1		35	[g/m³]
$dT_{Ambient}$	Ambient temperature rise			5	[°C/min]

5 LED – Module Corona II

5.1 Configuration

5.1.1 Breakdown of an identification number

Each Corona II unit can be freely configured in accordance with customer requirement. The configured unit has an identification number which reflects its design.

The table below shows an example of an identification number.

ProductID	ID1	ID2	ID3	ID4	ID5	ID6	ID7
CP000200	340	C	04	2.5	B	1	B
General identifier for Corona II products	Optical Length of Module	Reflector Type	LED Color	Cable Length	Connector	Screen options	Heat sink options

Example:

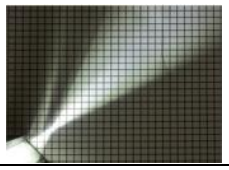
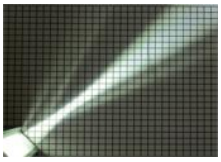
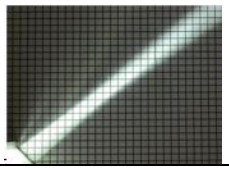
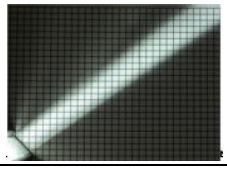
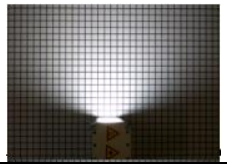
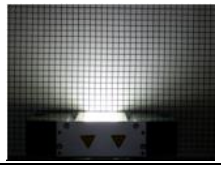
CP000200-340C-04-2.5-B1B

Because not all options are available in each combination, the tables below also show the limitations of single options:

	Standard – available without restrictions
	On request, may cause longer lead times
	Not applicable

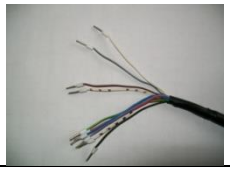
5.1.2 Options with identification number

ID 1	Optical Length of Module Fitting Length	
170	170 mm / 180 mm	
340	340 mm / 350 mm	
510	510 mm / 520 mm	
680	680 mm / 690 mm	
850	850 mm / 860 mm	
1020	1020 mm / 1030 mm	
1190	1190 mm / 1200 mm	
1360	1360 mm / 1370 mm	

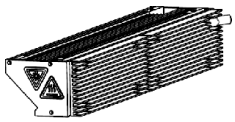
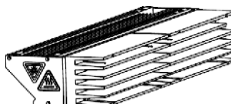
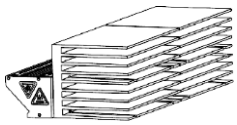
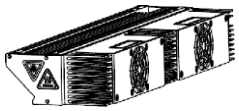
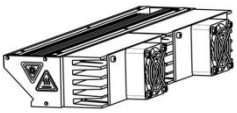
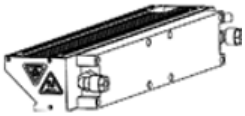
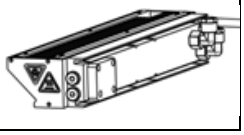
ID 2	Reflector Type Focal length / Recommended working distance								
A	Focal length 60 mm WD: 50-70 mm								
	170	340	510	680	850	1020	1190	1360	
B	Focal length 95 mm WD: 70-120 mm								
	170	340	510	680	850	1020	1190	1360	
C	Focal length 190 mm WD: 120 – 300 mm								
	170	340	510	680	850	1020	1190	1360	
D	Parallel beam WD: > 300 mm								
	170	340	510	680	850	1020	1190	1360	
H	Bright field								
	170	340	510	680	850	1020	1190	1360	
T	Tube light (tunnel light) – Viewing angle 0°								
	170	340	510	680	850	1020	1190	1360	
U	Tube light (tunnel light) – Viewing angle 15°								
	170	340	510	680	850	1020	1190	1360	

ID 3				LED Color							
Top light ID2 = A, B, C or D	Bright field ID2 = H	Tube light (Full power option) ID2 = T or U	Tube light (Half power option) ID2 = T or U								
01	01	n.a.	51	Red (634 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
02	02	02	52	Green (520 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
03	03	03	53	Blue (452 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
04	04	04	54	Standard white (cool white – 5500 K)							
				170	340	510	680	850	1020	1190	1360
07	07	n.a.	07	Daylight (white D50)							
				170	340	510	680	850	1020	1190	1360
08	08	08	58	Infrared (850 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
09	09	09	59	Infrared (940 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
10	10	n.a.	10	Daylight without UV (white D50)							
				170	340	510	680	850	1020	1190	1360
12	12	12	62	Warm white (3500 K)							
				170	340	510	680	850	1020	1190	1360
30	n.a.	n.a.	n.a.	UV (365 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360
33	n.a.	n.a.	n.a.	UV (395 nm peak wavelength)							
				170	340	510	680	850	1020	1190	1360

ID 4	Cable length								
1.3	1,3 m								
	170	340	510	680	850	1020	1190	1360	
2.5	2,5 m								
	170	340	510	680	850	1020	1190	1360	
5	5,0 m								
	170	340	510	680	850	1020	1190	1360	
7.5	7,5 m								
	170	340	510	680	850	1020	1190	1360	
10	10 m								
	170	340	510	680	850	1020	1190	1360	
15	15 m								
	170	340	510	680	850	1020	1190	1360	

ID 5	Connector								
A	**Wire end ferrules** - For use with other controllers, e.g. Gardasoft. - No support of I²C identification and temperature.								
	170	340	510	680	850	1020	1190	1360	
B	**Terminal block for XLC4**								
	170	340	510	680	850	1020	1190	1360	

ID 6	Screen options							
Top light ID2 = A, B, C or D	Bright field ID2 = H	Tube light ID2 = T or U							
n.a.	0	n.a.	Plexiglas (strong diffuse, bright field only, ID2=H)							
			170	340	510	680	850	1020	1190	1360
1	n.a.	n.a.	Glass (with little diffusion) GW55 (standard)							
			170	340	510	680	850	1020	1190	1360
2	n.a.	n.a.	Glass (with polarization) GW55							
			170	340	510	680	850	1020	1190	1360
3	n.a.	n.a.	Plexiglas (low diffusion)							
			170	340	510	680	850	1020	1190	1360
4	n.a.	n.a.	Plexiglas (medium diffusion)							
			170	340	510	680	850	1020	1190	1360
7	n.a.	n.a.	Glass GW4 (medium diffusion)							
			170	340	510	680	850	1020	1190	1360
n.a.	n.a.	N	no glass (for light tube only, ID2= T or U)							
			170	340	510	680	850	1020	1190	1360
B	n.a.	n.a.	Glass GW55 with anisotropic foil (30x1°)							
			170	340	510	680	850	1020	1190	1360
C	n.a.	n.a.	Plexiglas GW55 with anisotropic foil (30x1°)							
			170	340	510	680	850	1020	1190	1360

ID 7	Heat sink								
A	Passive, 50 x 10 mm								
	170	340	510	680	850	1020	1190	1360	
B	Passive, 50 x 40 mm								
	170	340	510	680	850	1020	1190	1360	
C	Passive, 90 x 100 mm								
	170	340	510	680	850	1020	1190	1360	
L	Fan (50 x 47 mm)								
	170	340	510	680	850	1020	1190	1360	
F	Fan (50 x 67 mm)								
	170	340	510	680	850	1020	1190	1360	
W	Water (up to 2019)								
	170	340	510	680	850	1020	1190	1360	
H	Water (from 2019)								
	170	340	510	680	850	1020	1190	1360	

5.1.2.1 Special options

In addition, there are some options available as add on for the bright field and dark field modules.

The options will be set additional to the product code, e.g.:

CP000200-CXT-170B-04-2.5B0L

ID 0	Special option								
CXN	Coaxial module, no protection screen								
	170	340	510	680	850	1020	1190	1360	
CXT	Coaxial module, protection screen top side								
	170	340	510	680	850	1020	1190	1360	
CXB	Coaxial module, protection screen bottom side								
	170	340	510	680	850	1020	1190	1360	
CXS	Coaxial module, two protection screens								
	170	340	510	680	850	1020	1190	1360	
CH2	Cable with Hummel connector Length: 0,5 m or 1 m								
	170	340	510	680	850	1020	1190	1360	
DW1	Drag chain cable with standard Würth connectors Length: All standard length available								
	170	340	510	680	850	1020	1190	1360	

5.2 Optical length / Fitting length (ID 1)

All dimensions are shown in millimeters (mm).

Detailed drawings and 3D CAD models are available at:

https://www.chromasens.de/corona-downloads

5.2.1 Mechanical dimensions

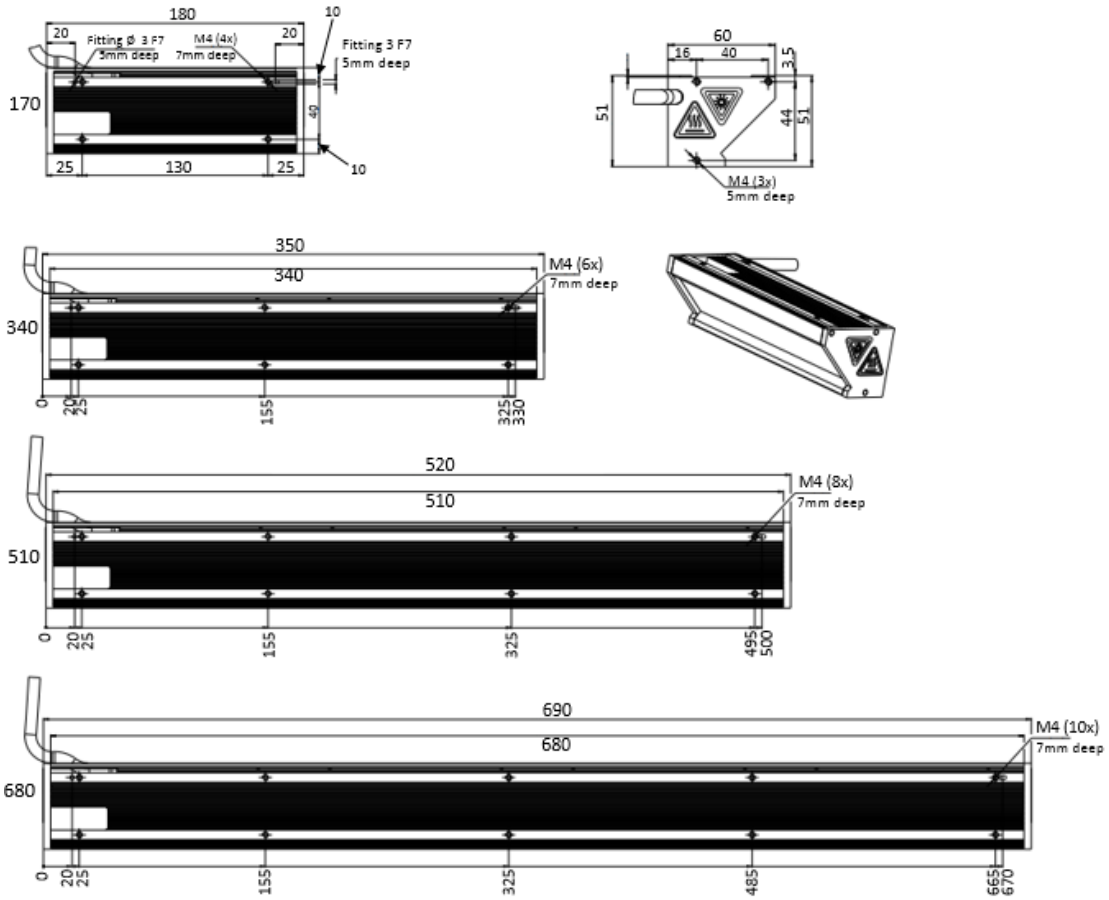


Figure 5-1 Optical length and threads up to 680 mm module length (ID 1)

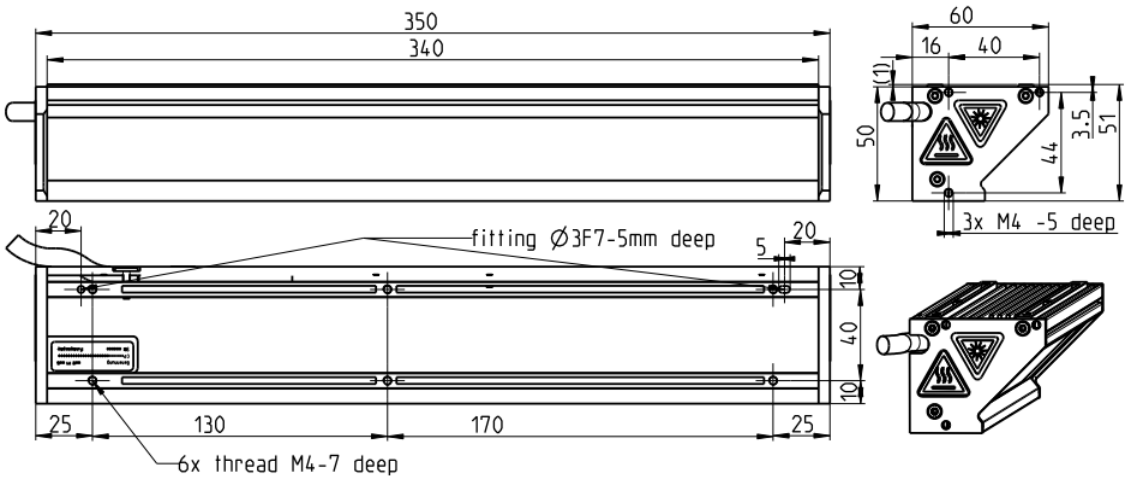


Figure 5-2 Mechanical mounting with fitting and threads for reflector types A, B, C and D

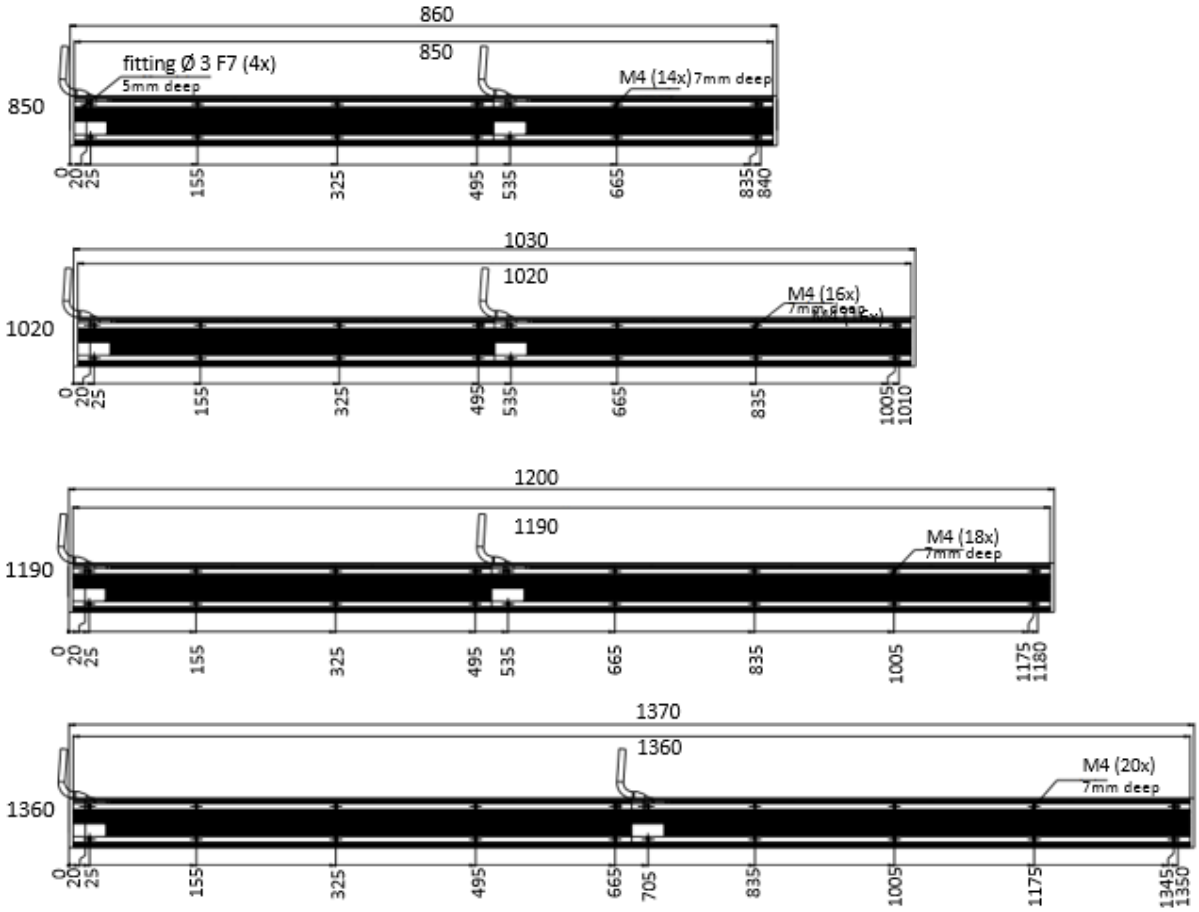
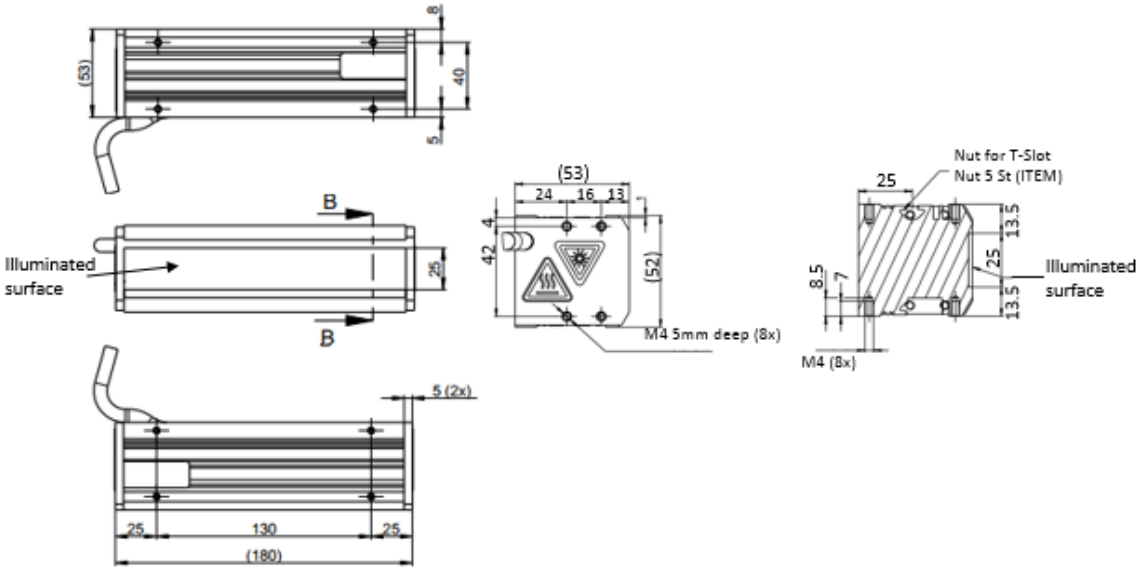


Figure 5-3 Optical length and threads > 680 mm module length (ID 1)



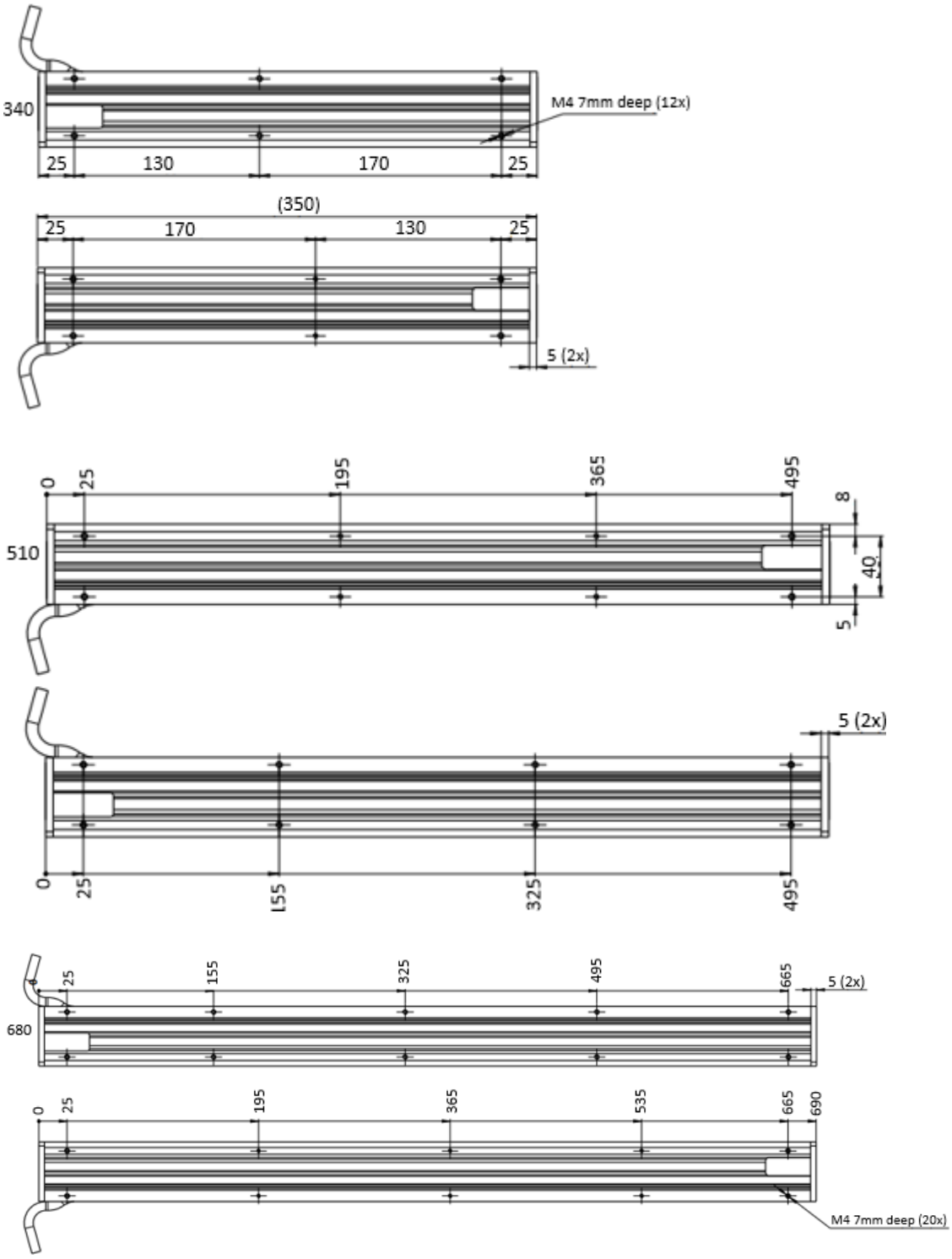


Figure 5-4 Mechanical fixation for bright field type version (type H) up to 680 mm

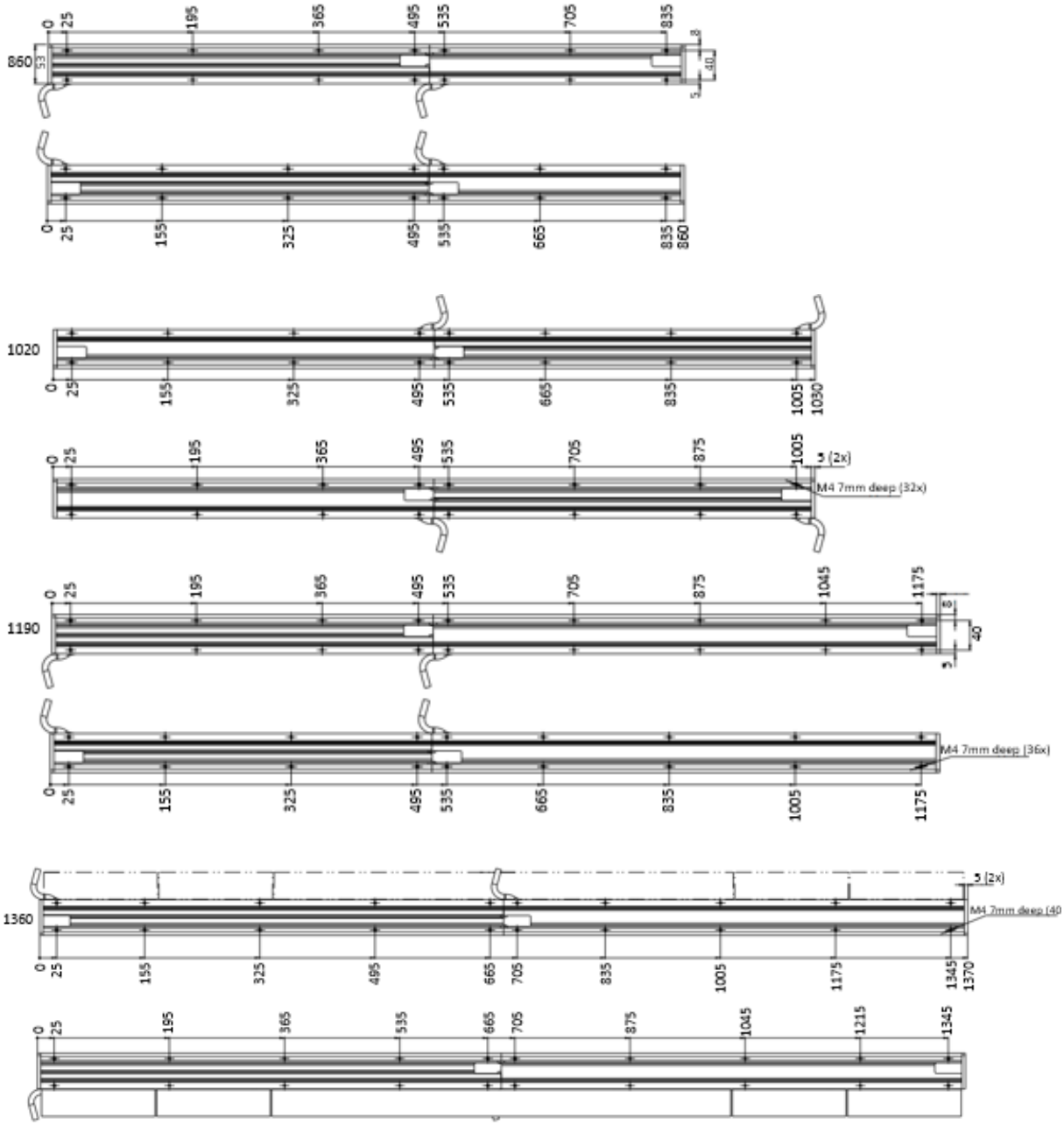


Figure 5-5 Mechanical fixation for bright field type version (type H) > 680 mm module length

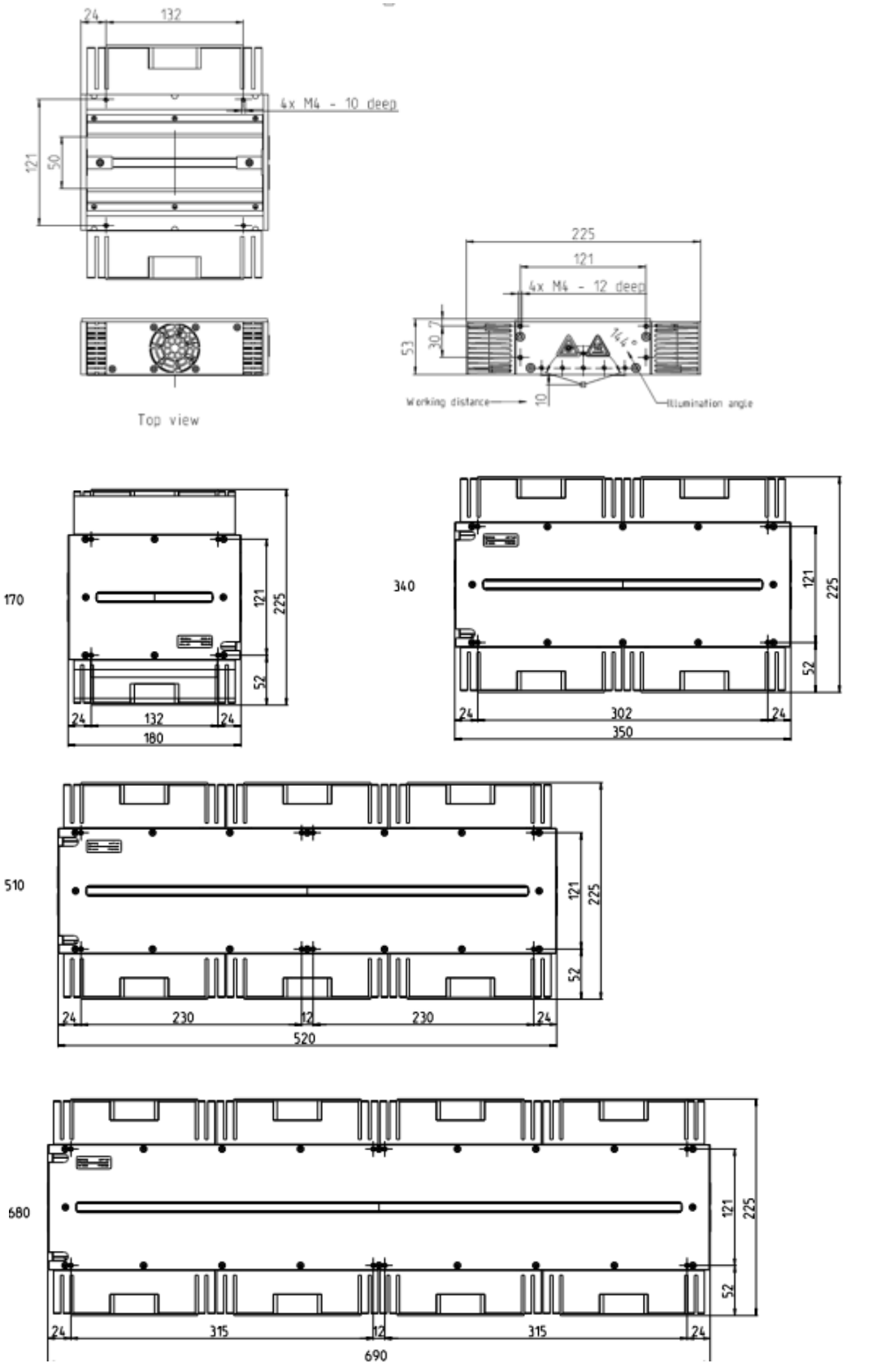


Figure 5-6 Mechanical fixation for tube light type version up to 680mm (type T and U)

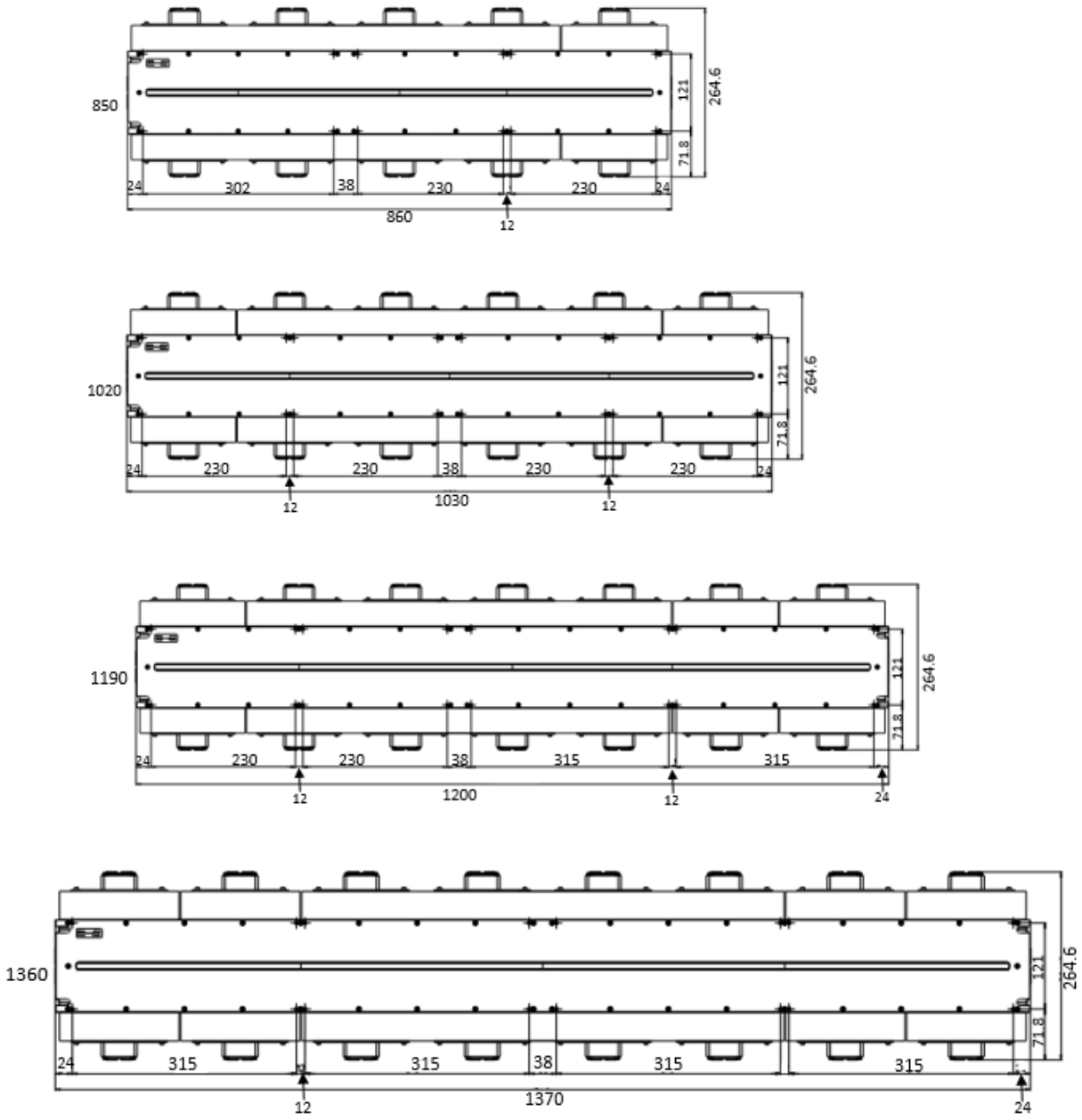


Figure 5-7 Mechanical fixation for tube light type version >680mm (type T and U)

5.2.2 Number of channels per module

For reflector type: A, B, C, D, and H:

Length (mm)	Number of channels	Number of XLC4-controllers
170	1	1
340	2	1
510	3	1
680	4	1
850	5	2
1020	6	2
1190	7	2
1360	8	2

For reflector type: T, U (Tube light):

Length (mm)	Ultra-high bright version		High bright version	
	Number of channels	Number of controllers	Number of channels	Number of controllers
170	4	1	2	1
340	8	2	4	1
510	12	3	6	2
680	16	4	8	2
850	20	5	10	3
1020	24	6	12	3
1190	28	7	14	4
1360	32	8	16	4

5.2.3 Mounting Corona II with length > 680 mm

It is recommended to use extra mounting structures for module length larger than 680mm. Please refer to following sample design:

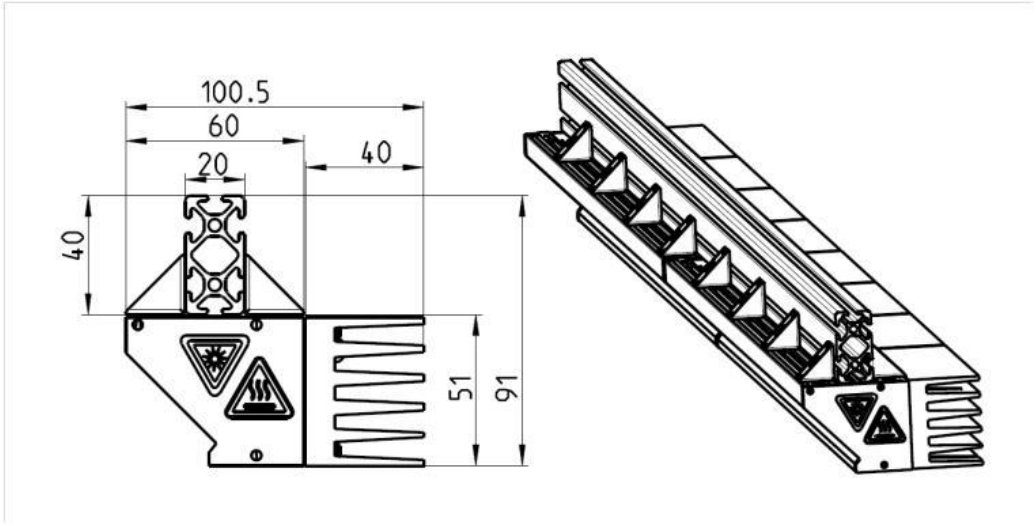


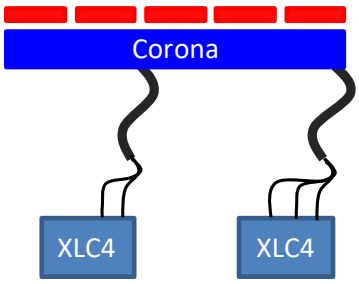
Figure 5-8 Mechanical mounting structure for long Corona II modules

5.2.4 Cabling and operating Corona II with length > 680 mm

Corona II longer than 680 mm are set up with different segments to length up to 1360 mm.

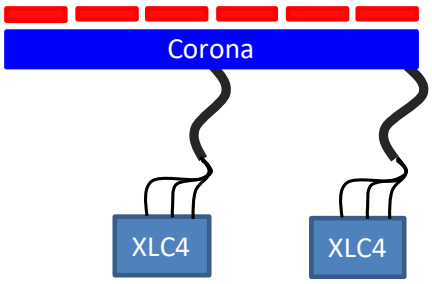
- A single XLC4 controller can serve four channels, so two controllers are needed.
- Both segments are equipped with its own temperature sensor and identification chip. Both chips will have the same serial number, but they have the individual numbers of channels saved.
- Each Corona II has two separate cables to be connected to two different XLC4 controllers.
- In the XLC4 commander the user must set up two connections with two tabs to control the two XLC4 separately.
- Cable lengths start at the fixing of the cable at the housing. If a cable is guided to one side, take care of the effective cable length of the second cable starting at the center of the module.

850 mm



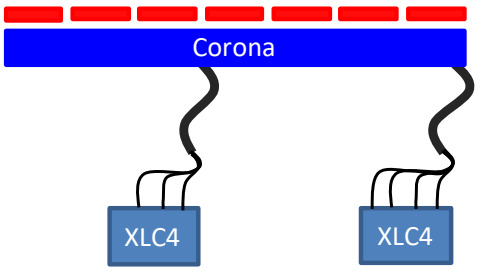
	Number of channels
Segment 1	2
Segment 2	3

1020 mm



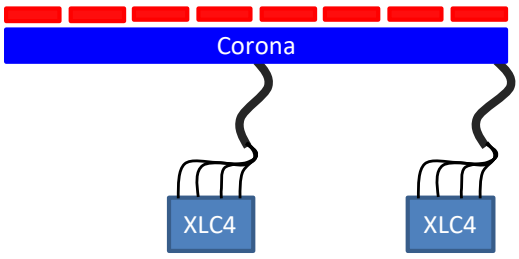
	Number of channels
Segment 1	3
Segment 2	3

1190 mm



	Number of channels
Segment 1	3
Segment 2	4

1360 mm



	Number of channels
Segment 1	4
Segment 2	4

5.3 Reflector types / Working distances (ID 2)

5.3.1 General setups

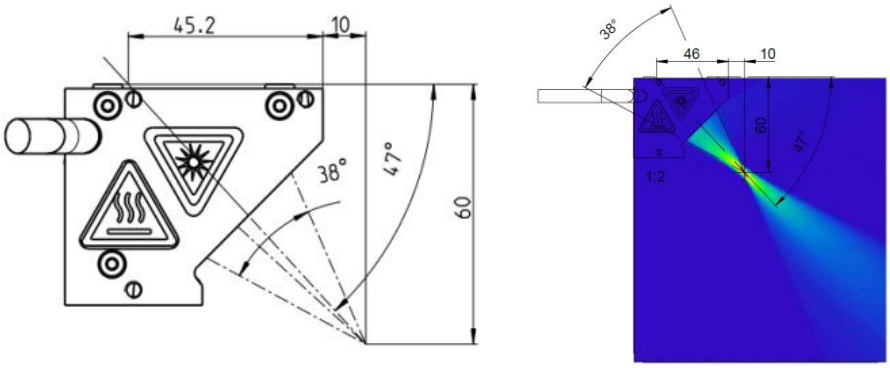


Figure 5-9: Focal length – 60 mm (ID 2 = A)
Working distance 50 – 70 mm

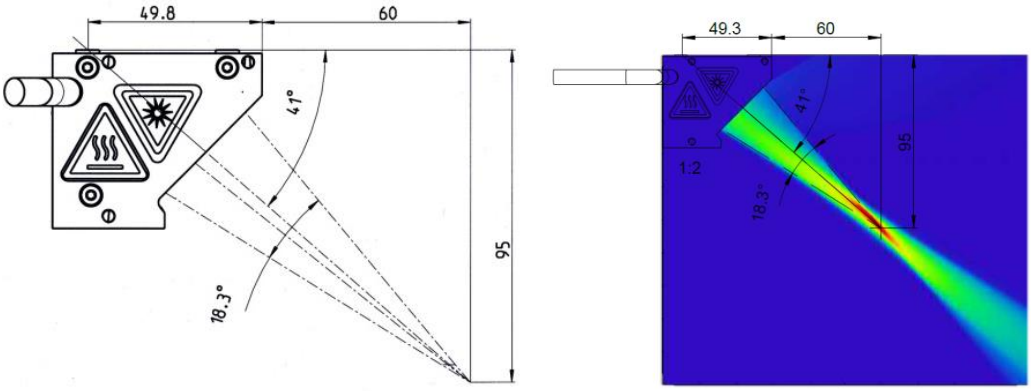


Figure 5-10 Focal length – 95 mm (ID 2 = B)
Working distance 70 – 120 mm

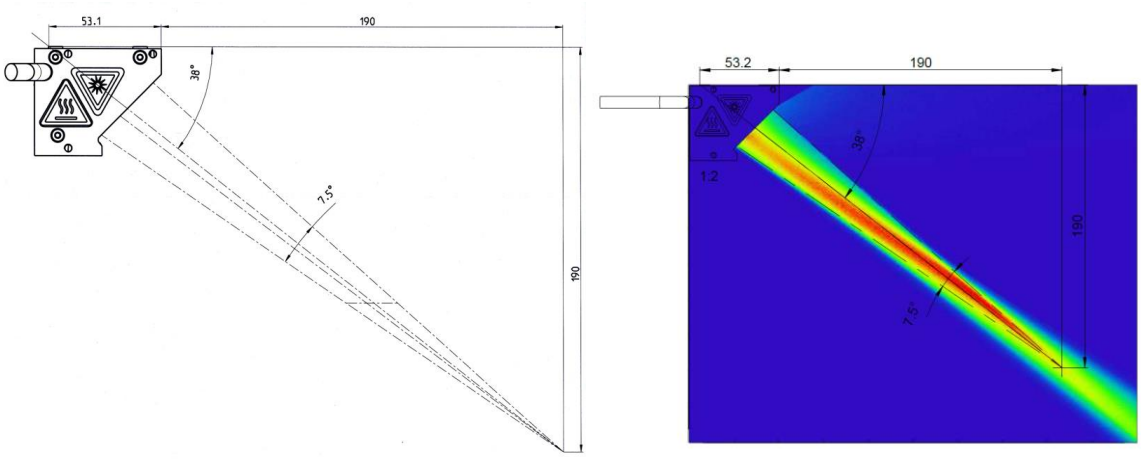


Figure 5-11 Focal length – 190 mm (ID 2 = C)
Working distance 120 – 300 mm

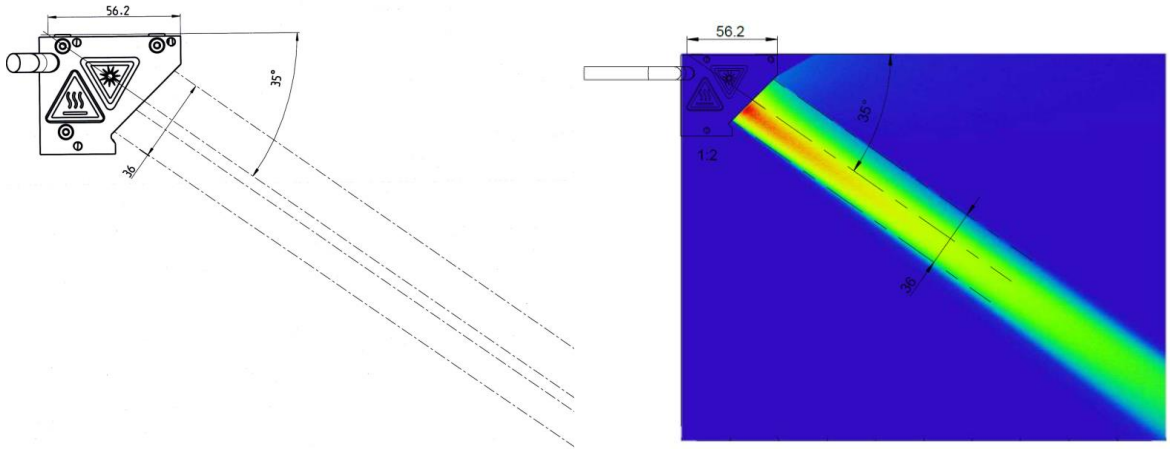


Figure 5-12 Parallel beam (ID 2 = D), Working distance >300 mm

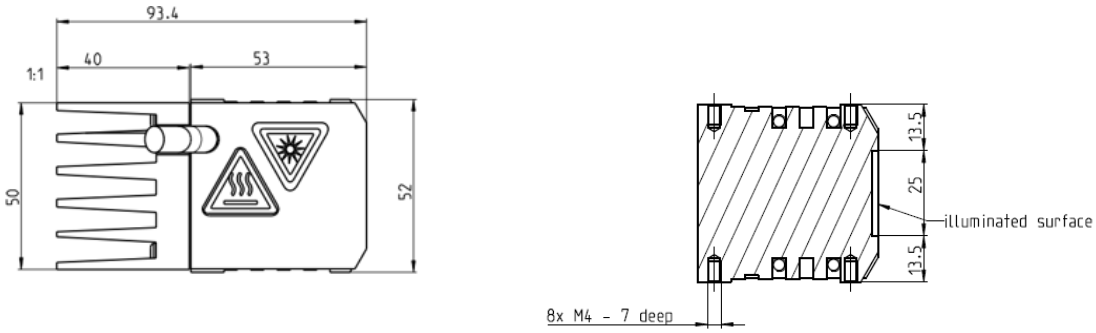


Figure 5-13 Bright field version (ID 2 = H)

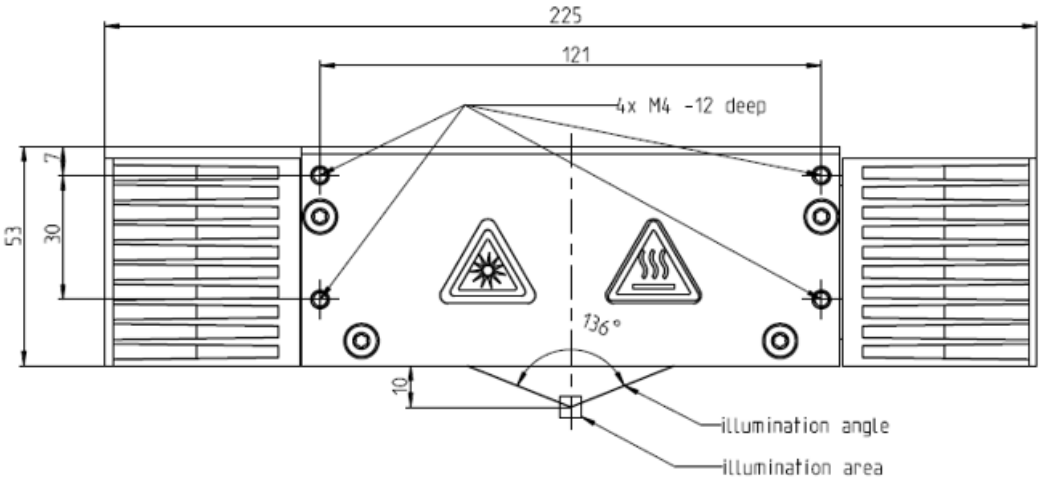


Figure 5-14 Tube light version (ID 2 = T and U)

ID2=T ID2=U

Figure 5-15 Different viewing angles for Tube light version

5.3.2 Coaxial modules

As an extension for the dark field modules as well for the brightfield modules are coaxial beam splitter setups are available. With the dark field setup, the possible focus options are B, C or D (option A is not applicable).

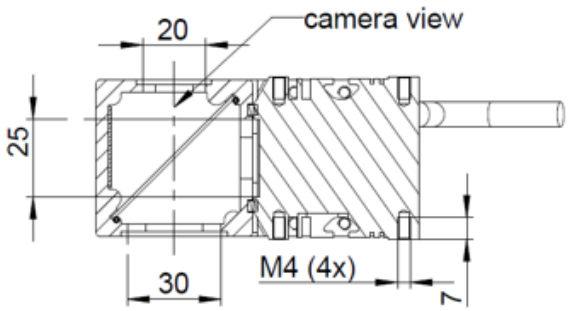


Figure 5-16 Setup for bright field module

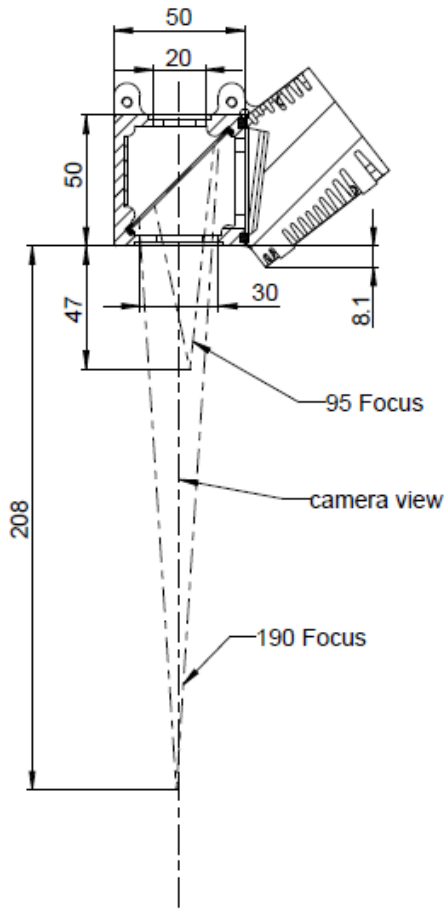


Figure 5-17 Setup for dark field module

In addition, it's possible to order protection screens with AR coating to avoid dust on the beam splitter.

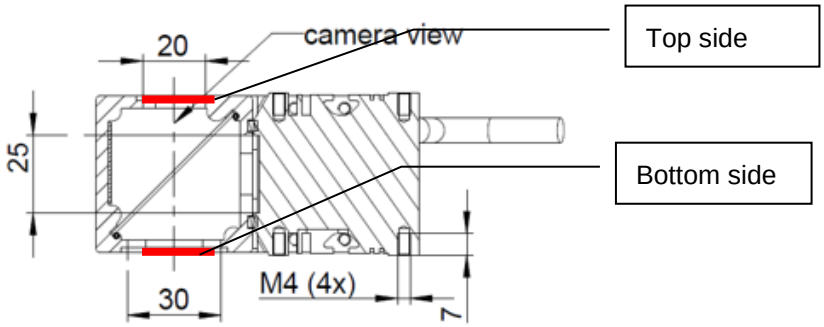


Figure 5-18 Protection screen options

CXT	Top side protection screen
CXB	Bottom side protection screen
CXS	Both sides protection screen
CXN	no protection screens

Note: Protections screens towards the object might cause some optical effects, so these options should be used carefully.

5.3.3 Illumination characteristics

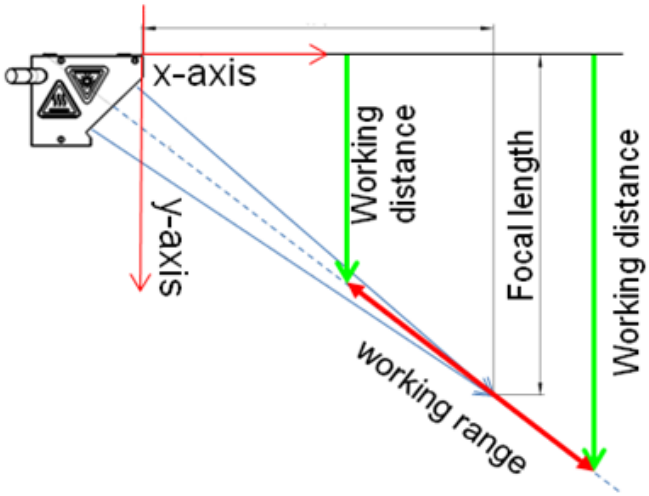


Figure 5-19 Definition of coordinate system of the Corona illumination

Conditions:

All charts are based on cool white LED (LED-color ID=04) and the maximum current of 1.8 amps.

All simulations and measurements are performed with screen option 1 “Glass with little diffusion”. To get the values for the other screen option apply with the following correction factors.

	Screen 1 & 3	Screen 2	Screen 4 & 7
	Glass, low diffusion	Polarizer screen	Glass, medium diffusion
Relative Illuminance @ 100 mm	100 %	approx. 40 %	approx. 50 %

The detector planes are orientated parallel to the x-axis.

		Recommended working distances	
	Focal length	From	To
Reflector “A”	60 mm	50 mm	70 mm
Reflector “B”	95 mm	70 mm	120 mm
Reflector “C”	190 mm	120 mm	300 mm
Reflector “D”	parallel	300 mm	∞

Figure 5-20 Maximum light intensities over working distances - Type A (Focal length 60 mm)

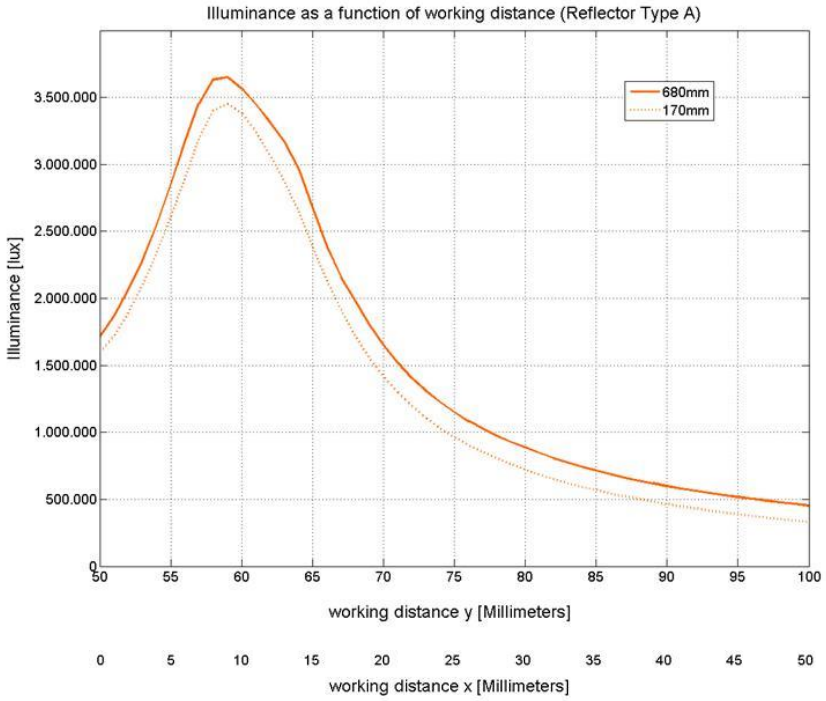
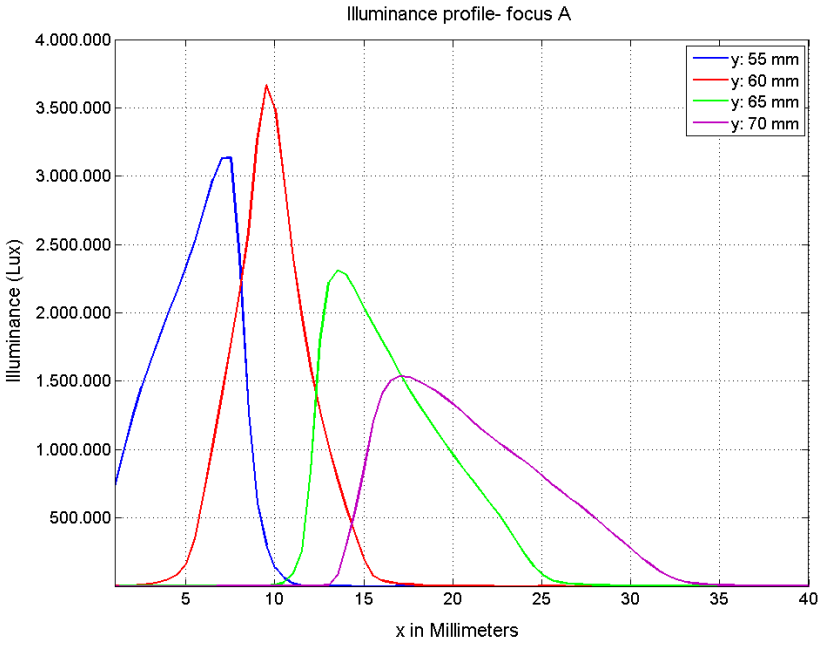


Figure 5-21 Typical illumination profile for reflector - Type A (Focal length 60 mm)



(Distribution of illumination along x-direction, measured in center of a 680mm module)

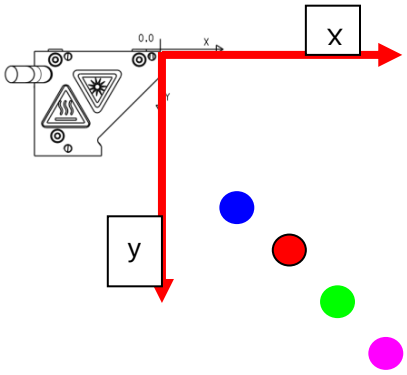


Figure 5-22 Maximum light intensities over working distances - Type B (Focal length 95 mm)

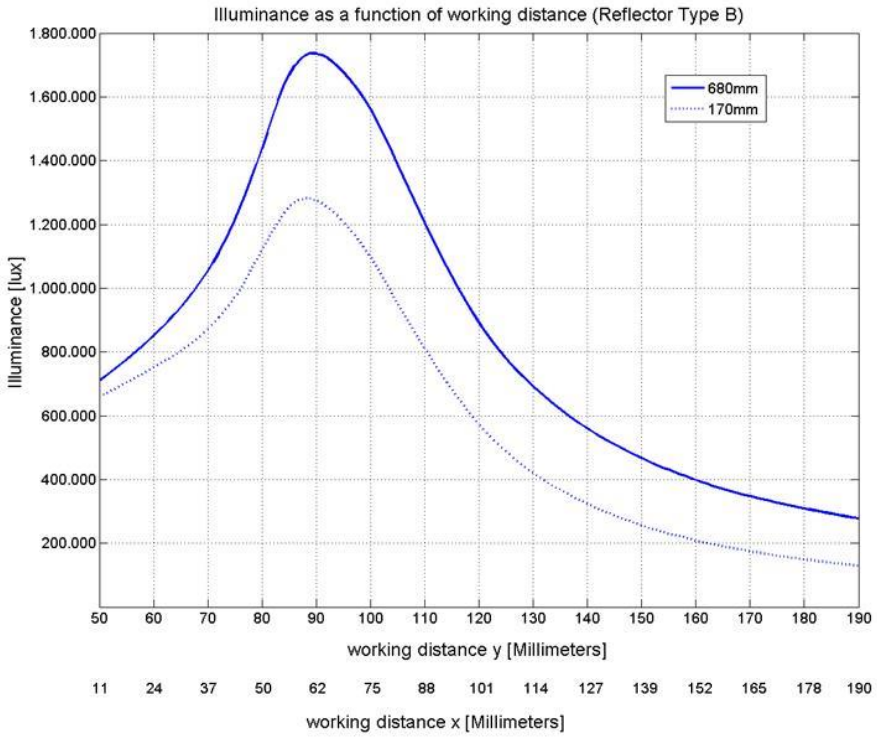
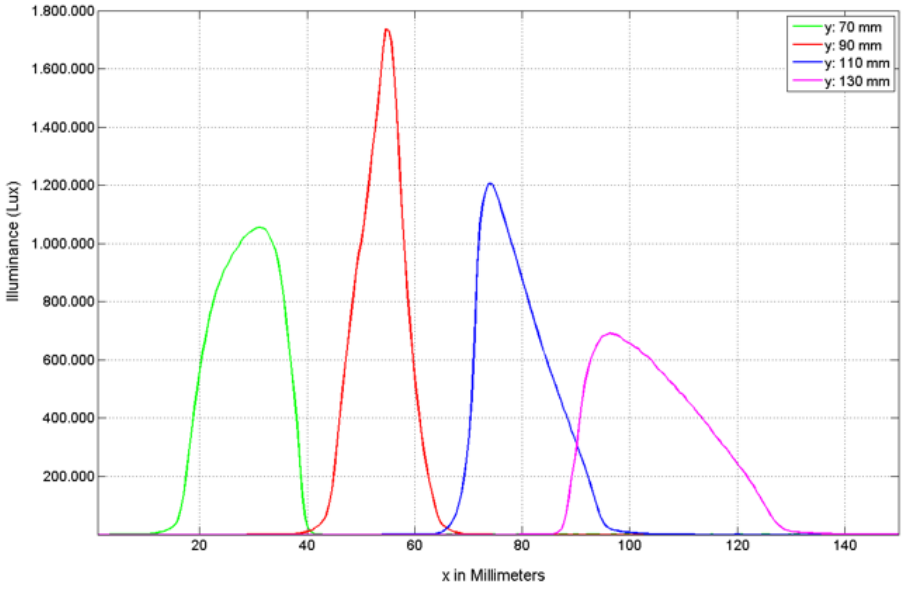


Figure 5-23 Typical illumination profile for reflector - Type B (Focal length 95 mm)



(Distribution of illumination along x-direction, measured in center of a 680mm module)

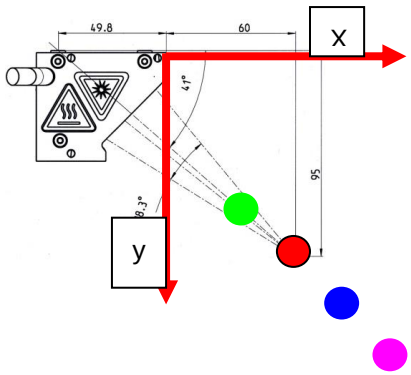


Figure 5-24 Maximum light intensities over working distances - Type C (Focal length 190 mm)

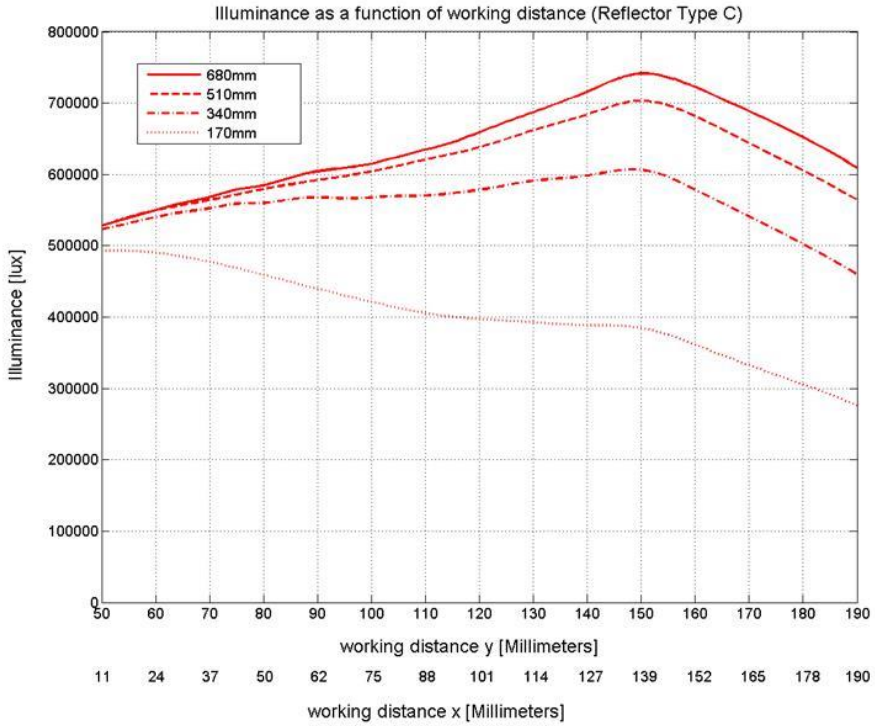
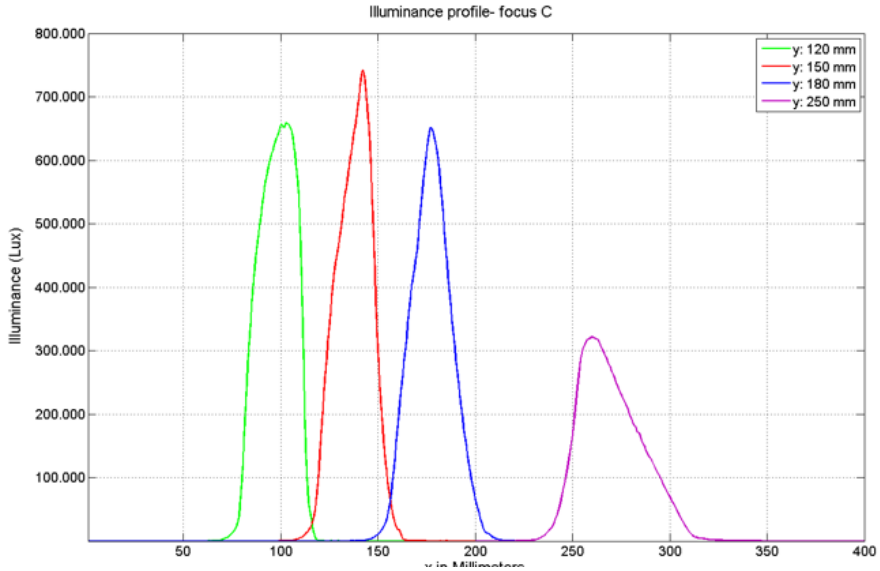


Figure 5-25 Typical illumination profile for reflector - Type C (Focal length 190 mm)



(Distribution of illumination along x-direction, measured in center of a 680 mm module)

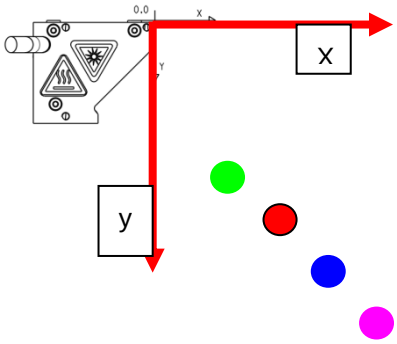


Figure 5-26 Maximum light intensities over working distances - Type D (Parallel beam)

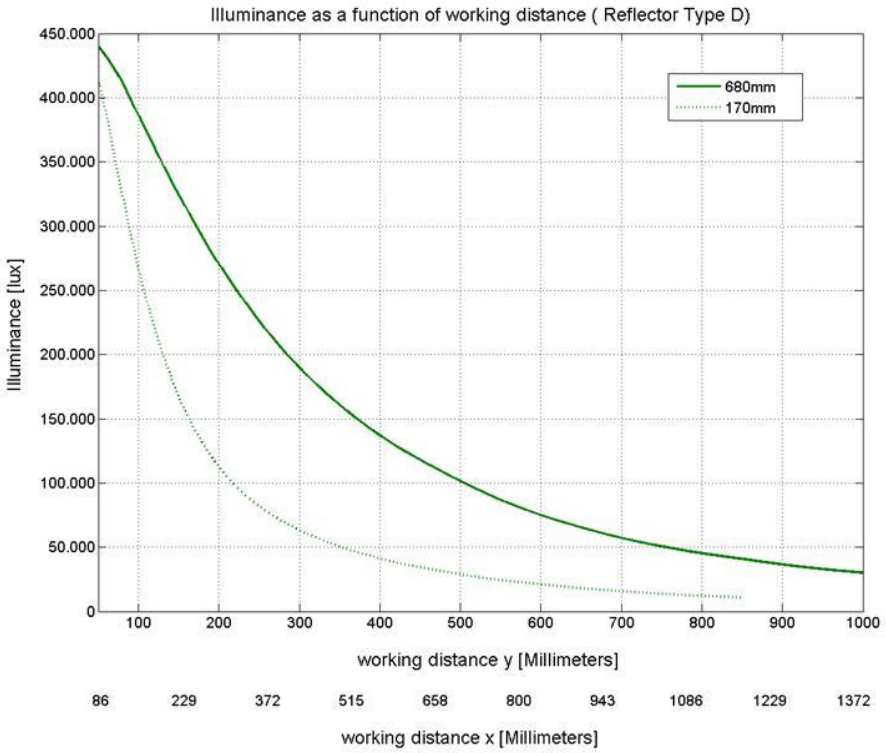
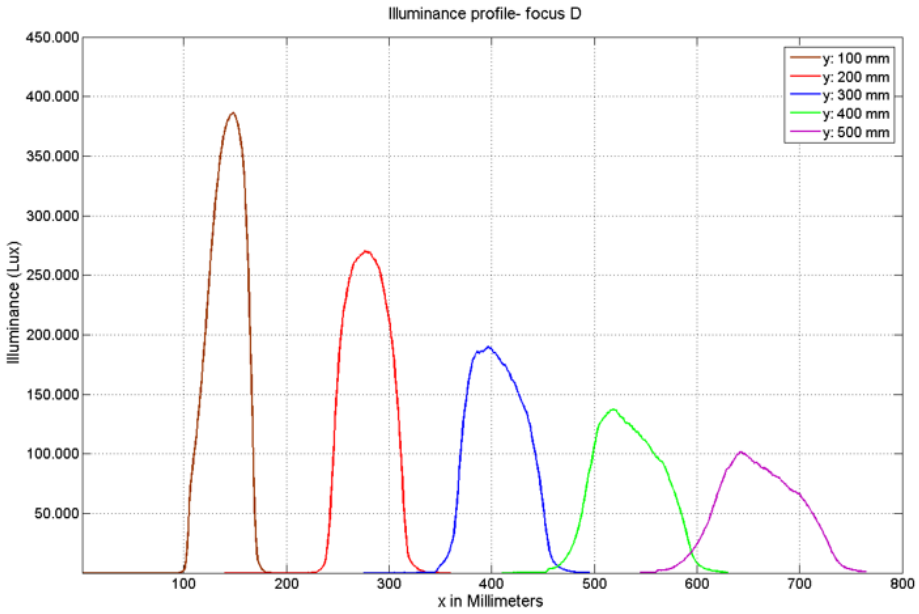
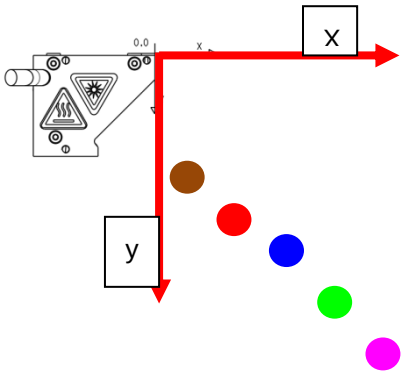


Figure 5-27 Typical illumination profile for reflector - Type D (Parallel beam)



(Distribution of illumination along x-direction, measured in center of a 680 mm module)



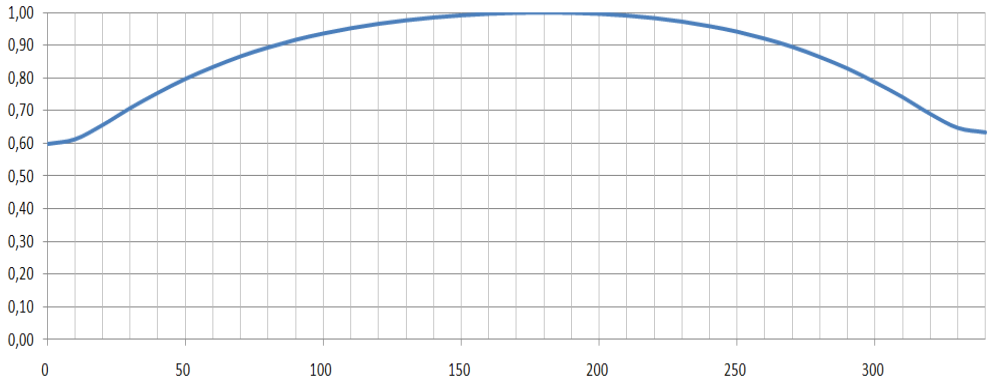


Figure 5-28 Typical illumination distribution parallel to illumination unit (reflector B / module length=340 mm, measured in focus plane)

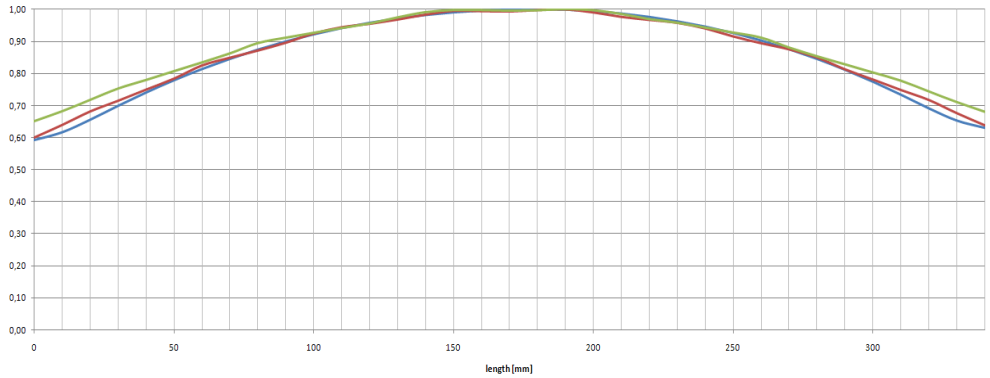


Figure 5-29 Typical illumination distribution parallel to illumination unit (Reflector C / Length=340 mm, measured in y=120 mm, y=150 mm, y=190 mm)

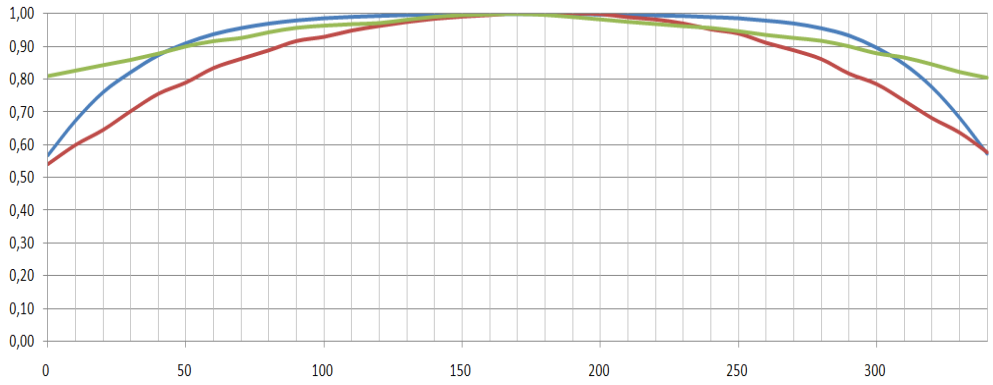


Figure 5-30 Typical illumination distribution parallel to illumination unit (Reflector D / Length=340mm, measured in y=50 mm, y=100 mm, y=300 mm)

5.3.4 Comparison of focal types

Figure 5-31 Reflector type A (60 mm) versus reflector type B (95 mm)

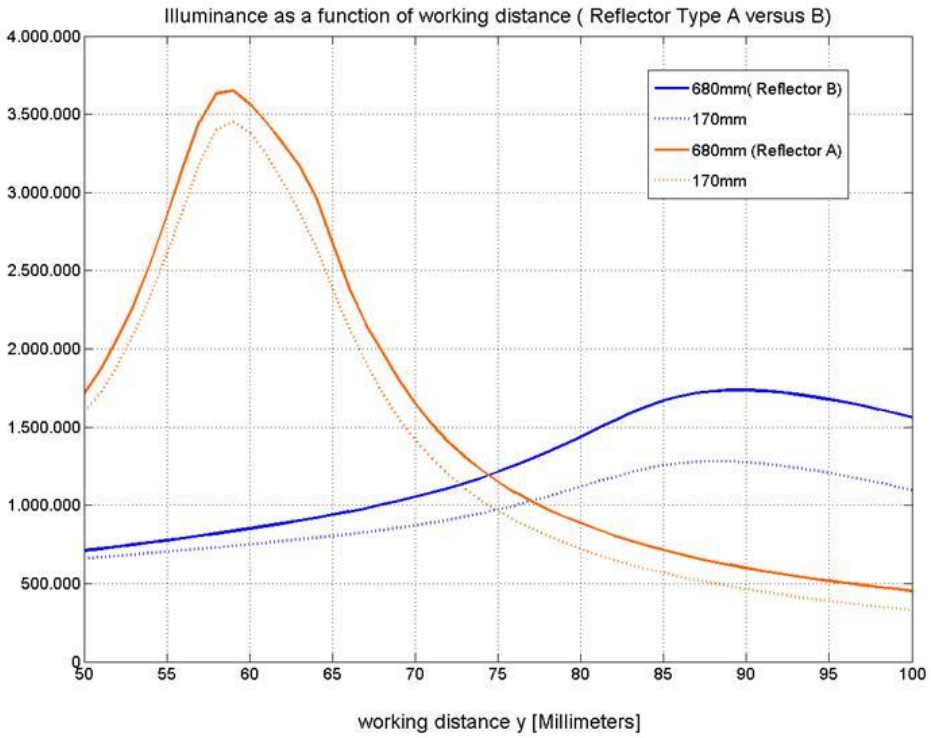


Figure 5-32 Reflector type B (95 mm) versus reflector type C (190 mm)

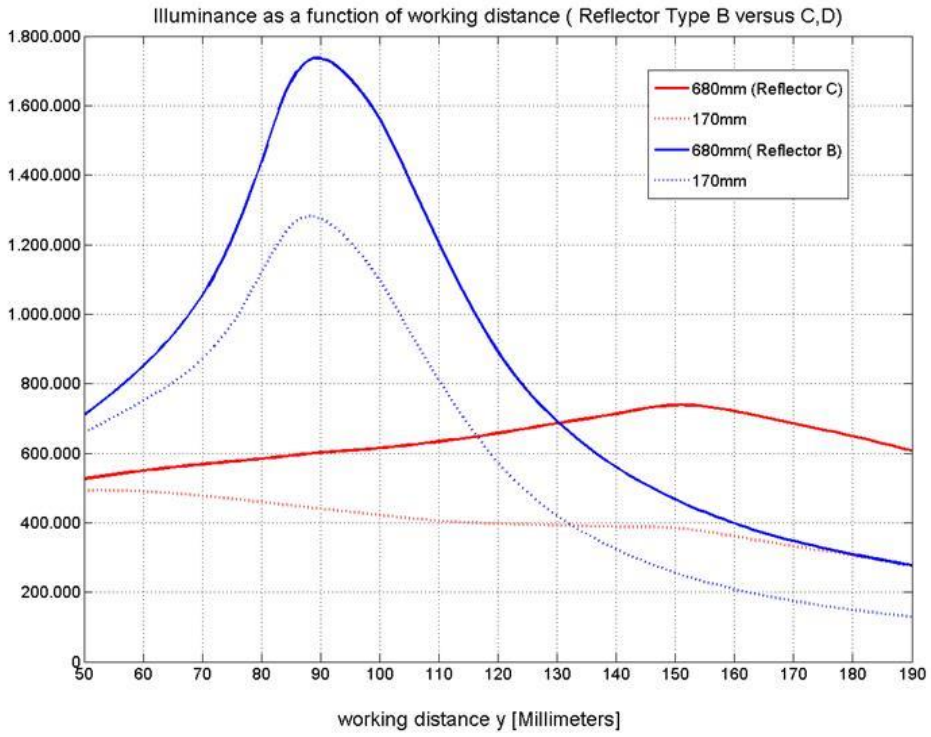
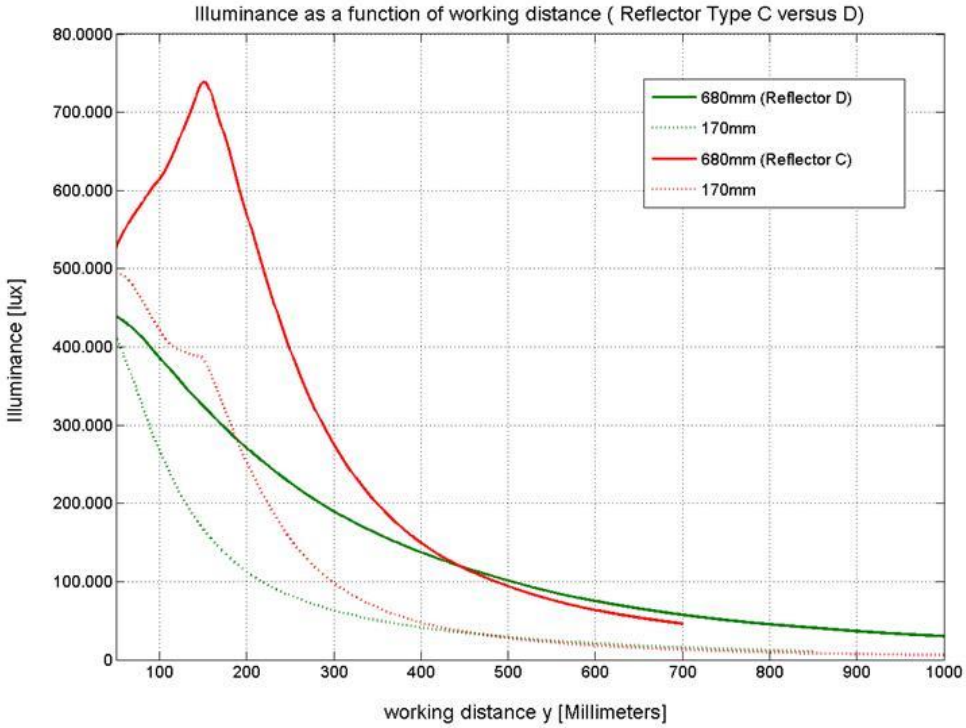


Figure 5-33 Reflector type C (190 mm) versus reflector type D (parallel)



5.3.5 Illuminance

The illuminance/irradiance on the target plane depends on various parameters.

These parameters are:

- Reflector type
- Operating current
- LED temperature
- LED type used in module
- LED specimen

Reflector type	LED-Type	Illuminance [lx] (min.) @ 1.8 A	Irradiance [W/m²] (min.) @ 1.8 A	y-distance to Module-Top-Plane [mm]	Notes
A	04	3.500.000	11.000	y = 60 mm	1,2
B	04	1.200.000	3.800	y = 90 mm	1,2
C	04	550.000	1.750	y = 120 mm	1,2
D	04	390.000	1.200	y = 50 mm	1,2

Reflector type	LED-Type	Illuminance [lx] (min.) @ 1.5 A	Irradiance [W/m²] (min.) @ 1.5 A	y-distance to Module-Top-Plane [mm]	Notes
A	01	2.200.000	12.500	y = 60 mm	1,2
B	01	670.000	3.800	y = 90 mm	1,2
C	01	330.000	1.900	y = 120 mm	1,2
D	01	230.000	1.300	y = 50 mm	1,2

Reflector type	LED-Type	Illuminance [lx] (min.) @ 1.5 A	Irradiance [W/m²] (min.) @ 1.5 A	y-distance to Module-Top-Plane [mm]	Notes
A	02	2.300.000	4.600	y = 60 mm	1,2
B	02	780.000	1.600	y = 90 mm	1,2
C	02	360.000	730	y = 120 mm	1,2
D	02	250.000	500	y = 50 mm	1,2

Reflector type	LED-Type	Illuminance [lx] (min.) @ 1.5 A	Irradiance [W/m²] (min.) @ 1.5 A	y-distance to Module-Top-Plane [mm]	Notes
A	03	500.000	14.800	y = 60 mm	1,2
B	03	165.000	4850	y = 90 mm	1,2
C	03	77.000	2250	y = 120 mm	1,2
D	03	55.000	1600	y = 50 mm	1,2

Reflector type	LED-Type		Irradiance [W/m²] (min.) @ 1.8 A	y-distance to Module-Top-Plane [mm]	Notes
A	08		16.900	y = 60 mm	1,2
B	08		5.500	y = 90 mm	1,2
C	08		2.500	y = 120 mm	1,2
D	08		1.800	y = 50 mm	1,2

Reflector type	LED-Type		Irradiance [W/m²] (min.) @ 1.8 A	y-distance to Module-Top-Plane [mm]	Notes
A	09		15.500	y = 60 mm	1,2
B	09		5.100	y = 90 mm	1,2
C	09		2.400	y = 120 mm	1,2
D	09		1.600	y = 50 mm	1,2

Reflector type	LED-Type		Irradiance [W/m²] (min.) @ 1.0 A	y-distance to Module-Top-Plane [mm]	Notes
A	33		13.900	y = 60 mm	1,2
B	33		4.800	y = 90 mm	1,2
C	33		2.100	y = 120 mm	1,2
D	33		1.000	y = 50 mm	1,2

Reflector type	LED-Type		Irradiance [W/m²] (min.) @ 1.0 A	y-distance to Module-Top-Plane [mm]	Notes
A	30		11.600	y = 60 mm	1,2
B	30		4.000	y = 90 mm	1,2
C	30		1.800	y = 120 mm	1,2
D	30		850	y = 50 mm	1,2

Notes:

1. For all illuminance values, an LED chip temperature of TS = 90°C is assumed. Depending on the temperature situation in the system, these values can be higher or lower (see the charts in LED Colors (ID = 3), *page 47*)
2. The LEDs are selected by brightness and color. However, there may be a variation in brightness between different modules, even if temperature and operating current is identical

5.4 LED colors (ID = 3)

The spectral characteristics shown below are taken from the OSRAM datasheets with friendly authorization of OSRAM.

The charts represent the characteristics of a single LED. In each Corona II module, two balanced LED lines are connected in parallel to one external LED-channel. Therefore, the I_F values must be doubled to describe the behavior of a Corona II module.

5.4.1 Red (ID 3 = 01)

5.4.1.1 Spectral characteristics

Parameter	Symbol	Value	Unit
Wavelength at peak emission (type) I_F = 800mA	λ_{peak}	632	nm
Dominant wavelength (min) I_F = 800mA (max)	λ_{dom}	620 632	nm
Spectral bandwidth at 50% $I_{rel\ max}$ (type) I_F = 800mA	$\Delta\lambda$	18	nm

5.4.1.2 Relative spectral emission of red LED

$\phi_{rel} = f(\lambda)$; T_S =25; I_F= 800 mA

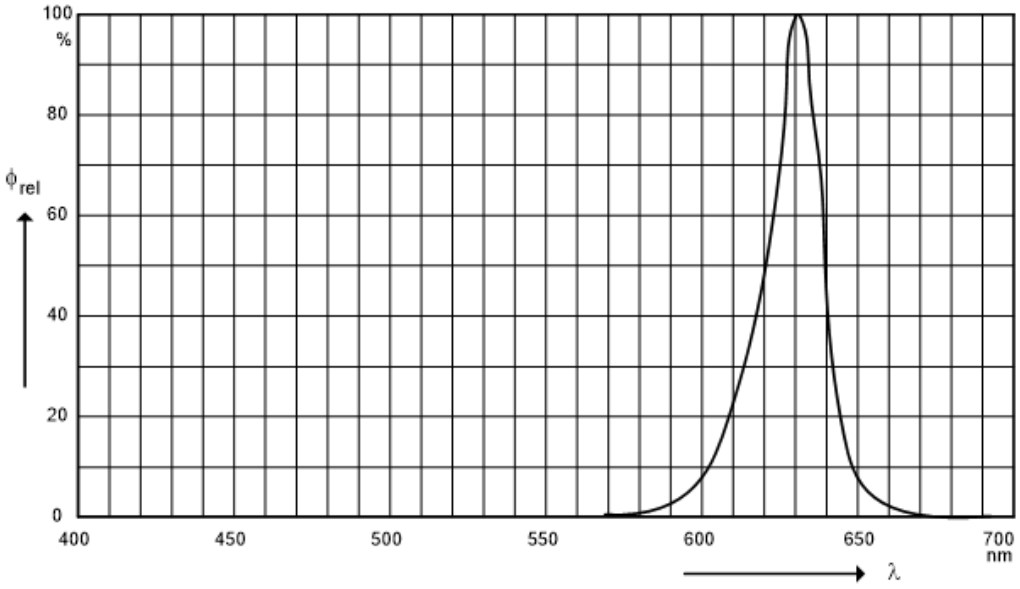


Figure 5-34 Relative spectral emission of red LED

5.4.1.3 Relative luminous flux of red LED

$\frac{\theta_V}{\theta_V(800mA)} = f(I_F)$; T_S=25 °C

$\frac{\theta_V}{\theta_V(25°C)} = f(T_J)$; I_F=800 mA

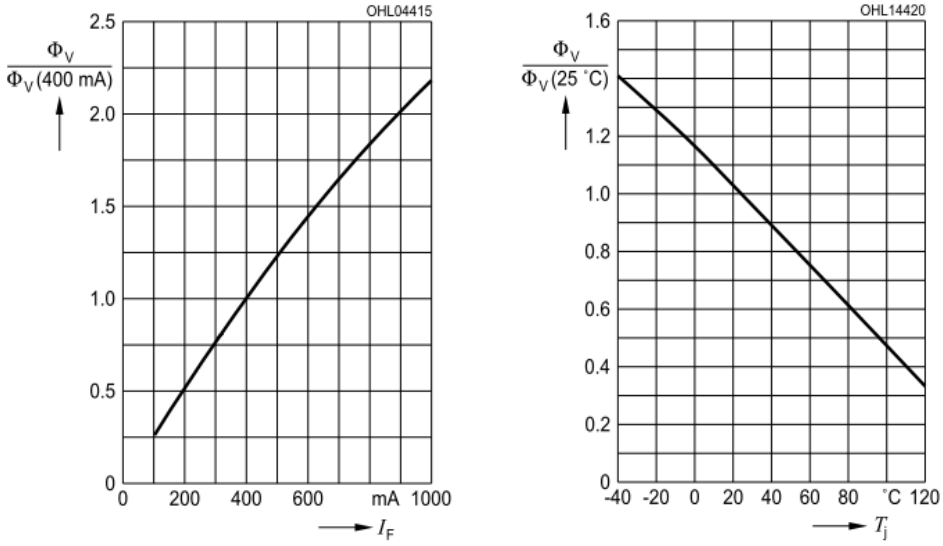


Figure 5-35 Relative luminous flux (in relation to operating current and temperature)

5.4.1.4 Shift of dominant wavelength of red LED

$\lambda_{dom} = f(T_J)$; I_F=800 mA

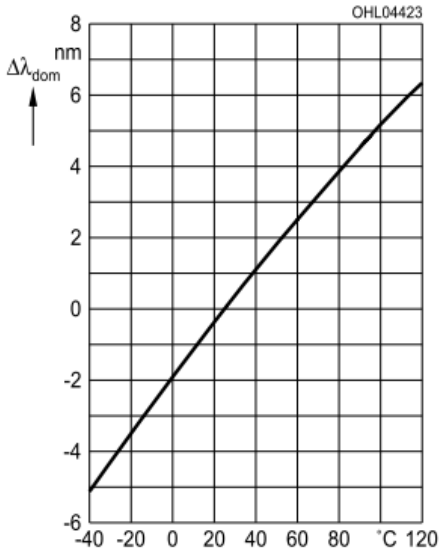


Figure 5-36 Shift of dominant wavelength – red LED

5.4.2 True green (ID 3 = 02)

5.4.2.1 Spectral characteristics

Parameter		Symbol	Value	Unit
Wavelength at peak emission (type) I_F = 700 mA		λ_{peak}	520	nm
dominant wavelength I_F = 700 mA	(min) (max)	λ_{dom}	513 537	nm
spectral bandwidth at 50% $I_{rel\ max}$ (type) I_F =700 mA		$\Delta\lambda$	33	nm

5.4.2.2 Relative spectral emission of true green LED

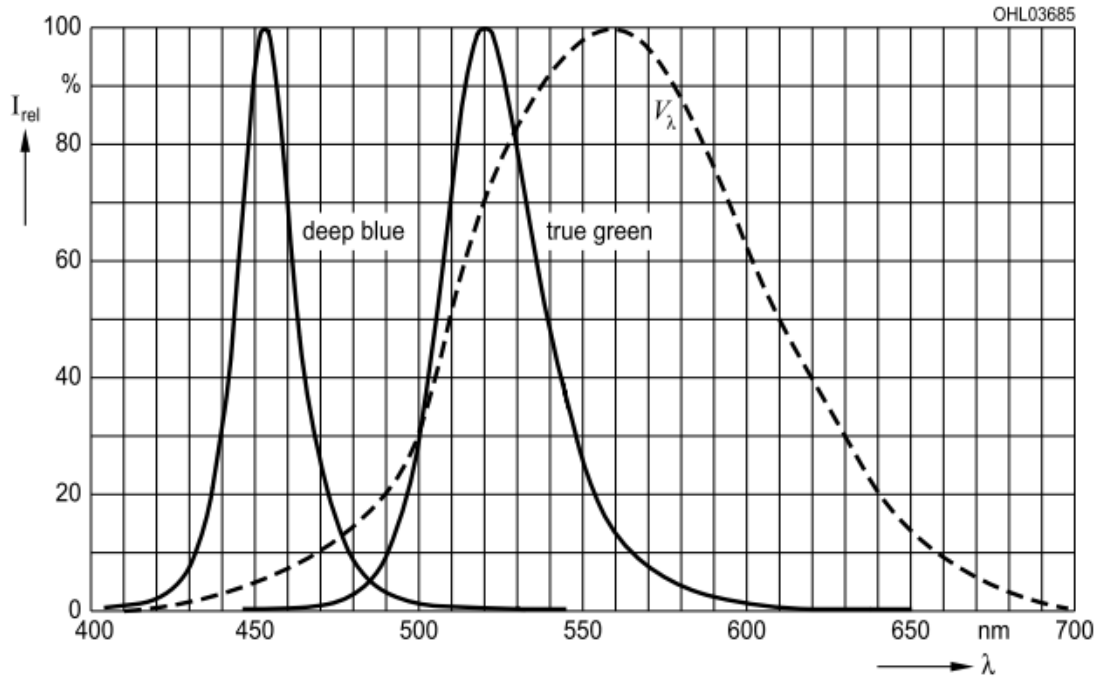


Figure 5-37 Relative spectral emission of true green LED

5.4.2.3 Relative luminous flux of true green LED

$\frac{\theta_V}{\theta_V(700mA)} = f(I_F)$; T_S=25 °C

$\frac{\theta_V}{\theta_V(25°C)} = f(T_J)$; I_F=700 mA

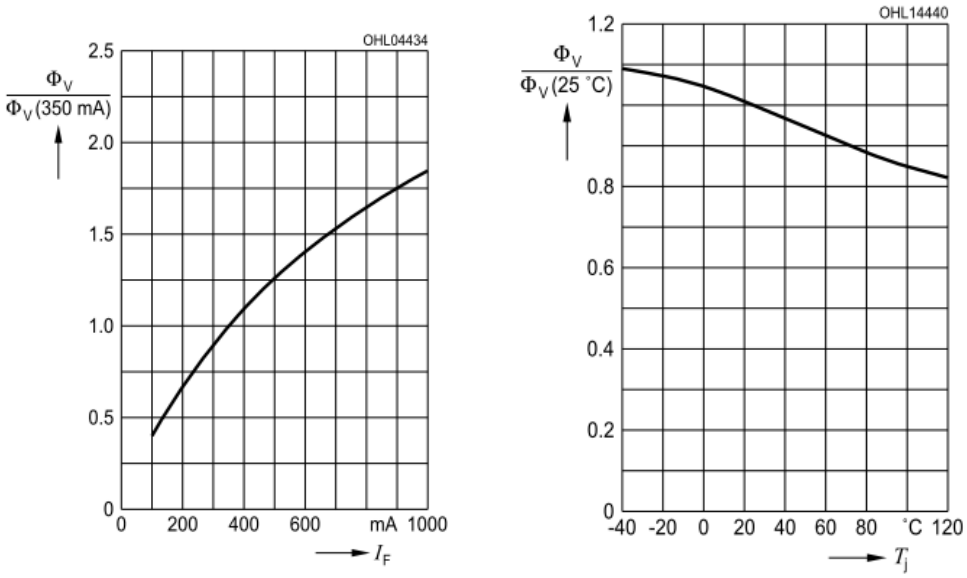


Figure 5-38 Relative luminous flux of true green LED

5.4.2.4 Shift of dominant wavelength of true green LED

$\lambda_{dom} = f(T_J)$; T_S=25 °C

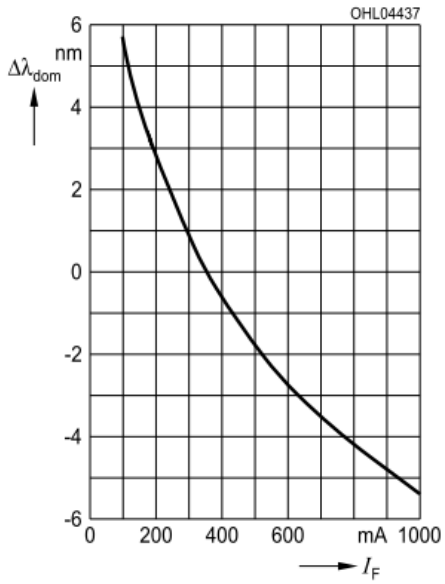


Figure 5-39 Shift of dominant wavelength of true green LED

5.4.3 Blue (ID 3 = 03)

5.4.3.1 Spectral characteristics of blue LED

Parameter		Symbol	Value	Unit
Wavelength at peak emission (type) I_F = 700 mA		λ_{peak}	452	nm
dominant wavelength I_F = 700 mA	(min) (max)	λ_{dom}	449 457	nm
spectral bandwidth at 50 % $I_{rel\ max}$ (type) I_F =700 mA		$\Delta\lambda$	25	nm

5.4.3.2 Relative spectral emission of blue LED

$\theta_{rel} = f(\lambda)$; T_S=25°C; I_F=700 mA

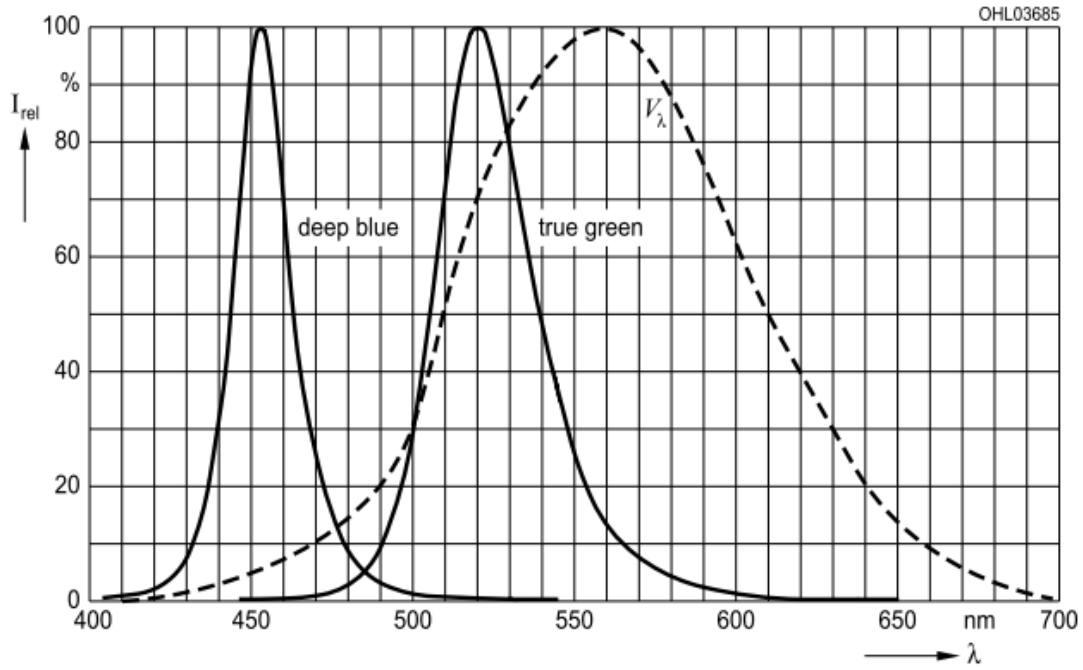


Figure 5-40 Relative spectral emission of blue LED

5.4.3.3 Relative luminous flux of blue LED

$\frac{\theta_E}{\theta_E(700mA)} = f(I_F)$; T_S=25 °C

$\frac{\theta_E}{\theta_E(25°C)} = f(T_J)$; I_F=700 mA

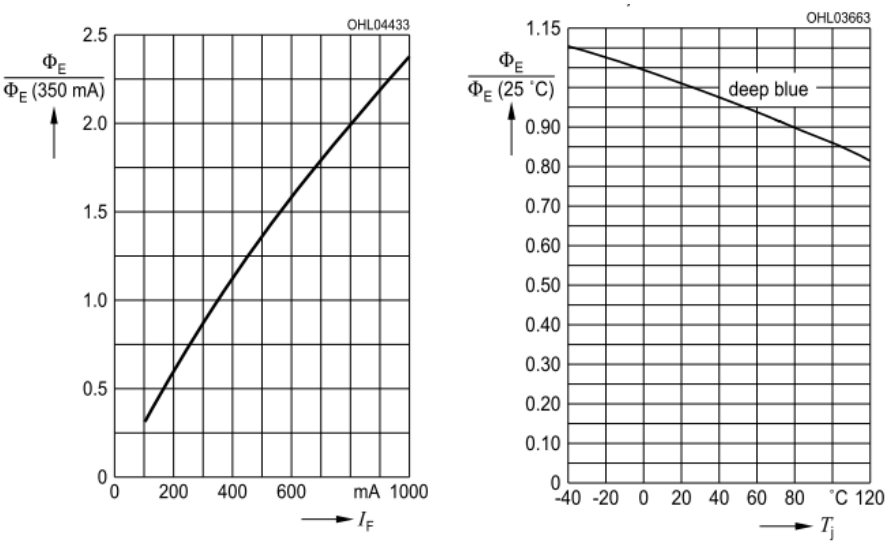


Figure 5-41 Relative luminous flux (in relation to operating current and temperature)

5.4.3.4 Shift of dominant wavelength of blue LED

$\lambda_{dom} = f(T_J)$; TS=25°C

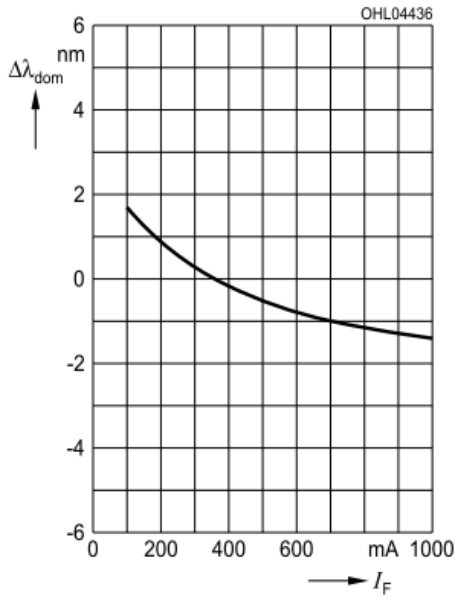


Figure 5-42 Shift of dominant wavelength of blue LED

5.4.4 White (ID 3 = 04 and ID3 =12)

5.4.4.1 Spectral characteristics of white LED

Parameter	Symbol	Value
Cool white LED (ID3=04)		
Chromaticity coordinate x acc. to CIE 1931 (type) I_F = 700 mA	x	0.31
Chromaticity coordinate y acc. to CIE 1931 (type) I_F = 700 mA	y	0.32
Warm white LED (ID3=12)		
Chromaticity coordinate x acc. to CIE 1931 (type) I_F = 700 mA	x	0.41
Chromaticity coordinate y acc. to CIE 1931 (type) I_F = 700 mA	y	0.39

5.4.4.2 Chromaticity coordinate groups of white LED

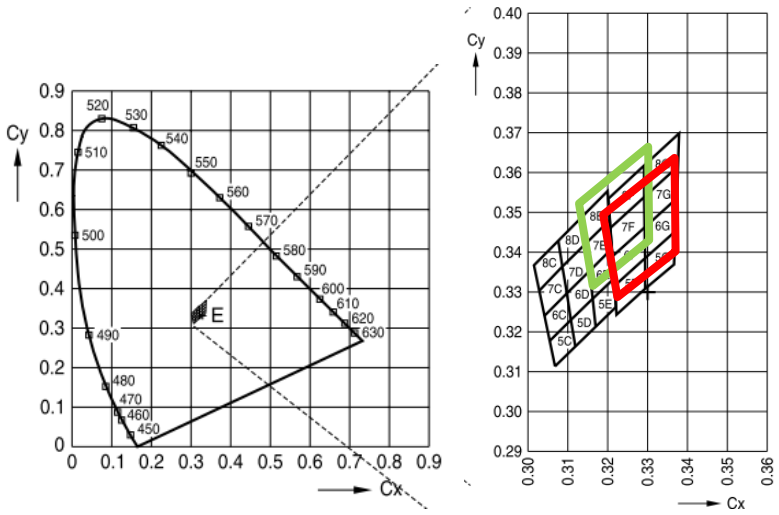


Figure 5-43 Chromaticity coordinate groups (cool white)

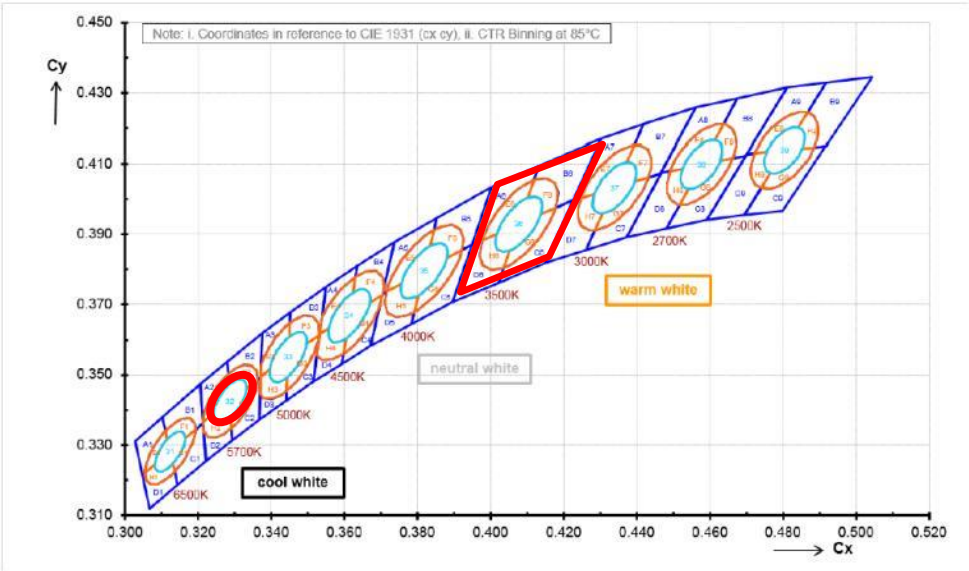


Figure 5-44 Chromaticity coordinate groups (warm white and cool white from SN 03460)

The LEDs in the Corona-modules are selected for color coordinates.

The following chromaticity coordinate groups are used in the Corona II:

- **Cool white:** 6E, 7E, 8E, 6F, 7F, 8F — up to serial number 01149
  5F, 6F, 7F, 5G, 6G, 7G — up to serial number 03460
  32
- **Warm white:** A636

It is not possible to order a Corona II with a specific subgroup. However, each Corona II unit only has LEDs of the same subgroup (e.g. 7E).

5.4.4.3 Typical relative spectal emission of white LED

$\theta_{rel} = f(\lambda)$; T_S=25°C; I_F=700 mA

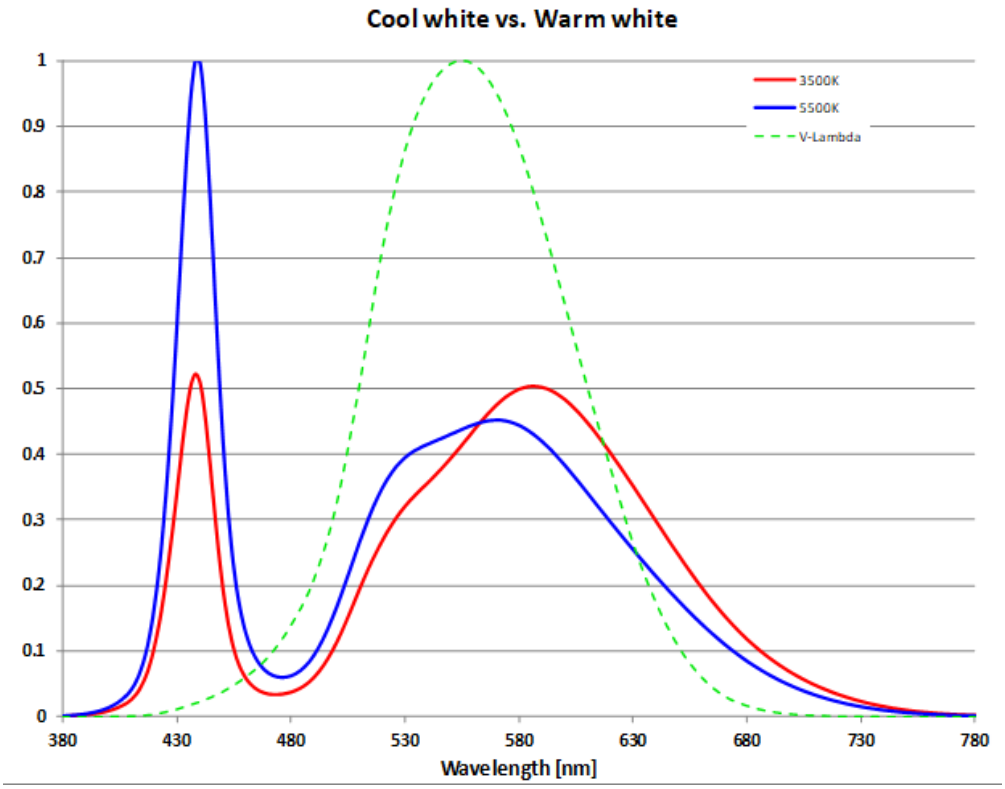


Figure 5-45 Typical relative spectral emission

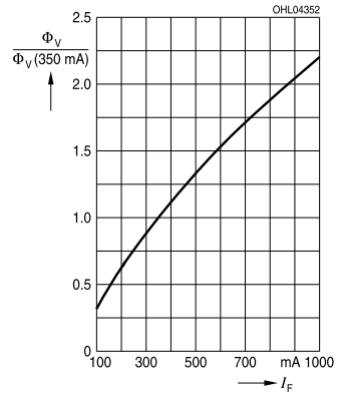
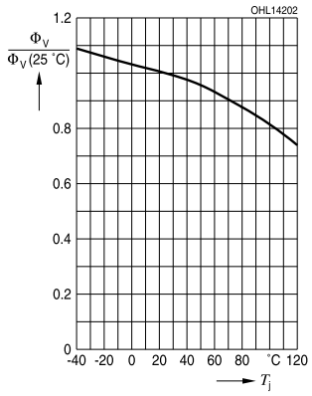
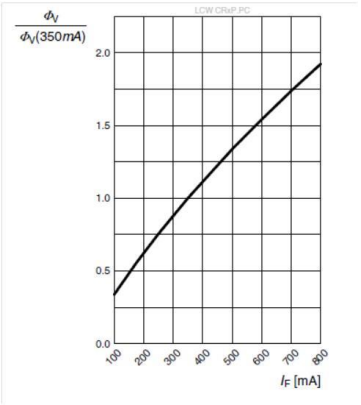
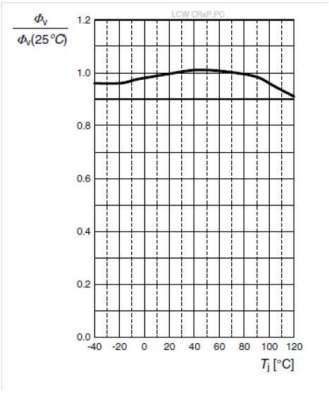
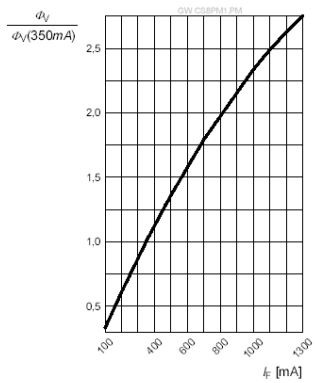
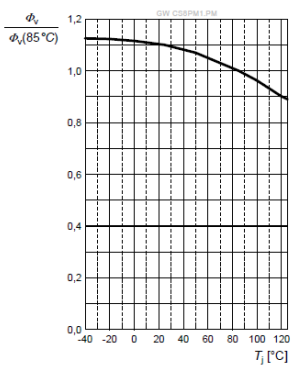
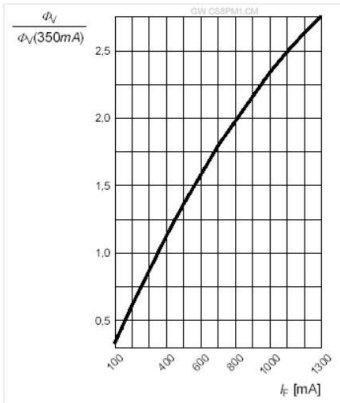
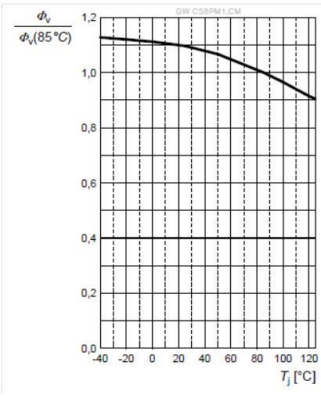
	In relation to current	In relation to temperature
Cool white Up to SN **01149**		
Cool white Up to SN **03460**		
Cool white		
Warm white		

Figure 5-46 Relative luminous flux (in relation to current and temperature)

5.4.4.4 Chromaticity coordinate shift of white LED

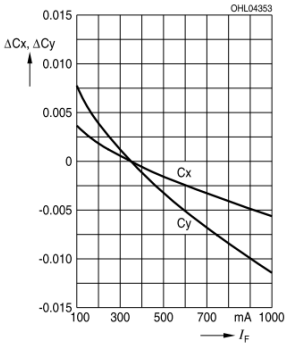
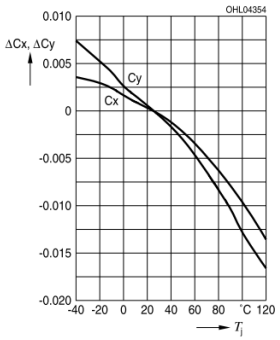
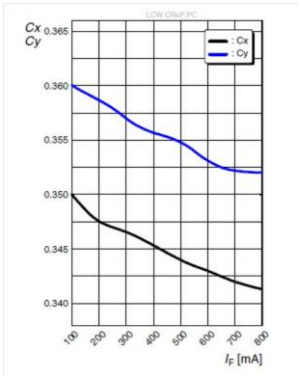
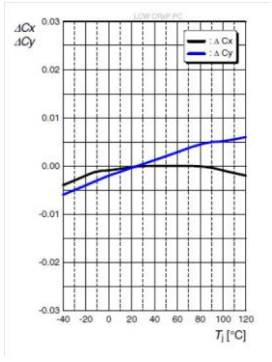
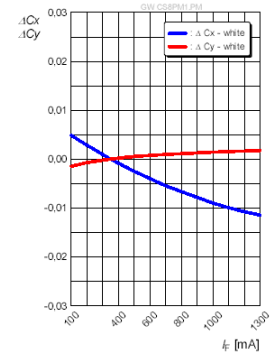
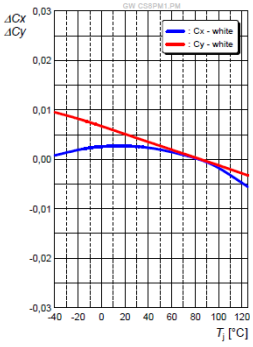
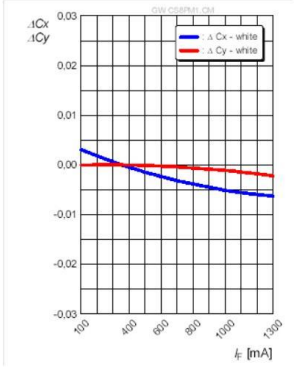
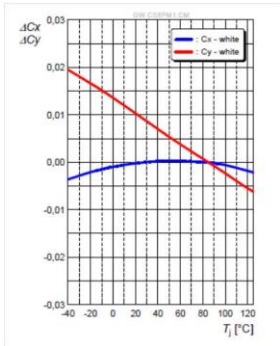
	In relation to current	In relation to temperature
Cool white Up to SN 01149	$x, y = f(I_F)$; Ts=25 °C 	$x, y = f(T_J)$; I_F=700 mA 
Cool white Up to SN 03460	$x, y = f(I_F)$; Ts=25 °C 	$x, y = f(T_J)$; I_F=350 mA 
Cool white	$x, y = f(I_F)$; Ts=85 °C 	$x, y = f(T_J)$; I_F=350 mA 
Warm white	$x, y = f(I_F)$; Ts=85 °C 	$x, y = f(T_J)$; I_F=350 mA 

Figure 5-47 Chromaticity coordinate shift

5.4.5 Infrared 850nm (ID 3 = 08)

5.4.5.1 Spectral characteristics of IR 850 nm-LED

Parameter	Symbol	Value	Unit
Wavelength at peak emission (typ.) I_F = 1800 mA	λ_{peak}	860	nm
centroid wavelength (min) I_F = 1800 mA	$\lambda_{centroid}$	850	nm
spectral bandwidth at 50% $I_{rel\ max}$ (typ.) I_F =1800 mA	$\Delta\lambda$	30	nm

5.4.5.2 Relative spectral emission of IR 850 nm-LED

T_S=25 °C; I_F=1800 mA

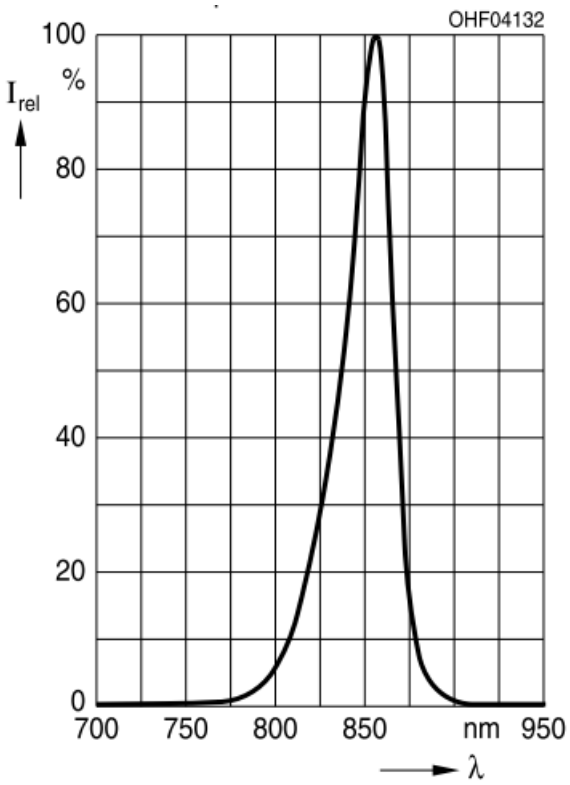


Figure 5-48 Relative spectral emission of IR850 LED

5.4.5.3 Relative radiant flux of IR850 nm-LED

$$\frac{\theta_E}{\theta_E(700mA)} = f(I_F)$$; T_S=25°C

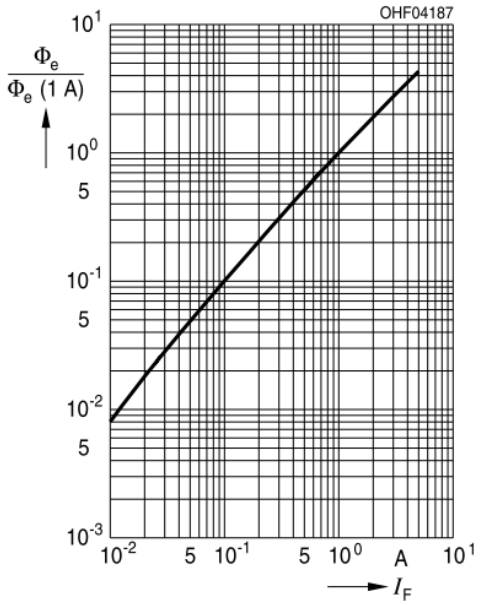


Figure 5-49 Relative radiant flux (in relation to operating current)

5.4.6 Infrared 940nm (ID 3 = 09)

5.4.6.1 Spectral characteristics of IR 940 nm-LED

Parameter	Symbol	Value	Unit
Wavelength at peak emission (typ.) I_F = 1800mA	λ_{peak}	950	nm
centroid wavelength (min) I_F = 1800mA	$\lambda_{centroid}$	940	nm
spectral bandwidth at 50% $I_{rel\ max}$ (typ.) I_F =1800mA	$\Delta\lambda$	37	nm

5.4.6.2 Relative spectral emission of IR940 nm-LED

T_S=25 °C; I_F=1800 mA

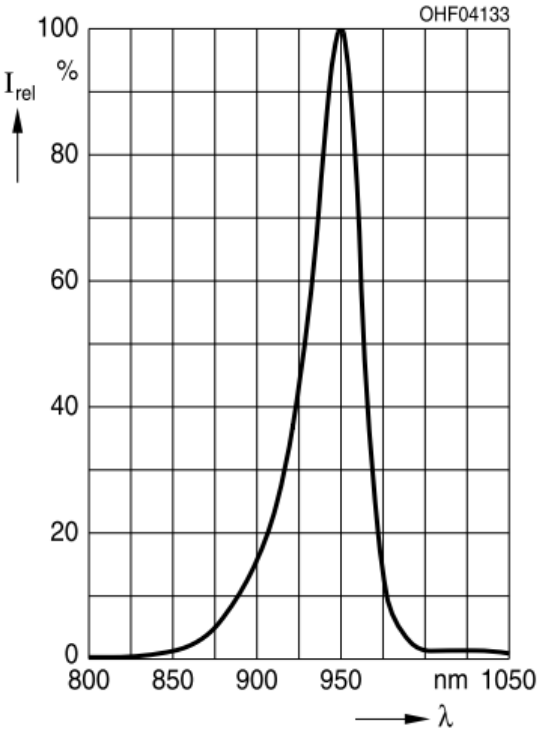


Figure 5-50 Relative spectral emission of IR940 LED

5.4.6.3 Relative radiant flux of IR940 nm LED

$$\frac{\theta_E}{\theta_E(700mA)} = f(I_F)$$; T_S=25 °C

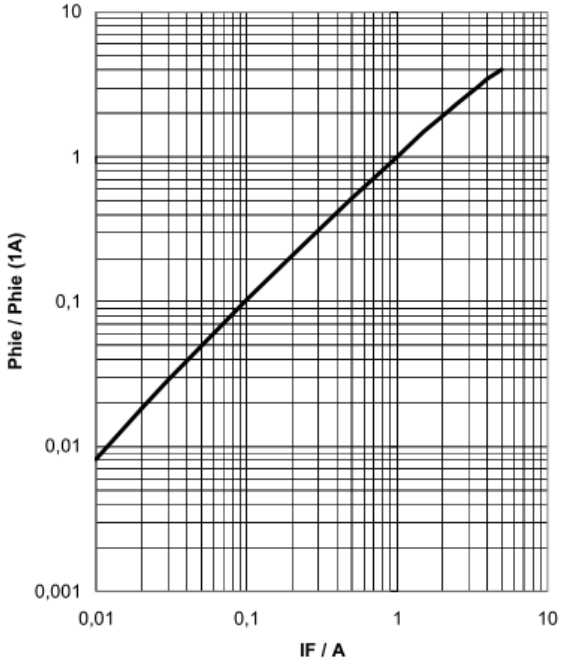


Figure 5-51 Relative radiant flux (in relation to operating current)

5.4.7 Standard light color D50 (ID 3 = 07 and 10)

The option D50 light is a mixture of 3 or 4 different LEDs to adjust the spectral behavior of D50 standard light source best.

The weights between the different LED colors are saved in the Corona identification chip. The controller reads these values at the boot process. In the XLC4 commander the D50 is shown as a single unit. Adjustment of brightness is done by using the weights of the single colors.

For further information of operating the D50 Corona, see section 8.5 “Operating the D50 Corona”.

5.4.7.1 Relative spectral emission of D50 light color

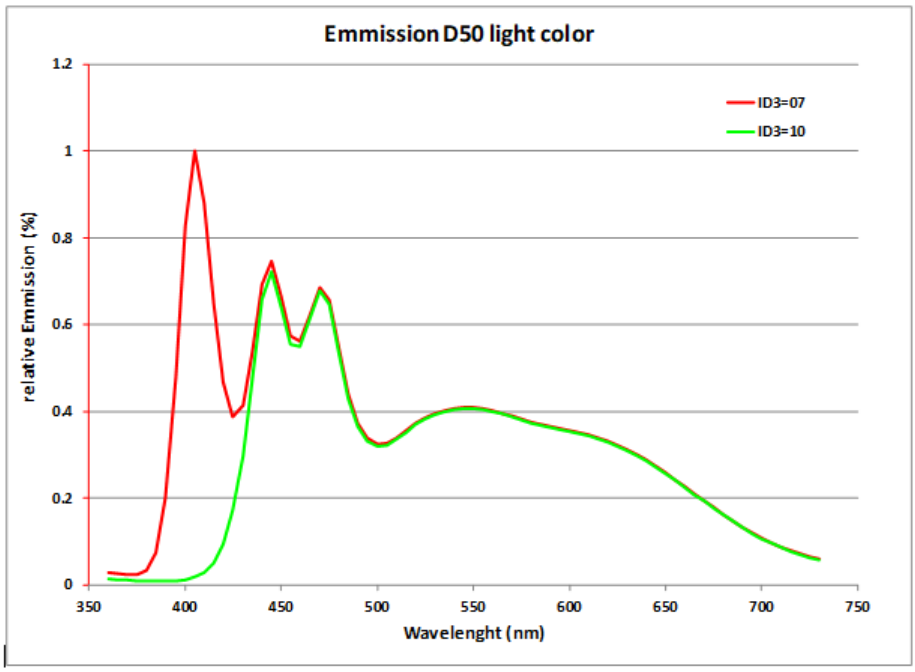


Figure 5-52 Relative spectral emission of D50 light source

5.4.8 UV 395 nm and 365 nm (ID 3 = 33 or 30)

CAUTION

Direct view into UV light might cause eye injury immediately. UV LED light source are in class 3 according to IEC 62471. Safety measures must be set up by the owner or the manufacturer of the machine.

5.4.8.1 Spectral characteristics of UV 395 nm-LED

Parameter	Symbol	Value	Unit
Wavelength at peak emission (typ.) I_F = mA	λ_{peak}	395	nm
spectral bandwidth at 50% $I_{rel\ max}$ (typ.) I_F = mA	$\Delta\lambda$	13	nm

5.4.8.2 Relative spectral emission of UV 395 nm LED

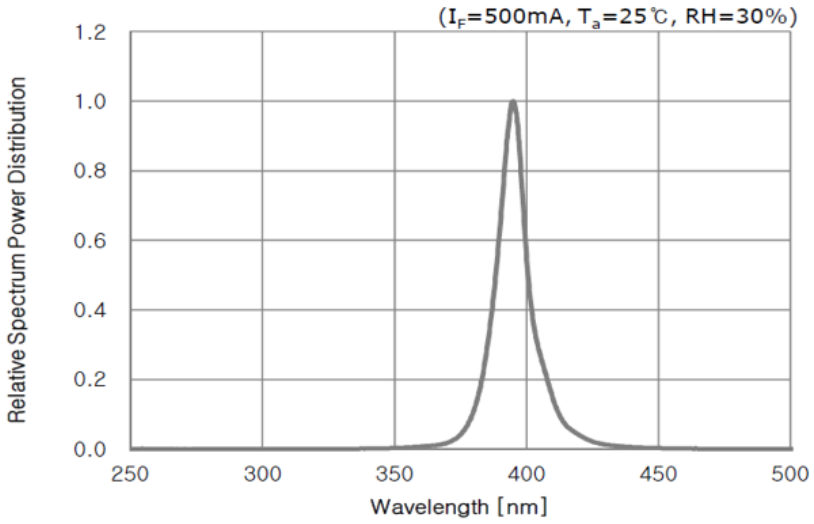


Figure 5-53 Relative spectral emission of UV395 LED

5.4.8.3 Spectral characteristics of UV 365 nm-LED

Parameter	Symbol	Value	Unit
Wavelength at peak emission (typ.) I_F = mA	λ_{peak}	367	nm
spectral bandwidth at 50% $I_{rel\ max}$ (typ.) I_F = mA	$\Delta\lambda$	13	nm

5.4.8.4 Relative spectral emission of UV 365 nm LED

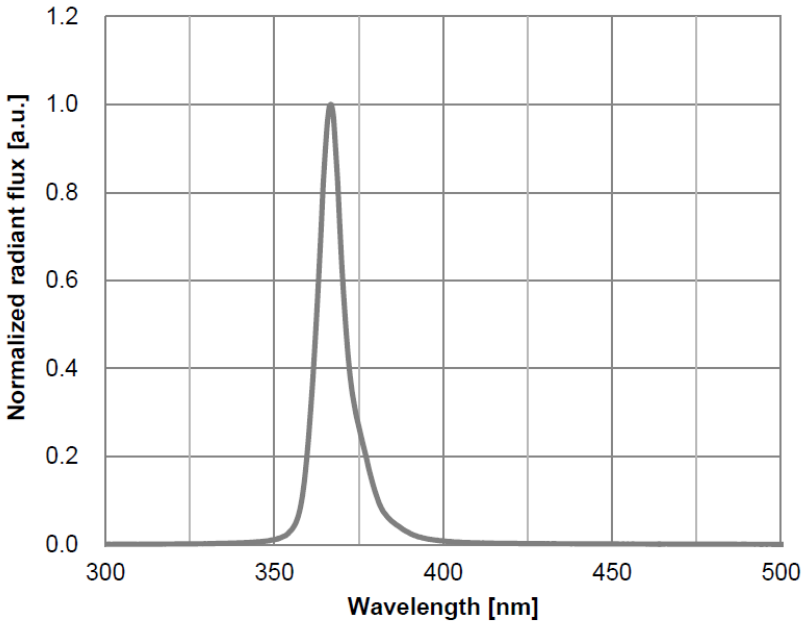


Figure 5-54 Relative spectral emission of UV365 LED

5.4.8.5 Relative radiant flux of UV 395 nm or 365 nm LED

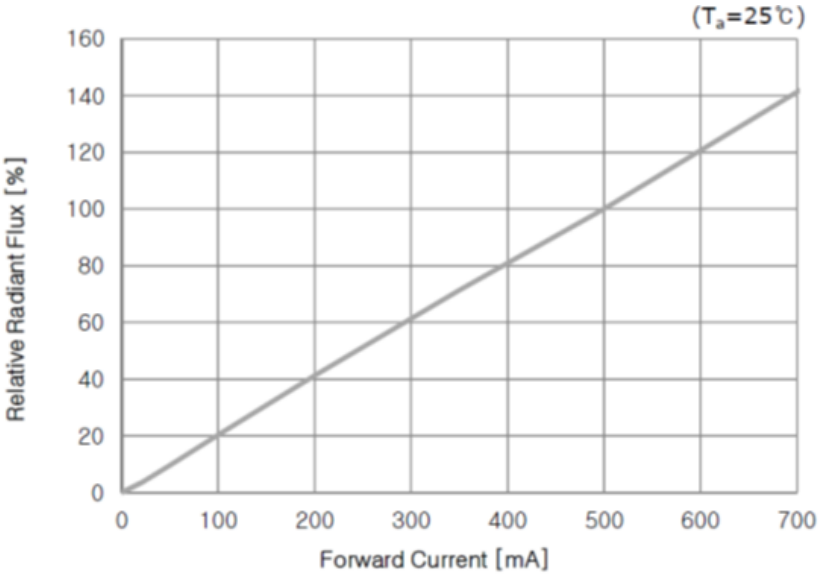


Figure 5-55 Relative radiant flux (in relation to operating current)

5.5 Connectors (ID 5)

NOTICE Wrong connections might cause a damage of the LED module or the controller due to a short circuit.

Note: It is strongly recommended to connect the shielding of all cables to ground. In EMC-contaminated environments, this might prevent problems with the I²C communication at longer cables.

For more information, see section 6.3.7.

5.5.1 Cable with wire end ferrules (ID 5 = A)

A connecting cable with wire end ferrules is used to connect the Corona II to LED controllers other than the Chromasens XLC4 Controller.

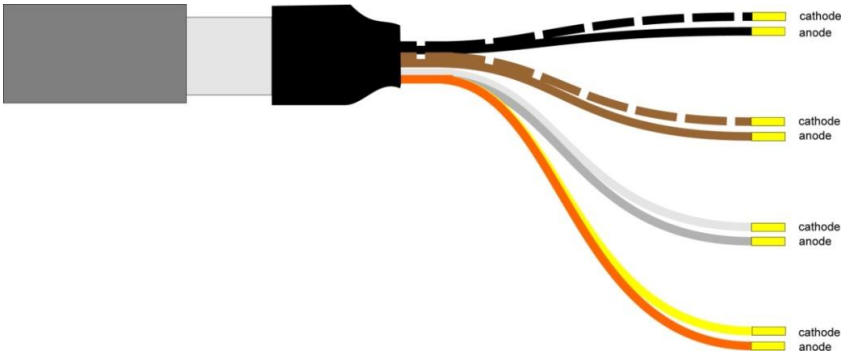


Figure 5-56 Cable with wire end ferrules (ID 5 = A)

The number of anode/cathode pairs depends on the length of the Corona module (i.e. the number of 170 mm basic modules). Each 170 mm basic module requires one anode/cathode pair.

5.5.2 Cable with terminal blocks (ID 5 = B)

A connecting cable with terminal blocks is used for connecting the Corona II to the Chromasens XLC4 Controller.

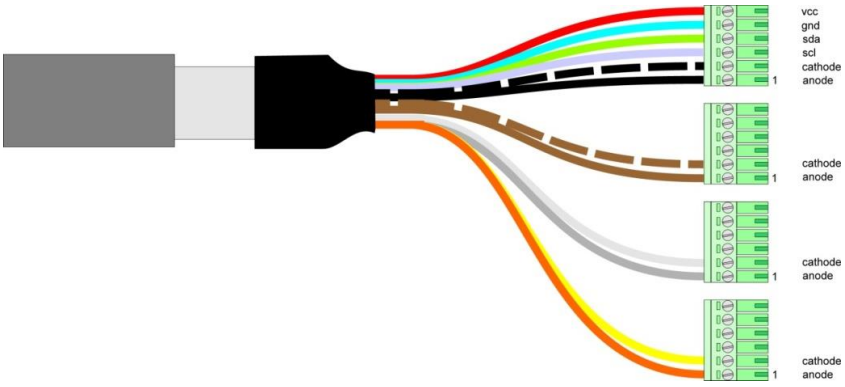


Figure 5-57 Cable with terminal blocks (ID 5 = B)

This is the standard configuration of a connecting cable to the Chromasens XLC4 Controller.

The topmost connector (with 6 wires) is present in all configurations.

For each additional 170 mm basic module an additional connector with an anode and cathode connection is required.

5.6 Screen (ID 6)

5.6.1 Standard screens

For different applications there are different screens available. They differ in the grade of diffusion as well as in the material, e.g. acrylic glass for food inspection applications.

Diffusion	Mineral glass	Acrylic glass
Low diffusion	ID6=1 Etching: GW 55	ID6=3
Medium diffusion	ID6=7 Etching: GW 4	ID6=4
Strong diffusion		ID6=0 (Only for ID2=H)

5.6.2 Glass (linearly polarized) (ID 6 = 2)

With option “polarizer” active, the Corona II provides linear polarized light output.

In Combination with a 90-degree rotated polarizer in front of the camera, unwanted light reflexes are eliminated almost completely.

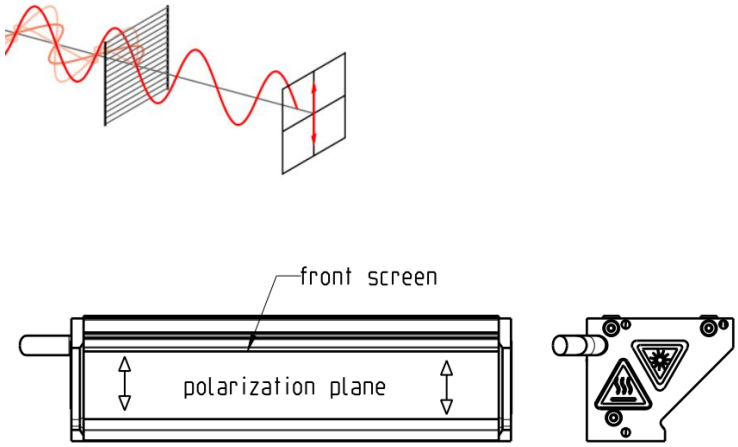


Figure 5-58 Polarization screen

5.6.3 Acrylic glass (ID 6 = 3)

MAINTENANCE

Cleaning Directions

Washing - Wash Plexiglas® sheet with a mild soap or detergent and lukewarm water solution. Use a clean soft cloth or sponge and as much solution as possible. Rinse well. Dry by blotting with a damp cloth or chamois.

Do not use: Window cleaning fluids, scouring compounds, gritty cloths, leaded or ethyl gasoline or solvents such as alcohol, acetone, carbon tetrachloride, etc.

To remove tar, grease, paint, etc., use a good grade of naphtha or kerosene. Users of these solvents should become familiar with their properties to handle them safely.

5.7 Heatsinks (ID 7)

5.7.1 General information for cooling options:

NOTICE The operation of high-power LEDs requires a thermal management for the LED module. Less cooling might result in damage of the LED module caused by over-temperature of the LEDs.

The cooling options must be set in relation to the total power input to the LED module.

The total power input is influenced by:

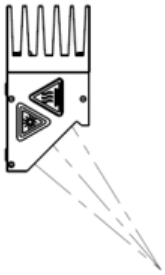
- Current set in the controller
- Duty cycle of LED operation in pulsed operation.

The ability to dissipate heat from the LED for the single cooling options is influenced by:

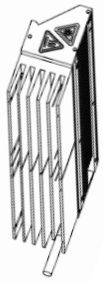
- Ambient temperature
- Orientation of the module

Figure 5-59 Orientation of passive cooling devices

Horizontal orientation Corona
Horizontal orientation cooling
Cooling efficiency: **85 %**



Horizontal orientation Corona
Vertical orientation cooling
Cooling efficiency: **90 %**



Vertical orientation Corona
Cooling efficiency: **100 %**

5.7.2 Small passive heat sink (ID 7=A)

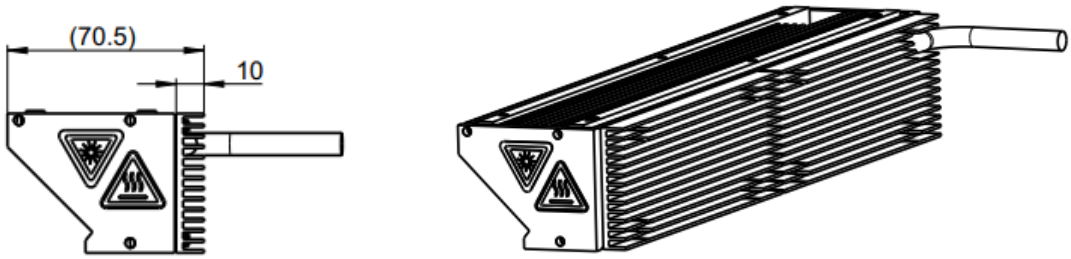


Figure 5-60 : Passive heat sink – ID 7 = A

5.7.3 Medium passive heat sink (ID 7=B)

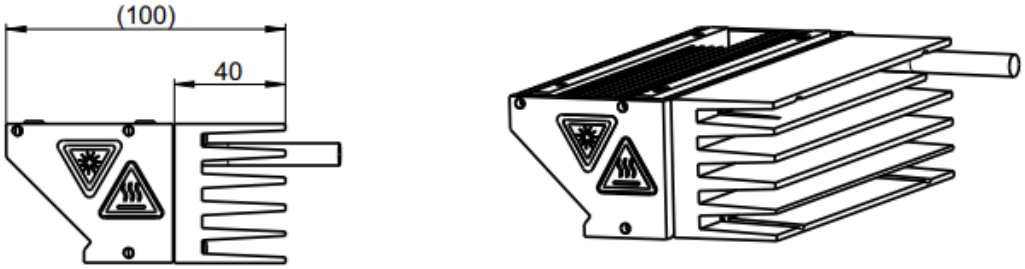


Figure 5-61 Passive heat sink – ID 7 = B

5.7.4 Big passive heat sink (ID 7=C)

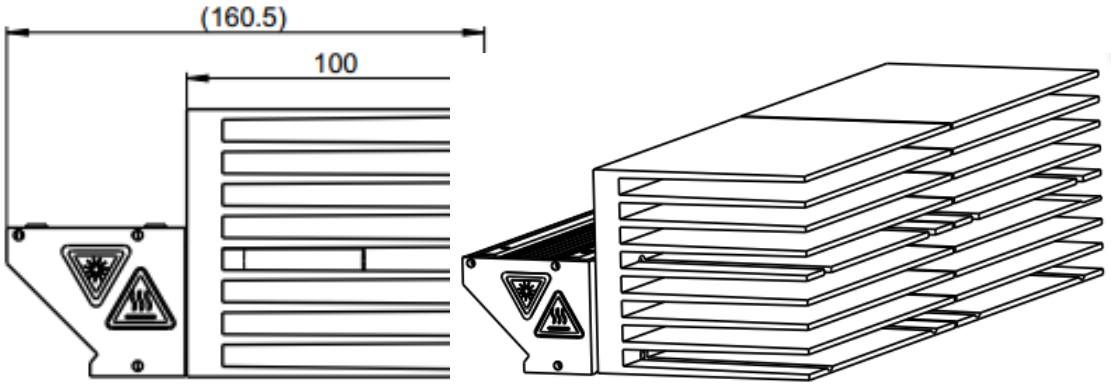


Figure 5-62 Passive heat sink – ID 7 = C

5.7.5 Water cooling (ID 7=W) (up to 2018)

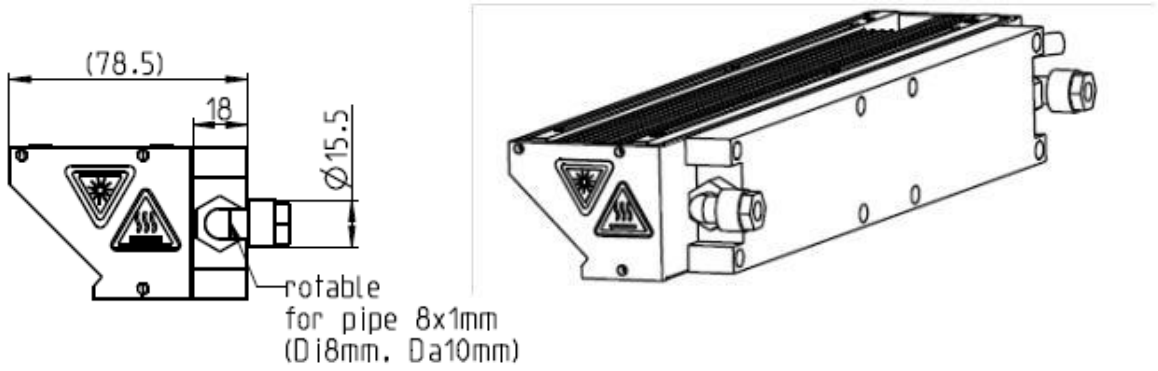


Figure 5-63: Active Heatsink – ID 7 = W

5.7.6 Water cooling (ID 7=H) (from 2019)

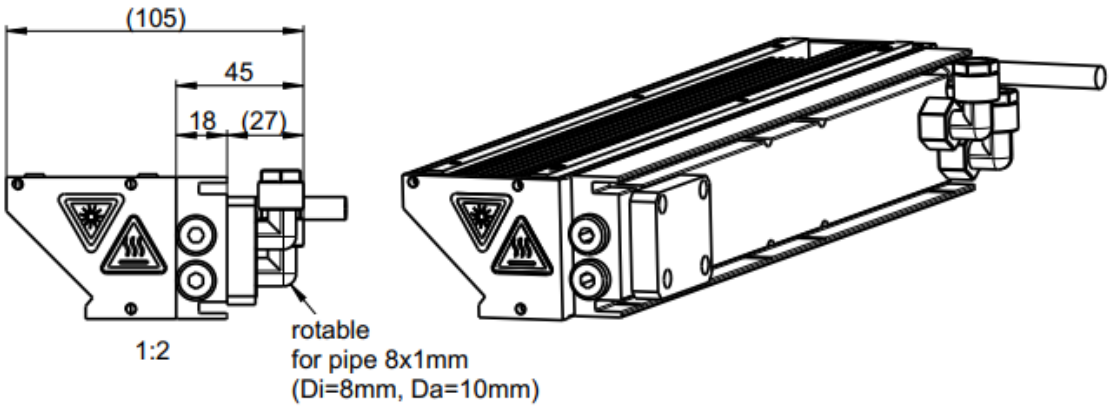


Figure 5-64 Water Cooling – ID 7 = H
For length more than 680 mm

5.7.7 Fan cooling (ID 7=L or F)

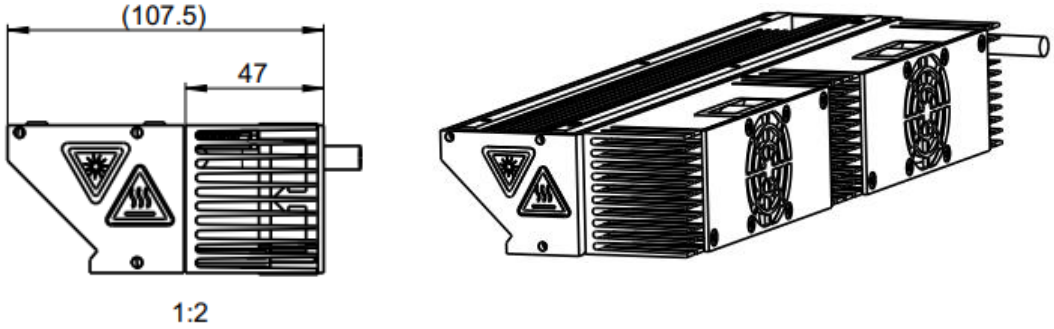


Figure 5-65 Fan Cooling – ID 7 = L
For length up to 680 mm

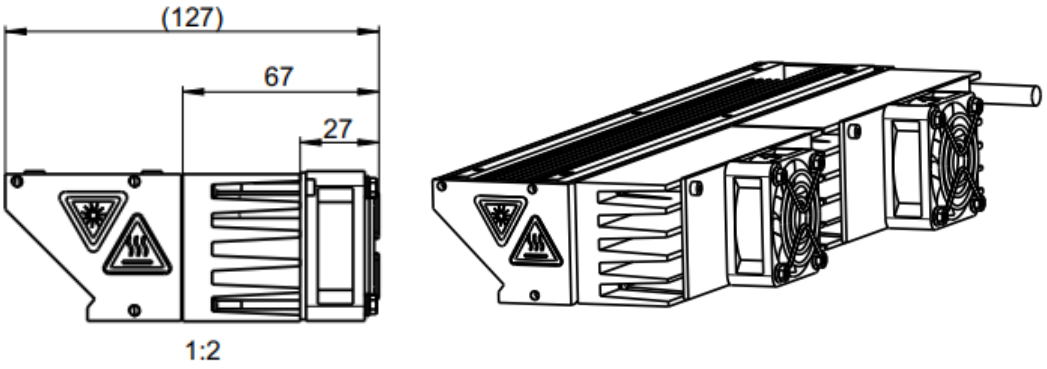


Figure 5-66 Fan Cooling – ID 7 = F
For length more than 680 mm

5.7.8 Thermal pad (ID 7=P)

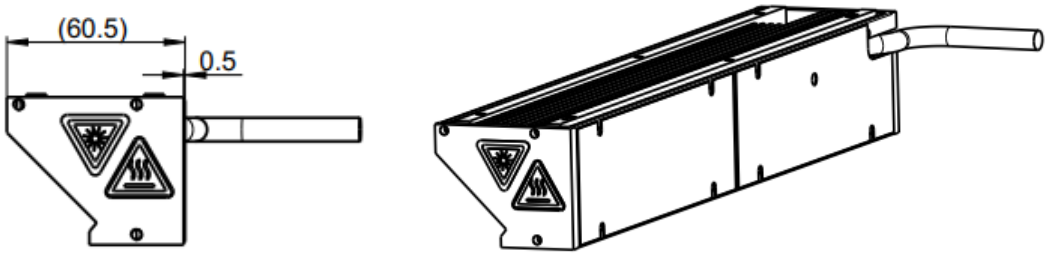


Figure 5-67 Thermal pad – ID 7 = P
For length more than 680 mm

5.8 Weights

The weights of the Corona II depend on module length and cooling options. For details, refer to the following table:

	Unit
Weight	[kg]

Focal types “A”, “B”, “C” and “D”					
	Cooling “A”	Cooling “B”	Cooling “C”	Fan	Water
170 mm	0,9	1,3	2,3	1,3	1,1
340 mm	1,5	2,3	4,4	2,3	1,9
510 mm	2,2	3,3	6,5	3,3	2,7
680 mm	2,8	4,3	8,6	4,3	3,6
850 mm	na	5,4	na	5,4	4,2
1020 mm	na	6,5	na	6,5	5,0
1190 mm	na	7,6	na	7,6	5,8
1360 mm	na	8,7	na	8,7	6,6

Bright field illumination “H”					
	Cooling “A”	Cooling “B”	Cooling “C”	Fan	Water
170 mm	1,1	1,5	2,5	1,5	1,3
340 mm	1,8	2,6	4,7	2,6	2,2
510 mm	2,7	3,8	7,0	3,8	3,2
680 mm	3,4	4,9	9,2	4,9	4,2
850 mm	na	6,2	na	6,2	5,2
1020 mm	na	7,4	na	7,4	6,2
1190 mm	na	8,7	na	8,7	7,2
1360 mm	na	9,9	na	9,9	8,2

Tube light “T”				
	Cooling “A”	Cooling “B”	Fan	Water
170 mm	1,2	2,0	2,0	1,6
340 mm	2,1	3,7	3,7	2,9
510 mm	3,0	5,4	5,4	4,2
680 mm	3,9	7,2	7,2	5,5
850 mm	n.a.	9,1	9,1	6,8
1020 mm	n.a.	10,8	10,8	8,1
1190 mm	n.a	12,6	12,6	9,4
1360 mm	n.a.	14,4	14,4	10,7

Weights are approximately numbers and might verify slightly due to tolerances.

Water cooling weights are without liquid.

5.9 Lifetime: reliability and durability

There are two main aspects:

- Reliability: Describes the probability of a total failure of the LED unit.
- Durability: Describes the time, during which the LED module is usable with a certain amount of light.

5.9.1 Reliability

Reliability is influenced e.g. by design, mounting or environmental parameters. To get a rough idea of reliability of a product, MTBF values are used. Take notice that this covers only statistical errors without external influences. They are calculated under special conditions, e.g. temperature.

For one segment of 170 mm an MTBF of better than 300 years at 80°C could be expected.

5.9.2 Durability

The amount of light output from the LED reduces over time. The degradation of light is influenced by:

- Operating temperature of LED chip

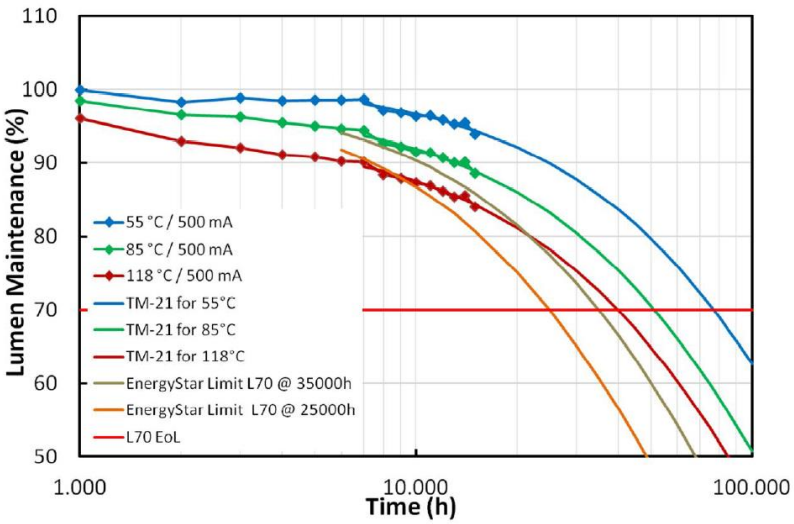


Figure 5-68 Degradation of light over time at different temperatures

Housing	40 °C	60 °C	75°C
Soldering point	55 °C	85 °C	118 °C
Lumen maintenance (70 %)	77.000 h	51.000 h	40.000 h
Years @ 250 days 100% operation	12 years	8,5 years	6,7 years

These values are for white LEDs. At other LEDs they might be lower, especially UV LEDs.

6 Controller XLC4

6.1 Possible setups

The controller can serve up to four channels or four separate Corona II modules with up to four channels in total. Please refer to the following sample setups:

1. Samples with one Controller:

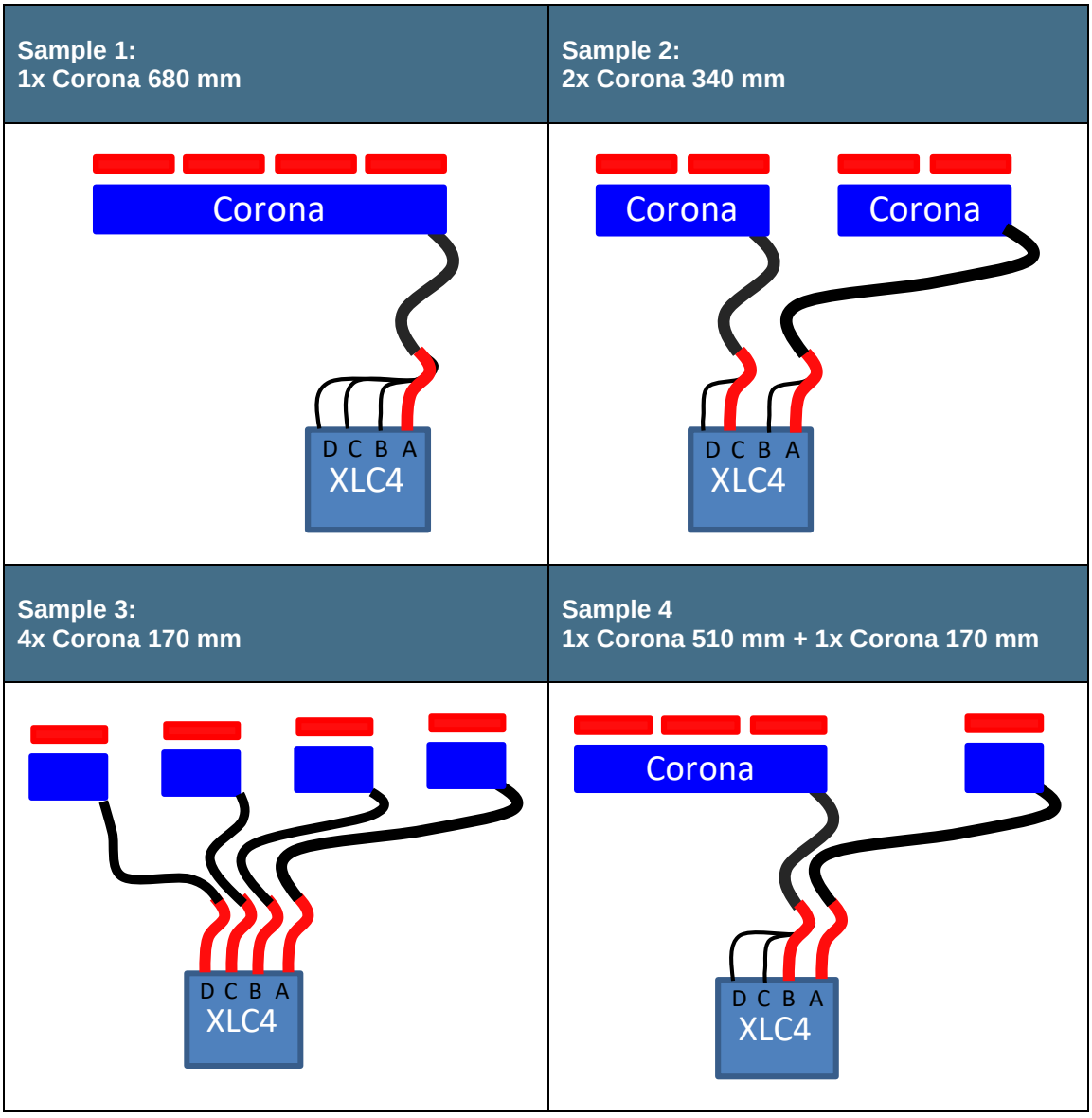


Figure 6-1 Samples of setups with one controller and Corona modules

2. Samples with two Controllers:

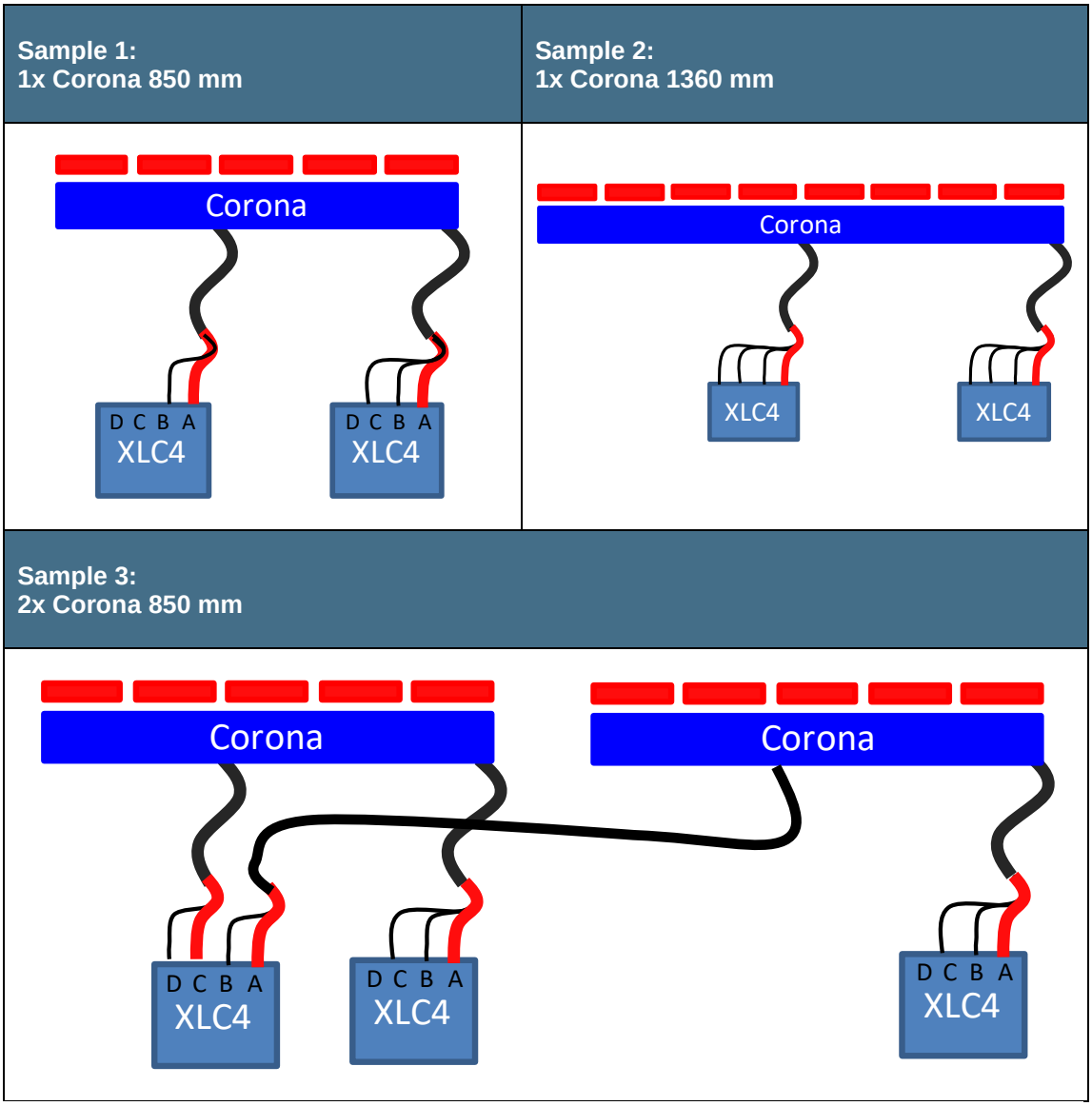


Figure 6-2 Samples of setups with one controller and Corona modules

Note: Start always with the lowest free port.
Use the lowest port for the I²C-Plug per module. Otherwise automatic module detection is not working correctly.

NOTICE It is not allowed to connect single channels of one Corona segment (one cable) to different XCL4 controllers. In this case the temperature monitoring does not work. LED boards might be destroyed.

6.2 Mechanical specifications

6.2.1 Dimensions

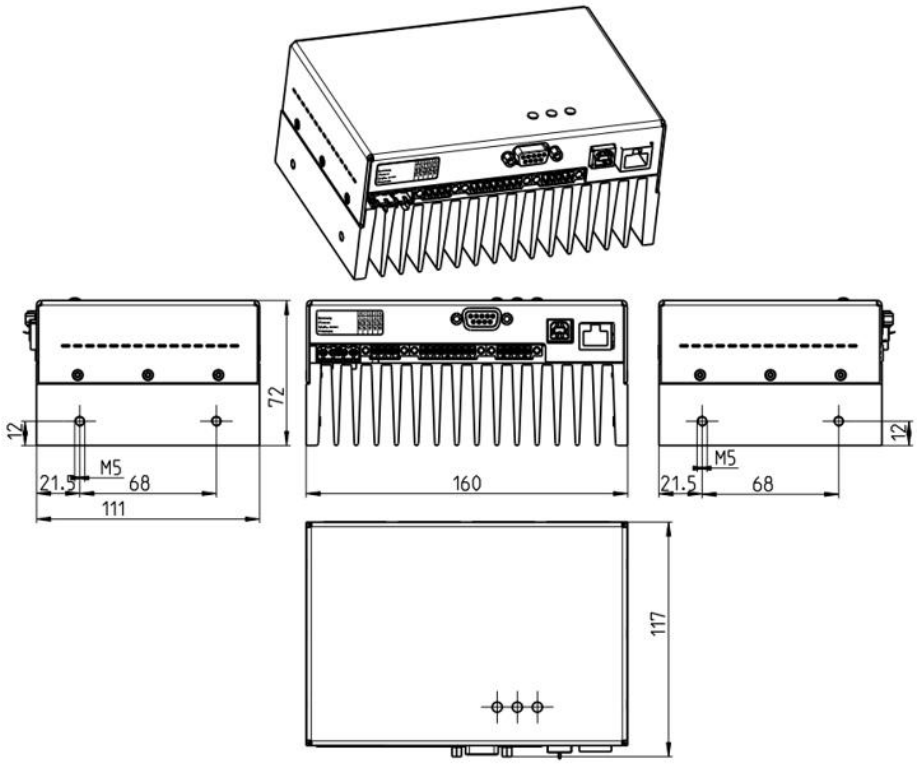


Figure 6-3: Dimensions of XLC4 controller (CP000411 and CP000411-1)

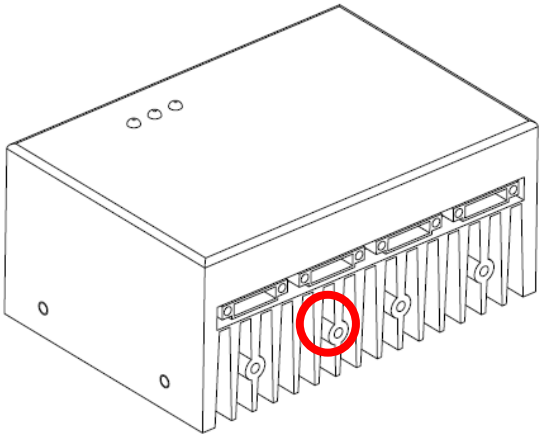


Figure 6-4: Additional threads for grounding of the cable to the Corona modules (for new versions CP000411-1A and CP000411-1F4)

All dimensions are given in millimeters (mm).

6.2.2 Weight:

	XLC4	Unit
Weight	1,5	[kg]

6.3 Inputs - outputs / connectors / status LEDs

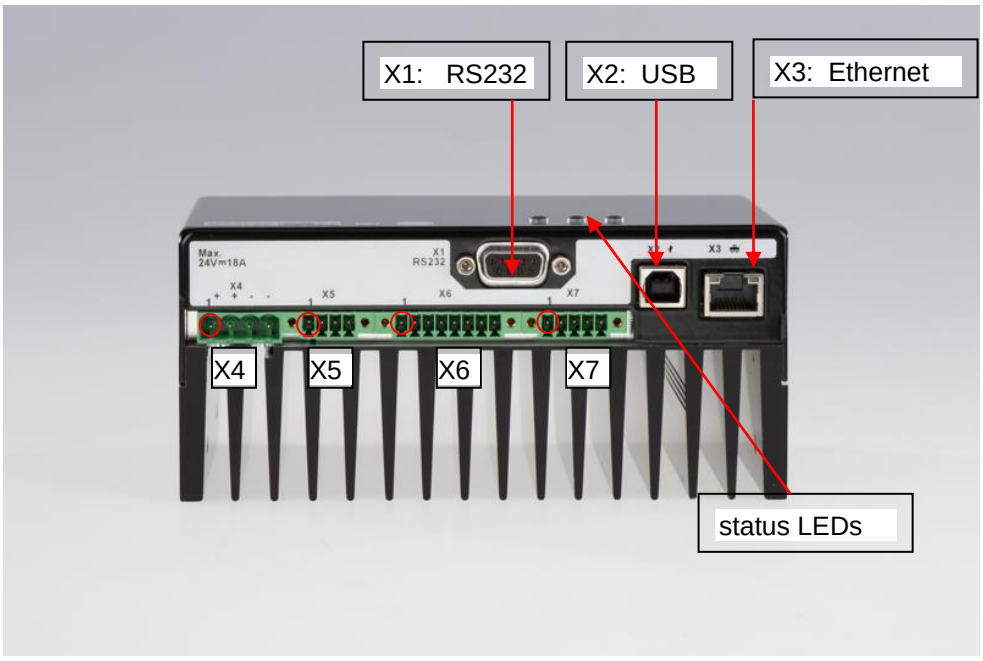


Figure 6-5: Ports of XLC4 controller – Front (Pin 1 is marked with ○)

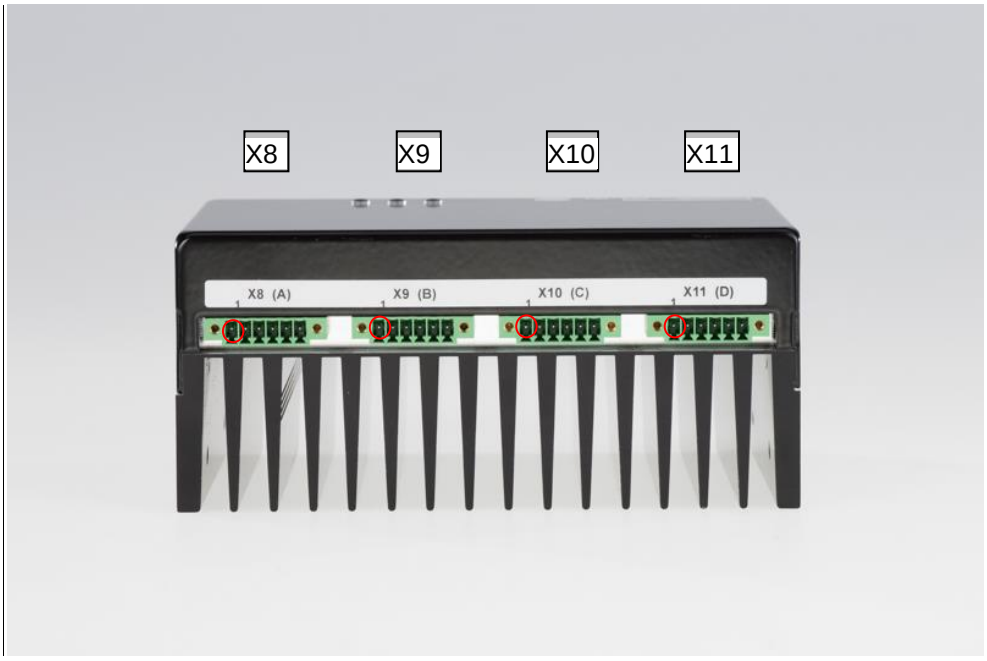


Figure 6-6: Ports of XLC4 controller – Back (Pin 1 is marked with ○)

NOTICE Wrong connections might cause a damage of the LED module or the controller by short-circuit.

6.3.1 RS232 connector X1

Pin	Name	Notes
1	nc	
2	TX	Data from XLC4 to PC
3	RX	Data from PC to XLC4
4	nc	
5	GND	
6	nc	
7	nc	
8	nc	
9	nc	

Connector type: Standard D-Sub-9 connectors,

Note: Cable to the PC must be a 1:1 cable, no crossing is needed.

6.3.2 USB connector X2

Pin	Name	Notes
1	+	Supply voltage 5 Volt
2	D-	Data
3	D+	Data
4	-	Ground

Connector type: Standard USB 1.0/2.0 Type B-Connector

Note: The USB connector is only recommended for service use because automatic detection at power-up does not work sufficiently with all PCs.

A specified driver is needed. It appears as a virtual COM port in the PC.

6.3.3 Ethernet connector X3

Pin	Name	
1	TX+	
2	TX-	
3	RX+	
4		
5		
6	RX-	
7		
8		

Connector type: Standard 8P8C connector (RJ45)

6.3.4 Power supply input X4

Pin	Name	
1	V_IN	Supply Voltage
2	V_IN	Supply Voltage
3	GND_IN	0V (signal ground)
4	GND_IN	0V (Signal ground)

Connector Type: **Würth Elektronik:** **691 317 710 004**
Counterpart**:** **Würth Elektronik:** **691 352 710 004**

Pins 1/2 and 3/4 are connected inside the XLC4 box. For low-current applications it is allowed to use a single power pair. (Current rating of the connectors: 20A/Pin)

6.3.5 Analog control / shutdown / VOUT X5

Pin	Name			Notes
1	ACTRL	1-10V	IN	analog control input
2	GND			0V (Signal ground)
3	SHUTDOWN		IN	security off switch input
4	VOUT	0 / VCC	OUT	output voltage for cooling device

Connector Type: **Würth Elektronik: 691 325 110 004**
Counterpart**:** **Würth Elektronik: 691 364 100 004**

In „Analog-Controlled Mode “, the voltage level between ACTRL and GND defines the current applied to the four output channels. (For more information, see section 6.5.3.4 „Analog-controlled mode “.

If the SHUTDOWN function is activated, the SHUTDOWN input must be connected to GND to activate the output channels of the XLC4.

The SHUTDOWN input is intended to be used in conjunction with a security switch. The signal gears directly into the output stage of the controller, without any microcontroller actions needed. (For information how to activate this function, see section 6.5.2.11)

Note: The shutdown function is not intended to be used for flash operation. It is only intended for safety issues like supervising a protection housing for the light source.

The VOUT port is used to activate an external cooling device if the temperature level of one channel or of one of the connected Coronas reaches a specific temperature value. This function must be activated by setting a control flag in the XLC4 Register “*ControlFlagA”* (How to activate this function, see section 6.5.2.12).

When the programmed level is reached, the supply voltage of the XLC4 is switched to the output VOUT. The values of the temperature levels for switching the cooling device on and off are defined by the “warning level” stored in the Corona II or by the values programmed with the FC command. (For more information, see section 6.5.2.14)

The maximum output current for the VOUT port is 1.5 A.

Attention:
Note that the overall input current of the supply input is limited. The current sunk at VOUT must be added to the calculated input current.

If the XLC4 is not operated in “Analog-Controlled Mode”, the ACTRL input has a second function. It can be used for fan function supervising of fan-cooled Corona II modules. If the cooling device is switched on, and a voltage lower than the model-depending limit is detected at ACTRL, a failure situation is generated (err 214). The red status LED is switched on and the FAIL output is activated. (How to activate this function; refer to command FA in “Commands” section of this document). This function is available in Version V5.1 and higher.

6.3.6 PWM interface / external switch X6

LED controller XLC4-1 and XLC4-1A

Pin	Name			Notes
1	ON		IN	switch signal for PWM mode operation
2	PWC		IN	control signal for PWM mode operation
3	ENC		IN	(don't use)
4	FAIL		OUT	failure signal
5	STAT		OUT	(don't use)
6	COMMON			common signals for pins 1-5
7	SW1			switch
8	SW2			switch

Connector Type: **Würth Elektronik: 691 325 110 008**
Counterpart: **Würth Elektronik: 691 364 100 008**

The Signal ON switches the illumination in PWM-Mode.
The Duty Cycle of Signal PWC controls LED current in PWM-Mode.
The FAIL Signal signals Error States in PWM Mode, Bulb Mode and Analog Mode.
For a detailed description of the logical behavior of this signals, see section 6.5.3.3.

The two Inputs ON and PWC are opto-coupled inputs with a common GND line COMMON.
The Output Signal FAIL is also opto-coupled with an open collector circuit to COMMON.

LED controller XLC4-1F4

Pin	Name			Notes
1	ON_1		IN	External LED control channel A
2	ON_2		IN	External LED control channel B
3	ON_3		IN	External LED control channel C
4	FAIL		OUT	failure signal
5	STAT		OUT	(don't use)
6	COMMON			common signals for pins 1-7
7	ON_4			External LED control channel D
8				

6.3.6.1 Signal “ON” (pin 1)

LED controller XLC4-1

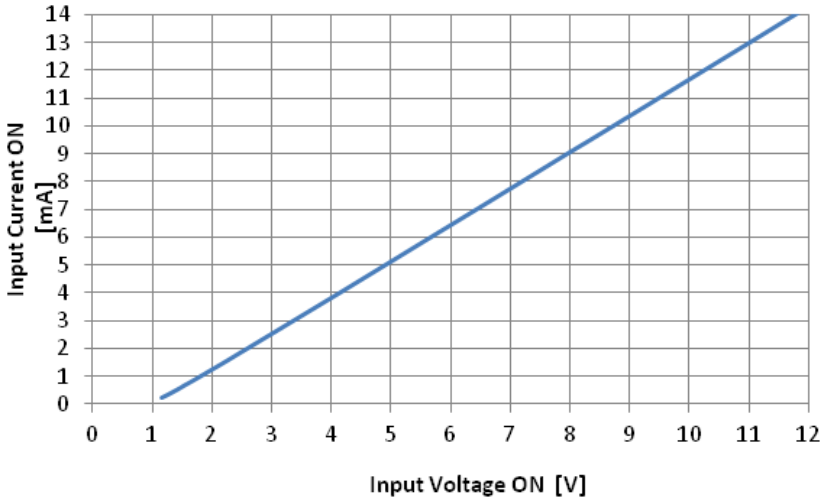
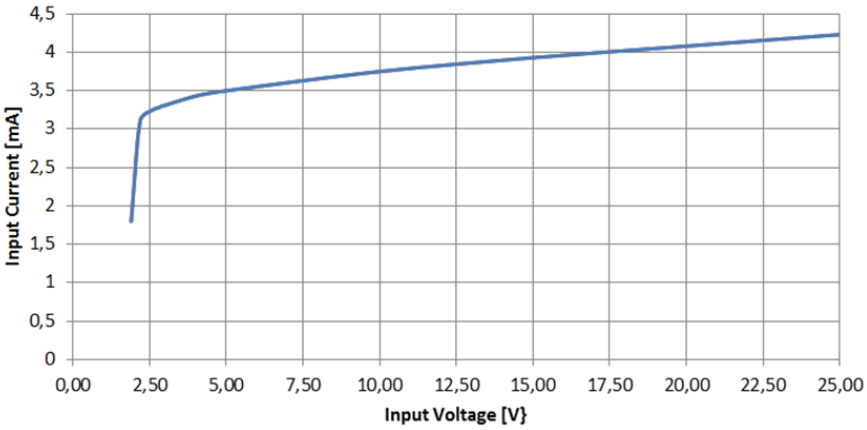


Figure 6-7: Typical Input Characteristic for Input ON

ON Max Voltage	Input Voltage ON <= 12 V
ON Max Current	Input Current ON <= 15 mA
ON Low Current	Input Current ON < 0,2 mA
ON High Current	Input Current ON > 0,7 mA (Recommended >2 mA)

LED controller XLC4-1A and XLC4-1F4



ON Max Voltage	Input Voltage ON <= 25 V
ON Voltage	>= 2.5V
OFF Voltage	<= 0.7V

6.3.6.2 Signal “PWC” (pin 2) (only for XLC4-1)

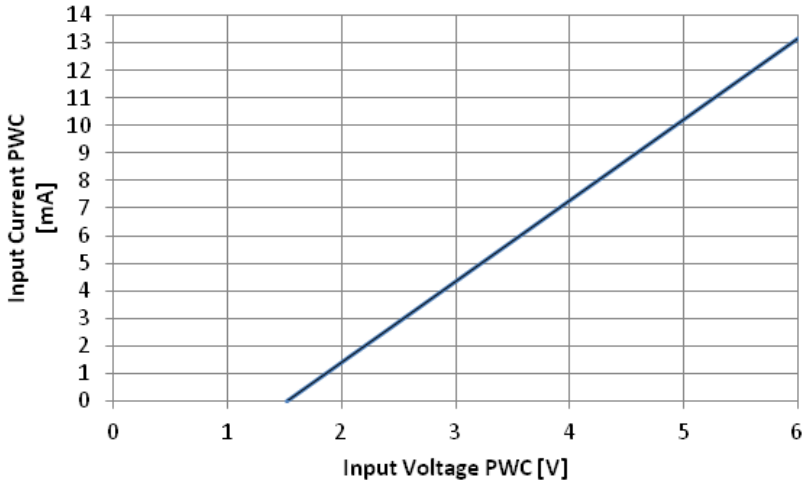


Figure 6-8: Typical Input Characteristic for Input PWC

PWC Max Voltage	Input Voltage PWC <= 6 V
PWC Max Current	Input Current PWC < 15 mA
PWC Low Current	Input Current PWC <= 0,7 mA
PWC High Current	Input Current PWC > 1,3 mA (Recommended >5 mA)

If PWC must be controlled with higher voltages, use a series resistor.

6.3.6.3 Signal “Fail” (pin 4)

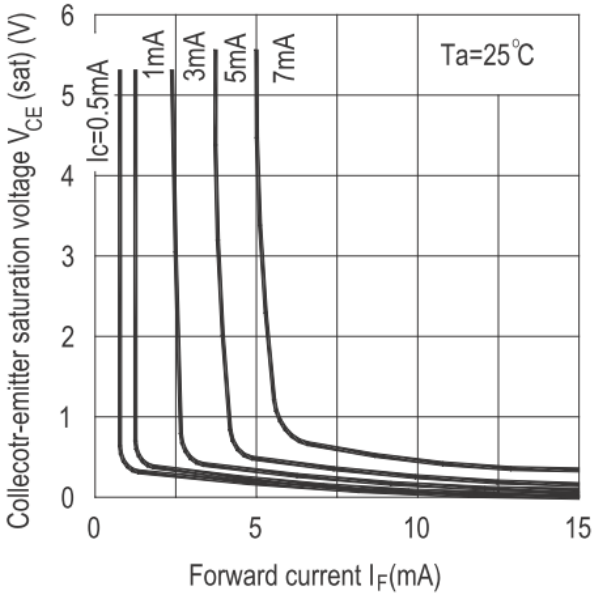


Figure 6-9: Output diagram of the open collector stage of FAIL

The driving Forward Current of the output stage is in the range 10 mA to 15 mA.

FAIL Max Voltage	Output Voltage FAIL <= 12 V
FAIL Max Current	Input Current FAIL <= 15 mA (Recommended: 5-10 mA)

NOTICE

The output transistor of FAIL is switched on if no error situation is detected. Use a pull-up resistor at the receiving unit. Thus, an interrupt at the FAIL signal line causes an error event (FAIL = H) at the receiver.

6.3.6.4 Signal “Switch” (pin 7 and 8)

SW1 and SW2 ports are used to activate an external cooling device if the temperature level of one channel or of one of the connected Coronas reaches a specific temperature level.

When the programmed level is reached, the connection between SW1 and SW2 is closed. The values of the temperature levels for switching on and off the cooling device are defined by the “warning level” stored in the Corona II or by the values programmed with the FC command. (For more information, see section 6.5.2.14)

- The maximum current within the internal switch is limited to 1.5 A
- The voltage at SW1 and SW2 must be lower than the supply voltage
- The voltage at SW1 must be higher than the voltage at SW2

This function must be activated by setting a control flag in the XLC4 Register “ControlFlagA” (For more information about activation of this function, see section 6.5.2.12**).**

6.3.7 RS485 interface X7

Pin	Name			Notes
1	RT1			RS485
2	RTN1			RS485
3	RT2			RS485 (internally connected with RT1)
4	RTN2			RS485 (internally connected with RTN1)
5	GND			

Connector Type: **Würth Elektronik: 691 325 110 005**
Counterpart**:** **Würth Elektronik: 691 364 100 005**

Use the RS485 Interface to connect several XLC4 modules on a single bus line. The device uses 2-wire RS485 operation.

Note that the XLC4 has no integrated bus termination resistors. In the last device of the chain, a resistor of 120 Ω must be connected between the pins RT2 and RT2N. For more information, see section 6.5.5.

6.3.8 LED output channels X8 (channel A) to X11 (channel D)

The 4 LED-ports X8 to X11 are on the opposite side of the controller box.
X8 is the leftmost connector, X12 the rightmost.
Each channel uses the following pinning:

Pin	Name	Notes
1	V_ANODE	anode output LED line
2	V_CATHODE	cathode output LED line
3	COR_SCL	clock for external I²C bus (only valid with Corona II)
4	COR_SDA	data for external I²C bus (only valid with Corona II)
5	COR_GND	ground for external I²C bus (only valid with Corona II)
6	COR_VCC	supply for external I²C bus (only valid with Corona II)

Connector Type: **Würth Elektronik: 691 325 110 006**
Counterpart**:** **Würth Elektronik: 691 364 100 006**

The four LED output channels can drive up to 1.8A per channel.
The output voltage is limited to 46V.

If used with a Corona II LED module, the XLC4 communicates with the LED module over an I²C interface. There is one I²C interface per Corona II.

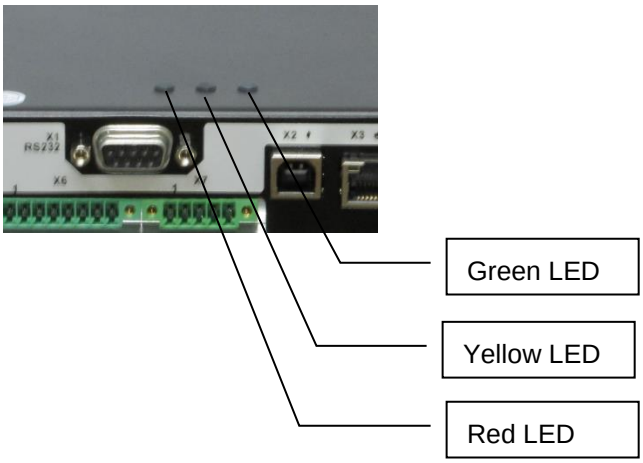
One XLC4 can drive up to 4 Corona II (depending on the number of channels per LED-module)

If more than one Corona II is connected to the XLC4, the modules must be connected with no gap, beginning with channel A. The connector with the I²C-Interface (6 wires) must be connected to the first connector associated with that Corona II. The sequence of the other connectors of a module is not relevant.

6.3.9 Status LEDs

Three LEDs show the status of operation of the XLC4 controller:

1 **Figure 6-10: Status LEDs**



Power-up: During power-up, the LEDs show the programmed ID of the device. For more information, see section 6.5.1.

Operation: During operation the LEDs show the status of operation:

Red: If an error occurs, the red LED turns to ON. When the error has been reset, the LED turns OFF.

Yellow: Temperature warning is activated.

Green: The green LED flashes every five seconds at regular operation.
Firmware <5.1: Green LED is ON for 100 ms.

Firmware>5.1: Green LED is OFF for 1 second.

6.3.10 Shielding

Because EMC influences the function of I²C communication between the controller and the modules, it is strongly recommended to set the shielding of the cable to the module to ground. Please refer to the following example:

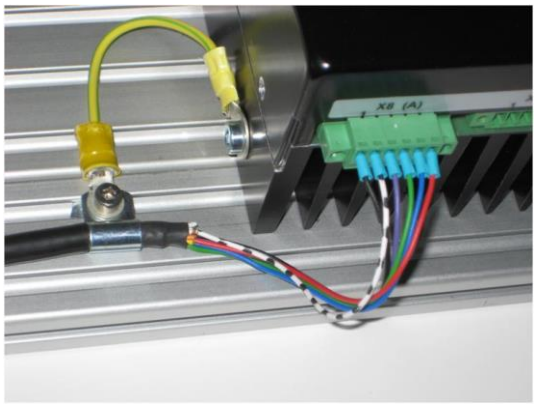


Figure 6-11: Connection sample of shielding

6.4 Electrical requirements

The XLC4 unit is designed to drive up to 4 independent LED Strings with a high, stabilized constant current.

NOTICE The switching regulators inside operate in boost mode. Therefore, the output voltage must be higher than the supply voltage of the XLC4.

6.4.1 Supply voltage

Item	Description	Min.	Nom.	Max.	Unit
V_IN	Supply Voltage	12		26.4	[V]

The input current depends on the value of V_IN, the voltage and current of the connected LEDs, the internal consumption and, if activated, current at VOUT.

Internal consumption: < 100mA@26.8V and <130mA@12V

For use with Corona II

Item	Description	Min.	Nom.	Max.	Unit
V_IN	Supply Voltage	21.6		26.4	[V]

For optimized performance of the XLC4, the supply voltage should be adapted to the properties of the connected LED-String.

Item	Description	Min.	Nom.	Max.	Unit
V_ANODE - V_IN	Voltage Difference (Output to Input)	5	>= 7	25	[V]

Keep in mind that a smaller voltage difference between V_ANODE and V_IN results in much lower internal power dissipation and in higher efficiency as well.

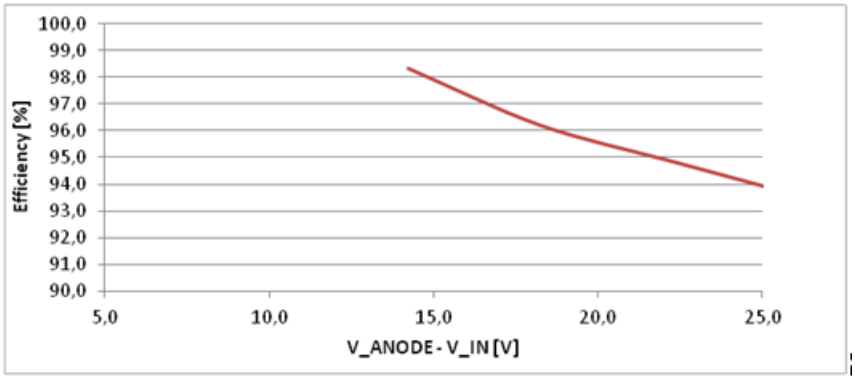


Figure 6-12: This diagram shows a typical efficiency chart of the XLC4's switching regulator. (Measured with Corona II, channel current 1000 mA, V_ANODE=38 V)

6.4.2 Supply current

NOTICE Make sure that under no conditions the maximum Input Current is exceeded by using fuses.

Item	*Description*	*Min.*	*Nom.*	*Max.*	*Unit*
I_{Input}	*Input Current*			*20*	*[A]*

Depending on the LED module in type and number as well as the maximum used output current, the power supply output current must be chosen:

Channels	1		2		3		4		
Output	typ.	max.	typ.	max.	typ.	max.	typ.	max.	unit
200 mA	**0,4**	0,5	**0,7**	0,9	**0,9**	1,2	**1,2**	1,6	[A]
400 mA	**0,7**	0,9	**1,3**	1,7	**1,9**	2,4	**2,5**	3,2	[A]
600 mA	**1,0**	1,3	**2,0**	2,5	**2,9**	3,7	**3,8**	4,9	[A]
800 mA	**1,4**	1,8	**2,7**	3,4	**3,9**	5,1	**5,2**	6,7	[A]
1000 mA	**1,8**	2,2	**3,4**	4,3	**5,0**	6,4	**6,6**	8,5	[A]
1200 mA	**2,1**	2,7	**4,1**	5,3	**6,1**	7,9	**8,0**	10,5	[A]
1400 mA	**2,5**	3,2	**4,8**	6,3	**7,2**	9,3	**9,6**	12,4	[A]
1600 mA	**2,9**	3,7	**5,7**	7,3	**8,5**	10,9	**11,3**	14,4	[A]
1800 mA	**3,3**	4,2	**6,5**	8,3	**9,7**	12,4	**12,9**	16,5	[A]

Typical values are calculated with typical forward voltage values for the LED and with 24 Volt input voltage. Values for maximum current are calculated with maximum forward voltage for the LED and with 21.6 Volt input voltage.

NOTICE The output for the fan power supply must be added to the currents above. Maximum limit must be observed. Otherwise the output might be destroyed.

The output for the fan power supply has to be added to the currents above.

Item	Description	Min.	Nom.	Max.	Unit
I_{Fan}	Current for fan power			**1,5**	[A]

6.4.3 Output voltage / Output current

Independent from the conditions mentioned above, the 4 outputs have the following limits:

Item	Description	Min.	Nom.	Max.	Unit
$I_{Channel}$	Operating Current (per Channel)	200		1800	[mA]

Item	Description	Min.	Nom.	Max.	Unit
V_ANODE	Output Voltage	17		46	[V]

Make sure, that the output current of the control unit is valid to drive the connected LEDs under all operating conditions.

6.5 Functionality

6.5.1 Power-up

After switching on the supply voltage, the XLC4 displays the stored device ID[1] by flashing the 3 status LEDs. The red LED has the valence of 10, the yellow LED 5 and the green LED 1.

Examples:

ID=3	green flashes 3 time while yellow and red are off
ID=7	green flashes 2 times while yellow is on
ID=13	green flashes 3 times while red is on

After signaling the device ID, the XLC4 checks the input voltage and the values of the temperature sensors. Then the controller tries to access Corona modules connected to the 4 output channels. During this process, the red LED is on.

After a successful power-up, the green LED of the XLC4 is flashing with a period of 5 seconds. Otherwise, the red LED is set.

After power-up, an identification string is sent over the serial interface. The string contains the controller type and the loaded firmware version and release.

```
Chromasens XLC4 LED-Controller; FW-Rel. 5.10
```

[1] Device IDs are used to address dedicated XLC4 modules in a multi module RS485 bus structure.

6.5.2 Commands

The XLC4 unit is controlled by a set of simple ASCII commands, independent of the selected electrical interface type. Therefore, it is very easy to control the XLC4 from any user application with access to either RS232, RS485, USB or Ethernet.

For a quick start without an application available, we recommend to use a freeware tool like ***HTerm*** or similar. This tool permits to send and receive ASCII and control sequences.

If a USB interface is used for serial communication, a USB-to-Serial emulator is the easiest way to perform the connection. (For example, **mchpcdc**, an applicable serial emulator driver which can be downloaded from the Microchip website)

Chromasens delivers an operating program “XLC4Commander.exe” for quick and easy control of XLC4 controller devices.

XLC4 commander is available for download at:

➔ “XLC4 commander Software “

https://www.chromasens.de/xlc4-commander-current

6.5.2.1 Code sampe in C++:

Chromasens provides code samples in C++, which show how to control the XCL4 LED controller.

Take notice: Error handling is not described in this sample code.

Sample code is available for download at:

➔ C++ sample code “RS232”

https://www.chromasens.de/sites/default/files/downloads/public/Corona/XLC4-RS232-Sample.zip

➔ C# sample code “RS232”

https://www.chromasens.de/sites/default/files/downloads/public/Corona/XLC4-CSharp.zip

➔ C++ sample code “Network/Telnet”

https://www.chromasens.de/sites/default/files/downloads/public/Corona/XLC4-IP-Demo.zip

6.5.2.2 General structure of all commands

The XLC4 commands are transferred in a command message of a uniform string structure:

Start	Address	Space	Command	End
STX	“#”,HexChar	Blank	String	ETX
0x02	0x23,HexChar	0x20		0x03
Start of the command	Optional, for use with RS485 port			End of the command
	Allowed characters: 0,1,2,3,4,5,6,7,8,9, A,B,C,D,F			

The message string is enclosed by STX as start character and ETX as end character. If the controller does not receive STX, the message is ignored. If the controller does not receive ETX, no response is sent. In both cases the sender of the message should handle this issue with a time-out.

The command string itself is built in the following structure:

CommandID	Space	ParameterList
2 or 3 uppercase characters	0x20	List of decimal or hexadecimal numbers alphanumeric characters.
See at each command	As separator from ParameterList	See at each command, more than one parameters are separated by a “Space” or by “,”; the sign “,” is used to separate numbers.

Each command message sent to the XLC4 is acknowledged by a response message of following structure:

ResponseMessage = STX , Response , ETX

with:

Response = ResponseID , [ValueList]
ValueList = Space, Value, {“,” , Value}
Value = decimal number | hexadecimal number | single character | string

6.5.2.3 Command VR (request firmware version and release)

The command VR is used to query the current Firmware Version / Release of the XLC4.

Command		Notes
CommandID	**VR**	VR works in all XLC4 operating modes
Parameter	None	
Parameter	**Value**	**Description**
None		The current version and release of the XLC4 firmware are coded in the return value.
Response		
	vr , space , version , “,” , release	
General notes		

Example:

VR
`vr 005,010`

6.5.2.4 Command IF (request hardware info of controller unit)

The command IF is used to query Information related to the hardware of the XLC4.

Command		Notes
CommandID	**IF**	**IF works in all XLC4 operating modes**
Parameter	None	
	channel	
Parameter	**Value**	**Description**
None		If the IF command is used without channel qualifier, the XLC4 returns information about version and release of the assembled electronic board and the serial number of the XLC4 device
Channel		If the IF command is used with a channel qualifier, the XLC4 returns information about the addressed driver unit of the XLC4. The current XLC4 has 4 identical driver units, named A to D.
	“A”	For channel 1 of the controller
	“B”	For channel 2 of the controller
	“C”	For channel 3 of the controller
	“D”	For channel 4 of the controller
Response		
	Without parameters: if , space , version , “,” , release , “,” , serial_number_xlc4	
	With channel parameter: if , space , duInfoList	
General notes		

Example:

```
IF                  # without channel parameter
if 1,7,10345
IF A                # with channel parameter response refers to the channel
if 1,0,1,1500,2540,200,3000,1,55,65,70,90,249
```

Version is intended for further use (currently set to 1)
Release defines the release of the controller board in the XLC4 (valid ranges are 3 to 7, 7 is the latest one)
5-digit *serial number* of the XLC4

The response to the IF command contains the content of a data structure which defines the properties of the driver units.

Without channel parameter		
No.	**Sample**	**Function**
1	1	Type of controller board
2	7	Revision number of controller board
3	10345	Serial number

With channel parameter		
No.	**Sample**	**Function**
1	1	Type of driver
2	0	Revision of driver
3	1	Number of channels at the driver unit
4	1500	MaxCurrentOfType
5	2540	Reserved
6	200	MinCurrentOfType
7	3000	MaxSensVoltage
8	1	MinSensVoltage
9	55	WarningTempDU
10	66	MaxTempDU
11	70	WarningTempLED
12	90	MaxTempLED
13	249	Reserved

Note: Parameters 4, 6,10, and 11 are compared with the values of a connected Corona module. The intersection values are taken.

6.5.2.5 Command TE (query temperatures)

The command TE is used to query the values of the XLC4's internal temperature sensors and the values of the temperature sensors in the connected Corona II modules.

Command		Notes
CommandID	**TE**	TE works in all XLC4 operating modes
Parameter	None	
Parameter	**Value**	**Description**
None		The temperature of the XLC4 and connected Corona II modules is returned.
Response		
	te , space , tempPair , "," , tempPair , "," , tempPair, "," , tempPair	
	tempPair = tval , ["-" , tval]	
General notes		

The value list in the response message contains the temperature values of the four output channels of the XLC4 (channel A first).If Corona II illumination modules are connected, the internal temperature values of the Coronas are added to the corresponding channel temperature values (separated by -)

Example:

TE
`te 23-22,22,23-21,22`

Note that only the first channel of a Corona II is connected to a temperature sensor. The channels with a temperature pair ('-'separated) are connected to the first channel of a Corona. In this example, there are 2 Coronas connected, one at channel A, B and another at C (or C, D)

The TE command can therefore be used to determine the number of connected Corona II modules.

6.5.2.6 Command LC (switch LED)

The command LC is used to switch one or more channels of the XLC4 on or off.

Command		Notes
CommandID	**LC**	LC is operative only in XLC4 mode “Command Mode”
Parameter	None	
	channel	
	new state	
Parameter	**Value**	**Description**
None		
channel	“A”	For channel 1 of the controller
	“B”	For channel 2 of the controller
	“C”	For channel 3 of the controller
	“D”	For channel 4 of the controller
	“E”	For Corona II connected to channel 1
	“F”	For Corona II connected to channel 2
	“G”	For Corona II connected to channel 3
	“H”	For Corona II connected to channel 4
new state	“0”	Off
	“1”	On
Response		
	lc , [channel] , new state	
General notes		
The new values are applied immediately. If no channel is defined, the command is applied to all 4 channels.		

Example:

```
LC 1          # all LEDs are switched on
LC 0          # all LEDs are switched off
LC A 1        # First Channel (A) is switched on
```

The channel identifiers A to D are used to access the 4 output channels.

If one or more Corona II illumination modules are connected to the XLC4, the modules are addressed by the channel specifiers E to H.

Important note:
If you work with Corona II modules, always use the channel qualifiers E, F, G and H instead of using the LC command without channel qualifier. If, for example, a 3 channel Corona is connected to outputs A, B, C, a “LC 1” command switches all 4 channels on. In this case the channel-supervising part of the XLC4 software indicates an error for channel D. If you use “LC E 1”, only channels A to C are switched on and no error is signaled.

6.5.2.7 Command IY (set channel current)

The command IY is used to set and inquire the current of the 4 XLC4 channels.

Command		Notes
CommandID	**IY**	IY is operative in XLC4 mode “Command Mode” and “Bulb Mode”
Parameter	None	
	channel	
	current	
	currentlist	
	Save state	
	Read option	
Parameter	**Value**	**Description**
None		Up to firmware release 4.24: If no parameter is specified, the command responds with the saved values for all channels From firmware release 4.25: If no parameter is specified, the command responds with the current values for all channels.
channel	“A”	For channel 1 of the controller
	“B”	For channel 2 of the controller
	“C”	For channel 3 of the controller
	“D”	For channel 4 of the controller
	“E”	For Corona II connected to channel 1
	“F”	For Corona II connected to channel 2
	“G”	For Corona II connected to channel 3
	“H”	For Corona II connected to channel 4
current	Integer value	The parameter “*current*” defines the output current rating in mA. The value is limited to a range from 200 (mA) to 1800(mA).A connected Corona module could limit these values to smaller values. (e.g. 1600 mA)
Currentlist		
Save state	“W”	If this flag is set, values are saved to nonvolatile flash memory as new default current values.
Read option	“S”	From firmware release 4.25: If this option is used with the IY command, XLC4 responds with the saved values.
Response		
	iy , space , current , current , current , current	
General notes		
If the value in **current** is higher than the specified maximum value, an error message is generated. An IY command with no channel specified is applied to all 4 channels.		

Example:

```
IY      # requests the current values
iy 1000,1000,1000,1000
IY S    # requests the saved current values (> 4.25)
        # requests the default current values (< 4.25)
iy 1000,1000,1000,1000
```

```
IY A 1000                 # Channel A is set to 1000mA
IY 1000,1000,1000,500     # Channel A,B,C  are set to 1000 mA, D to 500 mA
IY 1000,1000,1000,500 W   # Channel A,B,C  are set to 1000 mA, D to 500 mA
                          and are saved to the default values
IY 300                    # all channels are set to 300 mA
IY E 450                  # current for first Corona II is set to 450 mA
IY G 500                  # current for second Corona II is set to 500 mA
```

If Corona II modules are connected, the range of "*current*" might be changed to module-specific new values.

Channel specifiers E to H are used to set the current if Corona II modules are connected.

Current values:

The general range of this parameter is limited from 200 to 1800 mA. If Corona II modules are connected, this value might also be limited by the identification of the module LED color.

Red, blue, Green:	1500 mA
White, IR:	1800 mA
UV:	1400 mA

Program new default current values:

An additional W character after the IY command causes a change in the XLC4's default current values. (Register: *cuPar.DefaultCurrent[n]).* These values are stored non-volatilely in the XLC4 flash memory.

Command	=	IY , space , [channel] , space , current , space , "W"
Response	=	iy , space , channel , space , current , space , "W" | iy , space , current , current , current , current , space , "W"

Default current values are set:

- after switching on the XLC4 controller,
- after setting the controller to the bulb mode and repowering the controller.

6.5.2.8 Command ID (set device ID)

The command ID is used to change the individual device ID of the XLC4 unit.

Command		Notes
CommandID	**ID**	ID works in all XLC4 operating modes.
Parameter	None	
	new device ID	
Parameter	**Value**	**Description**
None		If no parameter is defined, the command responds with the current value for ID.
new device ID	Integer value	Integer value from “1” to “15”
Response		
	id , space , new device ID	
General notes		
The IDs are coded as decimal values in the ID command. For addressing, the IDs are coded in a single hexadecimal character. The new ID is applied after next power-up.		

Example:

ID # requests the current ID of the device

```
id 11
```

ID 11 # sets a new device ID

```
id 11
```

6.5.2.9 Command MO (set operating mode)

The command MO is used to change the operating mode of the XLC4 unit.

Command		Notes
CommandID	**MO**	MO is operative in all XLC4 operating modes
Parameter	None	
	new op. mode	
Parameter	**Value**	**Description**
None		If no parameter is defined, the command responds with the current value for MO.
new op. mode	“0”	Bulb Mode
	“1”	Command Mode (default)
	“2”	PWM-Controlled Mode
	“3”	Analog-Controlled Mode
Response		
	mo , space , new op mode	
General notes		
The new mode is applied after next power-up.		

The functionality of the operating modes is described in section 0 “*Operating Modes*”

Example:

MO 1

```
mo 1
```

6.5.2.10 Command MP (set read period for analog or PWM mode)

The command MP is used to set the read period for the inputs at analog or PWM mode.

Command		Notes
CommandID	**MP**	ID works in analog and PWM XLC4 operating modes.
Parameter	None	
	new MP value	
Parameter	**Value**	**Description**
None		If no parameter is defined, the command responds with the current value for MP.
new device ID	Integer value	Integer value from “500” to “5000”; default value is “1000”; values are in scans per second.
Response		
	id , space , new MP value	
General notes		

Example:

MP
```
mp 1000
```

MP 2500
```
mp 2500
```

6.5.2.11 Command SD (set activation of SHUTDOWN)

The command SD is used to activate the SHUTDOWN input. The shutdown function is not intended to be used for switching in regular operations. This function is intended for safety shutdown of the XLC4 and Corona by hardware like a safety cover of the LED module.

Command		Notes
CommandID	**SD**	SD works in all XLC4 operating modes
Parameter	None	
	new state	
Parameter	**Value**	**Description**
new state	"0"	deactivated (default)
	"1"	Activated shutdown for all channels
Only for firmware > 5.12:		
None		Controller sends a response message with the current value for **new state** in hex format.
new state	"0xF"	Deactivated for all channels (default) corresponding with "SD 0"
	"0x0"	Activated shutdown for all channels, corresponding with "SD 1"
	"W"	Writes the state of hex parameters to permanent memory
Response		
	sd , space , new state	
General notes		
Up to firmware 4.26 The new state is applied after next power-up. **From firmware 5.12** The new state for the commands "SD 1" or "SD 0" is applied after next power-up. The new state for hex parameters (e.g. "SD 0xF") has to be saved with the command "SD W" to the permanent memory. Otherwise changes are lost after a power-up cycle.		

Example:

```
SD 1        # activates the shutdown mode
sd 1


SD 0xF
sd 0xf
```

For a detailed description of the SHUTDOWN function, see section 6.3.

6.5.2.12 Command FA (set ControlFlagsA)

The command FA is used to set the contents of XLC4 control register *ControlFlagsA*.

Command		Notes	
CommandID	**FA**		
Parameter	None		
	register value	HexChar	
Parameter	**Value**	**Description**	
None		If no parameter is defined, the command responds with the current value for FA.	
register value	0x0000		Default value
	0x0001	Service	For service use only – set to 0
	0x0002	Internal	For internal use only – set to 0
	0x0004	ActSW	**XLC4-1 and XLC4-1A:** Activate use of Switch (SW1 to SW2 at connector X6)
	0x0008	ActVO	Activate use of VOUT (VOUT at connector X5)
	0x0010	CheckFan	Supervise Fan-valid signal (ACNTRL at connector X5)
	0x0020	Enable ON	Activates flash function (Signal ON at connector X6)
	0x0200	Channel control mode	**XLC4-1F4:** All channels are controlled independent from the inputs at X6
Response			
	fa , space , register value		
General notes			
The register value is applied after next power-up. Combinations of single flags are possible.			

Example:

```
FA 0x000C       # activates VOUT and SW1-SW2 for cooling device
fa 0x000C
```

Samples for combinations of the Control flags:

ControlFlagA (HexChar)	reserved	reserved	EnableON	CheckFan	ActVO	ActSW	Internal use	Service	Notes
0x0000	0	0	0	0	0	0	0	0	ON disabled, no FAN control or external cooling device control
0x0004	0	0	0	0	0	1	0	0	ON disabled, Standard mode with cooling device at SW1-SW2
0x0008	0	0	0	0	1	0	0	0	ON disabled, Standard mode with Fan at VOUT
0x000C	0	0	0	0	1	1	0	0	ON disabled, VOUT and SW1-SW2 active for cooling device
0x0020	0	0	1	0	0	0	0	0	Switching XLC4 with ON-Input - no cooling device connected
0x0024	0	0	1	0	0	1	0	0	Switching XLC4 with ON-Input - cooling device at SW1-SW2
0x0028	0	0	1	0	1	0	0	0	Switching XLC4 with ON-Input - Fan at VOUT
0x002C	0	0	1	0	1	1	0	0	Switching XLC4 with ON-Input - VOUT and SW1-SW2 active for cooling device
0x0018	0	0	x	1	1	x	0	0	Activating the fan monitoring functions

6.5.2.13 Command FB (set ControlFlagsB)

The command FB is used to set the contents of XLC4 control register *ControlFlagsB*.

Command		Notes	
CommandID	**FB**		
Parameter	None		
	register value	HexChar	
Parameter	**Value**	**Description**	
None		If no parameter is defined, the command responds with the current value for FB.	
register value	0x0000		Default value
	0x0001	CheckOpenChannelA	Enables supervising of Channel A for open circuit
	0x0002	CheckOpenChannelB	Enables supervising of Channel B for open circuit
	0x0004	CheckOpenChannelC	Enables supervising of Channel C for open circuit
	0x0008	CheckOpenChannelC	Enables supervising of Channel D for open circuit
Response			
	fb , space , register value		
General notes			
The register value is applied after next power-up. Combinations of single flags are possible. Only applicable for FW <5.1 and non-Corona LED modules.			

Example:

FB 0x000F

```
fb 0x000F
```

If one or more Corona II modules are connected to the XLC4's output channels, the associated channels are checked for open circuit failures during operation. (An open circuit at a channel can be detected only if this channel is switched on)

If the XLC4 is used with other LED modules than Corona II, the channel configuration is unknown to the XLC4. In this case, the channels that are to be supervised must be activated in ControlFlagsB.

Example:

If ControlFlagsB=0x000E, the XLC4 generates an error condition (err 203) if an open circuit condition is detected at channel C or channel D.

6.5.2.14 Command FC (fan control*)*

The command FC is used to set the switching temperatures for activation of the cooling device.

Command		Notes
CommandID	**FC**	FC works in all XLC4 operating modes
Parameter	None	
	off_temp	
	on_temp	
	save state	
Parameter	**Value**	**Description**
None		Controller sends a response message with the current values for **off_temp** and **on_temp**
off_temp	Decimal number	The connected fan is switched off if the maximum of the measured temperatures falls below the level **off_temp** **Special values:** "0" switches the fans off "1" switches the fans on
on_temp	Decimal number	The connected fans are switched on if the maximum of the measured temperatures reaches the level **on_temp** **Special values:** "0" switches the fans off "1" switches the fans on
save state	"W"	If the option "W" is set, the values are stored non-volatilely in the XLC4 memory.
Response		
	fc , space , off_temp, "," on_temp	
General notes		
The new values are applied immediately. FC is available in Version V4.22 and higher.		

If a cooling device is connected to VOUT or SW1-SW2 and the corresponding flag in FA-Register is set, the working range of the device is defined by the warning levels stored in Corona II or the temperature levels set with the FC command.

Example:

```
FC  50,55                 # set off_temp to 50 °C and
fc 50,55                  #      on_temp to 55 °C

FC  50,55 W               # set and store new values
fc 50,55

FC  1,1                   # switch on the fans independent of the temperature
FC  0,0                   # switch off the fans independent of the temperature
```

If the levels of **on_temp** and **off_temp** are set to 0, the warning levels stored in Corona II are used for fan switching. In this case, a hysteresis of 5K is implemented. That means, if the warning level is set to 60°C, the fans are switched on at 60°C and off if the temperature falls below 55°C.

6.5.2.15 Command IP (set and read IP address / set addressing mode)

The command IP is used to read and modify the IP address of the XLC4 and to change the addressing method.

Command		Notes
CommandID	**IP**	IP works in all XLC4 operating modes
Parameter	None	
	mode	
	ip_address	
Parameter	**Value**	**Description**
None		Controller send a response message with the current values for **mode** and **ip_adress**
mode	"M"	Static IP address (default)
	"D"	DHCP addressing
ip_adress	valid IP address string	e.g.: 192.168.87.234 (default)
Response		
	ip , space , mode , space , ip_address	
General notes		
Changes are applied after next power-up.		

Examples:

IP #Read addressing mode and address
`ip M 192.168.87.234` #XLC4 is in static IP mode

IP M #Change addressing mode
`ip M 192.168.87.234`

IP 192.168.87.234 #Change IP address
`ip M 192.168.87.234`

6.5.2.16 Command SV (set and read supply voltage limits)

The SV command is used to modify the voltage limits

Command		Notes
CommandID	**SV**	SV is operative in all operating modes
Parameter	None	
	voltage pair	
Parameter	**Value**	**Description**
None		Request for temperature levels channel A.
voltage-pair	Two comma-separated integer values	The two values are representing the new upper and lower limits for the input supply voltage [mV] which are to be stored in the nonvolatile memory of the XLC4 unit. Lower limit: 10600 Upper limit: 26400 Second value should be greater than the first value.
Response		
	sv , space , min-level , max-level	
General notes		
Values are stored in the nonvolatile memory of the XLC4 controller. The values are valid after the next power-up of the XLC4 controller. Applicable for firmware version 4.25 and higher. If the input voltage exits the defined voltage range, an error 200 is set and the Corona-LEDs are switched off. The error state is held, even if the input voltage changes back to a valid value. The error state can be cleared by sending the command ER 0 or by repowering.		

Example:

SV	# request for values
`sv 21600,26000`	
SV 22000,25500	# sets new values (22 Volt lower limit, 25,5 Volt upper Limit)
`st 22000,25500`	# return value

6.5.2.17 Command VT (read voltage values)

The VT command is used to read the voltage values in the XCL4 controller.

Command		Notes
CommandID	**VT**	VT works in all XLC4 operating modes
Parameter	None	
Parameter	**Value**	**Description**
None		
Response		
	vt, space, input , analog , channel 1, channel 2, channel 3, channel 4.	
General notes		
The output values are in mV. For the voltage of the LEDs a factor of 18,46 has to be applied.		

Example:

VT # request for values

```
vt 24758,0,1347,1343,1350,1350
```

Supply voltage:	24,758 volts
Analog input:	0 volts
LED voltage at channel A:	1,347 * 18,46 = 24,85 volts

6.5.2.18 Command ST (set temperature limits)

The command ST is used to change the Corona II temperature warning and temperature error limits.

Command		Notes
CommandID	**ST**	ST is operative in all operating modes
Parameter	None	
	channel	
	temperature-pair	
Parameter	**Value**	**Description**
None		Request for temperature levels channel A.
channel	"A"	Ask for and set levels of Corona at channel A
	"B"	Ask for and set levels of Corona at channel B
	"C"	Ask for and set levels of Corona at channel C
	"D"	Ask for and set levels of Corona at channel D
temperature-pair	Two comma-separated integer values	The two values are representing the new warning and error temperature levels [°C] which are to be stored in the Corona connected to the selected Channel.
Response		
	st , space , channel , space, warning-level , error-level	
General notes		
The ST command is used to modify the temperature limits, stored in the nonvolatile memory of the Corona II. Applicable for firmware version 4.25 and higher. Changes are applied after next power-up. Automated switch-off after temperature limit only for 4.25 and higher.		

Example:

```
ST                  # request for values
st 70,90            # return value for channel A
ST B 65,75          # sets new values for channel B
st B 65,75          #
```

Values for the temperature limits are limited between 0 and 90 °C.

If there is no I²C controller connected to a specified channel, an error is returned

```
ST B 65,75          #  try  to set new values for channel B
err 101             #  error if no I²C controller is connected to B
```

If the limits would be exceed for the new values, there will be an error

```
ST B 65,92          #  try  to set values for channel B higher than 90 °C
err 101             #  error values is higher than 90 °C
```

Error case:

If the temperature exceeds the set limits of the error level, the controller switches off all connected LED modules. The error LED is set, the error output pin is set to high, and error 205 is set. There is no automatic reset after cooling down of the module. The error has to be reset with "ER 0" or by repowering the XLC4 controller.

6.5.2.19 Command RS (restart controller)

The command RS is used to reset the controller, so that changed parameter take effect.

Command		Notes
CommandID	**RS**	RS works in all XLC4 operating modes
Parameter	None	
Parameter	**Value**	**Description**
None		
Response		
General notes		
Applicable for firmware version 5.002 and higher.		

Example:

```
RS                    # resets the controller
rs                    #
```

6.5.2.20 Command ER (query error state)

The command ER is used to query the XLC4's internal error state.

Command		Notes
CommandID	**ER**	ER works in all XLC4 operating modes
Parameter	None	
	reset	
Parameter	**Value**	**Description**
None		The current error state of the XLC4 is coded in the return value err_state
Reset	"0"	With this parameter the error state is reset.
Response		
	er , space , err_state	
General notes		
Resetting the error state only works if the reason for the error doesn't exist anymore.		

Example:

```
ER
er 205
ER 0                  # resets the error state
er 0
ER
er 0                  # no error state
```

(For information about error codes, see section 6.5.2.21 "Error codes")

6.5.2.21 Error codes

If a command is erroneous, an error response is generated instead of the standard response.

Examples:

```
MU 1
er 100              # unknown command
IY K 500
er 101              # unknown parameter
IY A 4000
er 102              # parameter out of range
```

If an internal error is detected, an error message is appended to the standard response.

Example:

```
TE
te 70-80,71,23-21,22;er 202,A
```

Table of error codes:

Number	Description
100	Unknown command
101	Unknown parameter
102	Parameter out of range
103	
200	Supply voltage exceeds limits
201	Analog control voltage exceeds limits
202	LED Voltage out of range
203	Output voltage exceeds limits (programmed in the Corona)
204	Warning temperature exceeded
205	Maximum temperature exceeded
206	Shutdown active
210	Write error to EEPROM in Driver Unit
211	Read error from EEPROM in Driver Unit
212	Write error to EEPROM in Corona
213	Read error from EEPROM in Corona
214	Fan failure detected at ACTRL
215	Programmable voltage value out of range (programmed int the controller)

6.5.3 Operating modes

The unit can operate in different operating modes. The operating mode can be programmed into the unit by a command and is stored in nonvolatile memory.

Use the MO command to change the operating mode.

For a detailed description of the operating modes, see the following sections.

cuPar. WorkingMode	Operating Mode
0	Bulb Mode
1	Command Mode
2	PWM-Controlled Mode
3	Analog-Controlled Mode

6.5.3.1 Bulb mode

Parameter	Value
cuPar.WorkingMode	0

In this mode, the LED controller behaves like a classical bulb lamp.
If the supply voltage is applied, the LEDs are switched on immediately.

The XLC4 provides constant output currents for all 4 outputs. The amount of the currents is pre-set by a command and stored nonvolatile in registers *cuPar.DefaultCurrent[0..3]*

The contents of this registers are changed with the command:

```
Command    =    IY , [channel] , current , “W” |
                IY , current , current , current , current , “W”

channel    =    “A” | “B” | “C” | “D”
current    =    decimal number
```

The value of current defines the channel current (in mA) for each of the 4 output channels.
If no channel is specified, the stated current value is set to all 4 channels

Example:

```
IY A 1000 W                 # Channel A is set to 1000mA
IY 1000,1000,1000,500 W     # Channel A,B,C  are set to 1000mA, D to 500mA
IY 500 W                    # all Channels are set to 500mA
```

The new currents are applied at once. If the programmed currents exceed the limits, the current is reduced to the maximum current.

Errors are indicated via the Status LED.

If the maximum temperature in the temperature sensors is exceeded, the external switch contact is closed (e.g. to activate a cooling system).

Note: This mode is intended to be used for starting with a fixed amount of light, e.g. for switching it once per day. It is not intended to be used for “flashing”, e.g. per work piece due to the long delay for powering up of the module.

6.5.3.2 Command mode (RS232, RS485 USB, Ethernet)

Parameter	Value
cuPar.WorkingMode	1

In this mode, the output current of the LED controller is switched and adjusted by commands.

The LEDs are switched on and off with the LC command.

The currents for the four channels are set by the IY command.

6.5.3.3 PWM-controlled mode

Parameter	Value
cuPar.WorkingMode	2

In this mode, the output currents of the LED controller are switched and adjusted by two external opto-isolated input signals, ON and PWC. (For information about electrical properties, see section 6.3.6.)

The LEDs are switched on with a High Level at input ON and switched off with a Low Level.

The currents for the 4 channels are controlled by the duty cycle of the PWC input.

PWC is a pulse-width-modulated signal. The duty cycle of PWC defines a current factor F which is multiplied with the default channel current of each individual channel to set the resulting output current.

$$I(channel) = I_{default}(channel) \cdot F$$

The duty cycle *D* is defined as $D = \frac{t_P}{T}$

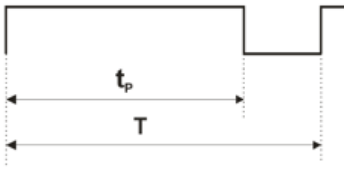


Figure 6-13

The current factor *F* is given by

$$F(PWC) = \frac{D(PWC)}{0.8} \cdot \qquad \text{for} \quad 0.1 \le D(PWC) \le 0.8$$

$$F(PWC) = 1 \qquad \text{for} \quad D(PWC) > 0.8$$

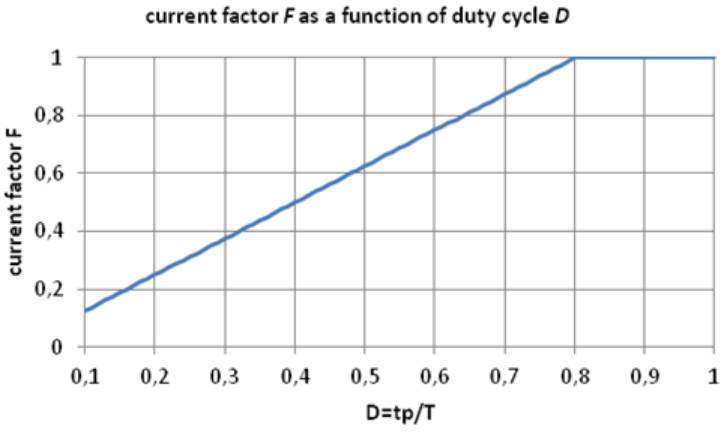


Figure 6-14

The base currents $I_{default}(channel)$ are read from *cuPar.DefaultCurrent[0..3]*

The following limits are valid for T and t_P

Item	Description	Min.	Nom.	Max.	Unit
t_P	pulse width (high)	10		100	[µs]
T	pulse period	20		250	[µs]

Additional condition: t_P >=0.1 x T

Errors are signaled by status LEDs and output signal FAIL.

6.5.3.4 Analog-controlled mode

Parameter	Value
cuPar.WorkingMode	3

In this mode, the output currents of the four LED channels are set by the external input control voltage ACTRL.

The current range of the output channels is mapped to an input voltage range of ACTRL from 0V to 10V. The output currents of the 4 channels are directly proportional to the voltage ACTRL.

$$I_{CHANNEL}[mA] = \frac{ACTRL[V]}{10} \cdot MaxCurrentOfType$$

If the level of ACTRL oversteps 10V, each current is limited to the maximum allowed channel current (*MaxCurrentOfType*).

If the LEDs are off, ACTRL must be higher than $\frac{MinCurrentOfType}{MaxCurrentOfType} \cdot 10$

to switch the LEDs on. This inhibits the controller to generate lower current levels than the lower limit *MinCurrentOfType*

If the LEDs are on, and the level of ACTRL falls under the “switch on level”, the current is limited to *MinCurrentOfType* until ACTRL falls under the switch on level minus 0.5 V.
If ACTRL underruns this limit, the LEDs are switched off.

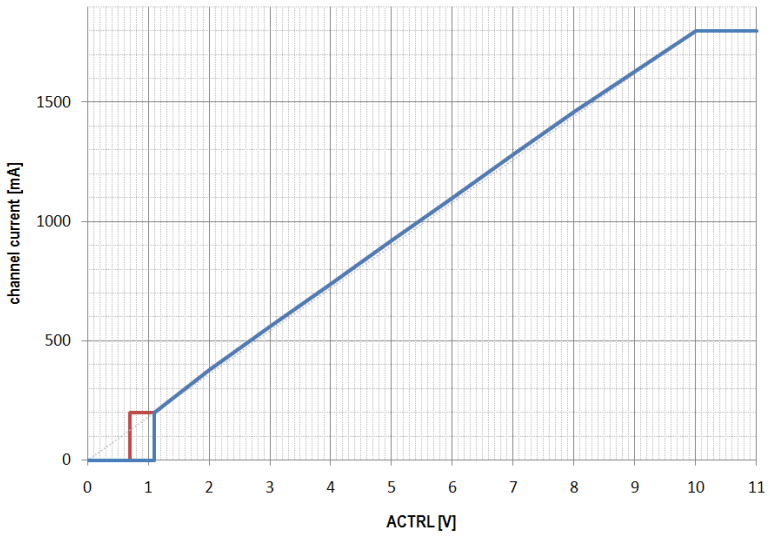


Figure 6-15: Channel current as a function of ACTRL-Voltage. (switch on / switch off)

For Standard XLC4-1, the MaxCurrentOfType is 1800 mA and MinCurrentOfType is 1800 mA. The chart above shows the behavior of the controller under that condition.

NOTICE

The range of *MaxCurrentOfType* and *MinCurrentOfType* can be further limited by connected Corona II modules.

If, for example, a Corona II with a maximum current of 1500mA is connected to channels A and B, and another Corona II with maximum current 1800mA is connected to C and D, a level of 10V at ACTRL results in a sourcing 1500mA at channels A and B and 1800mA at channels C and D

Errors are indicated via the status LED and the Signal FAIL.
If the maximum temperature in the temperature sensors is exceeded, the external switch contact is closed (e.g. to activate a cooling system).

6.5.3.5 Flash operating mode

This mode is intended to be used for flash operation, e.g. switching the light on per work piece.

This mode is limited to:

XLC4-1 (CP000411):

Item	Notes	Min.	Nom.	Max.	Unit
Flash frequency		1	10	20	kHz
Trigger pulse		10	20		µs
ON-Delay	for 4,5 Volt input voltage		10		µs
	for 10 Volt input voltage		3		µs
OFF-Delay	for 4,5 Volt input voltage		20		µs
	for 10 Volt input voltage		60		µs

XLC4-1A (CP000411-1A) and XLC4-1F4 (CP000411-1F4):

Item	Notes	Min.	Nom.	Max.	Unit
Flash frequency		1		60	kHz
Trigger pulse		10		Tp – 2	µs
ON-Delay			0,6		µs
OFF-Delay	for 4,5 Volt input voltage		0,6		µs

For more information please refer to chapter “8.2 Switching and flashing the Corona”

Note: **T**ake care about the timing and ask for support at Chromasens.

6.5.4 RS232 – Operation

The XLC4’s 3-wire RS232 interface works with fixed serial configuration.

Serial configuration	Value
Baud rate	115200
Data bits	8
Stop bits	1
Parity	None

6.5.5 RS485 – Bus configuration

Several XLC4 modules can be connected to a single RS485 control bus.

Serial configuration	Value
Baud rate	115200
Data bits	8
Stop bits	1
Parity	None

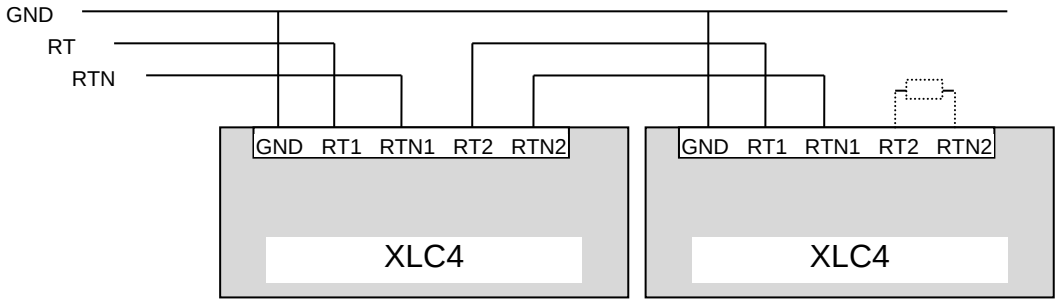


Figure 6-16: Electrical setup for RS485 operation

To access a dedicated XLC4 in the bus, individual device IDs must be programmed for each bus member. (Factory default is ID=1)

For programming individual device IDs, use the ID command.

If accessing a selected XLC4 device in the RS485 bus, each command has to be preceded by an address qualifier. An address qualifier is preceded by a '#' sign.

Valid device IDs are in the Range from 1 to 15 (hexadecimal #1 to #F)

A command with the address qualifier #0 is accepted from all XLC4s at the bus, independent of their individual device ID.

At direct addressing with #1 to #F a response is sent. At a broadcast message with #0, no response is sent by the controller-

Example:

```
#3 IY A 1000      # Channel A of XLC4 with ID=3 is set to 1000 mA
#E LC G 1         # second Corona II of XLC4 with ID=14 is
                  # switched on
#0 LC 0           # All channels of all XLC4 on this bus are switched
                  # off.
```

6.5.6 Ethernet control

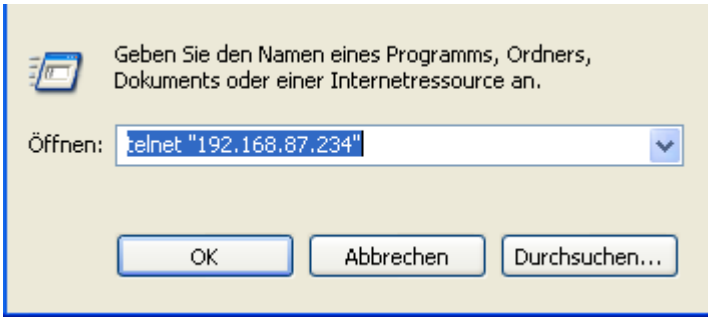
The controller is shipped with a default IP address (192.168.87.234) and it is set to manual mode.

For operation of several controllers the single controllers must be connected one-by-one to the computer and either set to DHCP mode or to be programmed with different IP addresses. Therefore, the host PC Ethernet controller has to be set to a fixed IP in the same net (e.g. 192.168.87.**10**) with the same subnet 255.255.255.0

It is recommended to set up closed networks for the lighting controllers with an extra Ethernet port and e.g. switches.

6.5.6.1 Telnet configuration

If no user application exists, the easiest way to control the XLC4 Controller via Ethernet is to establish a Telnet connection. Start a Telnet shell with the command `telnet`, followed by the IP address of the box.



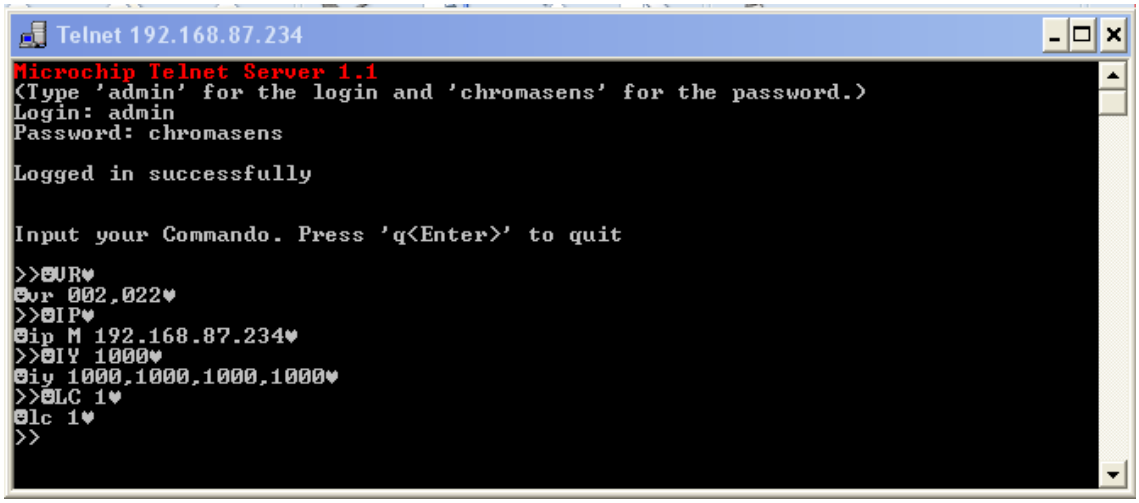
The standard IP address of the Controller (at delivery) is

192.168.87.234 and with static IP-address-mode

The standard IP address can be changed with the IP command.

The Telnet Server of the XLC4 requests a login name and a password:

Login: admin
Password: chromasens



After log-in, all XLC4 Commands can be sent in the same way as described for the serial interface.

Note that each command has to be enclosed in an <STX> <ETX> frame.

<STX> can be sent by pressing <CTRL>+B
<ETX> can be sent by pressing <CTRL>+C

6.5.7 DHCP

This function is available at firmware 5.1 or higher.

If the XLC4 is in DHCP Mode (set by command IP D), the controller gets its IP address from a DHCP Server.

If no DHCP server is available, the programmed standard IP address is used.

7 XLC4 Commander

Descriptions refers to Version 5.1.

7.1 Overview

The XLC4Commander program is intended as an easy-to-install and easy-to-use demonstration tool to get acquainted with the handling of the Chromasens Line Scan Illumination **Corona II** and its Control Unit **XLC4-1** (and XLC4-4 for D50 illumination). So it is assumed that you have carefully read the manuals describing the XLC4-1 and the Corona II as prerequisite.

Even though the XLC4 knows 4 different operating modes, namely Bulb Mode, Command Mode, PWM-Controlled Mode and Analog-Controlled Mode, the XLC4Commander is meant to be used mainly in Command Mode.

7.1.1 Installation

The program comes as an .exe file and needs no further files or installer kits. Just copy `XLC4Commander.exe` to a folder of your choice on your PC. It is started by double-click on the filename. Better store a copy or a shortcut on the desktop.

XLC4 commander can be downloaded at http://www.chromasens.de/en/Corona-software

7.1.2 Interfaces

The XLC4-1 is equipped with 4 different control interfaces:

RS232	(connector X1)
USB	(connector X2)
Ethernet	(connector X3)
RS422	(connector X7)

With XLC4Commander there are some restrictions. It works:

with RS232 (COMx interface)
with Ethernet TCP/IP using an IPv4 address
USB might be used if emulated as virtual COM interface

7.2 Handling

7.2.1 Cabling to PC

Connect your Corona II modules in the desired configuration to the XLC4-1 using the connectors X8 through X11. For cabling and valid combinations of Corona II modules and XLC4 see section 6.1.

For the connection to the PC use

1) RS-232-Cable DSUB9 1:1 female-male
2) Cat-5 Patch cable for Ethernet
3) USB cable AM-BM

7.2.2 Starting the program

To start the XLC4Commander program, double-click its .EXE file in the explorer or copy a shortcut to the desktop and start it from there.

After start the XLC4 commander displays the following window:

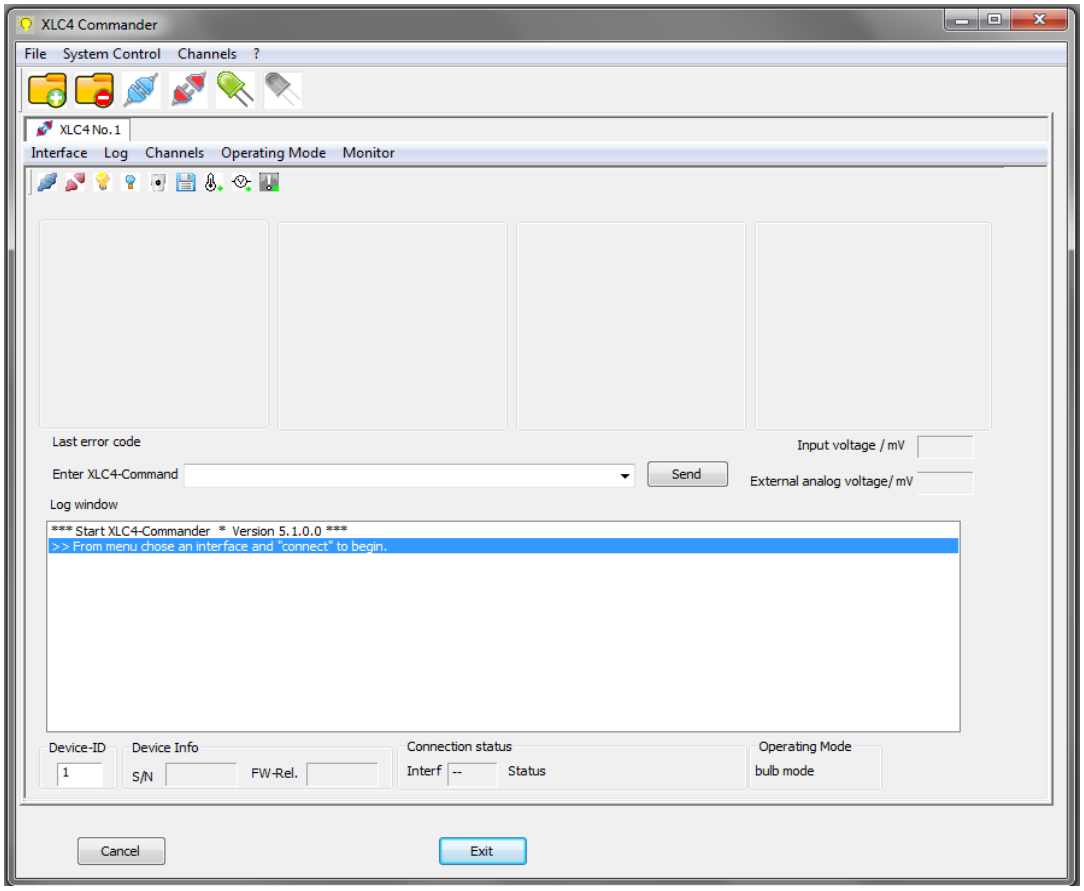


Figure 7-1: Start-up window

7.2.3 General functions

The XLC4 commander is able to operate with several XLC4 controllers. Therefore, different functions are available to operate the different controllers as well as all connected controllers.

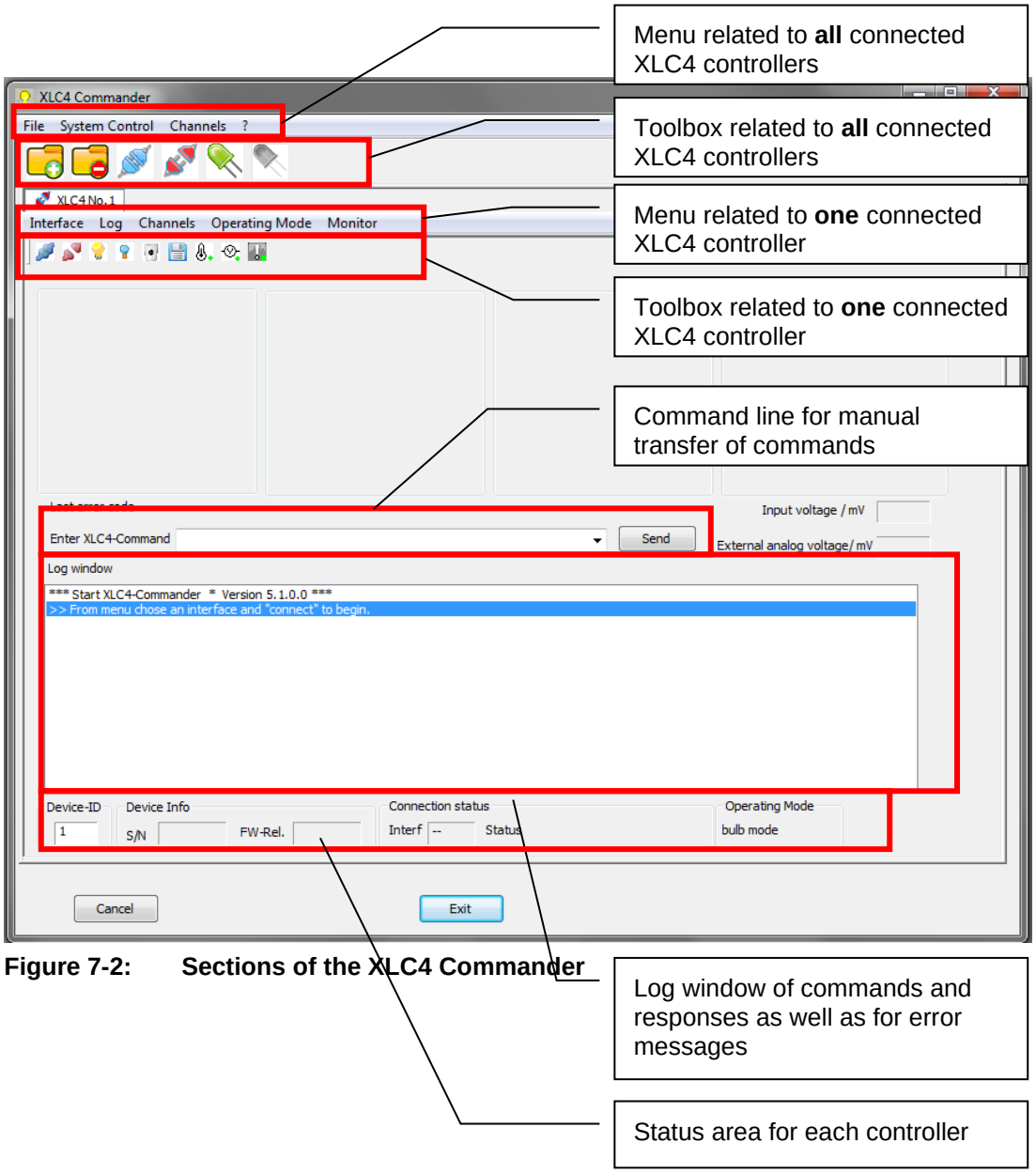
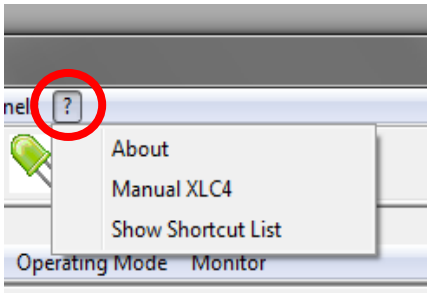


Figure 7-2: Sections of the XLC4 Commander

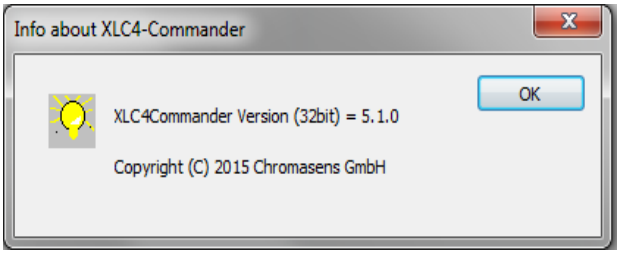
7.2.4 Information and support

When you click “?”, the menu for information and support opens.



1. **“About”:**

   This command returns the version of the XLC4 commander.



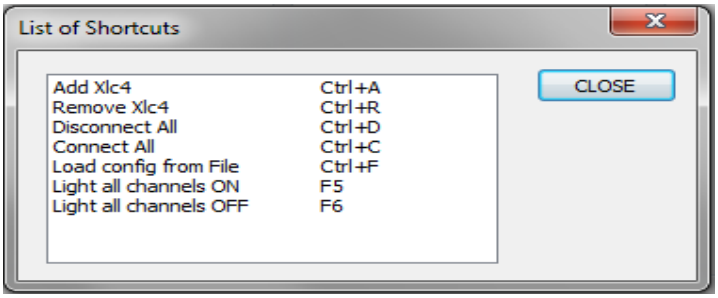
   Please check for newer versions on http://www.chromasens.de/en/Corona-software before you contact Chromasens support.

2. **“Manual XLC4”:**

   This command opens this manual as PDF. Make sure that an up-to-date version of a PDF reader is installed on your PC. A PDF reader is available on www.adope.com

3. **“Show Shortcut List”:**

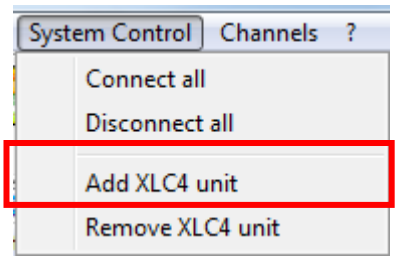
   XLC4 commander supports several shortcuts. This command shows a list of available shortcuts.



7.2.5 Multiple XLC4 operation

XLC4 commander can handle several XLC4 controllers. You can open a single tab per used XLC4 controller.

7.2.5.1 Adding a tab to the XLC4 commander



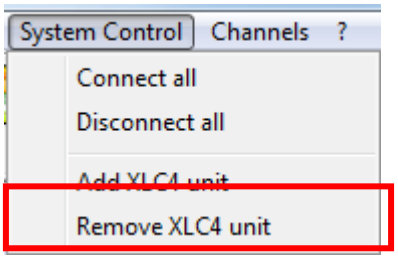
or

The number of available tabs is limited to 10 tabs.

Result:

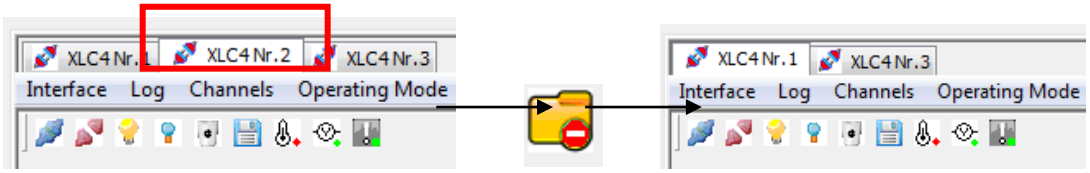
7.2.5.2 Removing a tab to the XLC4 commander

The active tab can be removed by using the following buttons.



or

Result:



Active tab

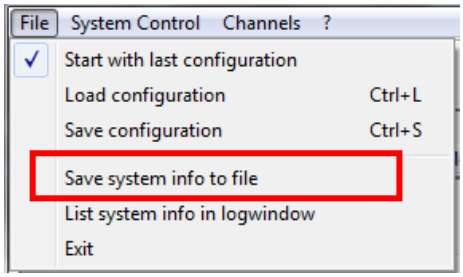
7.2.6 Support files

For better support the XLC4 commander permits to save log files or system information. Save these files to the PC and provide these files for Chromasens support.

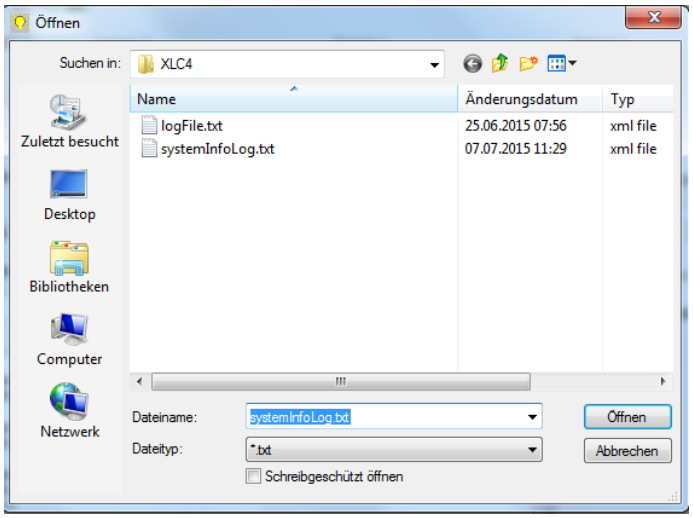
7.2.6.1 System information

Save system information:

This command permits to save system information of all connected XLC4 controllers and the Coronas connected to the XLC4 controllers to an ASCII file.



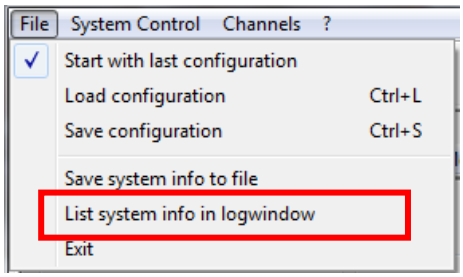
A file dialog box opens:



Default file name: systemInfoLog.txt

List system information to the log window:

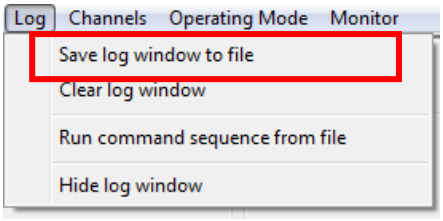
This command transfers the system information to the log window of the current tab.



7.2.6.2 Log files

Save log window to file:

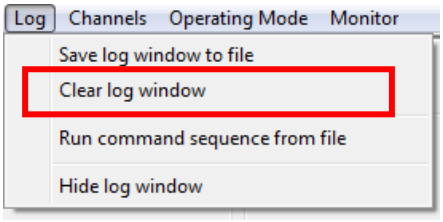
This command permits to save all messages as shown in the log window to a file. This command relates to the active tab and its connected XLC4 controller.



A standard windows file dialog opens.

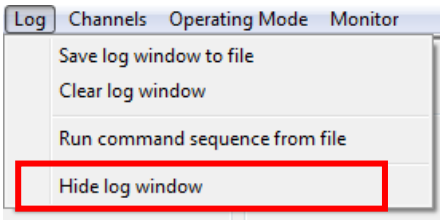
Clear log window:

This command removes all messages from the log window of the current tab.



Hide log window:

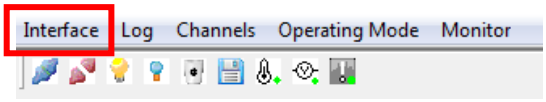
This command hides the logging window. The contents of the logging window is not deleted.



7.3 Operating an XLC4 controller

7.3.1 Connecting the XLC4 controller to the XLC4 commander

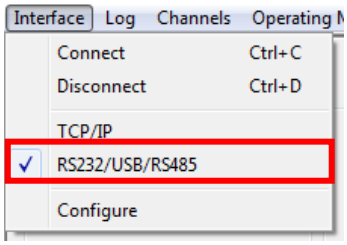
First step is to connect the commander software with the controller.



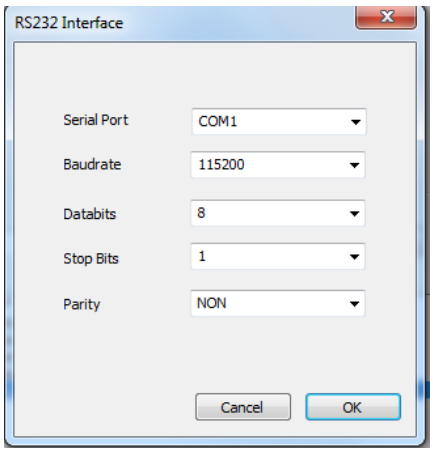
For each tab the connected interface type has to be selected.

7.3.1.1 RS232 / USB / (RS485)

Step 1: Select the interface



Step 2: Configure the port.

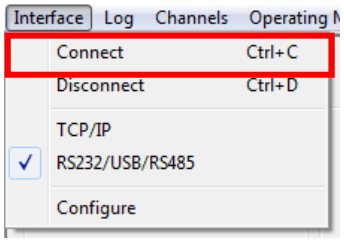


Only available COM ports are displayed in the list. If e.g. one COM port is already in use by another tab of the XLC4 commander, it is not displayed.

If the USB port is used, refer to the device manager of Windows to check the number of the virtual Com port.

Note: For the first setup it is important to click **OK**, even if the settings look correct.

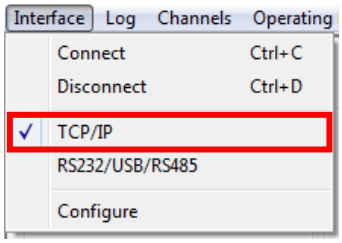
Step 3: Click **Connect**:



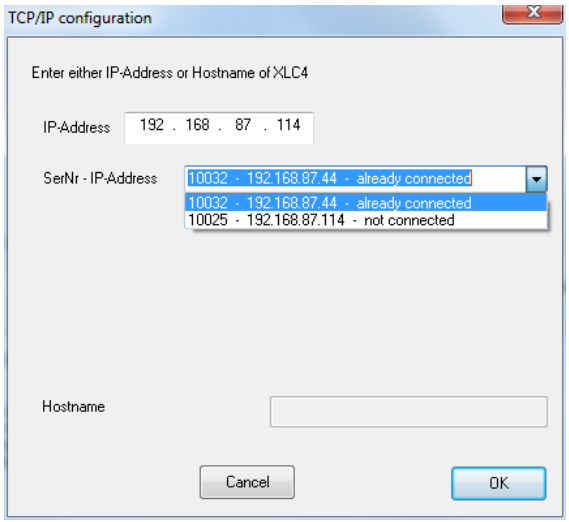
or 

7.3.1.2 Ethernet

Step 1: Select the interface

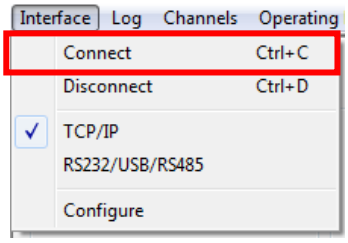


Step 2: Configure the port.



If you click **Configure**, the XLC4 commander scans the network for connected XLC4 controllers and displays them in the list with serial numbers and IP addresses.

Step 3: Click **Connect**:



or 

Firmware XLC4 – 4.23:

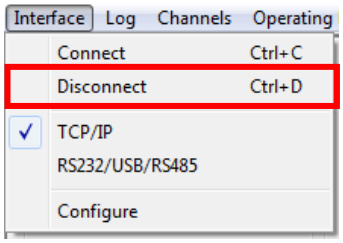
For XLC4 controllers with firmware release up to 4.26 do not support automatic detection. The IP address must be set manually in the XLC4 commander.

Firmware XLC4 - 5.1:

XLC4 controllers with firmware 5.1 or higher are shown in the drop box list. The XLC4 commander sends a broadcast on Ethernet and displays all available controllers as well if they are already connected.

7.3.2 Disconnect the XLC4 controller from the XLC4 commander

The connection for both interfaces could be closed by using:



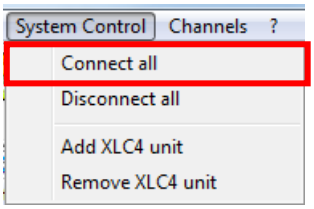
or 

Note: To avoid error messages it is recommended to disconnect the XLC4 commander from the XLC4 controller if the controller is switched, e.g. for setting a new operating mode.

7.3.3 Connecting and disconnecting several XLC4 controllers

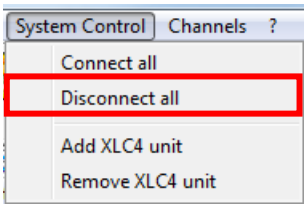
If there is a working setup with several XLC4 controllers, e.g. by a configuration file, it is possible to connect them within a single operation.

1. Connect all



or 

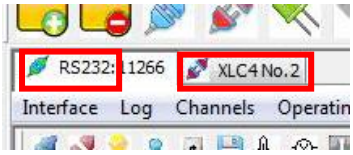
2. Disconnect all



or 

7.3.4 Status of connections

The status of the connections is displayed at the top of each single tab as well as in the status area in the bottom of each tab.

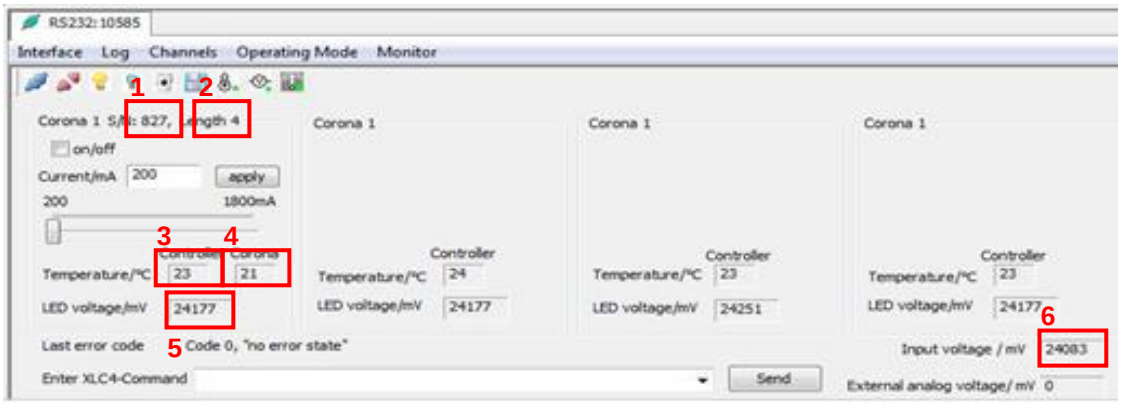


or 

7.3.5 Control panel for Corona modules

After connecting the XLC4 commander with an XLC4 controller with connected Corona module a control panel is shown:

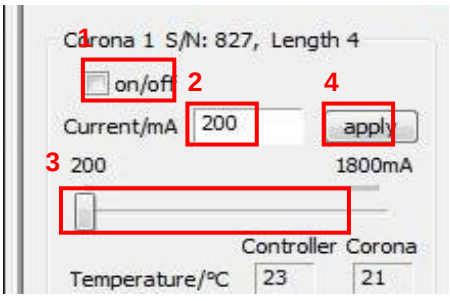
Information shown by the control panel:



1. Serial number of the connected Corona
2. Number of LED boards of the connected Corona
3. Temperature of the channel on the XLC4 controller
4. Temperature on the Corona module
5. Output voltage of the channel on the XLC4 controller
6. Supply voltage of the XLC4 controller

1. Serial number of the connected XLC4 controller
2. Firmware version on the XLC4 controller
3. Selected interface type for connection to the XLC4 controller.
4. Port name or IP address used by this tab.
5. Operating mode used in the connected XLC4 controller.

Operating functions available on the control panel



1. On-Off check box for the module or for a single channel (in manual channel setup)
2. Input box for manual entering the LED current value.
3. Slider for adjusting the LED current value.
4. Button for sending the new LED current value to the XLC4 controller.

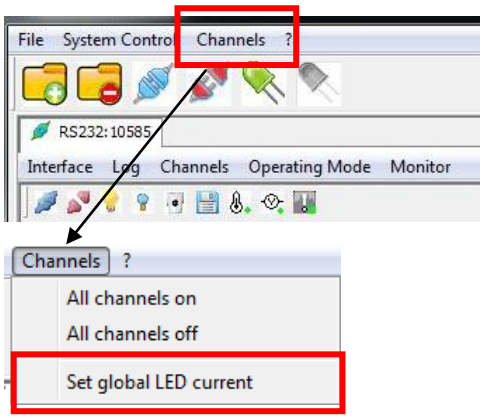
7.3.6 Operating the Corona with the XLC4 commander

7.3.6.1 Setting the LED current

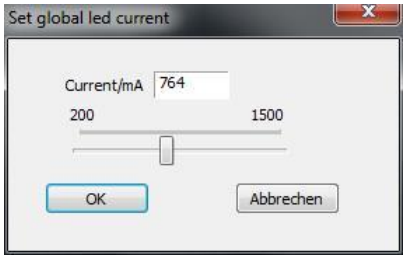
This function sets a new current to the channels of the XLC4 controller.

Note: This function does not save the currents into the permanent memory of the controller. Enter e.g. the command “IY 1000 W” in the command line and click the **send** button to save a current value permanently to the controller.

1. General setting of the LED current for all connected XLC4 controllers



A dialog box opens. You can set the current either with the input box as well as with the slider. When you click **OK**, the new value is transferred to all connected XLC4 controllers.



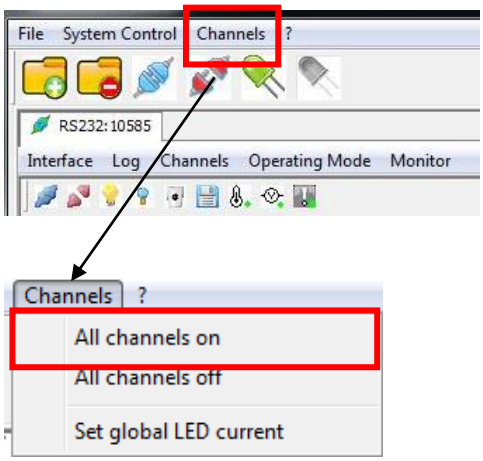
2. Setting the current for a single controller in the active tab.

The value could be entered in die input box as a number within the limits. There is also a slider to set up the current for all channels of a single connected Corona module.

Click **apply** to transfer the new value.

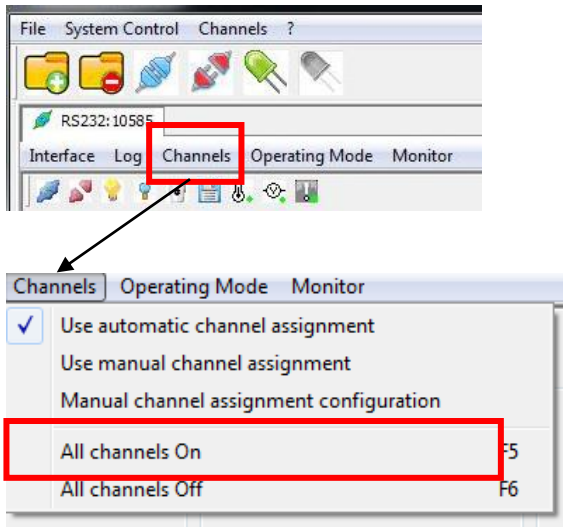
7.3.6.2 Switching the LEDs ON

1. General switching ON for all channels of all connected XLC4 controllers



or 

2. Switching all channels ON of a single connected XLC4 controller in the active tab.

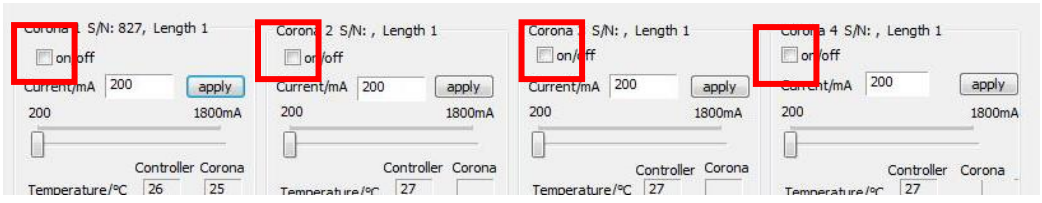


or 

Or

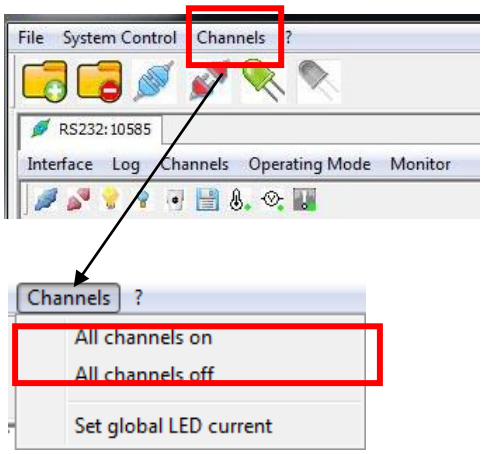
3. Switching ON single LED boards on a single connected XLC4 controller

   This is important for manual channel configuration.



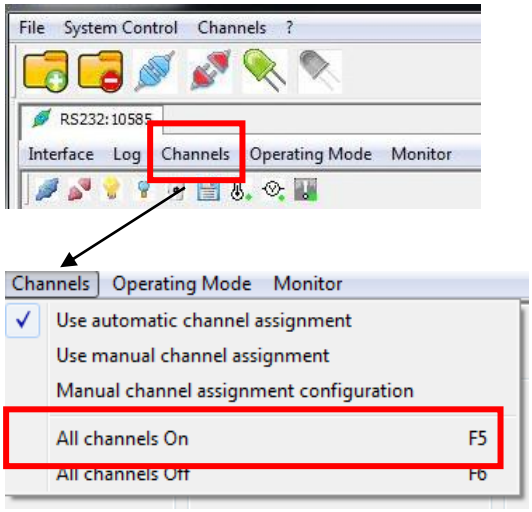
7.3.6.3 Switching the LEDs OFF

1. General switching OFF for all channels of all connected XLC4 controllers



or 

2. Switching all channels OFF of a single connected XLC4 controller in the active tab.

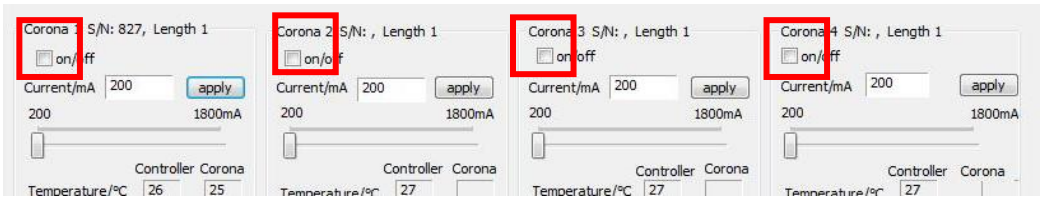


or 

Or

3. Switching OFF single LED boards on a single connected XLC4 controller

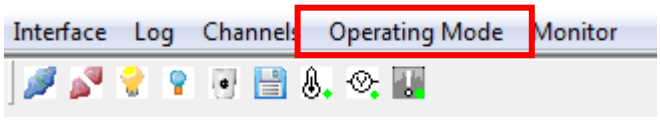
   This is important for manual channel configuration.



7.3.6.4 Setting the operating modes

There are four different operating modes available in the XLC4 controller.

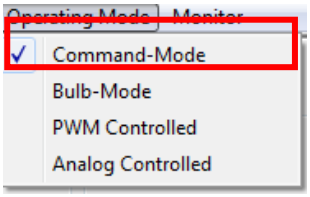
This function relates to the current tab and its connected XLC4 controller.



Note: After setting a new operating mode is necessary to repower the controller for setting the new operating mode in operation.

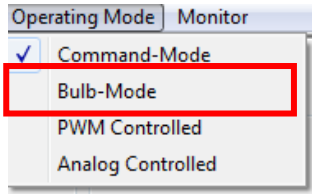
1. Command mode

You can control the module by commands from the XLC4 commander.



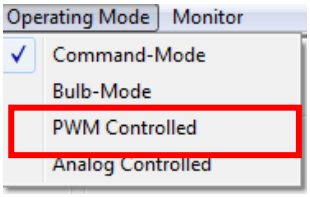
2. Bulb mode

The controller starts with the saved current in the controller after repowering the controller. The current has to be saved with e.g. “IY 1000 W” by using the command line.



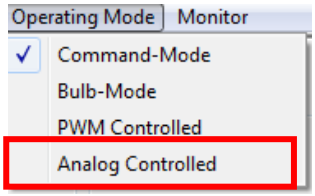
3. PWM mode

After setting this mode the brightness (current) could be controlled by a PWM signal at port X6.



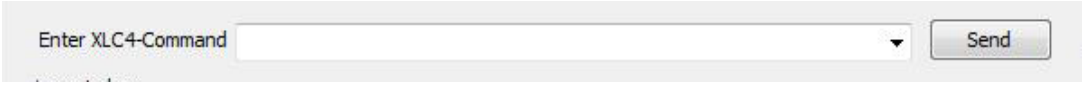
4. **Analog mode**

   After setting this mode the brightness (current) could be controlled by an analog signal at port X6.



7.3.6.5 Sending individual commands to the XLC4

By using the command line, you can send commands manually to the controller. After entering a command into the command line, you can transmit it by clicking **Send**:

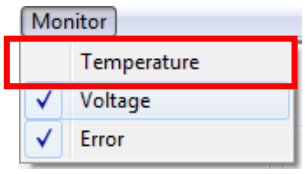


The transmitted command is shown in the log window. The response is displayed as well.

7.3.6.6 Monitoring the controller and the LED modules

1. **Temperature:**

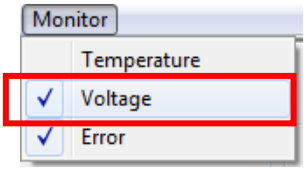
   If this option is selected, the temperature of the controller channels as well as of the connected Corona modules is polled and displayed in the commander.



or 

2. **Voltage:**

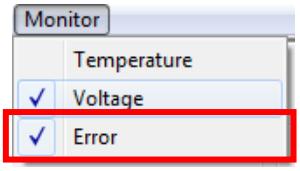
   If this option is selected the input voltage of the controller as well as the output voltage of each channel is polled and displayed.



or 

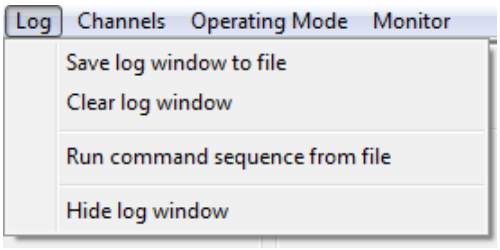
3. **Errors**

   If this option is selected, error messages are displayed in the log window.



or 

7.3.7 Sending command sequences to the controller



7.4 Configuration management

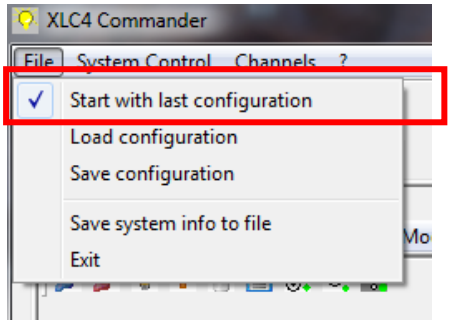
To improve the handling of several XLC4 controllers in different setups, there is the possibility to save and load configurations for the XLC4 commander.

7.4.1 Default configurations

If the XLC4 commander has been able to set up a connection to XLC4 controllers, this setup is saved to a file after closing the XLC4 commander.

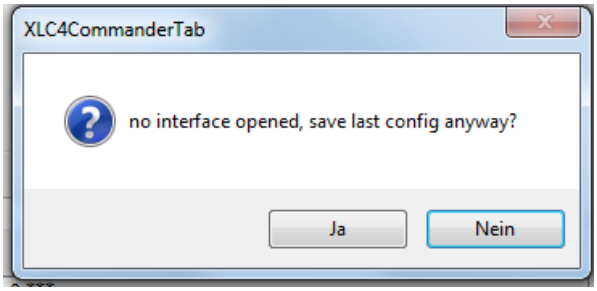
Filename: c:\Users\Public\Chromasens\XLC4\LastConfig.ini

To start the XLC4 commander with this last configuration the option has to be selected:



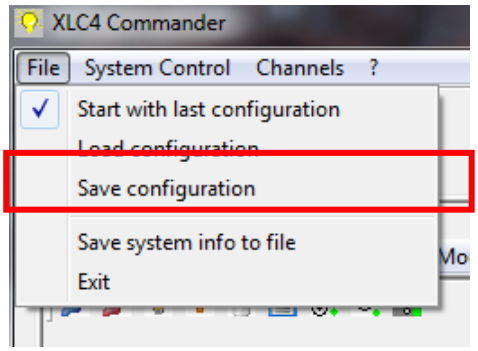
The status of this option is stored in the registry (current-user directory).

If there is no working connection established and the controller is closed, the user is asked whether the settings should be stored anyway.

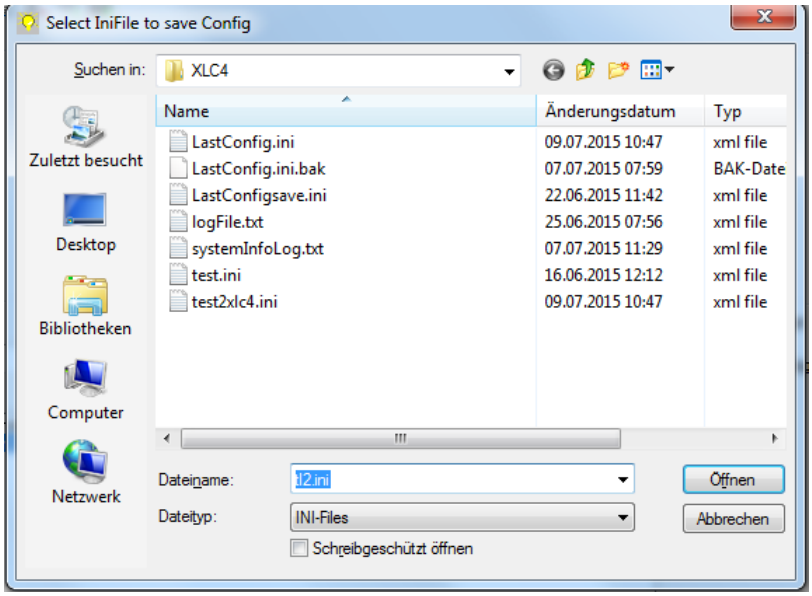


7.4.2 Saving configurations

You can store a configuration in an individual file.



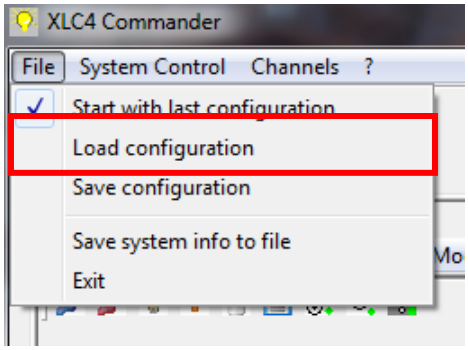
A standard Windows file dialog box opens:



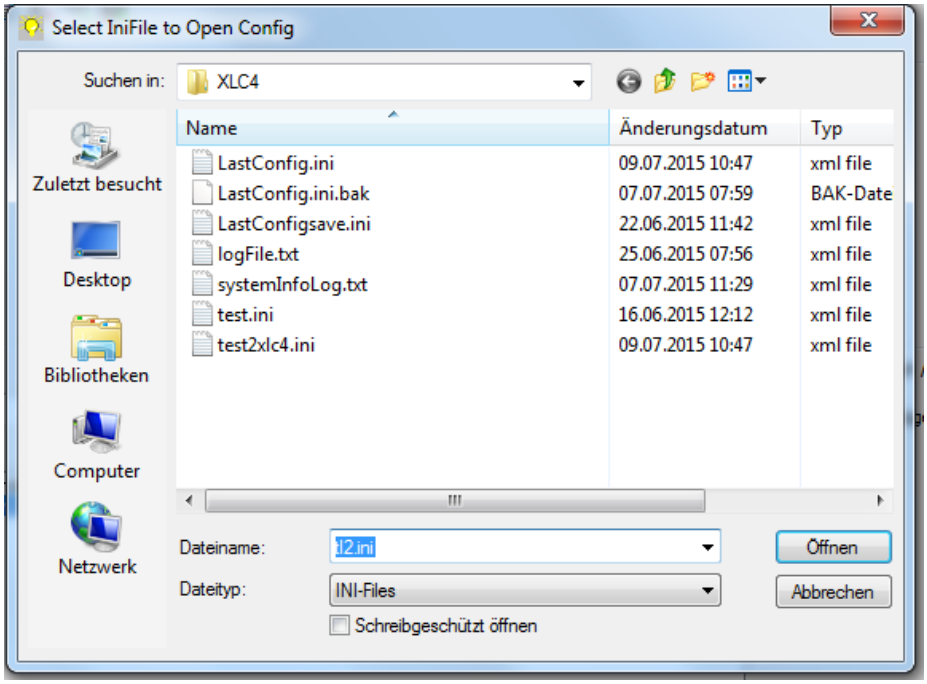
Default file type: *.ini

7.4.3 Loading configurations

You can load a configuration from an individual file.



A standard Windows file dialog box opens:



Default file type: *.ini

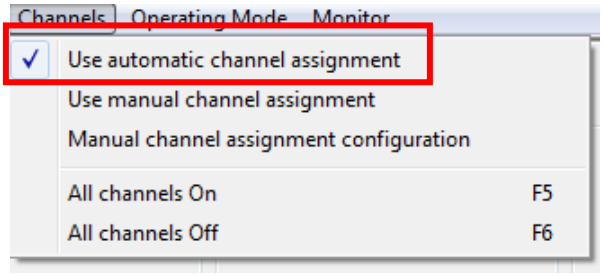
7.4.4 Channel configurations

The XLC4 controller checks during the boot process for connected Coronas and displays them in automatic mode as a single module in the XLC4 commander.

Note: This selection is stored in the registry and is used at the next start of the XCL4 commander.

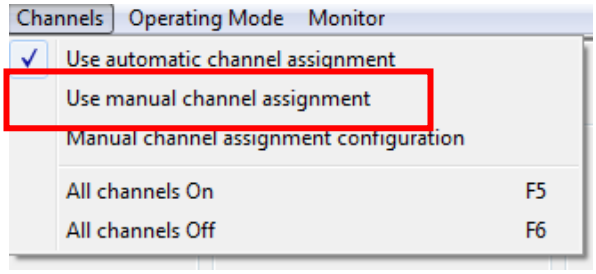
7.4.4.1 Use automatic channel assignment

If this option is selected, the XLC4 commander checks within the XLC4 controller for connected Corona modules and displays them as a single module in the related tab.



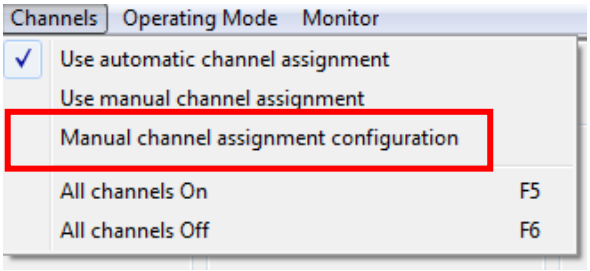
7.4.4.2 Use manual channel assignment

If this option is selected, you can set up an own configuration of the channel to be operated by the XCL4 commander. So it is e.g. possible to operate four channels of a 680 mm Corona separately.

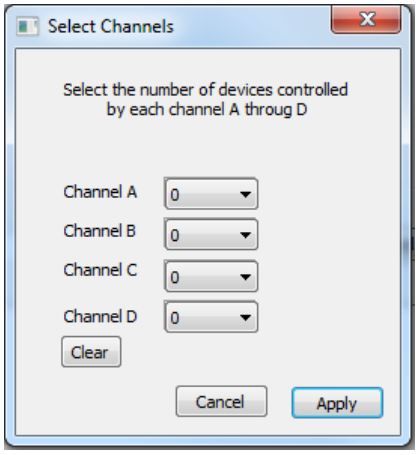


7.4.4.3 Manual channel assignment configuration

With this function you can configure the four channels of the XLC4 commander manually.

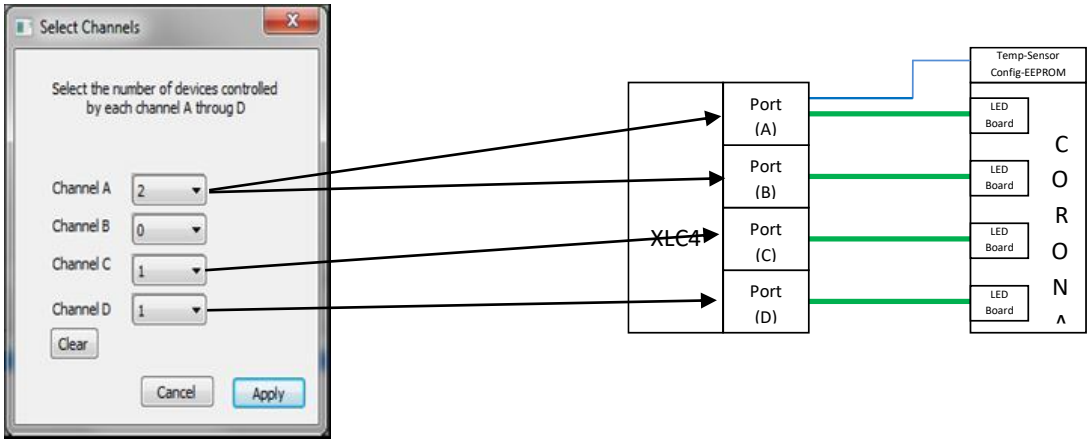


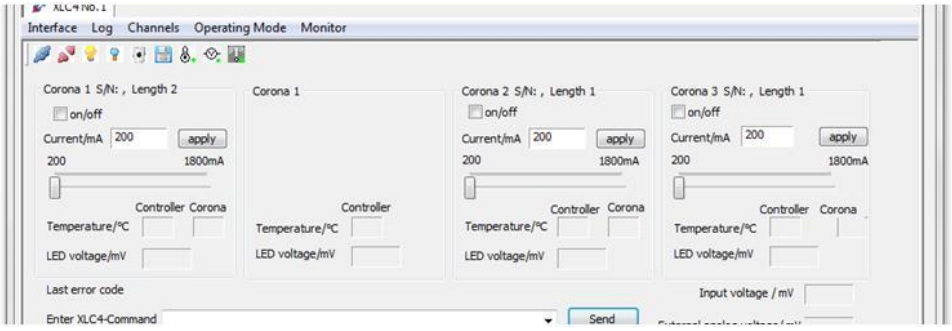
The configuration dialog opens.



Several combinations are possible.

Sample:





8 Operating support and application samples

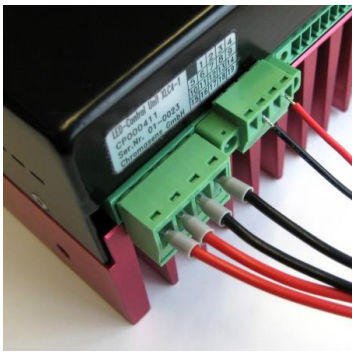
8.1 Controlling fans with LED control unit XLC4

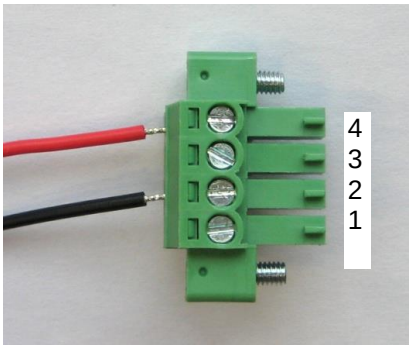
If the XLC4 controller is connected to one or more Corona II units, it permits to control a cooling unit to perform a stable temperature for save and homogeneous operation of the LEDs.

In the Corona II a temperature-sensing device monitors the current working temperature of the module. The temperature values of the connected Coronas are permanently read out by the XLC4 controller and are used as input data for the temperature control function.

8.1.1 Adapting the cooling device to the XLC4

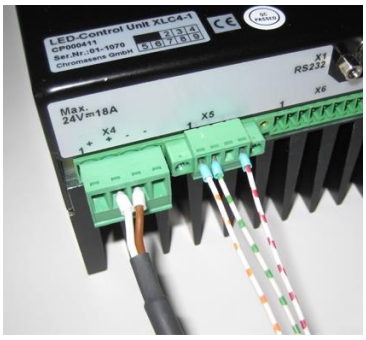
The fan (or another type of cooling device) is connected at the 4-terminal connector X5 of the XLC4-1 unit.





Pin 4: VOUT Pin 2: GND

Figure 8-1: Connecting the fan to the XLC4 without fan monitoring



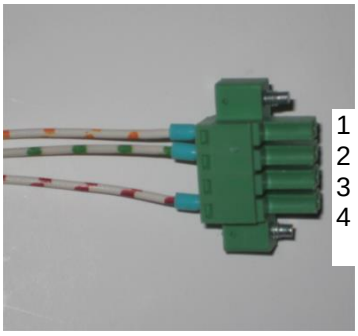


Figure 8-2: Connecting the fan to the XLC4 with fan monitoring

If the XLC4 measures a temperature higher than the switch-on level, the input voltage of the XLC4 is switched to VOUT.

The maximum output current for the VOUT port is 1.5A

Note that the overall input current of the supply input is limited. The current sunk at VOUT must be added to the calculated input current.

8.1.2 Setting up XLC4 for fan controlling

The VOUT port is activated if the temperature level of one of the connected Coronas reaches a specific temperature value.

To enable this function, bit 3 in the XLC4's control register FA must be set. For more information, see section 6.5.2.12 "Command FA".

The current setting of FA can be requested by sending the FA command without additional parameters.

Example:

```
FA
fa 0x0004
```

In this case, only bit 2 is set, and thus the function is disabled.

To activate the function, do a logical disjunction of the read out value and 0x0008, and write the result back with the FA command

Example:

```
FA 0x000C
fa 0x000c
```

Bit 3 is set now - the function of activating VOUT is enabled.

(The values of FA are stored in nonvolatile memory of XLC4. Changes are resistant after repowering)

There are two ways for adjusting the switching temperatures of the XLC4.

For default, the XLC4 uses the value of the warning temperature, which is stored in the Corona II itself. After power-up, the XLC4 checks all channels for connected Corona II modules and reads out the configuration data of these modules.

Another way is to set the temperature window to a user-defined range with the FC command.

Example:

```
FC  50,55          # set off_temp to 50°C and
fc 50,55           #      on_temp to 55°C

FC  50,55 W        # set and store new values
fc 50,55
```

The new values are applied immediately.

If the option "W" is set, the values are stored in nonvolatile XLC4 memory.

The connected fans are switched on when the maximum of the measured temperatures reaches the level **on_temp**.

The connected fan is switched off when the maximum of the measured temperatures falls below the level **off_temp**.

If the levels of **on_temp** and **off_temp** are set to 0, the warning levels stored in Corona II are used for fan switching. In this case, a hysteresis of 5K is implemented. That means, if the warning level is set to 60°C, the fans are switched on at 60°C, and they are switched off if the temperature falls below 55°C.

8.1.3 Fan monitoring

Chromasens has introduced the option for fan monitoring step by step for new Corona modules starting with shipments in 2016. Please contact Chromasens for more details about the supported Corona models.

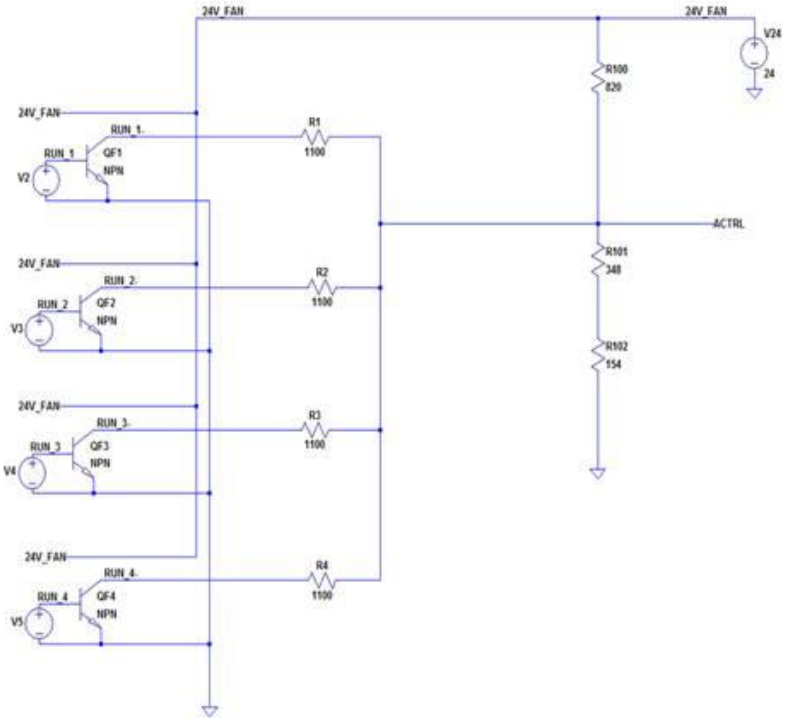
In the XLC4 controller, the fan monitoring is supported by firmware release 5.1 or higher.

General function:

Fan monitoring is working with a voltage measurement at the input ACTRL at the connector X5 pin 1.

The fans of supported Corona modules are equipped with an open-drain-switching-output. This output is switched to ON if the fan is working. In the modules the outputs are connected with a serial resistor of 1100Ω to a common signal. This signal is connected to ACTRL. In the XLC4 controller (starting with hardware release ES2) there is a pull-up resistor of 820Ω between the input ACTRL and VOUT.

If the fans (up to 4) are switched with VOUT and all fans are working, all the switching signals are set to Low signal. Depending on the number of the connected fans and the level of VOUT there will be a specific voltage at ACTRL. This voltage is measured by the XLC4 controller.



For correct interpretation of the signal, the XLC4 controller needs knowledge about the connected number of fans. This value is stored in the I²C chip on the Corona and is read at the start-up of the controller. With these values the controller is calculating a specific alarm level for the signal from the fans.

- Number of fans for the specific Corona
- Value for the pull-up resistor (always 0 because it is integrated to the XLC4)
- Value for the serial resistor in the Corona (always 1100 for Corona models)

To start the fan monitoring, the bits 3 and 4 in the register „FA“ have to be set to „1“:

Sample: `S: FA 0x18  R:fa 0x0018`

8.1.4 Conditions for a constant module temperature

To keep the module temperature of the Corona in a specific range, several conditions have to be fulfilled.

In the off-phase of the fan, the module is heated up by the power dissipation of the LEDs. At low ambient temperatures, the operating current of the module must be high enough to warm up the module to the low level of the operating temperature window.

In the on-phase of the fan, the module would be cooled down until a stable state is reached. In this stable state, the temperature gradient from module temperature to ambient temperature depends on the power dissipation (respectively operating current of the LEDs).

If, by a given operating current, the temperature gradient is higher than the high level of the operating temperature window minus the ambient temperature, the module temperature cannot be held within the control range. In this case, the operating current or the maximum ambient temperature must be reduced.

8.2 Switching and flashing the Corona

You can switch or flash the Corona modules with the XLC4 controller. Therefore, the port X6 pin 1 should be used. Please refer to section 6.3.6.

Figure 8-3: Connections for flash operation

Pin 1:	Signal
Pin 6:	Ground

The intended use is for switching the Corona per work peace in front of the camera or for line-synchronized flashing of the Corona.

Note: The shutdown port at X2 is not intended to be used for this function. It is intended for use with safety switches.

Timing & Limitations:

XLC4-1 (CP000411):

Item	Notes	Min.	Nom.	Max.	Unit
Flash frequency	(T1)	1	10	20	kHz
Trigger pulse	(T2)	10	20		µs
ON-Delay (D1)	for 4,5 Volt input voltage		10		µs
	for 10 Volt input voltage		3		µs
OFF-Delay (D2)	for 4,5 Volt input voltage		20		µs
	for 10 Volt input voltage		60		µs

XLC4-1A (CP000411-1A) and XLC4-1F4 (CP000411-1F4):

Item	Notes	Min.	Nom.	Max.	Unit
Flash frequency	(T1 / Tp)	200		60	kHz
Light pulse	(T2 / Ton)	10			µs
ON-OFF Delay	(D1 and D2)		< 1		µs
Rise time	(tr)		< 0, 5		µs
OFF-Timme	(Toff)	2		5000	µs

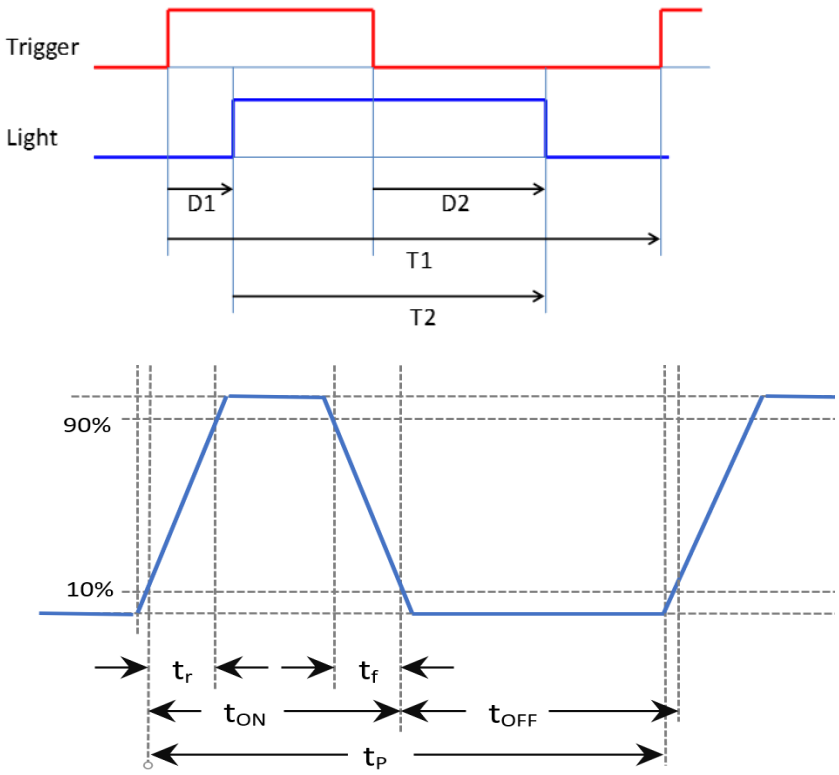


Figure 8-4: Timing diagram for flash operation

XLC4-1 (CP000411) and XLC4-1A (CP000411-1A)

The ON signal is applied to all four channels.

XLC4-1F4 (CP000411-1F4):

The ON signal could be operated to all channels synchronously or for all four channels independent.

Configuration:

Use the command FA to set the flash mode. For more information, see section 6.5.2.12.

```
FA 0x0020          # activates flash function
fa 0x0020
```

For XLC4-1F4:

```
FA 0x0220          # activates flash function and independent channel operation
fa 0x0220
```

Changes are applied after repowering the XLC4 controller.

For more information, see section 6.5.2.12 “Command FA”.

This mode only works in command mode only.

It does not work in bulb mode, PWM mode or in analog mode.

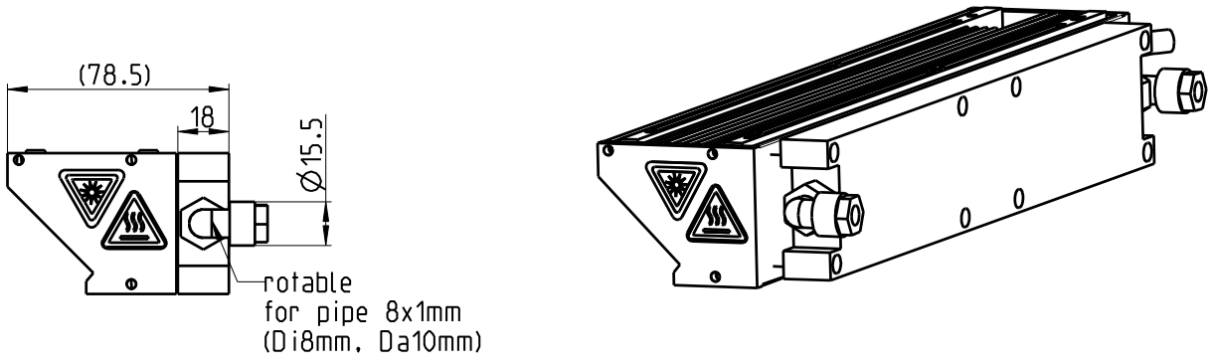
```
MO 1               # command mode
mo 1
```

Note: It is recommended to use higher currents (> 500 mA) at very low pulse durations to allow the capacitors in the electrical circuits to be charged for constant light output.

8.3 Corona II liquid cooling

If the Corona II illumination is powered by 100% and the environmental temperature is very high or if there is no space for a passive heat sink, the liquid cooling system is required.

8.3.1 Mechanical dimension



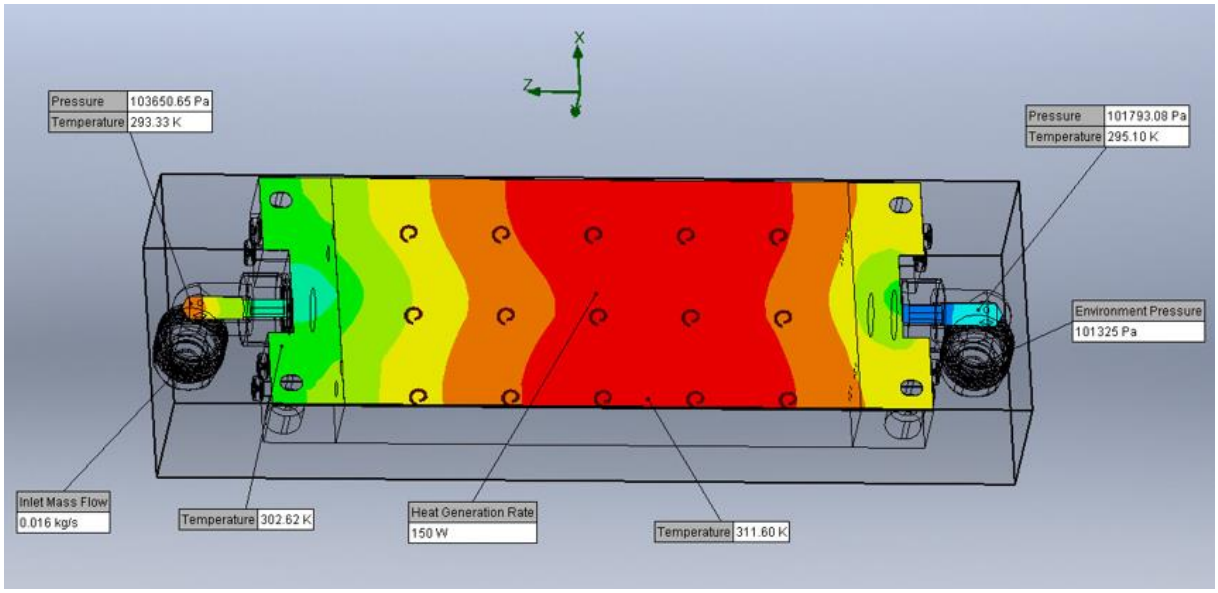


Figure 8-5: Thermo-simulation of the heat sink

8.3.2 Technical data for the 170mm unit:

Thermal resistance for water to base area 0,12 K/W (just for the unit)

Reduction in pressure by 1 l/min 1860 Pa

For connecting the liquid heat sink we recommend a pipe 8 mm diameter inside and 10 mm outside diameter material PA-pipe.

8.3.3 Liquid

For liquid we recommend a water glycol mixture with min. 18 % glycol to avoid algae in the liquid.

But check with the producer of the cooling system. Often, they need an additional additive to avoid corrosion in the system.

It is also possible to drive the heat sink with cooled air, but the cooling capacity is of course smaller.

8.4 Corona II heat sink selection

8.4.1 Introduction

The LED modules of the Corona II family are deliverable with several heat sink options. The right choice for a heat sink option depends on several factors, like maximum ambient temperature, mounting condition, possibility of free air flow and operating conditions.

The following instructions help you to find the best heat sink option for your application.

The formula below gives you a rough estimation for the module temperature, the Corona II reaches in thermal balance under a set of given conditions.

It is strongly recommended to perform tests under application conditions to prove the compliance with the temperature limits.

8.4.2 Heat sink options

Overview of the available heat sinks for the Corona II modules:

Type	Dimension[2] [mm]	Thermal resistance Rth[3] [K/W] for 170 mm length	Description
A	50 x 10	1,63	Passive less space
B	50 x 40	1,52	Passive Standard
C	90 x 100	0,8	Passive
L	50 x 47	0,38	Active with fan
W	50 x 18	0,25[4]	Active with water

[2] For mechanical dimensions refer to “Mechanical dimension of the different heat sinks” at the end of this document

[3] The thermal resistance is valid for one 170mm base unit segment.

[4] Typical, depends on water flow and cooling capability of aggregate.

8.4.3 Calculation of maximum module temperature

The maximum temperature of the Corona II housing can be estimated by using the following formula:[5]

$$T_{CORONA} = T_A + P_{CORONA} \cdot R_{TH} \cdot F_1 \cdot F_2 \cdot F_3$$

T_{Corona}	Temperature of Corona II surface at hottest point
T_A	Ambient temperature
P_{Corona}	Electrical power input into one Corona II channel. It is assumed that a Corona with several channels is operated with a unique operating current I_{WORK} for all channels. To get the typical channel power in dependency of I_{WORK} refer to "Chart 1"
R_{TH}	Thermal resistance of heat sink; refer to the table in section 8.4.2.
F_1	Correction factor for mounting orientation F_1=1.0 for horizontal mounting F_1=0.85 for vertical mounting
F_2	Length-dependent correction factor F_2=0.88 for 170 mm F_2=0.92 for 340 mm F_2=0.97 for 510 mm F_2=1.0 for 680 mm
F_3	Thermal-coupling-dependent correction factor F_3=1.0 for free mounting without additional heat flow over solid metal connections. F_3=1.0 down to 0.8 (depends on heat flow conditions in application)

[5] The correction factors F1 to F3 are only needed for the passive cooling options A to C

8.4.4 Example

A Corona II with length 340mm and heat sink option B is operated at an ambient temperature of 25°C. The module is mounted horizontally and has a good thermal contact to a large solid machine frame. The module should be operated with a channel current of 0.9A

$$T_{CORONA} = 25°C + 34W \cdot 1.52\frac{K}{W} \cdot 1.0 \cdot 0.92 \cdot 0.85 = 65°C$$

If the channel current is increased to 1.8A (full current) the calculation changes to

$$T_{CORONA} = 25°C + 74W \cdot 1.52\frac{K}{W} \cdot 1.0 \cdot 0.92 \cdot 0.85 = 82°C$$

The maximum surface temperature of the Corona II module for continuous operation is 75°C.

In the second example, the maximum temperature is exceeded. In this case, an additional air flow can decrease the temperature level. If this is not possible, a heat sink with lower RTH must be used.

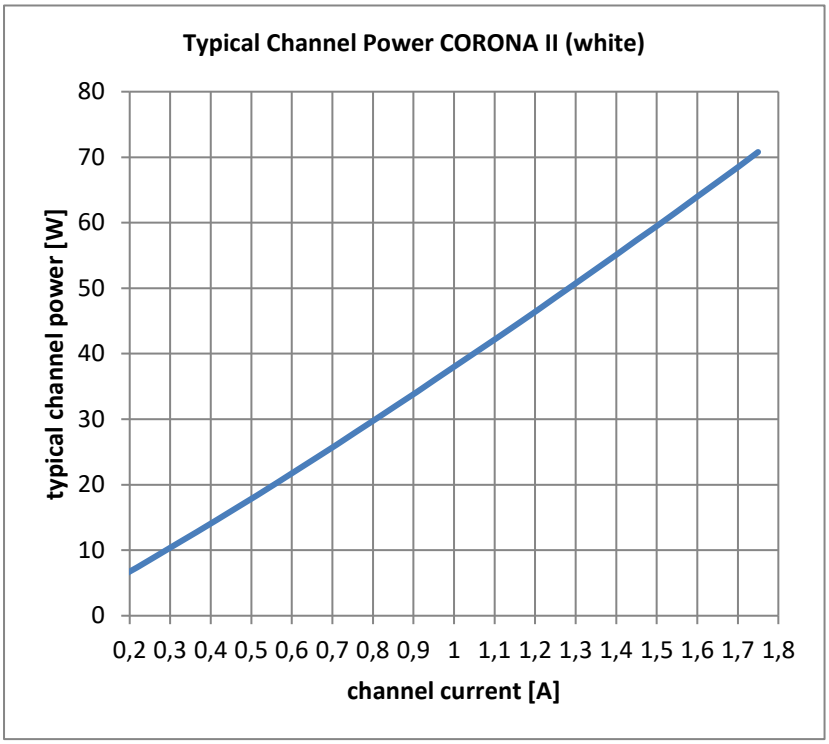


Figure 8-6:

8.5 Operating the D50 Corona

8.5.1 Requirements:

For use of the D50 LED color there are the following requirements:

Led Control Unit XLC4-1:	Firmware V 4.24 or higher
XLC4Commander:	Version 5.1 or higher

8.5.2 Connection:

The D50 Corona (LED color code 7 or 10) is equipped with 3 or 4 different LED types, each type supplied by one separate XLC4 output channel.

Connect the channels as shown in the following pictures:

Figure 8-7 Assignment connectors LED Color 7

Figure 8-8 Assignment connectors LED Color 10

Notes: If you use a D50 Corona with XLC4 version ***XLC4-1D50,*** the Firmware is V 4.24 or higher and the Corona connectors are coded to ensure a correct connector assignment.

8.5.3 Operation

If the illumination is controlled by sending serial commands, use the IY command to adjust the brightness. The weight of the 4 channels is tuned by the control unit itself.

Example:

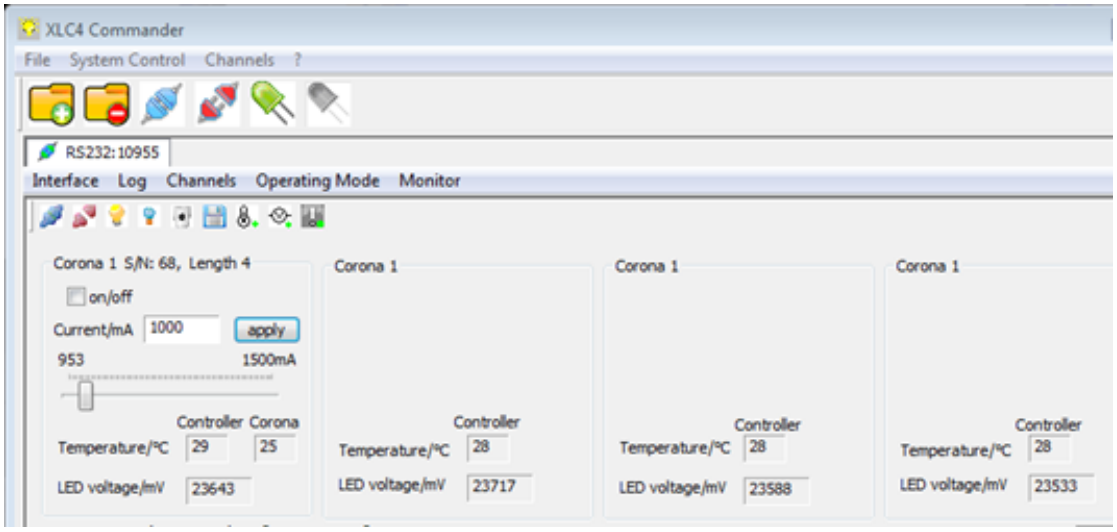
```
Send:      IY 1000
Receive:   iy 800,1000,466,210
```

Note: The valid range of the current setting in IY command is 953 to 1500. If a higher or lower value is set, an error message is produced and the command is ignored.

Example:

```
Send:      IY 952
Receive:   er 102
```

If the XLC4Commander software is used to control the Illumination, one slider is provided. This slider permits to set channel currents to values between 953 and 1500mA.



8.6 Firmware update XLC4

NOTICE Wrong operations at the update process might cause a loss of data at the update process. In this case the update process might be interrupted and could not be finished. The XLC4 controller must be returned to the manufacturer in this case.

It is strongly recommended to contact Chromasens support before starting a firmware update.

The firmware of the XLC4 LED controller is able to be updated in the field by the user.

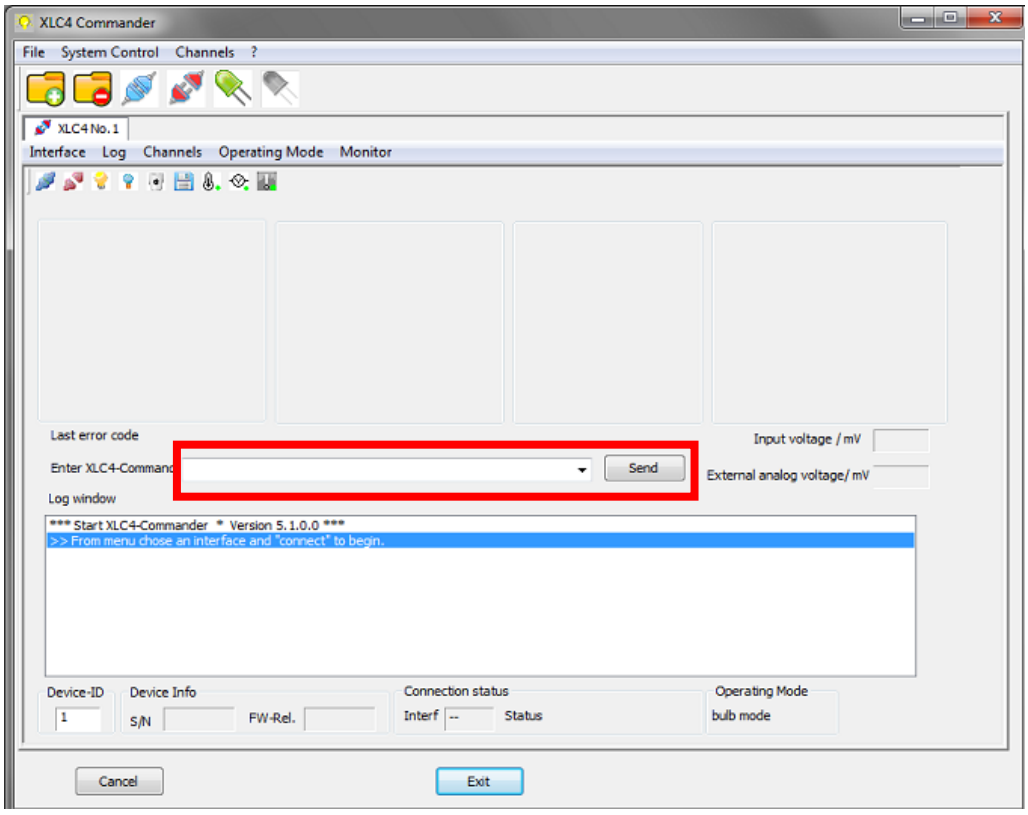
Notes: Saved settings in the XLC4 controller get lost at the update. It is recommended to check the setting and to take notes of them.

Requirements:

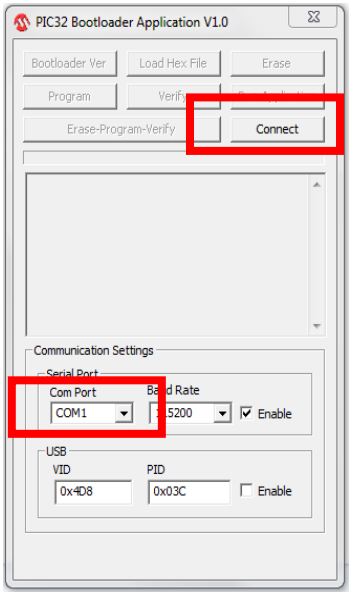
1. Connection to the XLC4 controller with RS232 port. Ethernet or USB is not applicable. **It is required to use COM port number 1 to 9** because the tool “PIC32UBL.exe” only supports this ports.
2. Software-Tool „PIC32UBL.exe“ – Please ask Chromasens support (email: support@chromasens.de)
3. XLC4 Commander

Steps:

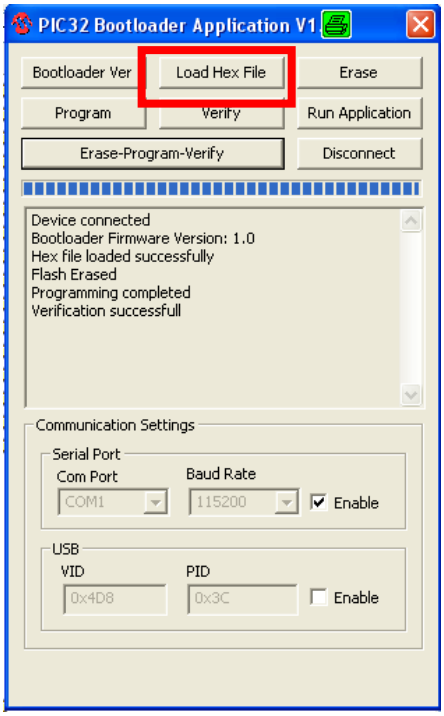
1. Connect the XLC4 LED controller with RS232 to the PC.
2. Start the XLC4 commander and connect it with the XLC4 LED controller.
3. Type the command `UP` into the command line and click **Send**. This command erases the old firmware:



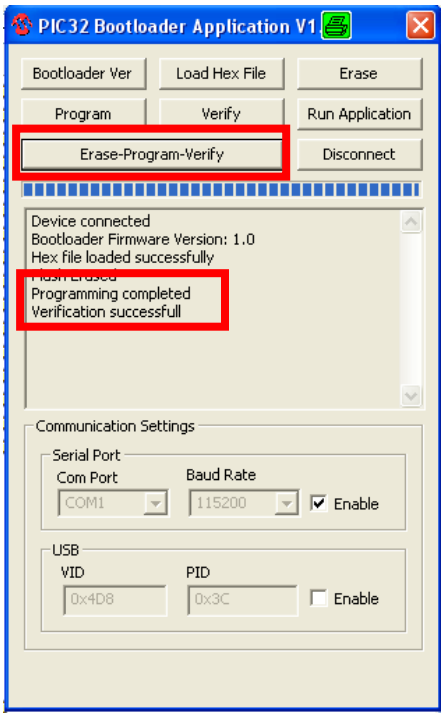
4. Disconnect the XLC4 commander.
5. Repower the XLC4 LED controller.
6. After repowering the controller, the yellow LED blinks. The boot loader waits for the new firmware.
7. To download the new firmware, start the application `PIC32UBL.exe`.
8. Select the com port and click **Connect**:



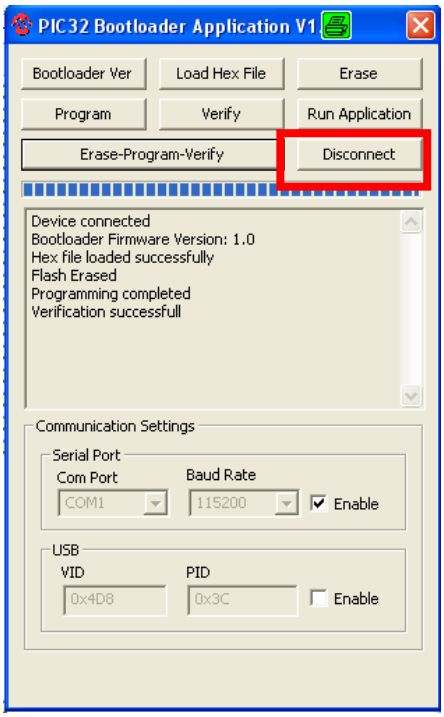
9. Click **Load Hex File** and then select the “HEX” file of the new firmware:



10. To start the download, click **Erase-Program-Verify** and wait for the response "`Verification successful`":



11. To disconnect the software from XLC4 LED controller, click **Disconnect.**



12. Repower the XLC4 controller.

13. Connect the XLC4 commander with the XLC4 LED controller and check the firmware release by using the command "`VR`".

8.7 Trouble-shooting

In these section typical problems and their solutions are described.

8.7.1 LED is blinking after repowering in bulb mode

Description:

After setting the controller to bulb mode and repowering the controller, the LEDs start to blink.

Possible reason:

The power supply is too weak for the programmed current.

Solutions:

1. Check whether the desired current has been saved by using the “W” option with the IY command. (e.g. IY 1000 W). Otherwise the last saved value or the default value is used.
2. Check the power supply for correct output range. The XLC4 needs approx. 3.5 amps per channel at full operation. For more information, see section 6.4.2.

8.7.2 LED is starting with a different brightness in bulb mode

Description:

After repowering the controller in the bulb, the brightness is different than before at setting up the controller.

Possible reason:

The value for the current has not been saved to the controller.

Solutions:

Use the “W” option of the “IY” command to save the desired brightness/current to the XLC4 controller, e.g. IY 1000 W.

8.7.3 LED cannot be switched on

Description:

Even with correct settings for operation mode the LEDs are not switched on.

Possible reason:

Shutdown function is activated, and no switch is connected to the port.

Solutions:

Check the error states by using “ER”. If the response is “er 206”, the shutdown function is activated. Use the command “SD 0” to deactivate the shutdown function. Repower the controller and try again to switch on the LEDs.

8.7.4 The fans do not work

Description:

The module gets hot and the fans don't start working.

Possible reason:

The new values of the FC command have not been saved to the controller.

The controller has not been repowered after setting the fan modes with the command FA.

Solutions:

Check the values of the switching temperatures by using "FC"; set correct values by using e.g. "FC 50,55 W". Don't forget the "W" to save the values.

Check the state of "FA" by using the command. Set correct values for "FA" and repower the controller.

8.7.5 Temperature monitoring shows wrong or periodically changing values

Description:

The temperature function shows that values are wrong or changing too fast.

Possible reason:

Due to EMC effects, the I²C communication is disturbed. This might occur primarily at the use of longer cables, e.g. 10 m.

Solutions:

Connect the shielding of the cable to ground.

Perform a firmware update to 5.1 or higher. There are new functions, which double-check the response to reduce errors from data transmission. Please contact Chromasens support.

8.7.6 XLC4 controller is not able to detect the connected Corona reliably

Description:

The controller is not able to detect the connected Corona reliably at all boot processes.

Possible reason:

Due EMC effects the I²C communication is disturbed. This might occur primarily at the use of longer cables, e.g. 10 m.

Solutions:

Connect the shielding of the cable to ground.

Perform a firmware update to version 5.1 or higher. There are new functions which double-check the response to reduce errors from data transmission. Please contact Chromasens support.

8.7.7 Illumination is switched off at setting a higher current

Description:

After setting a higher current, e.g. from 400 mA to 1500 mA, the controller and the module are switched off.

Possible reason:

The power supply is too weak for the programmed current.

Solutions:

Check the power supply for correct output range. The XLC4 needs approximately 3.5 amps per channel at full operation. For more information, see section 6.4.2.

8.7.8 Illumination is switched off unexpectedly at regular operation

Description:

The module is switched off unexpectedly at regular operation. The module is quite hot.

Possible reason:

The module gets to hot and has been switched off by the controller.

Solutions:

Check for error messages with the “ER” command. If it is the temperature error (205), let the module cool down and start it again. Check for correct heat sink selection regarding to the current setting. Check for correct operation of the fans.

9 Electrical requirements

If the Chromasens XLC4 LED Controller is used, the LEDs of the Corona II are driven by the integrated adjustable constant-current source of the XLC4 LED Controller.

Voltage at the LED strings (anode-cathode) depends on the operating temperature, operating current and the LED itself.

Within the valid operating range of Corona II, maximum voltage at the LED string is less than 46 V.

Allowed operating current of the Corona II illuminations is not constant. It is affected by the following conditions:

- Duty cycle
- Ambient temperature
- Fitting conditions (heat convection, fan)
- The selected heatsink

The channel currents of the white and infrared LEDs have the following limits (irrespective of the conditions mentioned above):

Item	Description	Min.	Nom.	Max.	Unit
$I_{Channel}$	Operating Current (per Channel)	200		1800	[mA]

The channel currents of the red, green and blue LEDs have the following limits (irrespective of the conditions mentioned above):

Item	Description	Min	Nom	Max	Unit
$I_{Channel}$	Operating Current (per Channel)	200		1500	[mA]

The channel currents of the UV LEDs have the following limits (irrespective of the conditions mentioned above):

Item	Description	Min	Nom	Max	Unit
$I_{Channel}$	Operating Current (per Channel)	200		1000	[mA]

10 Cleaning, maintenance, repair and disposal

WARNING

The equipment operates with electric current. Disconnect all mains cables before working on the equipment.

Make sure that the equipment is disconnected from the mains and potential-free!

WARNING

Do not perform repairs on the equipment by yourself.

The manufacturer of the host system is responsible for all repair and service issues.

Repairs other than the replacement of spare parts must be performed by Chromasens GmbH or an authorized partner.

Depending on the environmental conditions of the system, impurities can decrease the transparency of the front glass and as a result, system performance can be reduced.

To avoid a loss of light, the device should be inspected on a regular basis. Cleaning and maintenance intervals depend on the environmental conditions of the system.

10.1 Cleaning

Before starting with the cleaning, make sure that the unit has cooled down.

The illumination unit can be cleaned without having to remove parts.

The housing of the illumination unit as well as the front glass may be cleaned with a moist cleaning cloth and with Isopropanol alcohol.

Do not immerse the illumination unit in cleaning liquid or pour cleaning liquid over the illumination unit.

Never use hard or sharp tools to clean the equipment.

After cleaning, make a visual inspection of the cleaning result and repeat the process if necessary.

WARNING

The safety data sheet of the manufacturer for Isopropanol alcohol has to be kept at the installation. The staff for cleaning has to be instructed about the use of Isopropanol alcohol and also about the proceeds in case of emergency.

10.2 Service and repair

The device works with electric power. Before working on the device make sure that the device is disconnected from the power supply.

The body of the Corona will heat up during operation.

Before working on the device, you must switch off the device. Always allow hot surfaces to cool down before cleaning the device.

Do not perform any repairs at the device yourself, except if you need to maintain, exchange spare parts, or adjust the scanning position.

The manufacturer of the superior system is responsible for all repair and service matters. Repair activities, exceeding the exchange of spare parts, must be done by the manufacturer of the superior system, the device manufacturer Chromasens GmbH, or exclusively authorized partners.

Keep the original package for a possible return of the device. The device must be sent back in the original package to avoid damage.

10.3 Returning adress for repair

Contact Chromasens service first before returning the camera.

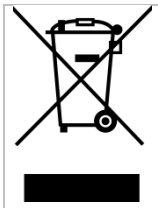
Ask for an RMA number before returning the camera back to the manufacturer.

Chromasens GmbH
Max-Stromeyer-Straße 116
D-78467 Konstanz
Germany

Phone: +49 (0) 7531 - 876-0
Fax: +49 (0) 7531 - 876-303

E-Mail: support@chromasens.de
Internet: www.chromasens.de

10.4 Disposal



This symbol indicates that electrical and electronic equipment should not be disposed with normal garbage at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.

The device consists of different kinds of material. For the disposal of the device the materials have to be separated according to the local regulations. The material has to be disposed properly to avoid and minimize any environmental or human impact.

11 Appendix

11.1 CE conformity

chromasens Imaging for Professionals	EU Declaration of Conformity	DCE _CHR_18002 Rev.01

We declare that the following products comply with the requirements of the listed directives and standards. Each type listed below, stands for all its related model variants.

Designation:	Corona II with XLC4
Series/ Systems:	CP000411-X... + CP000200-X...

Manuafcturer authorized representive:	**Chromasens GmbH** Max-Stromeyer-Str. 116 D-78467 Konstanz Germany www.chromasens.com

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

Electromagnetic compatibility	2014/30/EU
RoHS	2011/65/EU
Eco-design directive	2009/125/EC

Applied standards:

Electromagnetic Compatibility Emission:

- DIN EN 61000-6-4:2011-09 (IEC 61000-6-4:2006 + A1:2010)
- DIN EN 61000-6-3:2011-09 (IEC 61000-6-3:2006 + A1:2010)
- DIN EN 55032:2016-02 (CISPR 32:2015,) Class A

Electromagnetic Compatibility Immunity:

- DIN EN 61000-6-2:2006-03 (IEC 61000-6-2:2005)
- DIN EN 61000-4-2:2009-12 (IEC 61000-4-2:2008)
- DIN EN 61000-4-3:2011-04 (IEC 61000-4-3:2006 + A1:2008 + A2:2010)
- DIN EN 61000-4-4:2013-04 (IEC 61000-4-4:2012)
- DIN EN 61000-4-5:2015-03 (IEC 61000-4-5:2014)
-

The notified body (Reg. No. D-PL-11020-03-01) performed measurements of Electromagnetic compatibility and issued the certificate: E1KQ0001 (21.03.2012)

Konstanz, December 14, 2018

Martin Hund, CEO

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