

# Specifications Fast Shutter

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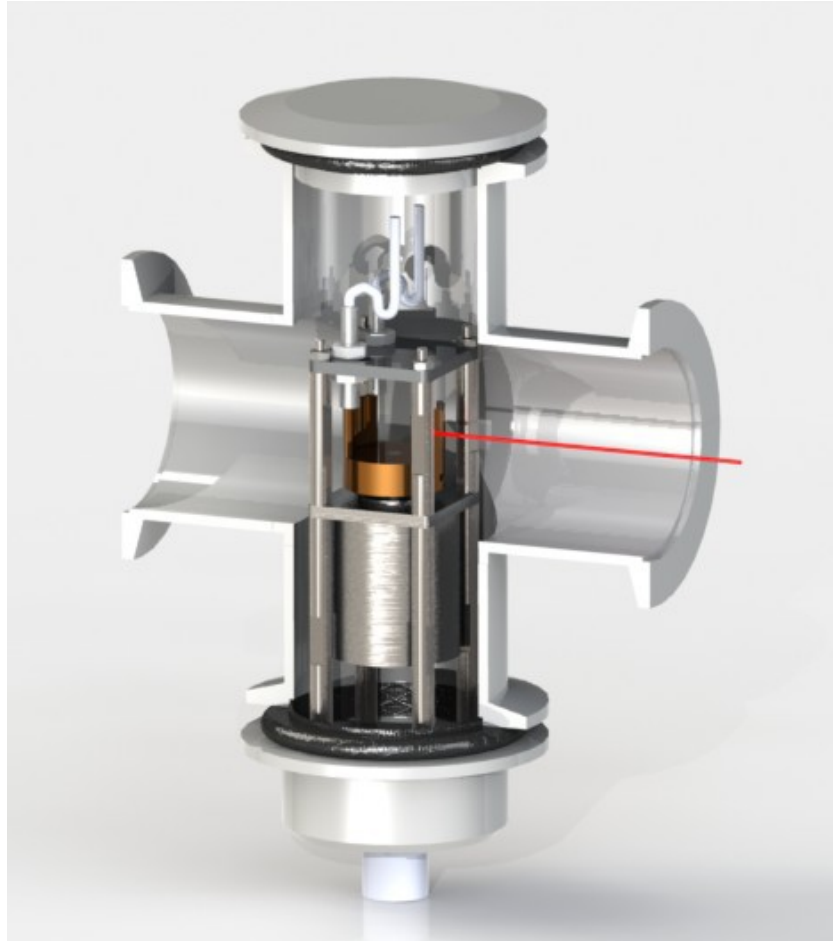
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## Table of Contents

1 How does it works ?.....	3
2 Versions.....	4
3 Electrical.....	4
4 Mechanical.....	5
4.1 Weight and Size.....	5
4.2 Absorption.....	6
5 Timing.....	7
5.1 Electrical mode.....	8
5.2 Ethernet mode n°1.....	9
5.3 Ethernet mode n°2.....	9
5.4 Ethernet mode n°3.....	10
5.5 Ethernet mode n°4.....	11

## 1 How does it works ?

The shutter is based on a stainless steel head mounted on a stepper motor. To open and close the shutter, a 90° rotation is operated. An inductive sensor is placed to allow a homing of the motor at the starting.



*Figure 1. Example of a Fast Shutter in a CF cross*

### **Main Characteristics:**

Monochromatic beam

From IR to X-ray

Aperture : 12 mm x 12 mm

Shutter head : 3 mm stainless steel

Normally Open or Normally Closed positions

5 functional modes :

- Electrical : open and close the shutter thanks to an electrical signal;
- Ethernet n°1: open and close the shutter thanks to an electrical signal. Choose a opening and closing delay by Ethernet;
- Ethernet n°2: open the shutter with an electrical signal and it closes automatically

after a “exposure time” defined by Ethernet. You can choose a opening and closing delay too;

- Ethernet n°3: define by Ethernet the time high, the time low, the opening and closing delay, and the number of cycles. Start the cycle with an electrical signal;
- Ethernet n°4: define by Ethernet a frequency rotation until 50 Hz. Start the continue rotation by an electrical signal.

Opening and closing time well-known depending on beam size. Typically 17 ms.

Beam crossing time well-known depending on beam size. Typically around 0,4 ms from 10 % to 90%.

Minimum time of a high and low level = 40 ms → maximum frequency = 50 Hz.

Maximum frequency in continue rotation = 50 Hz.

## 2 Versions

Several versions of this shutter exist to fit to your need. You can choose no housing to integrate yourself the shutter or an housing for atmospheric pressure, an housing with KF flange or CF flange. For more information, please see the selection guide of this product or contact NatX-ray.

## 3 Electrical

Ordering by a 5 V or 24 V signal (10 mA min)

- Low level : 0 V to 1,6 V
- High level : 2 V to 24 V

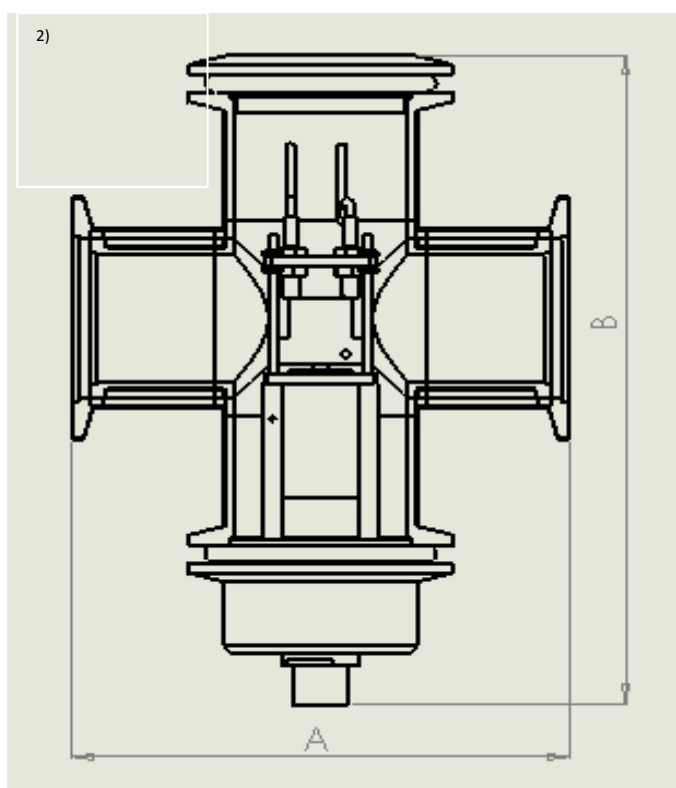
Resistance per phase at atmospheric pressure : 2.6 Ohms and for vacuum : 1.25 Ohms.

Power consumption (driver + shutter) : < 200 W.

## 4 Mechanical

### 4.1 Weight and Size

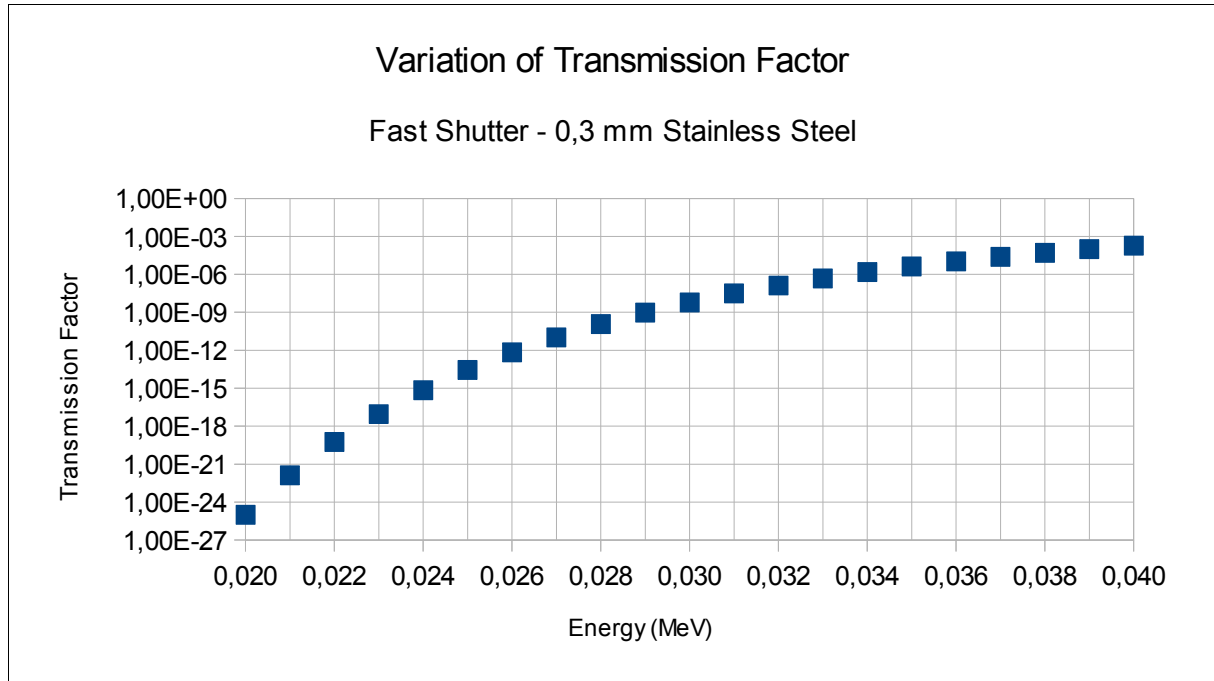
Weight Size A x B	Atmospheric Pressure (AP)	Medium Vacuum (FV) up to 10 <sup>-3</sup> mbar	High Vacuum (HV) up to 10 <sup>-6</sup> mbar
No Housing (NH)	PRT002-FS-AP-NH 0,390 kg 175 mm x 35 mm	PRT002-FS-MV-NH 0,390 kg 175 mm x 35 mm	PRT002-FS-HV-NH 0,410 kg 150 mm x 35 mm
Atmospheric Pressure Housing (APH)	PRT002-FS-AP-APH 0,570 kg	N/A	N/A
KF DN50 flange (KF)	PRT002-FS-AP-KF 1 kg 140 mm x 200 mm	PRT002-FS-MV-KF 1 kg 140 mm x 200 mm	N/A
KF DN50 flange Reduction DN40 (KFR)	PRT002-FS-AP-KFR 0,920 kg 130 mm x 200 mm	PRT002-FS-MV-KFR 0,920 kg 130 mm x 200 mm	N/A
CF DN63 flange (CF)	N/A	PRT002-FS-MV-CF 8 kg 210 mm x 245 mm	PRT002-FS-HV-CF 8 kg 210 mm x 245 mm
CF DN63 flange Reduction DN40 (CFR)	N/A	PRT002-FS-MV-CFR 6,3 kg 154 mm x 245 mm	PRT002-FS-HV-CFR 6,3 kg 154 mm x 245 mm



Operating Temperature: from +10 °C to 30 °C

## 4.2 Absorption

The shutter head is composed of 3 mm of stainless steel – 2 x 1,5 mm. The following graphic shows the transmission factor regarding the energy in MeV.

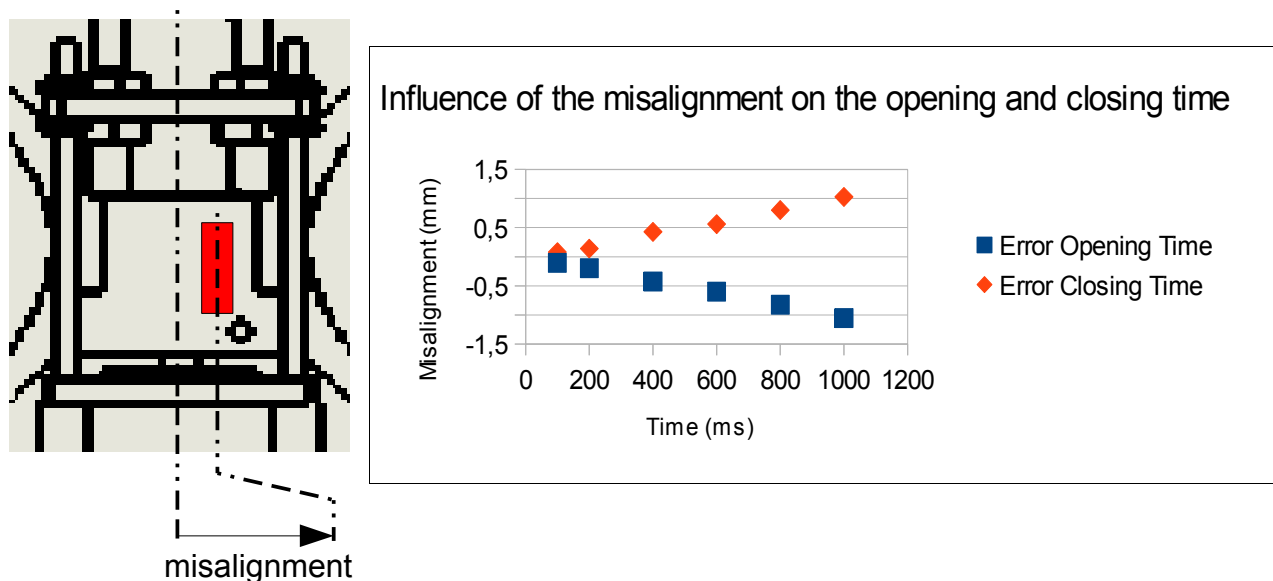


## 5 Timing

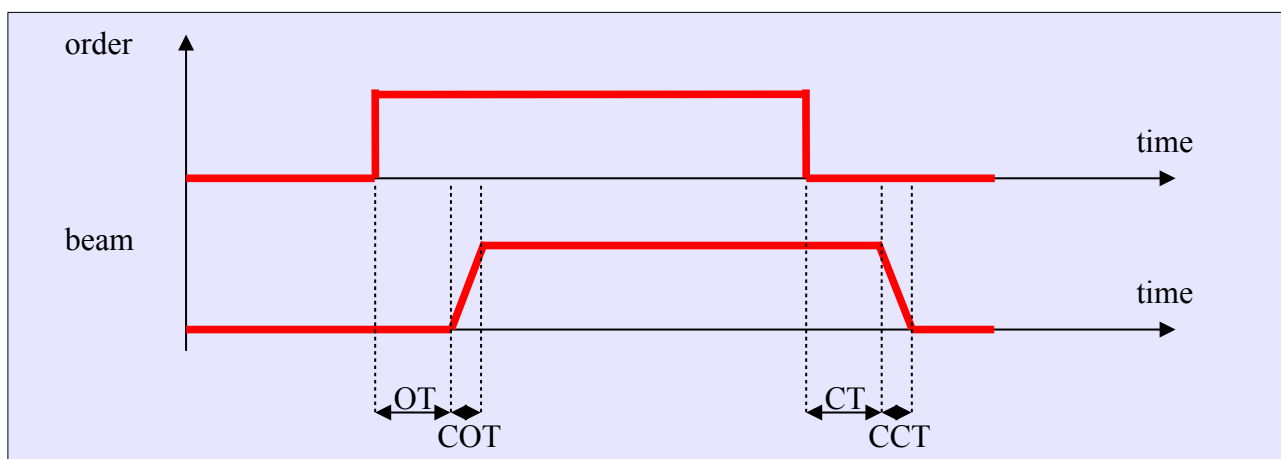
Timing typically measured on the shutter with a circular beam of 2 mm of diameter. All the shutter are delivered with **quality report** regarding on the timing on several hundred of cycles.

For a non-square beam, the orientation of shutter has an influence on the opening and closing time. It can be positioned horizontally or vertically.

The position of the shutter in the beam is a critical point. The following graph shows the variations of the opening time in milliseconds regarding this misalignment in millimeters.



Definition of a opening, closing time and crossing times:



Measurements	Timing (ms)	Standard Deviation
OT = Opening Time	17	0,1 ms → < 1 %
COT = Crossing Opening Time	0,4	0,025 ms → 6 %
CT = Closing Time	17	0,1 ms → < 1 %
CCT = Crossing Closing Time	0,4	0,025 ms → 6 %

These timings clearly depend on the beam size. These values are given for a circular beam with a diameter of 2 millimeters.

## 5.1 Electrical mode

In this mode, there is no need of an Ethernet communication. The opening and closing on the shutter is directly linked to an electrical signal:

- Low level: 0 V to 1,6 V
- High Level: 2 V to 24 V

The default position of the head is defined by the mini-switch on the shutter crate.

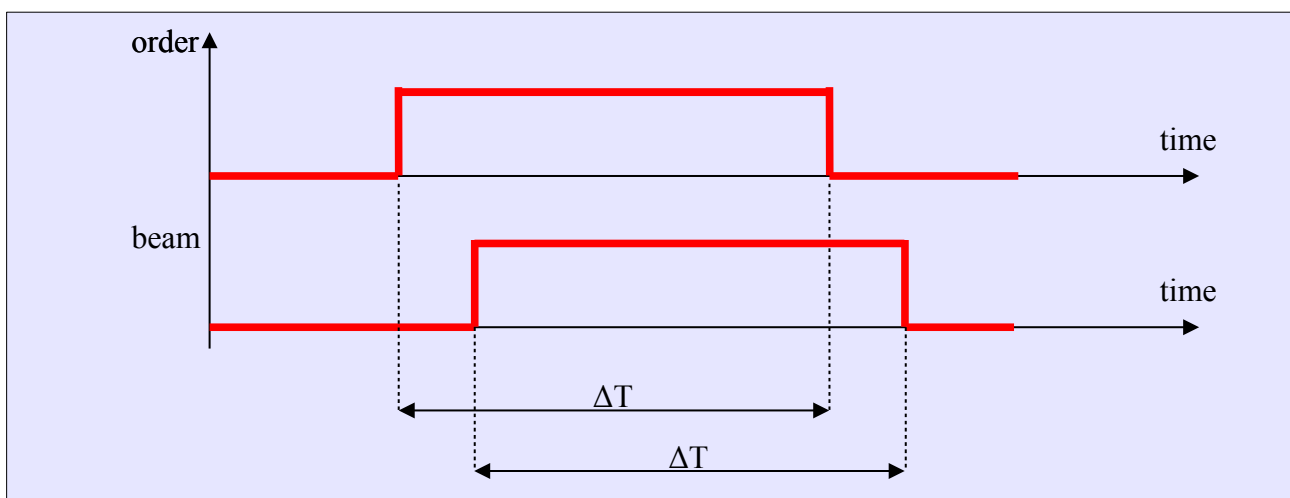


Figure 2. Cycle in electrical mode with Normally Close position



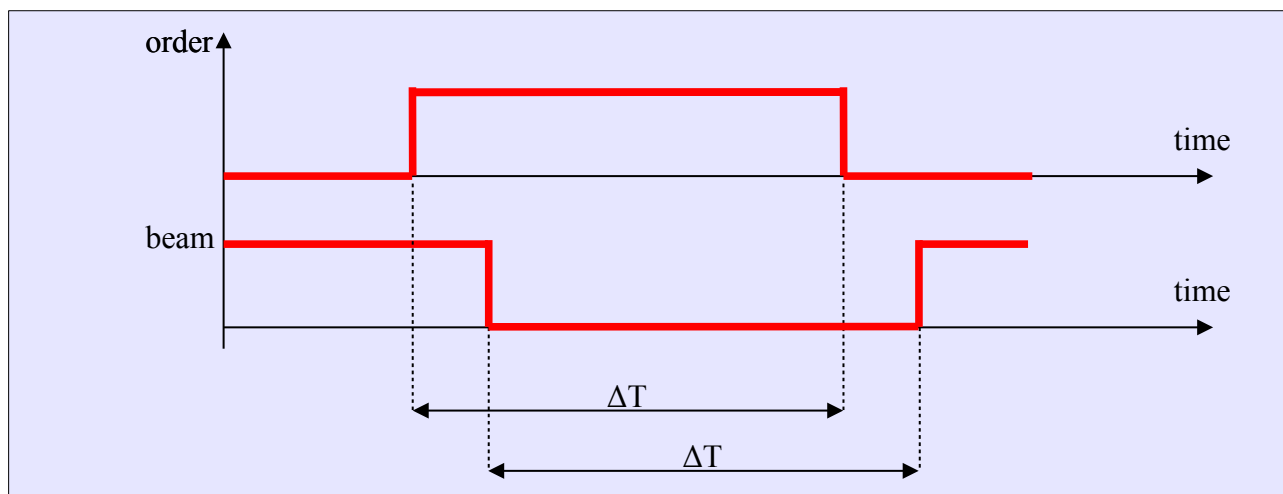
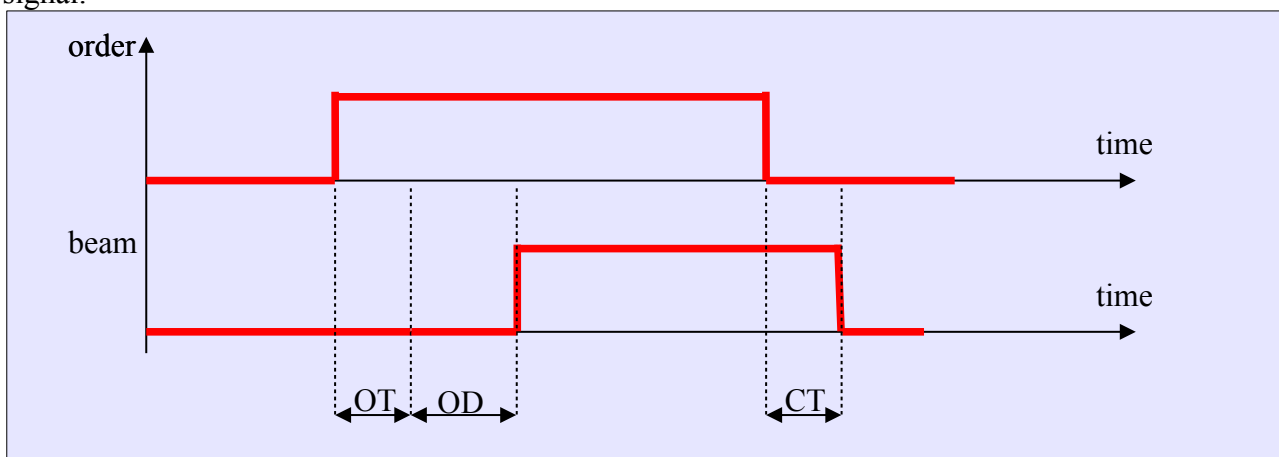


Figure 3. Cycle in electrical mode with Normally Open position

## 5.2 Ethernet mode n°1

This mode needs a Ethernet communication between the shutter controller and your server. (Please see the User Manual to learn more about this communication)

This mode has the same characteristics as the electrical one. The added functions are to control the opening and closing delays. The opening and the closing are define by the electrical signal.

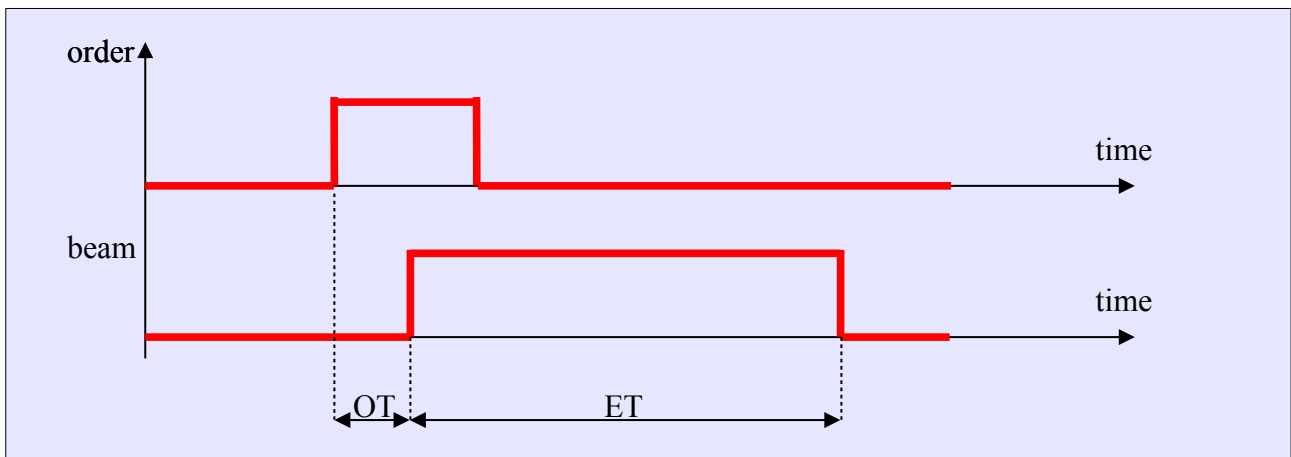


It's possible to define by Ethernet a opening delay and a closing delay separately. On the graph, only the opening delay is represented. There is no limitation of time except the low level of the electrical signal that should appear after the end of the opening delay and crossing opening time.

Be careful, if the mode is Normally Open, the Opening Delay and Closing Delay are inverted.

## 5.3 Ethernet mode n°2

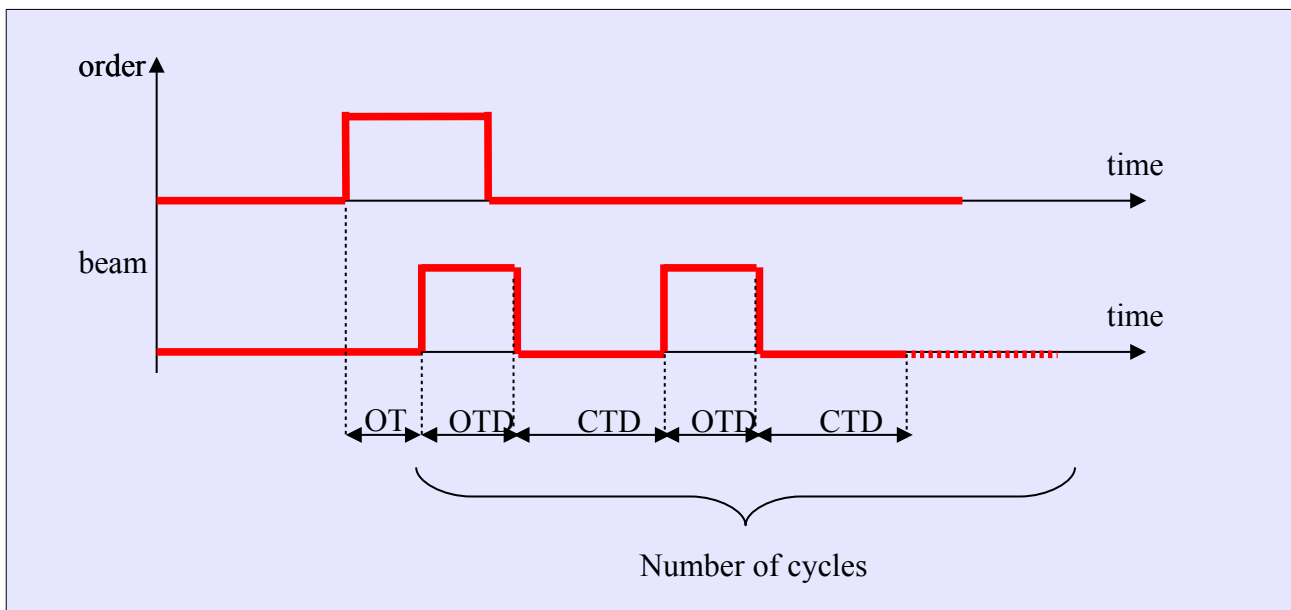
This mode is quit the same as the previous one except that the exposition time is not defined by the high level of the electrical signal but by a variable defined by Ethernet. The delays are also available. On the graph the delays are set to '0'.



ET is the Exposure Time defined in millisecond by Ethernet.

### 5.4 Ethernet mode n°3

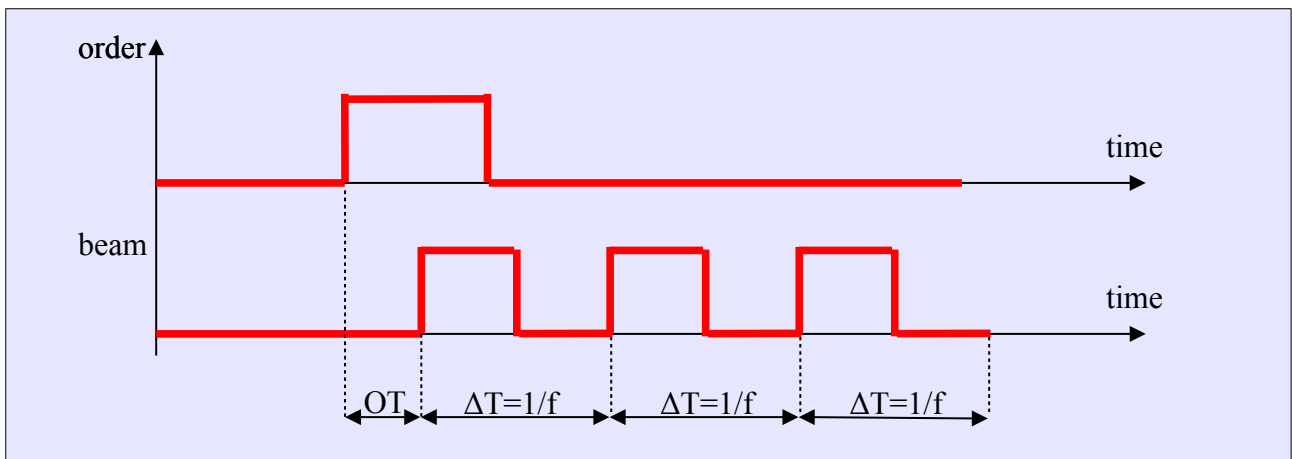
This mode allows to define a number of cycles with open time duration and a close time duration. The delays are also available. On the graph the delays are set to '0'.



OTD is the Open Time Duration and CTD is the Close Time Duration, both in millisecond.

### 5.5 Ethernet mode n°4

This mode provides a continue rotation of the shutter head. The maximum frequency is 50 Hz. The delays are not available in this mode.



f is the frequency in Hertz.

If the frequency is reduced, the Crossing Opening and Closing Time will raise. For example, at 50 Hz, the Crossing Opening Time is around 0,25 ms and 0,45 ms at 25 Hz.