CTR-Quickguide

1 General information

This document aims to provide the user with an overview of the changes for the new product type CTR-060 regarding IO-Link control compared to the previous products. The IO-Link interface description version 20230901 serves as the foundation

1.1 Document version

20240131 CTR-Quickguide

1.2 Valid for firmware version

2.05.xx-wip2

(IODD 20231102-V2.05.00.2)

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3 Important notes

The Firmware Version **2.05.xx-wip2** is specifically adapted for the rotational drive and is still under development. Unexpected behavior cannot be ruled out.

Currently, the CTR is designed for finite, rotational movements, i.e. movements between two end positions. The greater the separation between these two positions, the more limited the movement becomes in terms of positioning resolution and travel speed. Additionally, it is important to note that a position command can only have 7 significant digits.

Examples:

- When the actual position is approximately 700 revolutions, movements can only occur at speeds greater than 0.1 r/s. At around 7000 revolutions, the minimum speed increases to > 1 r/s, and so on.
- A position command of 1000.001 revolutions is possible, but 10’000.001 revolutions is no longer possible (due to having 8 significant digits)

For positioning tasks involving more than 1000 revolutions, it is advisable to consult with Cyltronic AG for further clarification and guidance.

4 Multiturn

The CTR-060-038-xxxx-x-MUL incorporates an absolute multiturn encoder with 16-bit singleturn and 22-bit multiturn resolution. Even if the axis is moved within the multiturn resolution range while in a power-off state, the absolute position is not lost. **There is therefore no need for referencing after system restart.**

However, if the axis is moved by ±21 bits or ±2’097’152 revolutions (whether in a power-off or powered-on state), the absolute actual position will no longer be accurate upon the next startup.

5 Units

The units for all movement commands are the following:

- Position: Revolutions (r)
- Velocity: Revolutions per second (r/s)
- Accel./decel.: Thousand revolutions per square second (kr/s^2)
- Torque: Newton meters (Nm)

In the CTR-IODD, the units may deviate from the definition provided above. The process variables for the actual and target torque are still referred to as “Actual Force” and “Target Force”, even though they represent “Actual Torque” and "Target Torque".

6 Referencing & teaching

- **Motion Mode 7 (HomeDirect)** can still be used to directly set a specific position. However, it is advised not to reference to “0” when the actual position is high. Doing so may mask the issue described in Chapter 3:
  - Example: The current absolute actual position is 700 revolutions. If the user references to position 0 using Motion Mode 7, subsequent movements will be limited to speeds > 0.1 r/s.
- When both logic and power supply voltages are connected, the yellow LED turns off, and the green LED turns on. The axis is in Ready state, and the Ready status bit is True
- **Motion Mode 2 (Teach)** can be used to teach a stroke as usual. It is important to ensure mechanical end stops are in place, otherwise referencing cannot be completed. After a successful teach, the “End Position In” is set to 0, and “End Position Out” corresponds to the teached stroke. These positions can be accessed using Motion Modes 3 and 4. The behavior is consistent with previous products (CTC, CTL)

- In the default state, “End Position Out” is set to 100 revolutions, and “End Position In” is set to -100 revolutions. Consequently, using **Motion Mode 3 will move to 100 revolutions, and Motion Mode 4 will move to -100 revolutions**
- If, in the default state, a position greater than 100 revolutions or less than -100 revolutions needs to be targeted using Motion Modes 5/6, the end positions must be adjusted accordingly (Note that with Modes 5/6, movement is limited within the end position range; refer to the IO-Link interface description for details)

7 Controller Bandwidth

The controller bandwidth can be changed via the parameter “Controller Bandwidth”:

[-] Controller Settings			
Controller Bandwidth	rw	standard	d
Position Control Pre-Filter (rad/s)	rw	0	d
Position Control Proportional Gain (1/s)	rw	33.589	d
Velocity Control Derivative Filter (Hz)	rw	200	d
Velocity Control Proportional Gain (As/rad)	rw	0.08	d
Velocity Control Integral Gain (A/rad)	rw	3.42	d

There are four options to choose from:

- **Controller Bandwidth = 0 (standard):** This is a standard controller, a compromise between acoustic/signal noise and controller bandwidth
- **Controller Bandwidth = 1 (low load / high bandwidth):** A controller with high bandwidth, designed for low load conditions
- **Controller Bandwidth = 2 (high load / high bandwidth):** A controller with high bandwidth, designed for high load conditions. **Caution: This controller may become unstable under low load conditions**
- **Controller Bandwidth = 3 (manual):** A controller that can be adjusted by the user using the five controller parameters listed above. This mode is intended for professionals with knowledge of control engineering

The actual internal switching of the controller occurs only when the axis is in State = 1 (Ready), meaning the controller must be turned off.

Notes on the five controller parameters:

- These five parameters represent those used for Controller Bandwidth = 3 (manual)
- When switching the controller, except when changing to manual mode, the five controller parameters are updated to pre-defined values corresponding to the selected controller type. So, for example, switching from 3 (manual) to 0 (standard) will lead to any user-customized parameters being lost.

8 Variable list

The following variables complement the variable list in the IO-Link Interface Description:

Name	Index	Datatype	Value Range	Unit	Single Values
Singleturn Offset	248	Float32T		°	(Read only)
Multiturn Offset	249	IntegerT_32		U	(Read only)
Controller Bandwidth	250	UIntegerT_8	0 to 3		standard (0), low load / high bandwidth (1), high load / high bandwidth (2), manual (3)
Position Control Pre-Filter (rad/s)	251	Float32T	0 to 7800	rad/s	
Position Control Proportional Gain (1/s)	252	Float32T	0 to 300	1/s	
Velocity Control Derivative Filter (Hz)	253	Float32T	0 to 1250	Hz	
Velocity Control Proportional Gain (As/rad)	254	Float32T	0 to 1	As/rad	
Velocity Control Integral Gain (A/rad)	256	Float32T	0 to 40	A/rad	