cyltronic

IO-Link

Servo Actuator

Electric cylinder CTC

Manual EN

CE

Experts **in IO-Link Servo Actuators**

1 General information

Original manual (acc. MRL 1.7.4.1 a)

1.1 Document version

20240814 Operating Instructions CTC EN (replaces previous versions)

1.2 Manufacturer information

Cyltronic AG

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Thank you for your confidence in our product. We recommend reading the entire operating instructions before commissioning.

Installation and commissioning may only be carried out by qualified personnel with appropriate qualifications in accordance with these operating instructions.

1.3 Device assignment

These instructions apply to the following devices:

Cyltronic electric cylinder:

- CTC-060-Kxx-xxxx-x-DIO
- CTC-060-Kxx-xxxx-x-IOL
- CTC-080-Kxx-xxxx-x-DIO
- CTC-080-Kxx-xxxx-x-IOL

1.4 Scope of delivery

The scope of delivery includes only the electric cylinder, all accessories must be purchased separately.

1.5 Further Documents

Description	Filename	Source:
IO-Link Interface Description	Vx.xx.xx-yyyymmdd-IO-Link_Interface_Description_EN	www.cyltronic.ch /produkte/downloads/
Datasheet CTC-060 **Datasheet CTC-080**	yyyymmdd_DataSheet_CTC-060_EN yyyymmdd_DataSheet_CTC-080_EN	www.cyltronic.ch /produkte/downloads/
Accessories catalog	yyyymmdd _Cyltronic_Zubehoer-Katalog_(DE).pdf	www.cyltronic.ch /produkte/downloads/
IODD (IO-Link Device Descriptions)	Cyltronic-CTC-0x0-Kxx- yyyymmdd -IODD1.1.xml	https://ioddfinder.io-link.com/productvariants/search?vendorName="Cyltronic AG"

2 Table of contents

3 Safety information

3.1.1 Local safety regulations

Before using this product, make sure that it complies with all local safety regulations. Take all necessary safety precautions to ensure proper operating function during and after the period of use. You may also add additional external protective features or structures to the product as needed. Restrict access to hazardous areas appropriately.

3.1.2 Accident risk

Do not remove any parts from the product or attempt to open it, for example by loosening screws or other components.

3.1.3 Modification

No modifications may be made to the product. Modifications may cause the product to malfunction and void any warranty claims.

3.1.4 Qualified personnel

Installation, commissioning, as well as maintenance and disassembly may only be performed by qualified personnel. The personnel must be familiar with the installation of mechatronic drives.

3.2 Intended use

The product is an incomplete machine in the sense of the Machinery Directive (Directive 2006/42/EC) and is intended for installation in a complete machine. This must not be put into operation until it has been established that the machine into which this partly completed machine is to be incorporated complies with the provisions of Directive 2006/42/EC.

The electric cylinder is to be used for linear movements of payloads or as a drive with the use of separate guides.

This product can be used in applications of various fields; therefore, the responsibility of the specific application passes to the user. The application or performance limits as well as the environmental or boundary conditions are described in chapter 6 "Technical data " and in the corresponding datasheet.

The risks associated with improper use lie solely with the user. No liability is accepted for damage resulting from improper use.

3.3 Foreseeable misuse

The product must not be used to transport or move people and animals. For example, the product must not be used for lifting suspended loads when direct failure may result in injury to a human being.

3.4 Safety instructions

3.4.1 General hazards

This product is built according to the current state of the art and is safe to operate. However, hazards may arise from the machine if it is not used by trained or at least instructed personnel, or if it is used improperly or for purposes other than those for which it is intended.

3.4.2 Warnings, notes

Warnings, notes and residual risks are identified by symbols in these operating instructions. It is essential to follow the instructions in order to avoid accidents, personal injury and damage to property.

Consider markings on the product.

Before mounting, installation and maintenance units: Switch off the power supply, check that no voltage is present and secure against being switched on again.

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

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

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

NOTE	
	...points out useful tips and work recommendations, which, however, have no influence on the safety and health of the personnel.

IMPORTANT	
	...indicates a possible harmful situation, which can lead to property damage if not avoided.

3.4.3 Residual risks

CAUTION	
	During operation, the product can become hot without affecting its function. The surface temperature can reach temperatures of up to reach 100 °C. Do not touch the product under any circumstances during operation and in the cooling phase after shutdown. Attach protective measures against contact at temperatures above 60 °C and contact duration of more than 1s. Ensure that no temperature-sensitive parts or objects are in contact with or attached to the product.

3.4.4 Product-specific warnings and notes

CAUTION	
	Depending on the operating conditions (speed, load, etc.), increased surface temperatures may occur on the product in the area of the drive. Touching the product during operation can cause minor burns. Do not touch the product during operation. During maintenance and repair work, make sure that the product has cooled down before starting work.
	Rapid movement of the piston rod due to an external force, without an electrical power consumer (such as a brake chopper or power supply) connected, can lead to voltage spikes and result in damage to the integrated electronics.

NOTE	
	The noise pattern does not necessarily indicate the service life of the cylinder. Different noise patterns may occur depending on the production process.

4 Transport, handling, storage

Lift the cylinder by the housing only. The cylinder must not be held by the trust tube only, as this may result in damage. The trust tube must be fixed and kept free of load during transport. Torques on the trust tube must generally be avoided.

5 Functional description

The electric cylinder CTC functions as an electromechanical spindle drive for linear movements. The main components are the synchronous servo motor, the spindle drive and the integrated electronics. All components are located in the housing.

The retraction and extension speed as well as the force limitation can be continuously adjusted via rotary knobs directly on the housing or set in real time via the IO-Link interface. Here, speeds, accelerations and other parameters can be changed, which allows positioning tasks such as in complex servo applications. Control via simple digital signals, which are used to control a simple pneumatic cylinder, for example, is also possible.

5.1 Device Overview

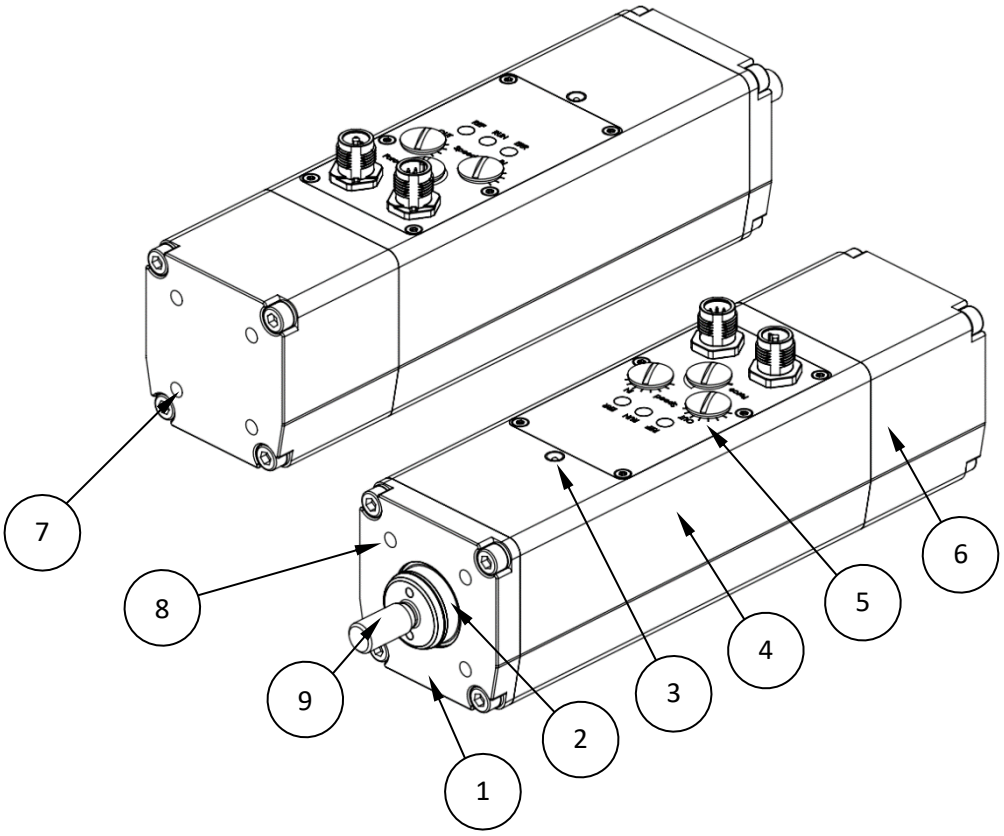


FIGURE 1: DEVICE OVERVIEW

No.	Description
1	Front cover
2	Piston rod
3	Grease nipple
4	Profile housing
5	Control panel, connections, display
6	Rear cover
7	Rear standard threads for mounting and fixing accessories
8	Front standard threads for mounting and fixing accessories
9	Threaded attachment on piston rod for mounting and fixing accessories

5.2 Control panel, connections, display

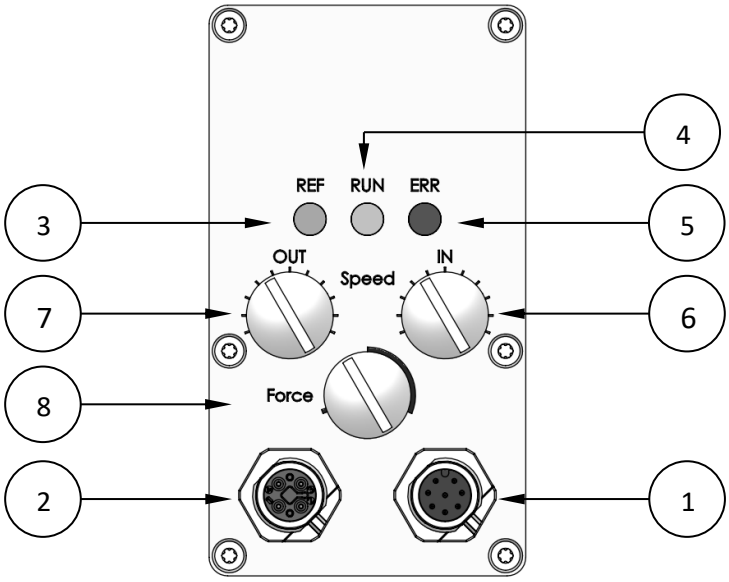


FIGURE 2: CONTROL PANEL

No.	Designation	Property
1	Connection for signal (M12 8-pin)	A-coded
2	Connection for power (M12 4-pin)	T-coded
3	LED display REF (orange)	Lights: Reference run required
4	LED display RUN (green)	Lights: Ready for operation / In operation Flashes: Signal supply ok, power supply missing
5	LED indicator ERR (red)	Lights: Error / not ready for operation Flashes: Error code see chapter 12.1
6	Rotary knob for setting the retraction speed (under the screw plug)	+ clockwise - counterclockwise
7	Rotary knob for setting the extension speed (under the screw plug)	+ clockwise - counterclockwise
8	Rotary knob for setting the force (under the screw plug)	+ clockwise - Counterclockwise

IMPORTANT	
	The scale on the rotary knob for setting the force only gives an indication of the continuous range and the peak force. An excessively long duty cycle with operation above the continuous range can lead to overheating. The unit has an internal temperature monitor which initiates a stop as soon as the temperature limit value is exceeded. However, damage due to overheating cannot be prevented.

5.2.1 Set speed / force

The knobs for speed and force adjustment are exposed with a flathead screwdriver, by removing the screw plugs:

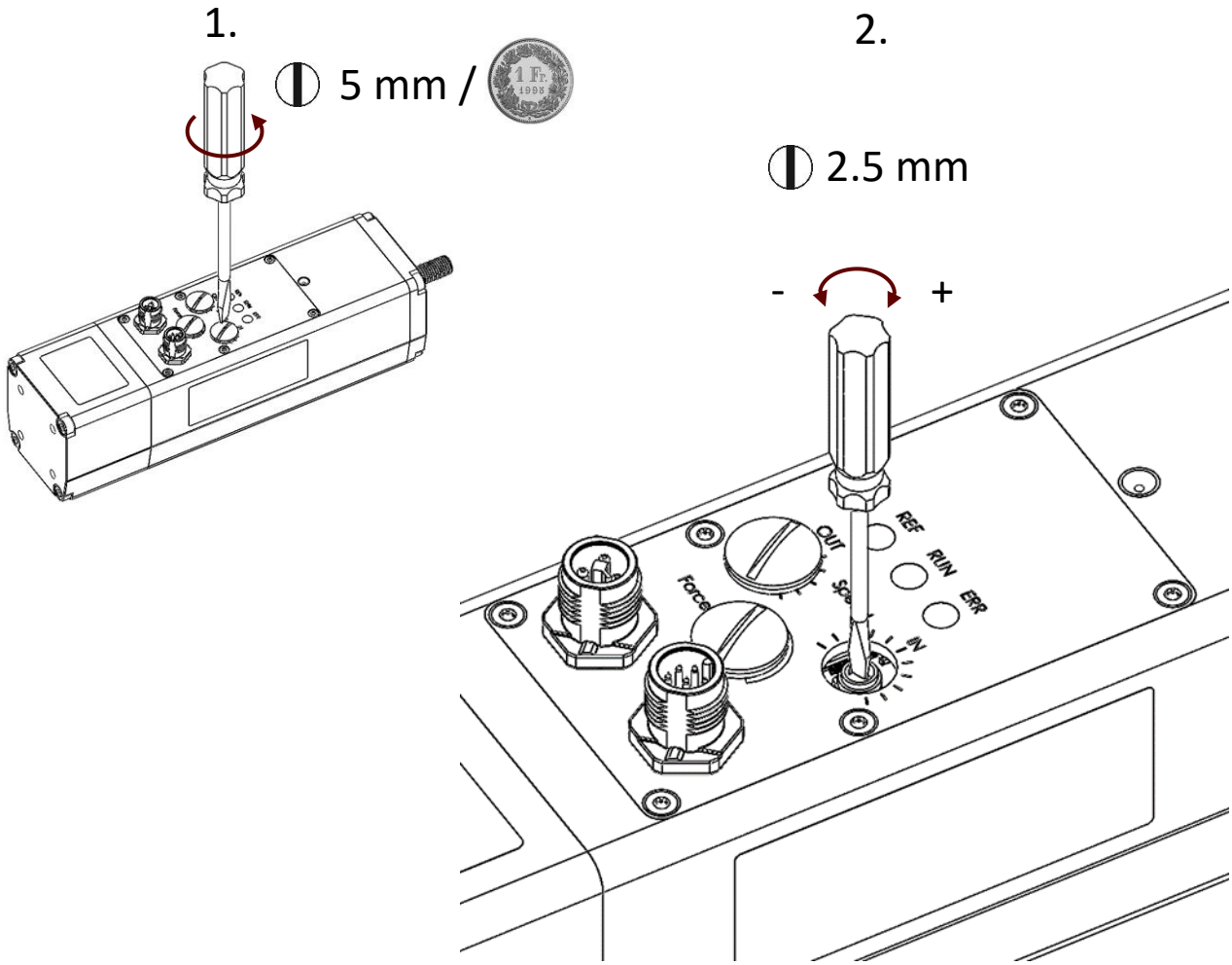


FIGURE 3: SET SPEED / FORCE

The retraction and extension speed as well as the force limitation are set via the rotary knobs (higher clockwise, lower counterclockwise).

IMPORTANT	
	Turn the knobs for force and speed carefully (approx. 0.5-1 Ncm). Do not turn beyond the end positions, as this may cause damage to the product.

IMPORTANT	
	The screw plugs may only be removed when the ambient humidity is below 90%. To avoid damage to the seal, tighten the screw plugs carefully when closing (approx. 2-5 Ncm).

6 Technical data

6.1 Design/Characteristics

For drive design, proceed according to the following steps. The required characteristic curves may vary depending on the component size and configuration, and can be found in the corresponding data sheet

If you require assistance with the design of our products, our Application Engineering team is at your service. Feel free to utilize the contact information provided in section 1.2 Manufacturer information.

6.1.1 Feed force F as a function of feed rate v

The force-speed characteristic curve for the respective device can be found in the data sheet. The following example graphic is intended to explain the essential limits:

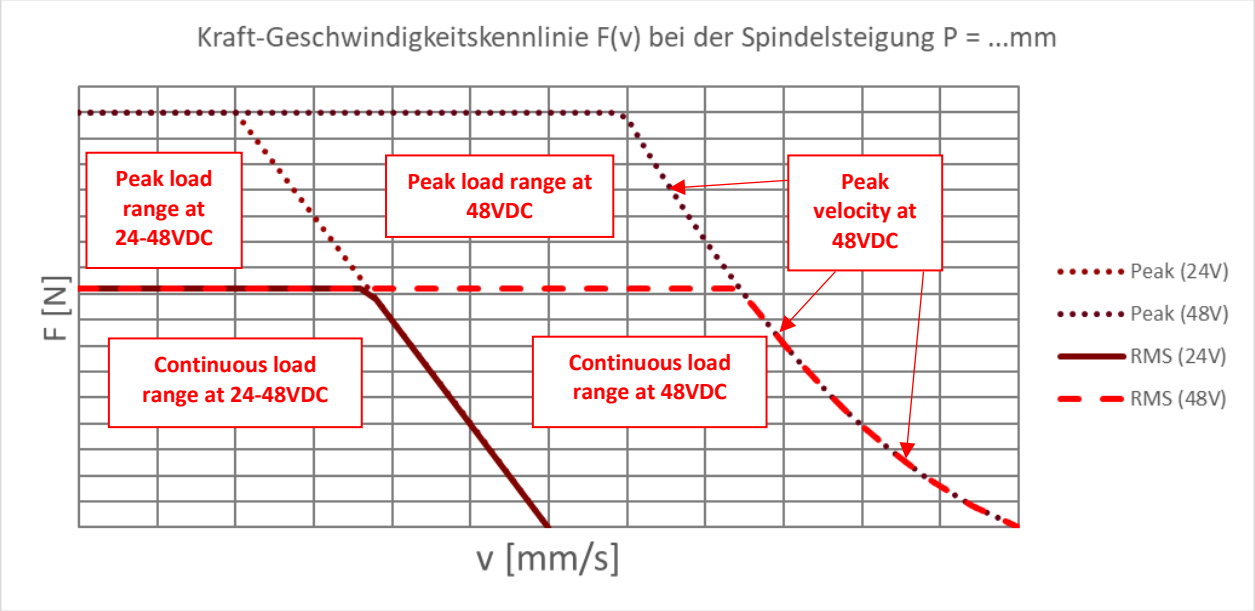


FIGURE 4: TYPICAL FORCE / SPEED CHARACTERISTIC OF AN ELECTRIC CYLINDER CTC

The force-velocity curves provide information about the continuous load (corresponds to a duty cycle of 100%) and the maximum available force / feed rate (peak), which can be used for short-term operation. If an operating point is above the RMS line, continuous operation is not possible. The load or operating time must be reduced accordingly, otherwise overheating of the actuator must be expected. The internal temperature monitoring withdraws the operational readiness from the cylinder and puts the cylinder into an error state (ERR LED flashing pattern see: Chapter 12.1).

If continuous operation is desired (100% duty cycle), all individual operating points must be below the peak line and the averaged effective load (F_{RMS}) must be below the RMS line. Unless otherwise stated, the respective characteristics apply to an ambient temperature of 20° C.
The calculations can be carried out according to the following description or handled by our application engineering using our tools.

A stroke movement is typically divided into the following chapter:

- b: Accelerate
- c: Run at constant speed
- v: decelerate
- h: Hold / Pause

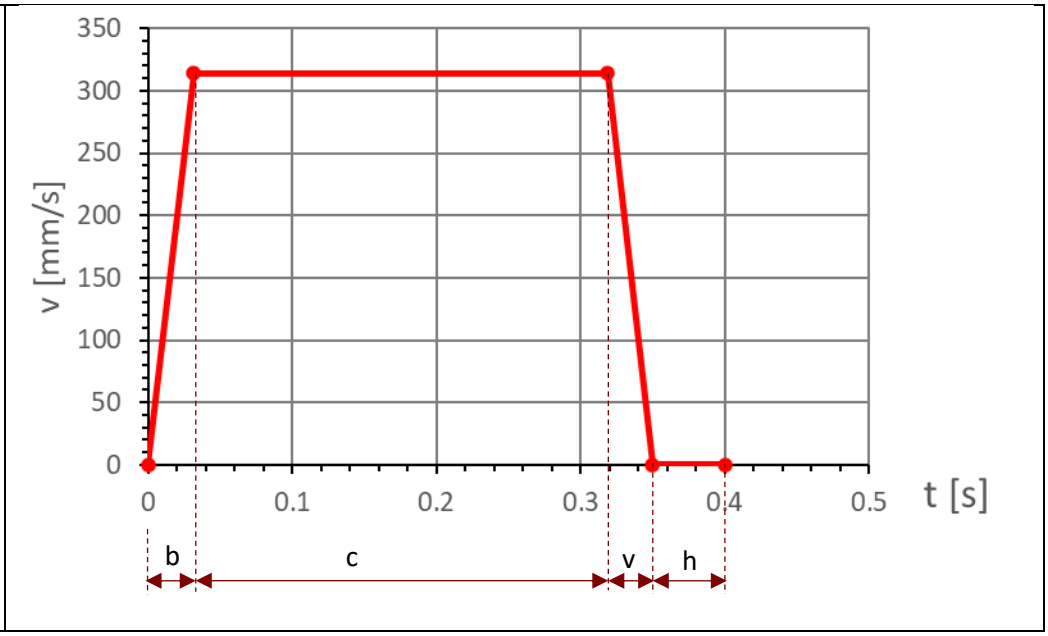


FIGURE 5: V-T-DIAGRAM OF A TYPICAL STROKE MOVEMENT

The effective load must be calculated for each movement phase. If the averaged effective load is above the RMS line, continuous operation is not possible. The peak curve indicates the load possible for a short time, although this cannot be operated permanently for thermal reasons. The load during acceleration or deceleration can be above the RMS curve but must be below the peak curve due to the physical limits of the drive.

6.1.1.1 Mean effective load (RMS)

The average effective load (RMS) is calculated using the following formula:

$$F_{RMS} = \sqrt{\frac{1}{t_{tot}} \cdot (t_b \cdot {F_b}^2 + t_c \cdot {F_c}^2 + t_v \cdot {F_v}^2 + t_h \cdot {F_h}^2)}$$ Average effective load in N

$t_b = \frac{v_{max}}{1000 * a_b}$	Acceleration time in s
$t_v = \frac{v_{max}}{1000 * a_v}$	Deceleration time in s
$t_c = \frac{s - \frac{v_{max}(t_b + t_v)}{2}}{v_{max}}$	Time for constant speed in s
t_h	Time for hold / pause in s
$t_{hub} = t_b + t_c + t_v$	Time for total stroke movement in s
$t_{tot} = t_b + t_c + t_v + t_h$	Time for total movement (incl. pause / hold) in s
$F_b = m \cdot a_b + m \cdot g \cdot \sin(\alpha)$	max. occurring load during acceleration in N
$F_c = m \cdot g \cdot \sin(\alpha)$	max. occurring load during constant speed in N
$F_v = m \cdot -a_v + m \cdot g \cdot \sin(\alpha)$	max. occurring load during deceleration in N
$F_h = m \cdot g \cdot \sin(\alpha)$	max. occurring load during hold in N (for pause $F_h = 0$)
$v_{avg} = \frac{\frac{v_{max}}{2} \cdot (t_b + t_v) + v_{max} \cdot t_c}{t_{tot}}$	mean velocity in mm/s
v_{max}	occurring velocity in mm/s
m	Mass in kg

s	Stroke in mm
a_b	Acceleration in m/s² (for rough design 10 m/s²)
a_v	Deceleration in m/s² (for rough design 10 m/s²)
g	acceleration due to gravity 9.81 m/s² (for simplicity 10 m/s²)
α	Mounting position (e.g., vertical: α = 90°, horizontal: α = 0°)

6.1.2 Design example

A load (m) of 15 kg is to be lifted vertically at a maximum speed (v_{max}) of 160 mm/s by a stroke (s) of 100 mm and held for a holding time (t_h) of one second. A value of 8 m/s² is selected for the acceleration (a_b) / deceleration (a_v).

Acceleration/deceleration times are calculated as follows:

$$t_b = \frac{v_{max}}{1000 \cdot\ a_b} = \frac{160\ mm/s}{1000\ mm/m * \ 8\ m/s^2} = 0.02\ s$$

$$t_v = \frac{v_{max}}{1000 \cdot\ a_v} = \frac{160\ mm/s}{1000\ mm/m * \ 8\ m/s^2} = 0.02\ s$$

Time to travel at constant speed:

$$t_c = \frac{s - \frac{v_{max}(t_b + t_v)}{2}}{v_{max}} = \frac{100\ mm - \frac{160\ mm/s \cdot (0.02\ s + 0.02s)}{2}}{160\ mm/s} = 0.605s$$

Time for the entire movement including holding:

$$t_{tot} = \ t_b + \ t_c + \ t_v + t_h = 0.02s + 0.605s + 0.02s + 1s = 1.645s$$

Average speed during the cycle:

$$v_{avg} = \frac{\frac{v_{max}}{2} \cdot (t_b + t_v) + v_{max} \cdot t_c + t_h}{t_{tot}} = \frac{\frac{160\ mm/s}{2} \cdot (0.02s + 0.02s) + 160\ mm/s \cdot 0.605s}{1.625s} = 61.54mm/s$$

Loads during the individual sections:

$$F_b = m \cdot a_b + m \cdot g \cdot \sin(\alpha) = 15\ kg\ \cdot\ 8\ m/s^2 + 15\ kg\ \cdot 9.81 m/s^2 \cdot \sin(90°) = \ 267.15\ N$$

$$F_v = m \cdot -a_v + m \cdot g \cdot \sin(\alpha) = 15\ kg\ \cdot -8\ m/s^2 + 15\ kg\ \cdot 9.81\ m/s^2 \cdot \sin(90°) = \ 27.15\ N$$

$$F_c = m \cdot g \cdot \sin(\alpha) = 15\ kg\ \cdot 9.81\ m/s^2 \cdot \sin(90°) = \ 147.15\ N$$

$$F_h = m \cdot g \cdot \sin(\alpha) = 15\ kg\ \cdot 9.81\ m/s^2 \cdot \sin(90°) = \ 147.15\ N$$

Mean effective load F_{RMS} is calculated as follows:

$$F_{RMS} = \sqrt{\frac{1}{t_{tot}} \cdot (t_b \cdot\ {F_b}^2 + \ t_c \cdot\ {F_c}^2 + t_v \cdot\ {F_v}^2 + t_h \cdot\ {F_h}^2)}$$

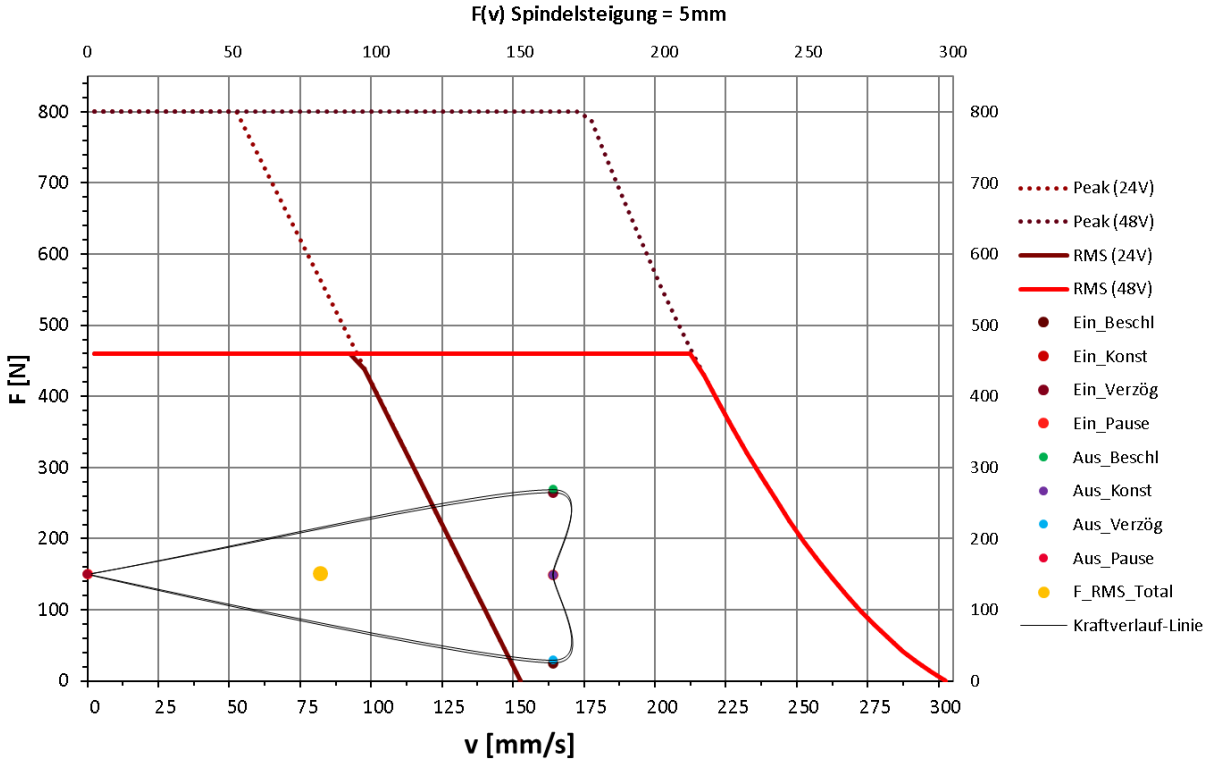
$$= \sqrt{\frac{1}{1.625s} \cdot (0.02s \cdot (270N)^2 + 0.585s \cdot (150N)^2 + 0.02s \cdot (27N)^2 + 1s \cdot (150N)^2)} = \mathbf{148.33\ N}$$

Following points must now be considered for the evaluation:

Operating point	Load in N	Velocity in mm/s	Evaluation
Acceleration	267.15	160	Operating point lies below the peak curve → Operating point ok
Constant velocity	147.15	160	Operating point lies below the peak curve → Operating point ok
Deceleration	27.15	160	Operating point lies below the peak curve → Operating point ok
Hold	147.15	0	Operating point lies below the peak curve → Operating point ok
F_{RMS}	148.33	61.54 (v_{avg})*	Operating point lies below the RMS curve → Operating point ok

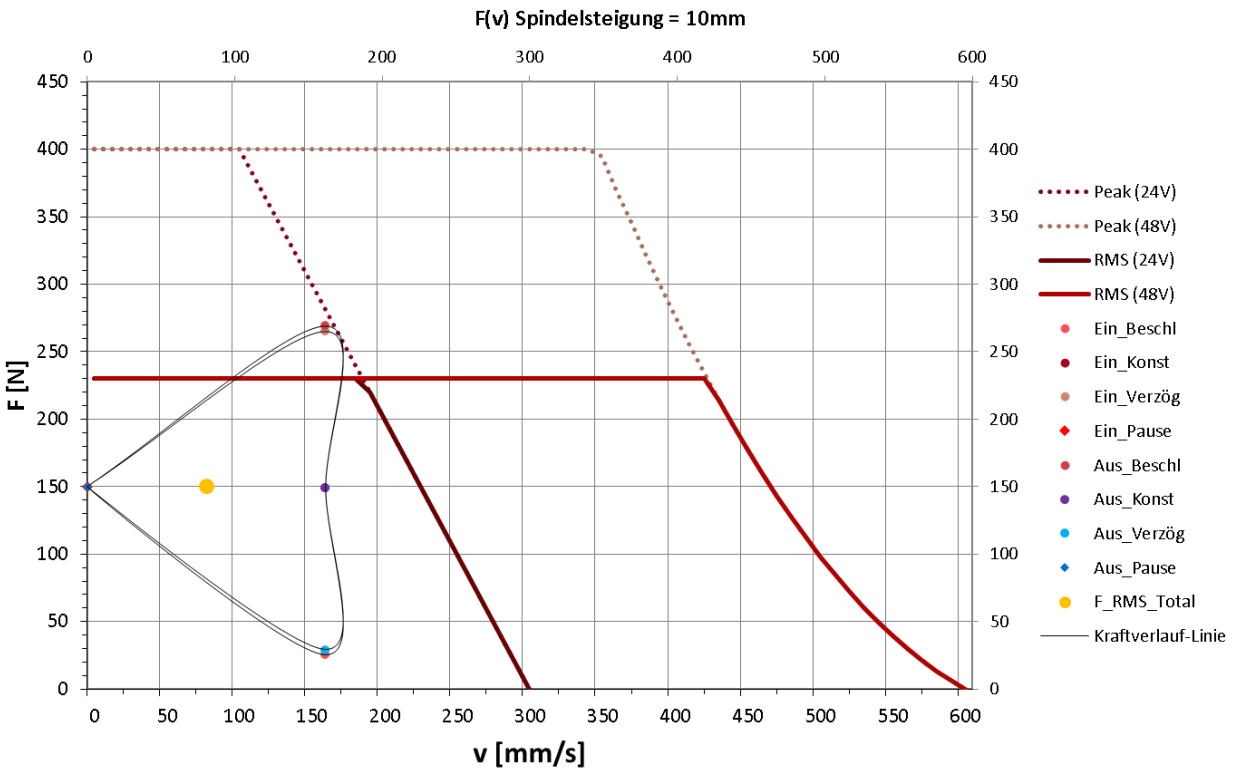
*Depending on the device, the permissible F_{RMS} load can depend on the speed, which is why the average speed is used as the basis here. This is a simplification that is sufficient for typical movement profiles.

The corresponding points are now entered into the F(v) diagrams of various products, in this example starting with the spindle pitch 5mm in the CTC-060.



As seen above, all points lie comfortably within the allowable limits. However, the speeds are above the maximum of the 24V characteristic, so the drive will only achieve the desired speed with a higher supply voltage (e.g. 48V).

The same points are entered below in the characteristic curve of the CTC-060 with a spindle pitch 10mm:



All operating points are now below the 24V peak characteristic and can therefore also be reached with this voltage. The peak load range is utilized during acceleration and deceleration. However, this is not critical because the F_RMS operating point is below the permissible RMS limit.

In this calculation example, the CTC-060 with a 10mm pitch would be suitable, also with 24V supply.

HINWEIS	
	If there is a constant high load, the control may have to be deactivated to allow a cooling phase (deactivate the control according to tables 7.2.1.2 or 7.2.2.2).

6.1.3 Risk of buckling (permissible compressive force)

Cylinder installation has an influence on the buckling load of the system. Assessment of the installation cases for the risk of buckling:

Case 1: Installation case 1 should always be avoided. Operation with an unguided piston rod involves a high risk of buckling and can therefore lead to damage to the drive spindle.

Case 2: Installation case 2 should be avoided for long cylinders and/or horizontal installation due to the influence of gravity.

Case 3: Installation case 3 is generally recommended. This prevents the system from buckling.

Case 4: Installation case 4 leads to a high degree of overdetermination of the system. This prevents the system from buckling but increases the risk of the system becoming distorted due to assembly tolerances.

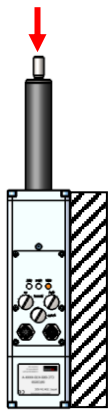
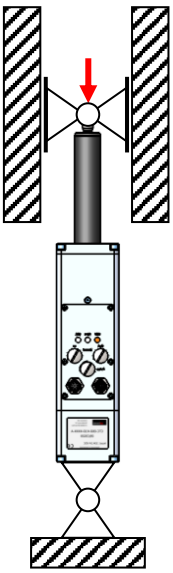
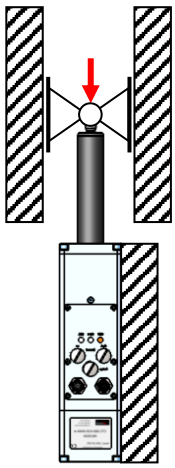
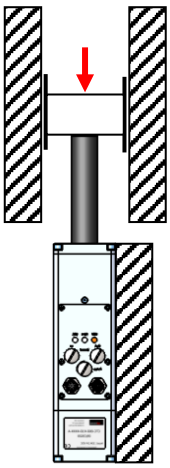
Case 1	Case 2	Case 3	Case 4
Cylinder fixed (rear and front), piston rod not guided	Cylinder hinged (rear or front), piston rod hinged and guided	Cylinder fixed, piston rod hinged and guided	Cylinder fixed, (rear or front), piston rod guided (not hinged)
			

FIGURE 6: POSSIBLE INSTALLATION CASES OF A CTC

6.1.4 Feed speed v as a function of stroke length

The longer the bearing distances (i.e. spindle length) is, the lower the critical speed becomes at which the spindle begins to oscillate. Therefore, the maximum spindle speed must be reduced accordingly for longer stroke lengths. This ultimately corresponds to a reduction in the feed speed. The maximum feed speed depends on the spindle pitch P. The product-specific characteristic curve can be found in the data sheet.

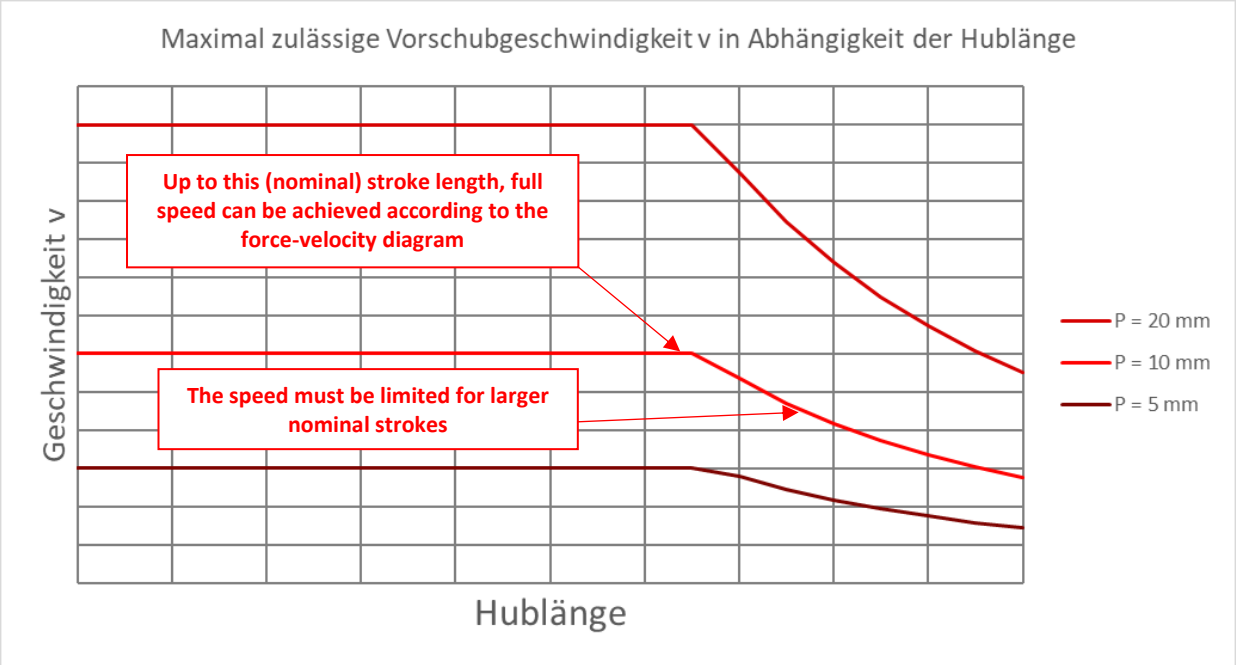


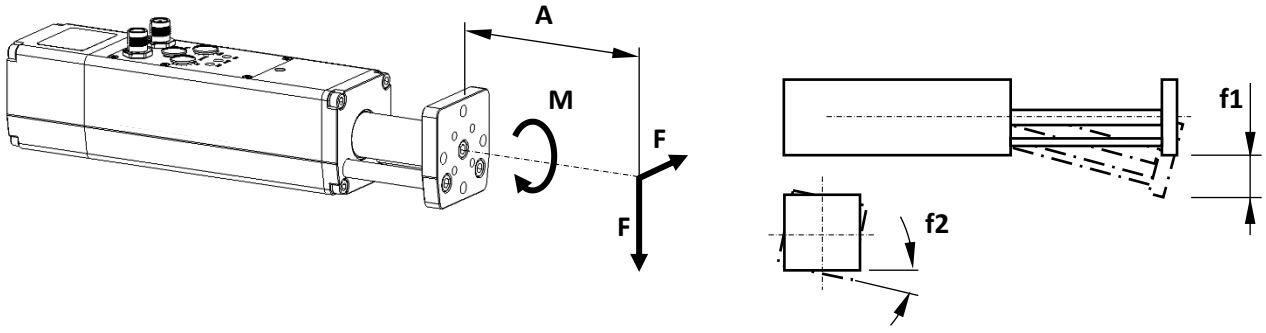
FIGURE 7: EXAMPLE DIAGRAM OF PERMISSIBLE FEED SPEED

6.1.5 Transversal load for CTC-K__-____-A / CTC-K__-____-I

Transverse load on the piston rod (version CTC-K__-____-**A** / CTC-K__-____-**I**) are not permitted and lead to a reduction in service life.

IMPORTANT	
	During installation, care must be taken to install the unit in its specified location without distortion or axial misalignment.

6.1.6 Permissible moment load M and transversal load F for CTC-K__-____-V and CTC-K__-____-F



The permissible load of the version with anti-rotation device or the guide cylinder (version CTC-K__-____-V / CTC-K__-____-F) can be found in the datasheet.

6.1.7 Generator / brake operation

IMPORTANT	
	Overvoltage can occur in the device and in the power supply unit during generator/brake operation. To avoid damage to other devices in the same voltage circuit due to overvoltage, the use of a braking resistor with integrated voltage monitoring (brake chopper) is recommended.

A brake chopper is connected to the DC link. When a set limit voltage is reached, it transfers the excess power to a braking resistor and thus effectively limits the voltage in the DC link. Suitable braking resistors (braking choppers) are available on request.

7 Operating modes

The cylinder can be controlled in two different operating modes. Mode 1 for monostable control and mode 2 for bistable control. **Mode 1** is the factory default state**. To** switch the operating modes, see chapter 7.4.

7.1 Operation with IO-Link

Connection and control via the IO-Link interface are described in detail in the IO-Link interface description:

Beschreibung	Dateiname	Quelle:
IO-Link Interface Description	Vx.xx.xx-yyyymmdd-IO-Link_Interface_Description_EN	www.cyltronic.ch /produkte/downloads/

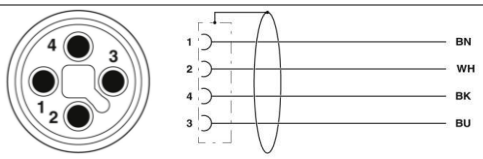
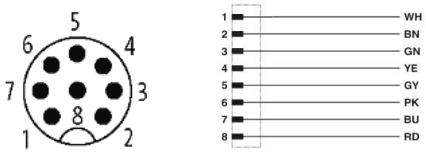
Operation with an activated IO-Link interface can also be combined with the following modes.

7.2 Mode 1: Monostable (& Omnistable)

7.2.1 Omnistable

In omni-stable mode, a stroke can be interrupted at any position. If neither a signal for retraction nor extension is detected, the cylinder stops and remains in control in the position reached. For a force-free state, the control can be interrupted (with DI Force-free).

7.2.1.1 Signal assignment Mode: Omnistable

Power	Signal
Plug M12x1, 4-pole T-coded according to EN 61076-2-11	**Plug M12x1, 8-pin** A-coded according to EN 61076-2-101 (Shielded cables are recommended)
	

Pin assignment Digital I/O

Pin	Color	Function
1	BN	Power voltage 24V-48V ± 15% (max. 10A) At 48V the use of a brake chopper is recommended.
2	WH	Functional earth (FE)
3	BU	GND 0V
4	BK	reserved, do not connect

Pin	Color	Function
1	WH	DO Ready / IO-Link CQ
2	BN	Logic voltage 24V ± 15% (max. 500mA)
3	GN	DO is extended
4	YE	DO is retracted
5	GY	DI Retract*
6	PK	DI Extend*
7	BU	GND 0V
8	RD	DI Teach / Reset / Powerless

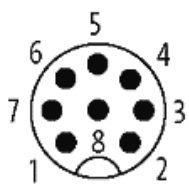
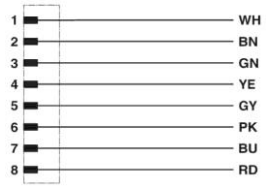
7.2.1.2 Truth Table Mode: Omnistable

Command	DI Extend	DI Retract	DI Teach	Comment
Cylinder brakes and stops in regulation	0	0	0	
Retract	0	1	0	
Extend	1	0	0	
Teach run: Start with retracted	0	1	1	The cylinder moves slowly to both end stops, starting with retraction, and teaches the new stroke.
Teach run: Start with extension	1	0	1	The cylinder moves slowly to both end stops, starting with the extension, and teaches the new stroke.
Undefined	1	1	0	A movement can be executed, this condition must be avoided!
Undefined	1	1	1	A movement can be executed, this condition must be avoided!
Reset / powerless	0	0	1	- Control is deactivated, actuator goes into a powerless state, but remains ready for operation - Acknowledge errors

7.2.2 Monostable, normally retracted

Corresponds to a control and behaviour as in the operation of a pneumatic cylinder with a monostable pneumatic valve. In which the cylinder is hosed so that it retracts when the valve is in the rest position.

7.2.2.1 Signal assignment Mode: monostable, normally retracted

Signal connector assignment	Pin	Color	Function
Plug M12x1, 8-pin A-coded according to EN 61076-2-101 (shielded cables are recommended)	**1**	WH	DO Ready / IO-Link CQ
	2	BN	Logic voltage 24V ± 15% (max. 500mA)
	3	GN	DO is extended
 	**4**	YE	DO is retracted
	5	GY	**Logic voltage 24V (max. 500mA)**
	6	PK	**DI Extend**
	7	BU	GND 0V
	8	RD	DI Teach / Reset

7.2.2.2 Truth table mode: monostable, normally retracted

Command	DI Extend	DI Teach	Comment
Extend	1	0	
Retract	0	0	
Teach run: **Start with Retract**	0	1	The cylinder moves slowly to both end stops, starting with retraction, and teaches the new stroke.
undefined	1	1	Undefined state, this state must be avoided!

7.2.3 Monostable, normally extended

Corresponds to control and behaviour as in the operation of a pneumatic cylinder with a monostable pneumatic valve. In which the cylinder is hosed so that it extends when the valve is in the rest position.

7.2.3.1 Signal assignment Mode: monostable, normally extended

Signal connector assignment	Pin	Color	Function
Plug M12x1, 8-pin A-coded according to EN 61076-2-101 (Shielded cables are recommended)	**1**	WH	DO Ready / IO-Link CQ
	2	BN	Logic voltage 24V ± 15% (max. 500mA)
	3	GN	DO is extended
	**4**	YE	DO is retracted
	5	GY	**DI Retract**
	6	PK	**Logic voltage 24V (max. 500mA)**
	7	BU	GND 0V
	8	RD	DI Teach / Reset

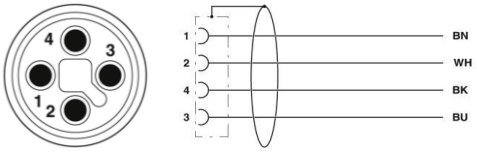
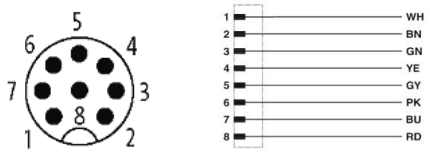
7.2.3.2 Truth table mode: monostable, normally extended

Command	DI Retract	DI Teach	Comment
Extend	0	0	
Retract	1	0	
Teach run: **Start with extension**	0	1	The cylinder moves slowly to both end stops, starting with the extension, and teaches the new stroke.
undefined	1	1	Undefined state, this state must be avoided!

7.3 Mode 2: Bistable

Corresponds to control and behaviour as in the operation of a pneumatic cylinder with a bistable pneumatic valve. If a run command is initiated, the cylinder runs the entire (taught-in) stroke, even if the signal drops. The cylinder remains in control in the corresponding end position until the counter signal is received. For a force-free state, the control can be interrupted (with DI Force-free).

7.3.1.1 Signal assignment Mode: Bistable

Power	Signal
Plug M12x1, 4-pole T-coded according to EN 61076-2-11	**Plug M12x1, 8-pin** A-coded according to EN 61076-2-101 (Shielded cables are recommended)
	

Pin assignment Digital I/O

Pin	Color	Function	Pin	Color	Function
1	BN	Power voltage 24V-48V ± 15% (max. 10A) At 48V the use of a brake chopper is recommended.	**1**	WH	DO Ready / IO-Link CQ
2	WH	Functional earth (FE)	**2**	BN	Logic voltage 24V ± 15% (max. 500mA)
3	BU	GND 0V	**3**	GN	DO is extended
4	BK	reserved, do not connect	**4**	YE	DO is retracted
			5	GY	DI Retract
			6	PK	DI Extend
			7	BU	GND 0V
			8	RD	DI Teach / Reset / Powerless

7.3.1.2 Truth Table Mode: Bistable

Command	DI Extend	DI Retract	DI Teach	Comment
Extend	1	0	0	
Set	0	0	0	Exit command remains active
Retract	0	1	0	
Set	0	0	0	Retract command remains active
Stops	1	1	0	
Set	0	0	0	Stand command remains active
Reset / powerless	0	0	1	- Control is deactivated, actuator goes into a powerless state, but remains ready for operation - Acknowledge errors
Teach run: **Start with extension**	1	0	1	Cylinder moves slowly to both end stops starting with extension and teaches the new stroke.
Teach run: **Start with retract**	0	1	1	Cylinder moves slowly to both end stops starting with Retract and teaches the new stroke.
Stops	1	1	1	Not allowed (programming mode can be reached accidentally)

7.4 Switching the operating modes

Perform the following steps to switch to another operating mode.

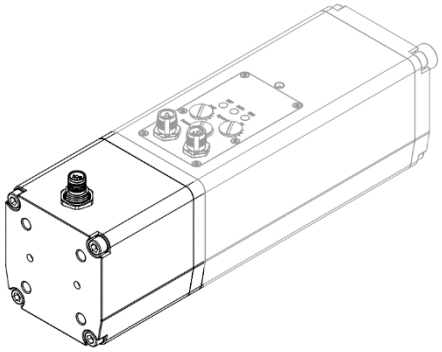
1. Disconnect the power and logic voltage supply
2. Connect the logic power supply and immediately activate the signals "DI Retract", "DI Extend" as well as "DI Teach".
3. The signals under point 2. must remain active for 3 seconds. As soon as the device is in programming mode, the LED display "REF" flashes with 2 Hz, deactivate the 3 signals.
4. To switch to another mode, switch the "DI Teach" signal on and off once:
    a. Blinking pattern for **mode 1 (mono-/omni-stable)**: LED "RUN" blinks **once**, then 1 s pause, ...
    b. Flashing pattern for **mode 2 (bistable)**: LED "RUN" flashes **twice**, then 1 s pause, ...
5. To confirm and exit the programming mode, disconnect the logic power supply

NOTE	
	Switching the operating modes is only possible when no power voltage is applied.

7.5 Operation with holding brake

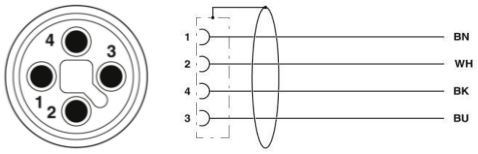
The CTC is optionally available with an integrated holding brake. The brake prevents the spindle from rotating, in order to block the piston rod. This enables loads to be held without an enabled controller (no current).

By applying the brake operating voltage, the brake is released, and rotation of the spindle is enabled. If the brake is not energized, braking is enabled and prevents movement.

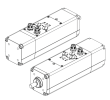


7.5.1 Electrical connection of the holding brake

The connection assignment of the holding brake can be found in the data sheet.

Power	Pin	Color	Function
Plug M12x1, 4-pole T-coded according to EN 61076-2-11 	1	BN	Power voltage 24V ± 10%
	2	WH	Reserved, do not connect
	3	BU	GND 0V
	4	BK	Reserved, do not connect

GEFAHR	
	The holding brake may only be used to maintain process sequences and to prevent damage to material. When used, it must be ensured that no injury to persons occur if the brake fails.

WICHTIG	
	The holding brake may only be used to hold loads and not to decelerate them. The holding brake may only be activated when the spindle is in standstill. Travel commands that lead to a rotational movement of the spindle may only take place when the rotational movement of the spindle is enabled by the brake. After the holding brake is engaged, the position controller must be deactivated.

8 Installation, assembly

The CTC cylinders have mounting holes at the rear, front and bottom of the cylinder. The hole spacing is chosen so that standard attachments for ISO pneumatic cylinders can be attached. Corresponding attachment parts can be ordered directly along with the cylinder. Suitable attachments can be found in the accessories catalog as described in section 1.5. The dimensions are described in the respective datasheets.

WARNING	
	The internal ball screw is not self-locking! It must always be ensured that the piston rod is secured against unintentional movement, especially when the cylinder is in vertical position!

WARNUNG	
	Under no circumstances may the internal end positions of the electric cylinder be driven into during operation. The cylinder may only be driven into the internal end positions slowly (max. 15% of the maximum speed) in setup mode and only to determine the end positions or for relubrication. During normal operation, the cylinder automatically ensures that the end positions are not driven into, if the device has been correctly teached and referenced. The energy from external loads can the electric cylinder into the end positions if the power supply or drive fails. Since this can lead to damage to the cylinder, such situations must be prevented using a holding brake or external dampers. The service life of the electric cylinder depends heavily on the extent to which its performance has been exhausted and whether impermissible operating conditions have arisen - even if only for a short time.

IMPORTANT	
	The cylinder must be mounted free of stress and distortion. The cylinder must always be installed as a pendulum support. Lateral forces on the cylinder and the piston rod considerably reduce the service life of the cylinder and must be avoided.

IMPORTANT	
	The piston rod must not be loaded with a torque. When mounting accessories on the piston rod, always use the appropriate lock nut for tightening / applying counteracting force.

8.1 Tightening torques of screws

The tightening torques for the fastening screws can be found in the datasheet.

WARNING	
	Failure to comply with the specifications may result in a failure of the bolted joint, which, depending on the situation, may result in serious injuries

8.2 Connecting signal and power supply

Connect the cables according to the operating mode (see chapter 7). Depending on the mode (see chapter 7.2.1), inputs 5 or 6 are wired to the 24V power supply.

DANGER	
	The connection of the electrical lines may only be carried out by qualified personnel.

IMPORTANT	
	To avoid interference with other components in the 24V mains / 48V mains, the power voltage supply of the cylinder must be connected to a separate power supply unit or to a mains filter. Several cylinders can be operated on the same power supply unit.

IMPORTANT	
	The signal power supply must not exceed 24V DC. A range of 24-48V DC is permissible for the power voltage supply, but in this case the signal voltage supply must be provided by a separate 24V power supply unit.

8.3 Commissioning

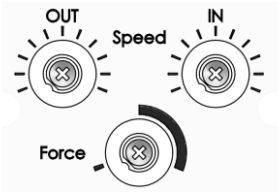
IMPORTANT	
	To prevent damage to the microprocessor, the "DI Retract", "DI Extend" and "DI Teach" signals must not be switched until the logic power supply is connected.

1. The Force and speed are to be set to the smallest position via the rotary knobs (Attention: Do not turn the rotary knobs out beyond the stop!)
2. Connect the power and control connection
3. Optional: Place the cylinder in such a way that the trust tube can move without obstruction and load during extension and retraction.
4. Perform a function check according to chapter 8.4.

8.4 Function control

First carry out all points according to chapters 0 and 8.3 through.

1. By signal input on "DI Extend" or "DI Retract", the cylinder starts to move at a reduced reference speed (reference run according to chapter 8.5)
2. The cylinder automatically moves to the corresponding end position and then stops.
3. Press the opposite signal ("DI retract" or "DI extend") to move the cylinder to the other end position. The cylinder now moves at the working speed.
4. Optional: Install the cylinder in its final mounting position.
5. If the cylinder does not perform the full stroke when installed, but is operated with external end stops, perform a teach run according to chapter 8.6 to teach in the new stroke.

	If the potentiometer is set to the black area, care must be taken that the maximum force is not applied at 100% for a duty cycle. On the other hand, the cylinder will heat up and the internal temperature monitoring will put the cylinder into an error state ("DO Ready" = 0).

8.5 Reference run

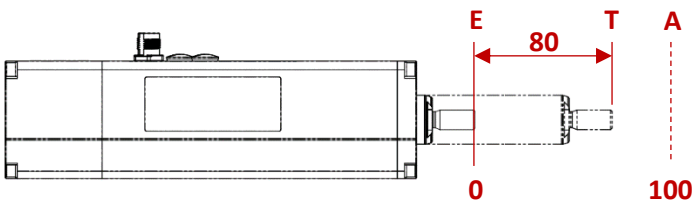
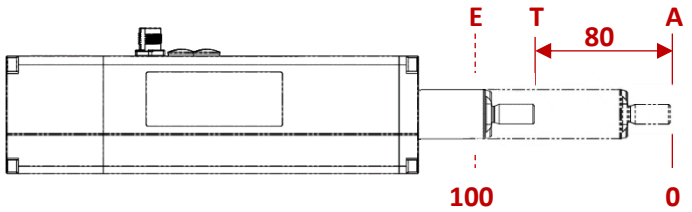
The reference run is used to move the cylinder slowly to an end position and to reference it there (set 0-position).

A reference run is always necessary when the logic voltage has been disconnected from the cylinder. A disconnection of the power voltage, on the other hand, does not require a new reference run.

A reference run is performed automatically as soon as a logic voltage is applied and a signal for retraction or extension is present. If the cylinder is already in the corresponding end position, no movement is performed, and the cylinder is referenced directly.

The reference run differs from the teach-in run in that a new stroke is taught in during the teach-in run. During the reference run, on the other hand, only the start position of the stroke is determined.

This request is represented by the simultaneous illumination of the "REF" and "RUN" LEDs.

Process	**Image representation of the run range after reference run (nominal stroke: 100mm)**
Referencing with a taught-in stroke of 80mm with reference run to the inner stop (E)	
Referencing with a taught-in stroke of 80mm with reference run to the outer stop (A)	

8.6 Teach run

The teach-in run is used to teach-in a new stroke length (or external stops that are shorter than the nominal stroke). As a rule, the teach-in run only has to be performed once during initial start-up or when replacing the cylinder. The cylinder moves at slow speed in the specified direction until an end stop is detected by setting a force threshold. The direction of movement is then changed until the second end stop has been detected by means of a force threshold.

The teach-in run is always initiated in combination by the two signals "DI Teach" and the "DI Retract" or the "DI Extend".

"DI Teach" and "DI Extend" → Teach run starting with Extend*.

"DI Teach" and "DI Retracted" → Teach run starting with Retracted*.

*Possible teach run initiations may differ depending on the operating modes, see truth tables in chapter 7 Operating modes.

Procedure Teach run:

1. Mount the cylinder in the intended installation location
2. Commissioning according to chapter 8.3 perform
3. Execute signal combination for teach-in operation:
    a. "DI Teach" and "DI Extend" → Teach run starting with Extend
    b. "DI Teach" and "DI Retracted" → Teach run starting with Retracted.
4. Cylinder extends/retracts slowly to the internal or external end stop
5. Cylinder changes direction of movement and moves to the opposite end stop
6. Cylinder automatically saves the new stroke length.
    a. Green LED (RUN) lights up.
    b. Signal "DO cylinder is extended" or "DO cylinder is retracted" becomes active
7. Teach run completed

The teach run can be canceled if necessary by pressing the “DI Teach” signal again

If the teach run fails, the red LED (ERR) lights up. Typically this is because the power supply is too small or set too low for the desired power value.

NOTE	
	After successful teach-in run, the cylinder brakes before the end stops and remains in position at the end stops. The applied force of the cylinder only corresponds to the force required to hold the end position.

WARNING	
	Using external stops without performing a teach-in run can lead to high wear and damage to the spindle. In addition, too much power is called up because the cylinder always tries to reach the programmed end positions with the maximum set force (force threshold).

9 Maintenance and care

9.1 Maintenance plan

When	What	Action
After commissioning	Spindle	The cylinder is supplied lubricated from the factory. However, if the cylinder lies longer than 1 year in stock by the customer, it must be relubricated, see **9.2 Relubrication**
According to mileage ran	Spindle	Relubricating of the spindle, see **9.2 Relubrication**
Annual	Electric cylinder	Check for visible damage (external) Contact Cyltronic AG in the event of visible, externally caused damage.
Annual	Mounting fastener	Check screw tightening torques, see **tightening torques of screws 8.1**

9.2 Relubrication

The electric cylinder is lubricated from the factory. Relubrication of the spindle must be carried out according to the mileage. The relubrication interval varies depending on the application and is dependent on the operating conditions (series, spindle pitch, speed, acceleration, loads, etc.). Environmental influences such as high loads, shocks and vibrations can shorten the lubrication intervals.

The lubrication intervals and grease quantities can be found in the table in the datasheet.

9.3 Short stroke applications

In short-stroke applications, a lubrication run must be carried out after a defined number of motion cycles. The execution of the lubrication run and the interval can be found in the datasheet.

9.3.1 Relubrication of the spindle

Bring the piston rod into the lubrication position for the spindle by extending it. This is achieved when the distance from the front cover to the thread attachment is at least 108mm (see Figure 8). Relubrication may only be carried out in this position. Lubrication quantity and number of motion cycles are according to the datasheet.

Lubricant: A food-grade grease is recommended (e.g., Fuchs Cassida Grease EPS 2).

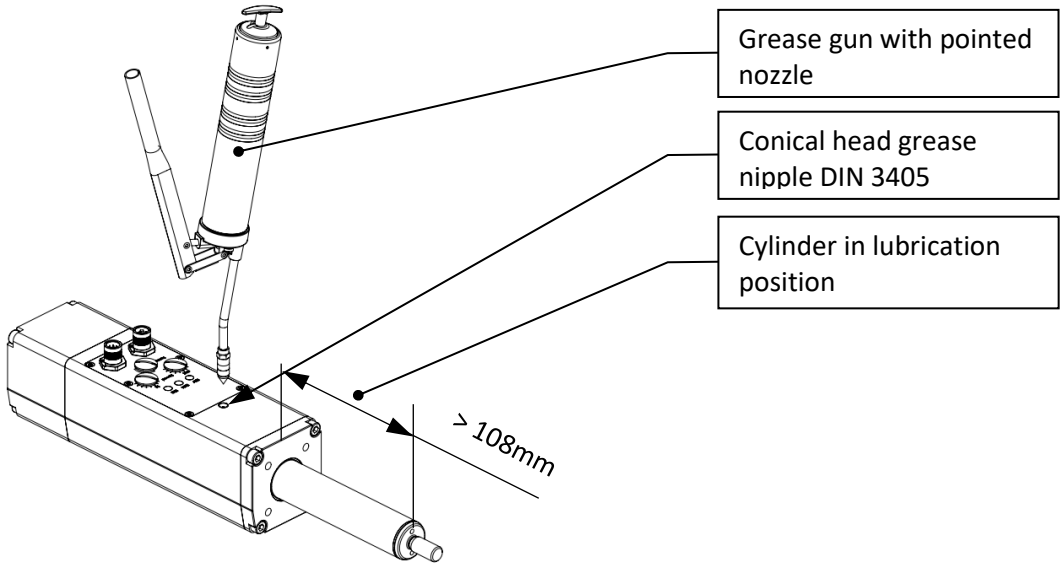


FIGURE 8: LUBRICATION POSITION

Example lubrication procedure CTC-060-K10-0100 with medium mileage

→ Relubrication interval: 3 months

1. bring piston rod into lubrication position
2. insert 0.6 cm^3 of lubricant
3. 6x slow lubrication run over entire travel distance
4. bring piston rod into lubrication position
5. insert 0.6 cm^3 of lubricant
6. 6x slow lubrication runs over entire travel distance

IMPORTANT	
	For optimum relubrication, it is recommended that the cylinder be placed in a horizontal position (see Figure 8) so that the grease nipple points upwards. Lubrication in a vertical position is possible.

9.4 Cleaning

IMPORTANT	
	Before cleaning, make sure that the screw plugs are correctly tightened. Cleaning of the product may only be carried out when it is at a standstill. Direct directing of strong jets of water at the grease nipple must be avoided and may cause damage. The product must be in dry condition before restarting after cleaning.

10 Removal and repair

In the event of damage or defect, the entire unit must be returned to Cyltronic AG. The repair may only be carried out by Cyltronic AG trained personnel.

11 Disposal

Dispose of the device properly according to the prevailing legal regulations or return it to Cyltronic AG.

12 Troubleshooting

IMPORTANT	
	Do not attempt to open the cylinder or remove individual parts. Improper disassembly may result in damage. Any warranty claims will be forfeited.

Malfunction	Possible cause	Remedy / further measures
Reversing backlash too large	Torque arm defective / worn	Contact Cyltronic or your Cyltronic dealer.
Strong retracting noise	Torque support or spindle defective / worn out	Contact Cyltronic or your Cyltronic dealer.
Piston rod cannot be moved by hand	Spindle nut wedged too tightly with stop	1. Electrically extend / retract 2. Increase force potentiometer 3. Contact Cyltronic or your Cyltronic dealer.
Piston rod cannot be moved electrically	- Spindle nut wedged too tightly with stop - Force set too low	1. Increase force potentiometer 2. Contact Cyltronic or your Cyltronic dealer.
Piston rod can be rotated	- Torque arm defective / worn - Connection between piston rod and recirculating ball nut has loosened.	Contact Cyltronic or your Cyltronic dealer.

12.1 Error codes

Faults are indicated by the flashing pattern of the red LED on the device. If a fault occurs, the respective flashing pattern is repeated continuously with a pause of 1s. Faults can be acknowledged with the Teach command.

Blink / light pattern	Error Code	Possible cause	Remedy
LED red lights constantly (after teach or reference run)	Voltage dip during teach or reference run, teach or reference run could not be completed	The power supply delivers less current than the actuator requires. Force setting too high.	-Reduction of the force by means of potentiometer -test by a new run command whether sufficient reduction has been made, if not-> repeat -If the force should then no longer be sufficient, a voltage supply with a higher output current must be used.
LED flashes red: **1x, Pause, 1x, ...**	Power voltage too high	- Overvoltage generated by braking loads	- Checking the power supply - Speed reduction - Installation of a braking resistor
LED flashes red: **2x, pause, 2x, ...**	Temperature too high	Overload of the device	Allow the device to cool down. If the error occurs again, reduce the switch-on time.
LED flashes red: **3x, pause, 3x, ...**	Error controller	Current internally too high or tracking error	Tracking Error Monitoring is active, and device is in tracking error. Alternatively, this error indicates a defect in an internal electronic component. If the error occurs repeatedly or cannot be acknowledged, contact Cyltronic.
LED flashes red: **4x, pause, 4x, ...**	Internal error	Internal error	Indicates a defect in an internal electronic component. If the error occurs repeatedly or cannot be acknowledged, contact Cyltronic.
LED flashes red: **5x, pause, 5x, ...**	Signal voltage too high	- Overvoltage generated by braking loads - Overvoltage caused by another device in the 24V intermediate circuit	- Checking the signal power supply - If necessary, install a separate power supply unit for the signal voltage supply.
LED flashes red: **6x, pause, 6x, ...**	Signal voltage too low		- Checking the signal power supply

13 Appendix

13.1 Declaration of incorporation

Declaration of incorporation CTC-060

in the sense of the Machinery Directive 2006/42/EC, Annex II, 1.B for partly completed machinery

The manufacturer:

Cyltronic AG
Technoparkstrasse 2
CH-8406 Winterthur

Confirms that the said product

Product name:	Cyltronic electric cylinder
Type designation:	CTC-060
Trade name:	CTC-060
Year of manufacture:	from 05/2021
Function:	Electromechanical extension and retraction of the thrust tube to generate a linear motion

meets the requirements of an **incomplete machine** according to the EC Machinery Directive 2006/42/EC.

The following essential requirements of the Machinery Directive 2006/42/EC according to Annex I are applied and fulfilled:

Appendix I, Paragraph: 1, 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.5.1, 1.5.2, 1.5.4, 1.5.8, 1.6.1, 1.7.1, 1.7.1.1

Standard	Title	Edition
DIN EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction	12100:2010

It also declares that the specific technical documentation has been prepared in accordance with Annex VII, Part B.

It is expressly declared that the **incomplete machinery** complies with all relevant provisions of the following EC Directives:

2011/65/EU Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Cyltronic AG undertakes to transmit the technical documentation on the partly completed machinery in electronic form to the national authorities upon justified request.

Person established in the Community authorized to compile the relevant technical documentation:

Jeremias Wehrli
Cyltronic AG
Technoparkstrasse 2
CH-8406 Winterthur

Commissioning is prohibited until the machine into which this incomplete machine is installed is installed complies with the provisions of EC Directive 2006/42/EC.

Before being placed on the market, this must comply with the CE directives, including documentation.

Winterthur / 20.05.2022
(Ort/Datum)

J. Wehrli
(Unterschrift)

Jeremias Wehrli
Geschäftsführer
(Angaben zum Unterzeichner)

Cyltronic AG
Technoparkstrasse 2
8406 Winterthur

Telefon: +41 77 404 36 64
E-Mail: info@cyltronic.ch
Web: www.cyltronic.ch

Declaration of incorporation CTC-080

in the sense of the Machinery Directive 2006/42/EC, Annex II, 1.B for partly completed machinery

The manufacturer:

Cyltronic AG
Technoparkstrasse 2
CH-8406 Winterthur

Confirms that the said product

Product name:	Cyltronic electric cylinder
Type designation:	CTC-080
Trade name:	CTC-080
Year of manufacture:	from 01/2024
Function:	Electromechanical extension and retraction of the thrust tube to generate a linear motion

meets the requirements of an **incomplete machine** according to the EC Machinery Directive 2006/42/EC.

The following essential requirements of the Machinery Directive 2006/42/EC according to Annex I are applied and fulfilled:

Appendix I, Paragraph: 1, 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.5.1, 1.5.2, 1.5.4, 1.5.8, 1.6.1, 1.7.1, 1.7.1.1

Standard	Title	Edition
DIN EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction	12100:2010

It also declares that the specific technical documentation has been prepared in accordance with Annex VII, Part B.

It is expressly declared that the **incomplete machinery** complies with all relevant provisions of the following EC Directives:

2011/65/EU Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Cyltronic AG undertakes to transmit the technical documentation on the partly completed machinery in electronic form to the national authorities upon justified request.

Person established in the Community authorized to compile the relevant technical documentation:

Jeremias Wehrli
Cyltronic AG
Technoparkstrasse 2
CH-8406 Winterthur

Commissioning is prohibited until the machine into which this incomplete machine is installed is installed complies with the provisions of EC Directive 2006/42/EC.

Before being placed on the market, this must comply with the CE directives, including documentation.

Winterthur / 14.08.2024
(Ort/Datum)

J. Wehrli
(Unterschrift)

Jeremias Wehrli
CEO
(Angaben zum Unterzeichner)

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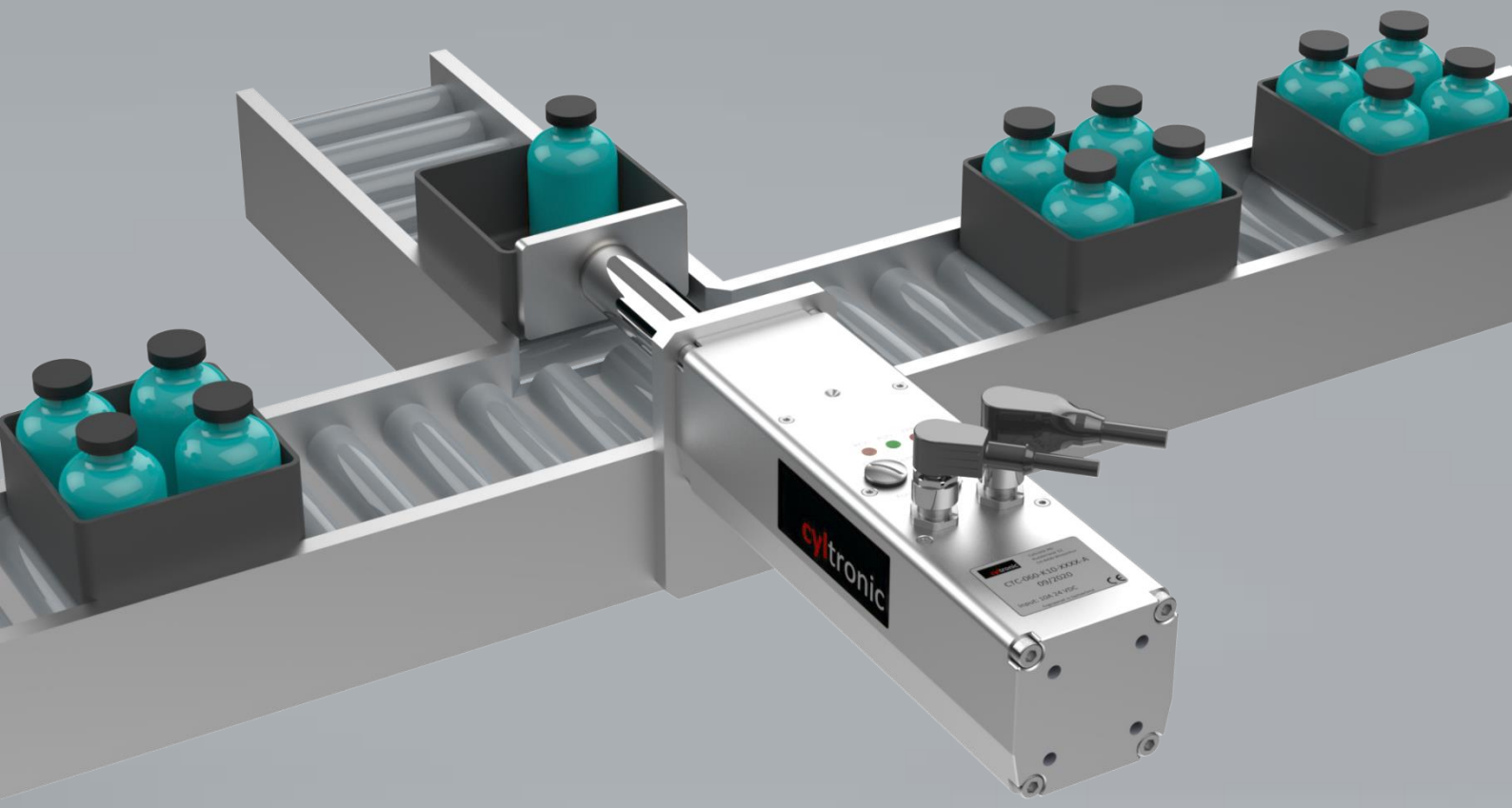
Web: www.cyltronic.ch

13.2 List of Figures



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