



Rotational Direction

Triamec Convention

This document describes the convention regarding rotational directions used for the *Triamec* Drives. This convention is in accordance with the standards of IEC 60034-8 and DIN EN60034-8. With motors and encoders connected according to this convention, a predictable direction of rotation is ensured.

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1 Direction of Rotation According IEC 60034-8

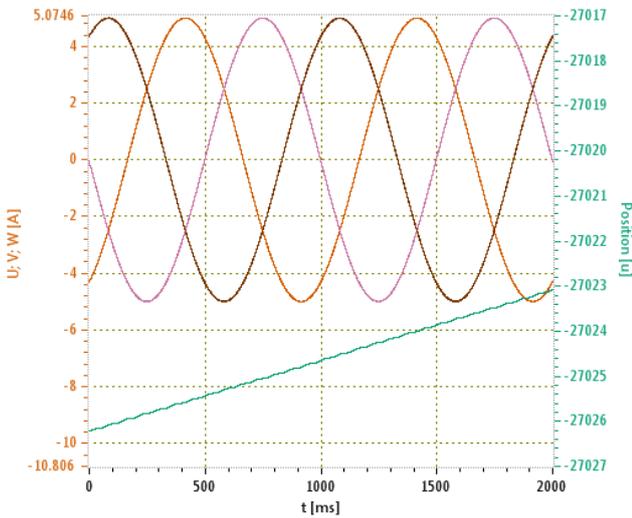
According to IEC 60034-8, a motor is rotating in positive direction if it rotates in clockwise direction while looking at the shaft-side of the motor.



Figure 1: Positive rotational direction

If a three-phase alternating current is applied to a synchronous motor which fulfills IEC 60034-8, the motor rotates in positive direction if

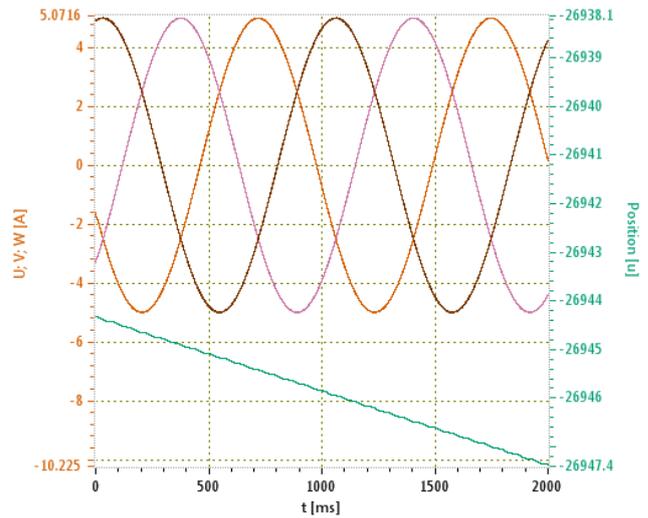
- phase U leads phase V by 120° and phase V leads phase W by 120°.



Axis 1 U Axis 1 V Axis 1 W Axis 1 Encoders 0 Position

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Figure 2: According to IEC 60034-8 phase-current order of U-V-W causes rotation in positive direction.



Axis 1 U Axis 1 V Axis 1 W Axis 1 Encoders 0 Position

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Figure 3: According to IEC 60034-8 phase-current order of W-V-U causes rotation in negative direction.

2 Interpretation of Rotational Direction by Triamec Drives

This section describes how the rotational direction is handled by the *Triamec* drives by default. The rotational direction can be adjusted by the parameters

- `PositionController.Encoders[].InvertDirection` and
- `Motor.InvertDirection`.

2.1 Phase-Current Rotation

If the current-vector is rotated in positive direction (commutation angle has a positive velocity) and the parameter `Motor.InvertDirection` and `Encoders[].InvertDirection` are set to false (default), the phase current at the connector will have the order U-V-W by as shown in Figure 2. Therefore, a motor which fulfills IEC 60034-8 will rotate in positive direction in this case.

2.2 Encoder Rotation

For encoders, there exists no standard regarding the rotational direction and the positive direction depends on the implementation by the manufacturer. If `Encoders[].InvertDirection` is set to false, the *Triamec* drive interprets the encoder signals as follows:

Analog Encoder and Incremental Encoder

To determine the rotational direction, the phase shift of 90° between the phase A and phase B is used:

- Positive direction: Phase A leads phase B by 90°
- Negative direction: Phase A lags phase B by 90°

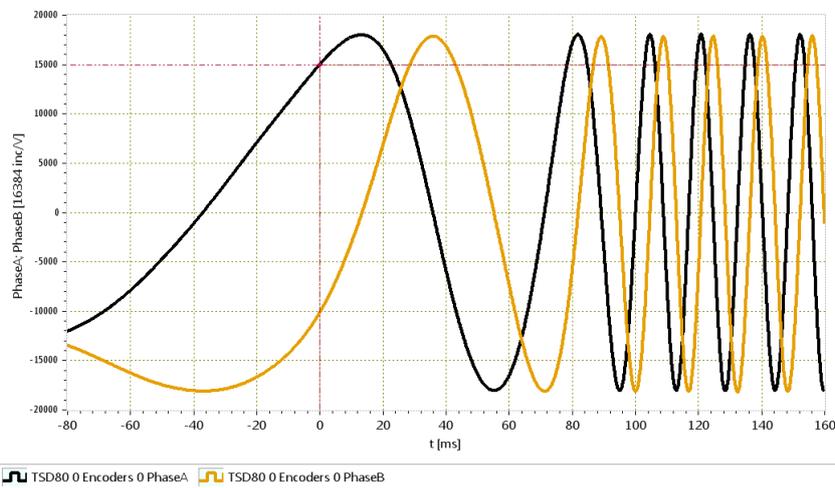


Figure 4: Phase A leads phase B by 90° -> encoder counts in positive direction.

Digital Encoders with Serial Protocol

As the position transfer is based on a serial protocol, the rotational direction is defined by the manufacturer of the encoder.

2.3 Encoder Inversion

In case the desired positive direction of the axis is opposite to the encoder count, the parameter `PositionController.Encoders[].InvertDirection`

can be set to `true` so the positive direction does match with the direction of the actual position of the drive. This parameter also affects the direction of the commutation of the motor (see next section).

2.4 Motor Inversion

The direction of the commutation angle and the direction of the encoder count have to be aligned. If this is not the case, the parameter

`Parameters.Motor.InvertDirection`

has to be set to `TRUE`.

Motor direction U-V-W	Encoder count direction	InvertDirection
CW	CW	FALSE
CW	CCW	TRUE
CCW	CW	TRUE
CCW	CCW	FALSE

3 Digital Encoders: Alignment Between Motor and Encoder

Some digital encoders are aligned with the motor at the factory. For example, this is done by setting the encoder count to zero while a current is applied between two phases (e.g. Kollmorgen: positive DC current into phase W and out of phase V (U floats)).

Absolute Sine Encoder Options

Encoder Alignment

With positive DC current into phase W and out of phase V (U floats) the encoder is aligned to ± 1 electrical degree¹.

EnDat Optical

Type		Single-Turn "DA"		Multi-Turn "DB"	
Frame Size		AKM 2, 3, 4	AKM 5, 6, 7, 8	AKM 2, 3, 4	AKM 5, 6, 7, 8
Cycles Per Revolution		512	2048	512	2048
Input Voltage	Vdc $\pm 5\%$	5	5	5	5
Current Consumption	mA MAX.	160	150	200	250
Operating Temperature	$^{\circ}\text{C}$ MIN/MAX	-20/115	-20/115	-20/115	-20/115
Inertia	kg-cm ²	0.040	0.260	0.040	0.260
Output Interface		HEIDENHAIN EnDat			
Type		ECN1113	ECN1313	EQN1125	EQN1325

Figure 5: Kollmorgen AKM encoder alignment.

If the motor is aligned with the encoder, the encoder count can be used for the commutation of the



motor and the motor can be enabled without an initial phasing. See [1] section “Commutation with Absolute Encoder” for more information.

References

- [1] “Servo Drive Setup Guide”, ServoDrive-SetupGuide_EP025.pdf, Triamec Motion AG, 2024
- [2] “Encoder configuration for the TSD drive series”, AN107_Encoder_EP023.pdf, Triamec Motion AG, 2023.
- [3] “Kollmorgen AKMTM Servomotor Selection Guide”, AKM-Selection_Guide-en-US_RevB.pdf, Kollmorgen Corporation.

Revision History

Version	Date	Editor	Comment
001	2019-02-07	dg	Initial edit
002	2024-03-14	ab, dg	Applied actual template, review and updated for release

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Triamec Motion AG
Lindenstrasse 16
6340 Baar / Switzerland

Phone +41 41 747 4040
Email info@triamec.com
Web www.triamec.com

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