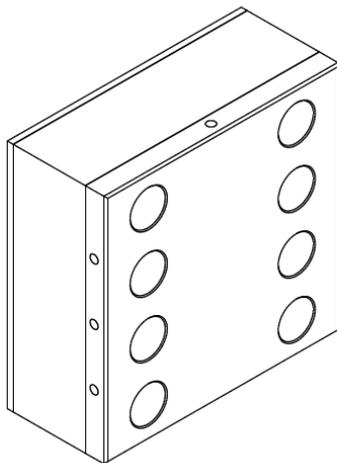


Installation and operation manual for

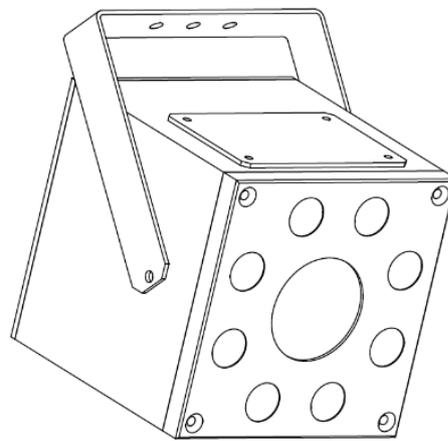


CamStrobe CS-2/3

Stroboscopic LED-flash light module



CS-2



CS-3

Please familiarize yourself with the contents of this manual before installation and operation.

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Documentation article number: HO-CS1/2-DOC-NL

Version / Release date: V01 / January 2019

Content

General.....	4
About this manual.....	4
Name plate.....	4
Limitation of liability	4
Particular hazards	4
Product description.....	5
Function	5
Technical specifications	5
Safety	6
Installation and Maintenance	6
Operation.....	7
General operation principle.....	7
Controlling the flash duration.....	7
Installation	8
Preparations.....	8
Mounting the device.....	9
Device orientation.....	9
CS-3 only: mounting a camera inside the unit.....	10
Choosing a suitable LED lens type when ordering.....	11
Connection to the Huygens Optics Camera interface.....	11
Connection to other interfaces.....	12
Connection to an external pulse generator	13
Maintenance	13
Troubleshooting.....	14
Appendices.....	16
Appendix A: dimensional drawings.....	16
Appendix B: illumination profiles.....	17
Appendix C: CS-2 spot sizes and intensities.....	18
Appendix D: Available versions and accessory overview	19

General

About this manual

This manual is intended for persons who are responsible for the installation, use and maintenance of the Huygens Optics CamStrobe versions CS-2 and CS-3 (hereafter referred to as CS-2/3). For safe and proper working with the device it is required that the device is used in compliance with all the safety and handling instructions in this manual. In addition, local accident prevention regulations and general safety rules for the location of use must be complied with.

Installation and use should only be done by persons with a sufficient level of knowledge on these subjects. Read the operating instructions carefully before attempting any work on or with the device. This manual should be kept in the immediate vicinity of the product for future reference.

In case you have any questions that are not answered in this manual, please contact your local distributor or visit the Huygens Optics website at www.HuygensOptics.com for contact information

Name plate

The CamStrobe versions CS-2 and CS-3 can be identified by the name plate located on the back side of the unit. The name plate also contains the serial number of the unit. Please note the serial number of the unit here for future reference and in the case of communication with Huygens Optics.

TYPE:	SERIAL NUMBER:
-------	----------------

Limitation of liability

The manufacturer assumes no liability for damage and operation faults resulting from:

- Failure to use according to these operating instructions
- Improper installation by insufficiently-trained staff
- Faulty electrical and mechanical connections
- Use for other purposes than the intended purpose of this product
- Failure to use original replacement and accessory parts
- Any technical modifications done to this product without approval of Huygens Optics
- Failure to perform maintenance required for this product

Particular hazards



WARNING: This product produces high intensity light flashes in the frequency range between 1 and 150 Hz. These flashes can induce epileptic fits, even with people who have previously never experienced epileptic fits before. Make sure that persons susceptible to epileptic fits are not in the vicinity when using this product. In addition, looking directly or even indirectly into the light beam can cause temporary loss of vision, especially in dark environments.



WARNING: Operating the device can make fast-moving parts appear to be standing still. This visual illusion can lead to **serious or even fatal injuries if not recognized as such** by those observing. Please inform everyone in the vicinity of this optical effect, to prevent them from accidentally reaching into a running machine.

Product description

Function

The Huygens Optics CamStrobes (CS-2/3) are LED flash light sources with variable light pulse duration (5-200 μ s). They are intended for use with modern digital inspection cameras. The units require a power supply of 12V DC.

To set off the individual flashes, the unit also requires a trigger pulse in the range of 4-24V. The trigger pulse is input is galvanically separated from the device by means of an optocoupler. Upon every trigger, the unit gives a short but intense light flash. The short duration of the flash can be used to “freeze” the movement and allows for the inspection of sub-mm details on fast moving parts (up to 80m/s or 300km/u) without motion blur.

Technical specifications

Dimensional	CS-2	CS-3
L x W x D. See appendix A for dimensional drawings	120 x 120 x 57mm	120 x 120 x 120mm
Weight	0.8kg	0.9kg
Electrical		
Nominal supply voltage	12V DC (max. 16V DC)	
Max. power consumption (at 150Hz, 200 μ s pulse duration)	12W (@12V, 1A)	
External control	Pulses 4-24V; minimal pulse width 1 μ s. Frequency 0- 150 Hz (devices reduce pulse frequencies above \sim 175Hz). Pulse consumes between 4 and 24mA current	
Optical		
Intended flash length range	5-200 μ s, controlled by input pulse length and limited to 200 μ s	
Color temperature	6200K	
Illumination strength	Up to 3000lx @ 200mm distance of optics, measured at 50Hz and 50us flash duration. During the pulse, the luminance is \sim 1.2Mlx	
Use conditions		
Ambient temperature range	0 to +45 °C	
Storage temperature range	-20 to + 60 °C	
Degree of protection	IP51	IP21

Table 1. CS-2/3 technical specifications.

Safety

Installation and Maintenance

Installation and maintenance should only be attempted by knowledgeable personnel that is aware of the technical aspects and risks of the equipment. Relevant regulations for electrical installations have to be observed.

Take notice of the particular hazards of this product such as risk of epileptic attacks, misleading visual perceptions of fast-moving parts (see section General > particular hazards). Instruct every user of this equipment on the presence of these hazards.



WARNING: Only use the unit with the correct voltage as indicated on the device and this manual. Do not apply the reverse polarity on the terminals. The operating voltage is indicated on the serial plate. As accessories, only use the equipment certified or supplied by Huygens Optics.



WARNING: Allow for sufficient ventilation of the electrical parts. Lack of ventilation may lead to overheating and subsequent damage of the unit. Never cover the device with flammable materials (such as cloth, paper, etc.) since this introduces a fire hazard.



WARNING: Do not operate the unit in an environment with temperatures in excess of 40° C or below 0°C. Prevent the contact of the equipment with water and formation of condensation in- or on the equipment.



WARNING: Do not attempt to repair the unit yourself, since the circuitry in the device temporarily deliver high peak currents with a total of up to 60 Amperes. Always refer to Huygens Optics for repairs and spare parts. Incorrectly executed repairs can lead to personal injury and damage of the unit.

Operation

General operation principle

The CamStrobe units generate high-intensity light flashes with a duration between 5-200 microseconds (μs). The pulses are triggered from the positive flank of the trigger input.

Controlling the flash duration

The duration of the light flash can be controlled by the length of the trigger pulse. Generally, the flash duration will be equal to the duration of the trigger pulse. However, in order not to damage the LEDs, the length of the flash is internally limited to a maximum of 200 μs . If the trigger pulse duration is longer than 200 μs , the light flash will be cut off after 200 μs . This is illustrated in figure 1.

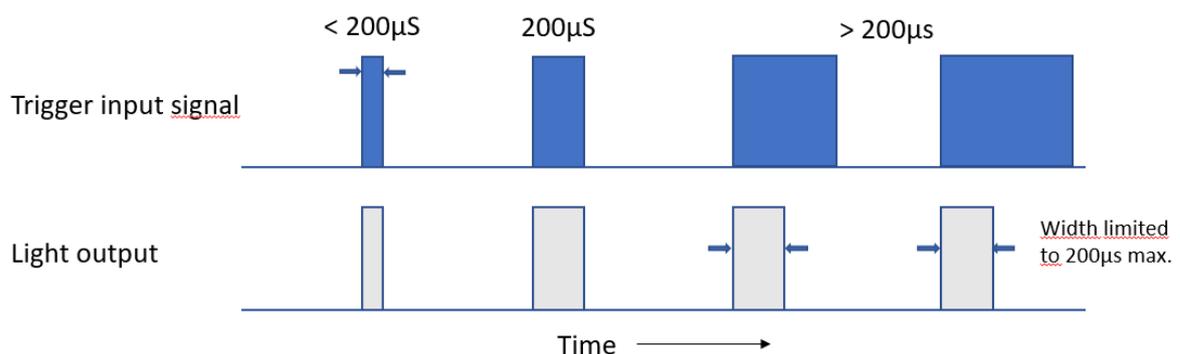


Figure 1: Trigger input pulse and the resulting light output pulse.

In the same reason (damage to the LED's), the maximum frequency that the device accepts is also limited. The maximum device frequency is specified as 150Hz. However, the physical limitation is set at about 175 Hz. If trigger frequencies above 175 Hz are fed into the device, it will automatically switch back to a frequency that is one n^{th} of the input frequency (where $n = 2, 3, 4$, etc.). This is illustrated in figure 2, where the resulting light pulse train is shown for a frequency below- and above 175 Hz.

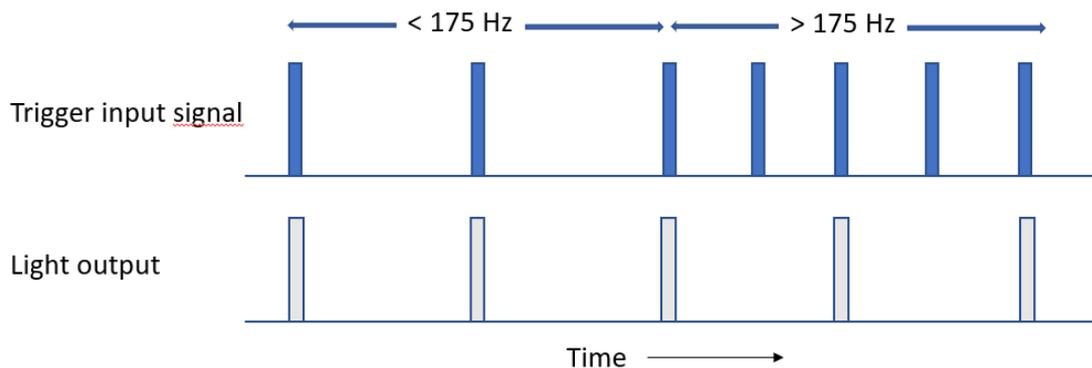


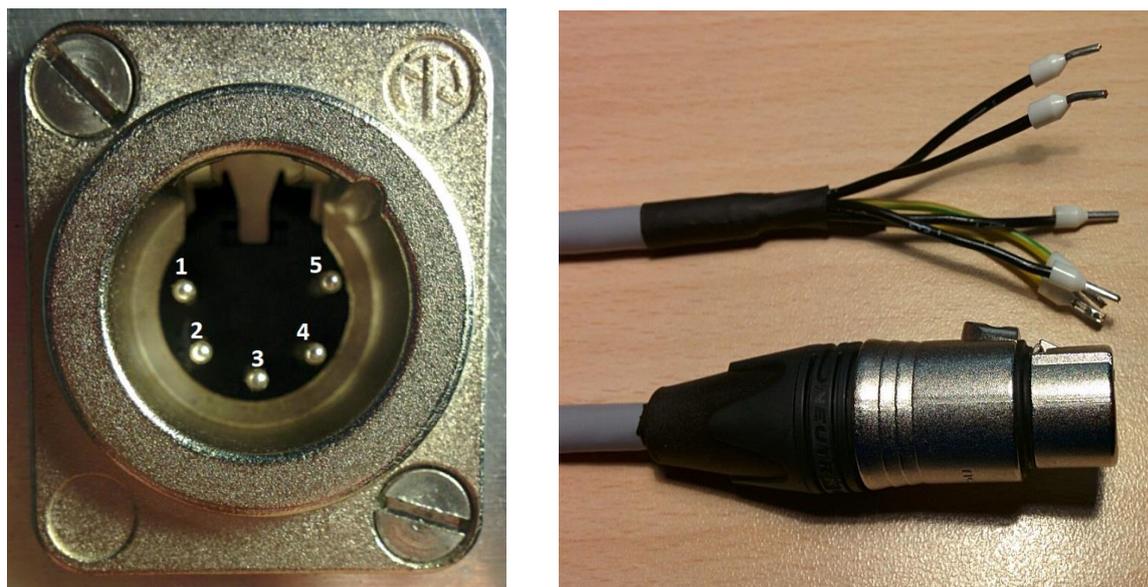
Figure 2: Trigger input pulse train and the resulting light output frequency.

Installation

Preparations

The CS-2/3 can be delivered with a cable with suitable connectors, which can supply power and signal to the unit. This cable can either have 2 connectors (Neutrik NC5FXX-XLR) on both sides or the cable, or can have one connector and one open end on one side. Please refer to Appendix D for ordering information.

WARNING: When using an open-end cable, make sure that the appropriate connections are made to the power supply and pulse generator. Failure to do so can possibly damage the device. The open-end wires are numbered (on the wires themselves) as described in the table below.



Back terminal of the device (Neutrik NC5MD-LX)	
Pin number	Function
1	+12 V
2	0 V
3	Housing GND
4	Pulse – (opto)
5	Pulse + (opto)

Open-end wire description	
Wire nr (color)	Function
1 (black)	+12 V (power)
2 (black)	0 V
3 (black)	Pulse – (opto)
4 (black)	Pulse + (opto)
- (yellow-green)	Housing GND / pin3

Figure 3. terminal and connection cable numbering.

When using a Huygens Optics signal and power distribution unit, the second 5-pin XLR connector can be connected directly to one of the strobe outputs of the distribution unit. When the 12V power is correctly connected, the green LED on the back side of the device will light up.



IMPORTANT: Check the correct polarity and voltage on the power lines before connecting to the device. Applying reverse polarity or incorrect voltage can damage the electronics or might blow the internal fuse, in which case the device should be shipped back to Huygens Optics for repair.

NOTE: When using a 2-sided connector cable, the pins on both sides have a 1-1 connection based on the pin numbering. Therefore, the cables do not have a specific connection direction. Please make sure that all cables are securely connected and stowed away safely before operating any machinery.

Mounting the device

The device can be mounted to a setup by using one or more of the 8 mounting holes (M5, thread depth 10mm), located on the front plate of the device. Please make sure that the device is firmly secured and vibrations in the mounting setup cannot cause the mounting to loosen or release during operation. An optional mounting bracket is available for easy adjustment of the beam orientation (see Appendix D, for ordering information).

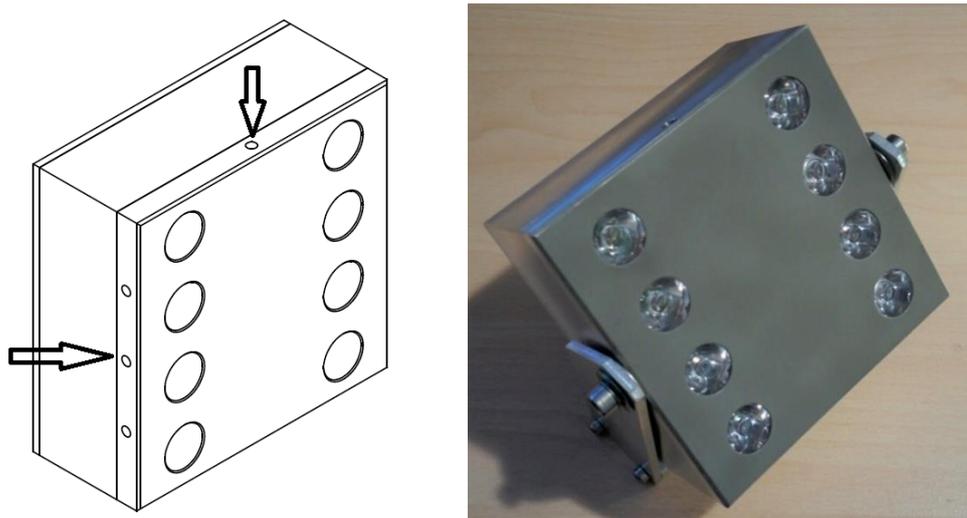


Figure 4. Position of mounting holes. On the right a photo of the unit placed in a mounting bracket.

Device orientation

There many orientations possible for light exposure. However, with shiny surfaces, direct reflections of the shiny surface (so called “specular reflections”) can inhibit accurate inspection (situation in Configuration 1). A preferred configuration for shiny surfaces is shown in Configuration 2, where the CamStrobe is placed at an angle. In this case, only the diffuse scattering of the surface can reach the camera, resulting in a clear image without specular reflections. An additional advantage is that the camera can be placed perpendicular to the surface and the images have no perspective deformation or distance blur, as can be the case in Configuration 1.

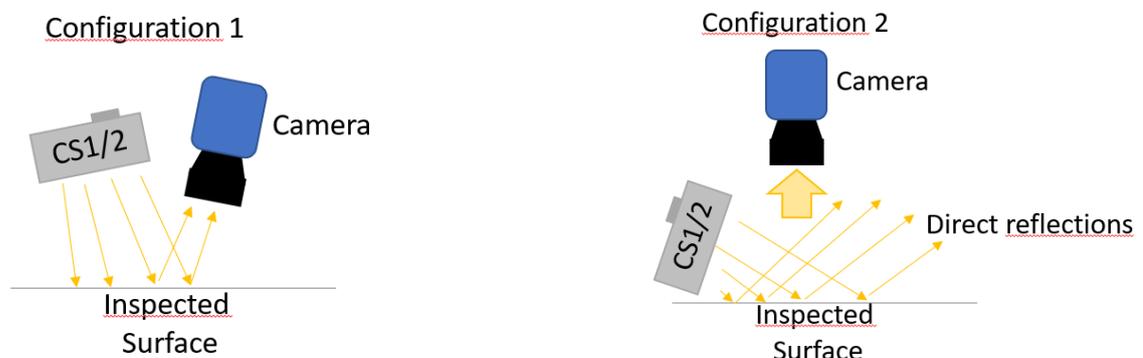


Figure 5. Two possible CamStrobe configurations. Right is generally the preferred configuration.

CS-3 only: mounting a camera inside the unit.

The CS-3 can also be used as the housing for an external camera. Please follow the following procedure for mounting a camera inside the unit.

- 1) Disconnect all existing cables to the unit and place the unit on a flat surface. Use a 2.5mm Allen key to open the unit on the front side by removing the 4 front screws (Fig. 6)
- 2) Slide the front away to the left. Handle the power cables to the LED front with care as not to damage them during mounting of the camera
- 3) Place the camera inside the housing on an appropriate mounting. (Fig. 7) The type of mounting is specific for a camera. Please contact Huygens Optics on information as to which mount to use with your camera.
- 4) Make sure the lens has a free view through the front protective window. Also, make sure that the connectors on the back side of the camera are accessible and can be connected externally through the opening on the back side of the CS-3 device. (Fig. 8)
- 5) Close the front of the unit. Make sure the power cables of the LEDs are not in any way between stuck or clamped between the housing parts.
- 6) Open the lid on the top of the device by removing the 4 screws with a 2mm Allen key (Fig. 9).
- 7) Mount the CS-3 with the camera in the inspection position and connect all the cables, including the power/pulse signal cable to the CS-3 as well as the power to the camera unit and UTP cable (GigE camera's) or USB cable (USB-3 camera's)
- 8) Start up the camera software as to view the camera images and set the focus and diaphragm of the lens to the appropriate values.
- 9) Close the top lid of the unit firmly with the 4 Allen screws.

Your unit is now ready for use.

You can also have the unit preassembled by Huygens Optics. Notice however that the camera is not a part of the CS-3 unit and that the warranty of the camera is the responsibility of the camera manufacturer.



Fig.6. remove front screws



Fig. 7. Open housing and place camera



Fig. 8. Position camera I/O's



Fig. 9. Adjust lens settings

Choosing a suitable LED lens type when ordering

Appendix B gives the illuminance in unit Lux for various distances and lens types. In the graphs, the average illuminance is displayed at a pulse frequency of 50Hz and a pulse length of 50µs. Figure 10 shows an example of the illuminance profile of a CS-2 unit at 600mm distance, with various lens types. The tight lenses keep most of the light confined within an area of approx. 215 mm diameter area at 600mm distance, whereas the medium beam is wider (270mm) and thus also has a lower maximum illuminance. The ultra-wide has a low luminance, but a very uniform distribution (spot size > 420mm, see Appendix B and C for details)

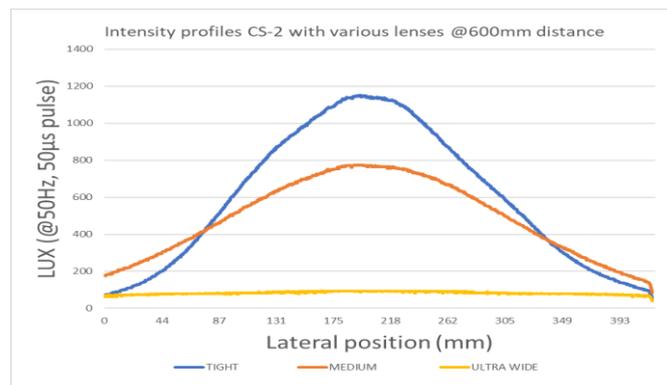


Figure 10: illuminance profiles at 600mm distance for a CS-2 with tight (narrow), medium and ultra-wide illumination.

Be aware that at a setting of 50Hz and 50us pulse width, the strobe light is in the “on” state only 1/400th of the time. When using a camera, the luminance during the light pulse is actually more important. Under these conditions the value is 400x times higher than the value given in the graphs.

The choice for a specific LED lens type is dependent on the distance from the object and the required surface area and intensity. Table 2 gives typical values for advised working distances for the various lens types

Lens type	Min. distance (mm)	Max distance(mm)
Tight	300	1200
Medium	200	600
Wide	200	400
Ultra-wide	100	200

Table 2. Indicative application distances for the lens types available for the CS-2

Connection to the Huygens Optics Camera interface

Connection of the units to the to the Huygens Optics Camera Interface is straight forward and is shown in figure 11. It requires a cable with XLR connectors on both sides, one connecting to the unit and one to the back side of the Camera Interface. The standard camera interface allows 2 CamStrobes and 1 camera to be connected. The Interface also has an input for external triggering available.

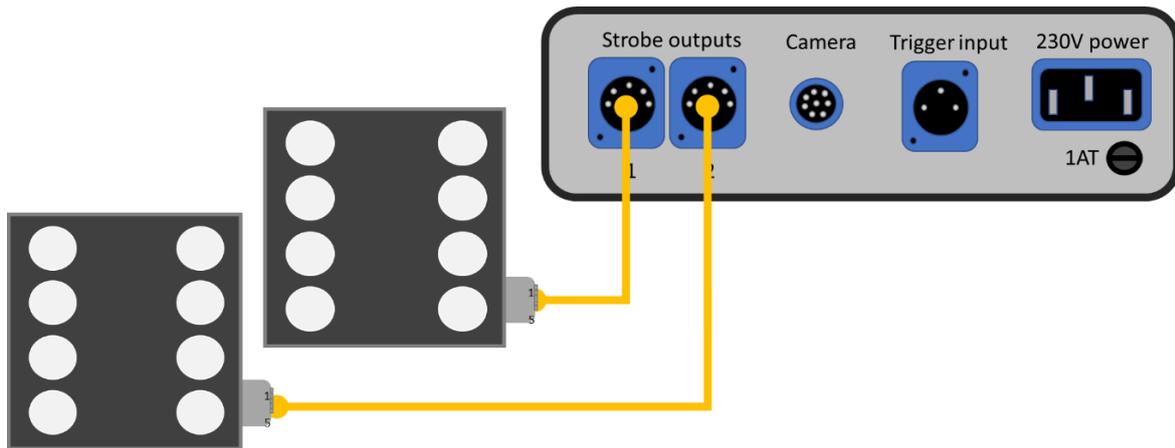


Figure 11. Connecting Strobe units to a Huygens Optics Camera Interface (Type: HO-CIF2.001 with 2 outputs) using standard strobe cables (HO-STCA.001)

When using the Huygens Optics Camera Interface, the power supply to the units as well as the trigger pulses from a camera or external source (optical or inductive pick-up element) will be routed correctly. Always first connect all the cables to the interface **before switching on the power**. For more information, refer to the Camera Interface manual.

When connecting to a camera, the timing of the camera should be set such that the flash is within the exposure interval of the camera. This is schematically shown in figure. Make sure that the positive slope of the camera's trigger output is within the exposure interval of the camera. Otherwise the camera will show a dark or underexposed image.

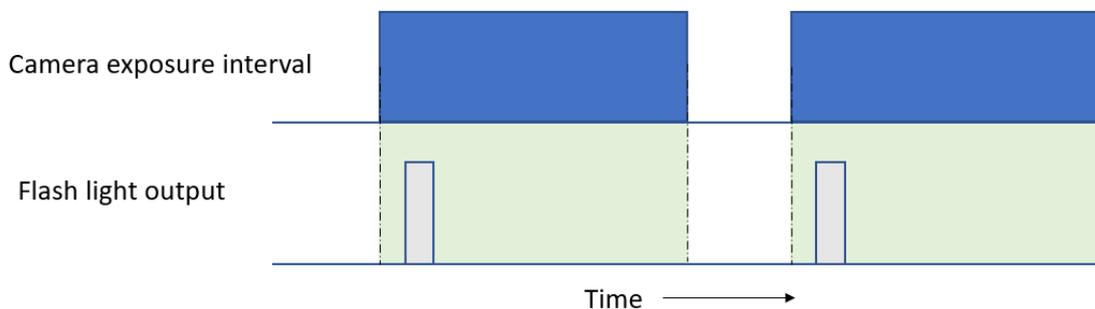


Figure 12. Flash timing with respect to the exposure interval (shutter open, indicated in green).

Connection to other interfaces

The device can also be connected to other camera interfaces. Modern industrial cameras generally contain (multiple) IO ports that can be used to trigger units such as the CamStrobe. If an optocoupler output is available, this is the preferred way to connect the camera, since it is less likely that the I/O port of the camera is damaged. Many direct camera IO ports only allow voltages of 3.3V. Figure 13 shows a typical scheme of how a CamStrobe can be connected to an optocoupler output of the camera.

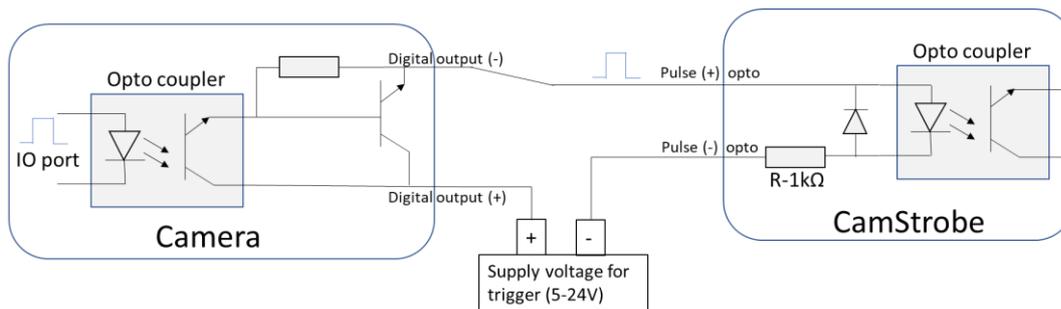


Figure 13. Typical connection scheme of a camera and CamStrobe.

Multiple CamStrobes can be connected to a single camera. However, it is important to consider the maximum current load of the camera port. The CamStrobe has an internal resistance of 1kOhm to limit the current of the pulse input. Therefore, the pulse input of the CamStrobe requires between 4 and 24mA, depending on the supply voltage used for generating the trigger pulse.

Connection to an external pulse generator

CamStrobe units can also be connected directly to an external pulse generator, provided that it is producing a pulse of at least 1 μ s wide and meets the specified values for voltage and current.

Note: It is important to notice that this pulse voltage level on the pulse (+) terminal is defined with respect to the voltage on pulse (-) terminal of the strobe unit, not with respect to ground or the power supply minus terminal. This is because the connections for the pulses are galvanically isolated from the rest of the device by means of an opto-coupler. This galvanic separation can be overruled by connecting the power supply 0V, ground (GND) and sensor power (-) terminal. The figure shows an example schematic for connecting an external inductive sensor.

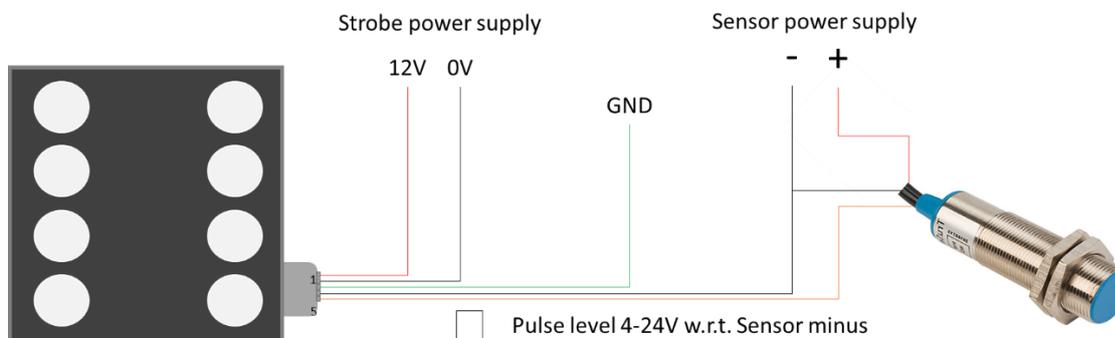


Figure 14. Example connection scheme when using an external inductive sensor as a direct trigger.

Maintenance

The device can be cleaned using a damp cloth with a soap solution or isopropanol. Aggressive solvents such as acetone or thinner should never be used, since they can damage the device surface and the transmission quality of the lenses.

Troubleshooting

Device not flashing:

- 1) First Check green LED indicator on the back of the device. If green light is not lit or very dim: check power supply voltage level, connections and polarity of the power source.
- 2) If the green LED light is on and no flashes occur, check connections of the pulse input connections, the polarity, and check if the pulse level is between 4 and 24V.

Device flashing but very dimly:

- 1) Power supply voltage too low, should be 12 V
- 2) Internal electronics failure: please contact Huygens Optics.

Device flashing at correct level but not correctly timed:

- 1) Check polarity of the trigger connections.
- 2) Check for ghost pulses on the trigger connection

If you have tried all the above with no success, please remove the power from the device and contact Huygens Optics for additional support.

EC DECLARATION OF CONFORMITY

In accordance with the requirements of Council Directive 2004/108/EG relating to electromagnetic compatibility,

Manufacturer
Huygens Optics
Prof. Poelsstraat 50
1221HT Hilversum

declares under Huygens Optics sole responsibility that the product

CamStrobe CS-2 camera stroboscope

to which this declaration relates is in conformity with the following standards:

EN55011 + EN55022 (RE+CE)
EN61000-4-2 (ESD)
EN6100-4-3 (RI)
EN61000-4-6 (CI)

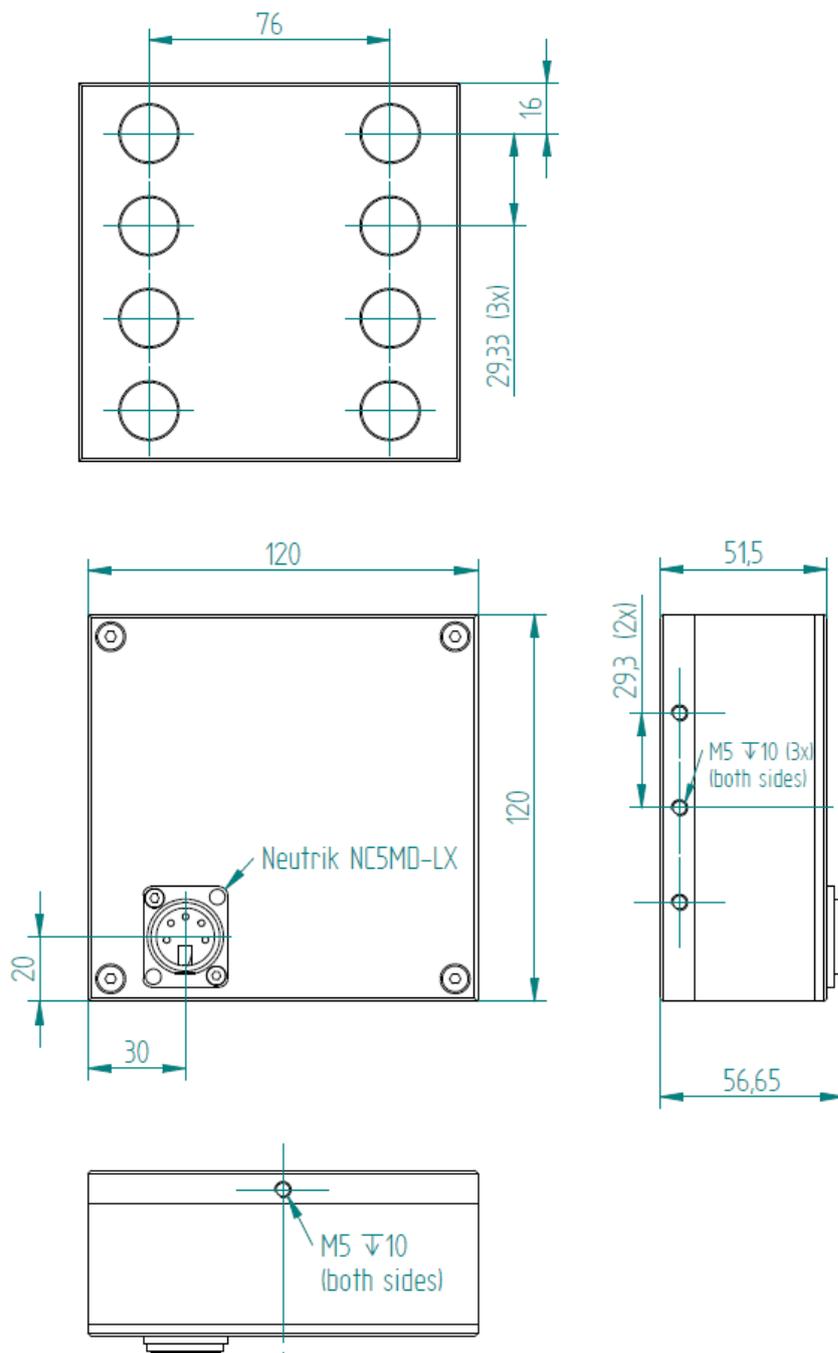
When operated in accordance with the user guide. The technical file is available from the manufacturer using the address data above or electronically from www.huygensoptics.com

Signed on behalf of: Huygens Optics
Place of issue: Hilversum, the Netherlands
Test location: DARE Instruments, Woerden, the Netherlands
Date of Issue: December 17th 2018
Name: J. Vleggaar
Position: company owner
Signature:

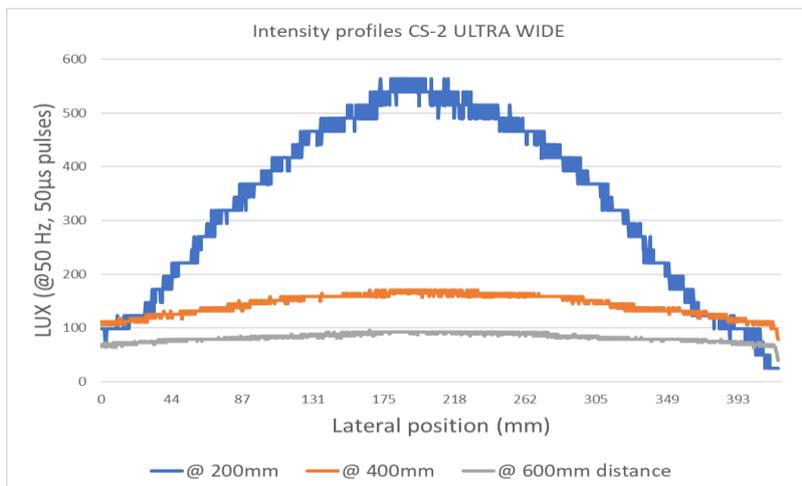
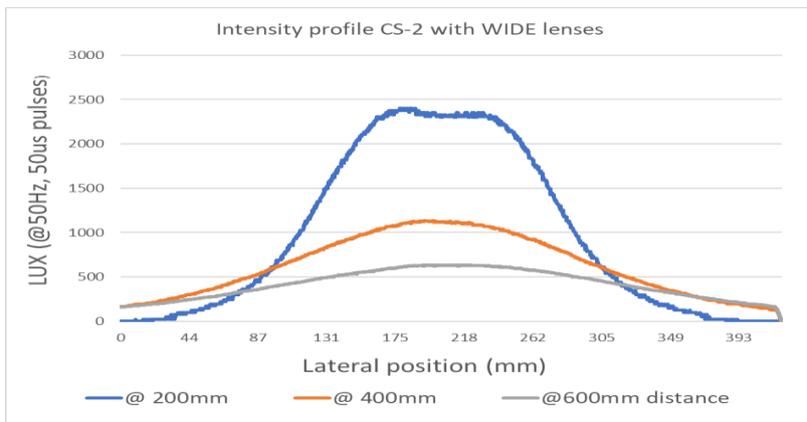
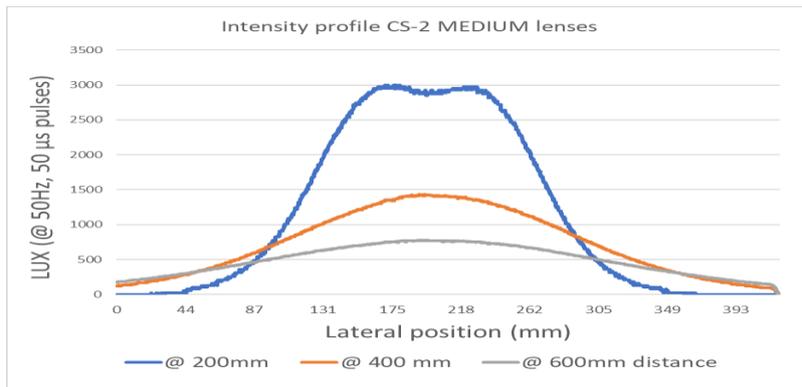
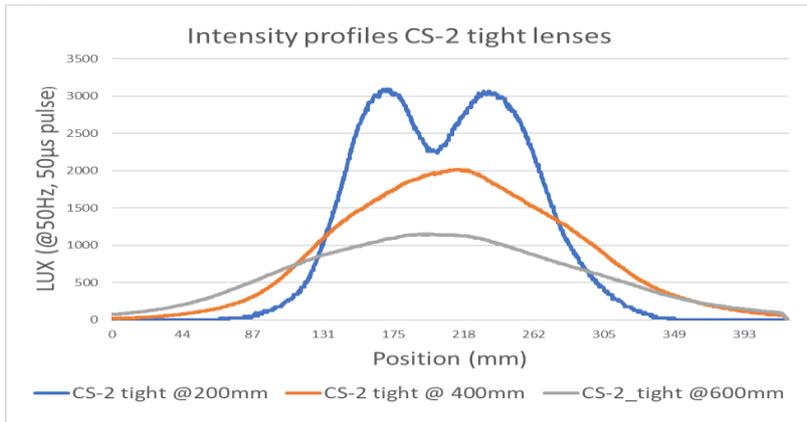


Appendices

Appendix A: dimensional drawings



Appendix B: illumination profiles



Appendix C: CS-2 spot sizes and intensities

Spot sizes are defined as the size of the area where the illuminance is at least ½ of the maximum spot illuminance and is derived from the intensity plots of Appendix B.

200mm illumination distance		
Lens type	Spot size (mm)	Max intensity (LUX @50Hz,50us)
Tight	135	3000
Medium	155	2900
Wide	165	2400
Ultra-wide	264	550
400mm illumination distance		
Lens type	Spot size (mm)	Max intensity (LUX @50Hz,50us)
Tight	180	2000
Medium	200	1420
Wide	210	1120
Ultra-wide	>420	175
600mm illumination distance		
Lens Type	Spot size (mm)	Max intensity (LUX @50Hz,50us)
Tight	215	1150
Medium	270	780
Wide	290	627
Ultra-wide	>420	100

Appendix D: Available versions and accessory overview

Camstrokes lenses are available with illumination profiles: T (Tight), M (Medium), W (Wide) and U (Ultra-wide). When ordering a CamStrobe, please indicate required illumination angle.

- 1) **CS-2: CamStrobe with 8 high power LED units. Order code: HO-CS2.001-x ***
- 2) **CS-3: CamStrobe with 8 high power LED units. Order code: HO-CS3.001-x ***
- 3) **CS-2/3 mounting brackets. Order code: HO-MB2.001**

where X is the required illumination profile (N, M, W or U). Refer to Appendix B for more information on the illumination profiles.

When ordering cables and sensors, please indicate the required length of the cable. Cable lengths can be supplied with lengths between 1 and 10 meters.

- 4) **Strobe connection cable, 2 connectors; Order Code: HO-STCA.001-XX ****
- 5) **Strobe connection 1 connector and 1 open end (wires). Order Code: HO-STCB.001-XX ****
- 6) **Camera Interface cable for GigE Matrix Vision camera Order Code: HO-CIC.MV-XX ****
- 7) **Camera Interface cable for GigE IDS camera; Order Code: HO-CIC.IDS-XX ****

Camera Interfaces are available with 2 to 4 strobe outputs and either external pulse or incremental encoder input for synchronization.

- 8) **Camera Interface, pulse input with 2 strobe connection outputs; Order Code: HO-CIF2.001**
- 9) **Camera Interface, pulse input with 4 strobe connection outputs; Order Code: HO-CIF4.001**
- 10) **Camera Interface, encoder input 2 strobe connection outputs; Order Code: HO-CEN2.001**

The following sensor types are available for external synchronization of the Camera Interface

- 11) **Inductive sensor; Order Code: HO-SIN.001-xx ****
- 12) **Capacitive sensor; Order Code: HO-SCA-xx ****
- 13) **Optical transmission sensor; Order Code: HO-SOP-T.001-xx ****
- 14) **Optical reflectivity sensor; Order Code: HO-SOP-R.001-xx ****
- 15) **Incremental encoder wheel sensor; HO-ENC.yyyy-xx *****

(*) with illumination profiles: T (Tight), M (Medium), W (Wide) and E (elliptical)

(**) XX being the length in meters (for example xx=05 means cable of 5 meter)

(***) yyyy encoder pulses per revolution, xx cable length