MSD Servo Drive

Specification

Option 2 - Technology

Sin/Cos Encoder
# Specification Option 2 - Technology

**Sin/Cos Encoder**

ID No: CB13516-001, Rev. 1.1

Date: 04/2017

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## NOTE:

This document does not replace the MSD Servo Drive Operation Manual. Please be sure to observe the information contained in the “For your safety”, “Intended use” and “Responsibility” sections of the Operation Manual. For information on installation, setup and commissioning, and details of the warranted technical characteristics of the MSD Servo Drive series, refer to the additional documentation (Operation Manual, Device Help, etc.).

We reserve the right to make technical changes.

The content of our Specification was compiled with the greatest care and attention, and based on the latest information available to us.

We should nevertheless point out that this document cannot always be updated in line with ongoing technical developments in our products.

Information and specifications may be subject to change at any time. Please visit drives-support@moog.com for details of the latest versions.

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This documentation applies to:

<table>
<thead>
<tr>
<th>Series</th>
<th>Model</th>
<th>Hardware version</th>
<th>Firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSD Servo Drive</td>
<td>G392-xxxx-xx1xxx</td>
<td>to Rev. B</td>
<td>from V1.10</td>
</tr>
<tr>
<td>Single-Axis System</td>
<td>G395-xxxx-xx1xxx</td>
<td>to Rev. B</td>
<td>from V1.10</td>
</tr>
<tr>
<td>MSD Servo Drive</td>
<td>G393-xxxx-xx1xxx</td>
<td>to Rev. B</td>
<td>from V1.10</td>
</tr>
<tr>
<td>Multi-Axis System</td>
<td>G397-xxxx-xx1xxx</td>
<td>to Rev. B</td>
<td>from V1.10</td>
</tr>
<tr>
<td>MSD Servo Drive</td>
<td>not available</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compact</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1 Sin/Cos Encoder

The Sin/Cos module enables evaluation of high-resolution encoders. A track signal period is interpolated at a 12-bit resolution (fine interpolation).

1.1 Technical data and terminal assignment

The following encoder variants can be evaluated: They are identical to encoder channel 1.

<table>
<thead>
<tr>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sin/Cos encoder with zero pulse without absolute information</td>
<td></td>
</tr>
<tr>
<td>- e.g. Heidenhain ERN1381, ROD486</td>
<td></td>
</tr>
<tr>
<td>- ( U_1 = 5 \text{ V } +/- 5% ), ( I_{\text{max}} = 150 \text{ mA} )</td>
<td></td>
</tr>
<tr>
<td>Heidenhain Sin/Cos encoder with EnDat2.1 interface. Encoder data are recorded just once on initialization</td>
<td></td>
</tr>
<tr>
<td>- e.g. 13 bit single-turn encoder EGN1313-EnDat01</td>
<td></td>
</tr>
<tr>
<td>- 25 bit multi-turn encoder EGN1325-EnDat01</td>
<td></td>
</tr>
<tr>
<td>- ( U_2 = 5 \text{ V } +/- 5% ), ( I_{\text{max}} = 150 \text{ mA} )</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1.1 Encoder type selection table**

**NOTE:**
When using two identical encoders, so as to obtain optimum control performance the encoder for the speed should be connected to channel 1 and the encoder for the position to channel 3.

**ATTENTION:**
The 5 V sense voltage counteracts a voltage drop on the encoder cable. Only by using the sense cable can it be ensured that the encoder is being supplied with the correct voltage.

Always connect the sense cable!
If a Sin/Cos encoder is not delivering sense signals, connect pins 12 and 13 (+ / -Sense) to pins 3 and 8 (+5 V / GND) on the encoder cable end.

**Table 1.2 Pin assignment Sin/Cos encoder / EnDat encoder**
1.2 Encoder configuration with encoder channel 3

Interface configuration of encoder for loop control

<table>
<thead>
<tr>
<th>Parameter no.</th>
<th>Designation</th>
<th>MDAS designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 0521</td>
<td>ENC_SCon</td>
<td></td>
<td>Encoder: Channel select for Speed Control. Selection of encoder channel for speed configuration. Feedback signal for speed controller.</td>
</tr>
<tr>
<td>P 0522</td>
<td>ENC_PCon</td>
<td></td>
<td>Encoder: Channel select for Position Control. Selection of encoder channel for speed configuration. Feedback signal for speed controller.</td>
</tr>
<tr>
<td>P 0523</td>
<td>ENC_RefCon</td>
<td></td>
<td>Encoder: Channel select for Master &quot;IN&quot;. Selection of channel to act as master encoder.</td>
</tr>
</tbody>
</table>

Parameter setting for: P 0520, P 0521, P 0522, P 0523

<table>
<thead>
<tr>
<th>Parameter no.</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0) OFF</td>
<td>No Encoder selected</td>
<td>No encoder selected</td>
</tr>
<tr>
<td>(1) CH 1 (1)</td>
<td>Channel 1 (SinCos encoder X7)</td>
<td>Channel 1: For SinCos encoder X7</td>
</tr>
<tr>
<td>(2) CH 2 (2)</td>
<td>Channel 2 (Resolver X6)</td>
<td>Channel 2: For resolver X6</td>
</tr>
<tr>
<td>(3) CH 3 (3)</td>
<td>Channel 3 (SinCos encoder X8)</td>
<td>Channel 3: For SinCos encoder X8</td>
</tr>
</tbody>
</table>

Table 1.3 Encoder configuration
1.2.1 Configuration of encoder channel 3

Figure 1.2 Configuration of encoder channel 3

1.2.2 Overview of parameters:

<table>
<thead>
<tr>
<th>No.</th>
<th>Field index</th>
<th>Setting</th>
<th>Designation in MDA5</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 0502</td>
<td>Actual value parameter</td>
<td>Actual Value ST, MT</td>
<td>Raw data of single-turn and multi-turn information to test encoder evaluation.</td>
<td></td>
</tr>
<tr>
<td>(0)</td>
<td>00...00hex</td>
<td>Single-turn</td>
<td>The raw data are displayed after the electronic gearing and before the factor group (see drawing).</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>00...00hex</td>
<td>Multi-turn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1.4 Basic setting of encoder channel
1.3 Zero pulse evaluation via encoder channel CH3

The zero pulse evaluation via encoder channel CH3 is only set “active” for Sin/Cos encoders with no absolute value interface.

Setting via parameter:
P 0507 ENC_CH3_Sel (setting “Sin/Cos encoder”) and P 0570 ENC_CH3_Abs (setting “OFF”) enabled.

Assumption:
- Sin/Cos encoders only ever output a zero pulse when no absolute value interface is present.
- TTL encoders always have a zero pulse.
- Resolvers output no zero pulse.

If zero pulse evaluation by parameter-setting has been enabled, it can be activated by selection of the appropriate homing methods (see section 1.5).

1.3.1 Test mode for zero pulse detection

Test mode is activated by parameter P 0571 ENC_CH3_Np = 1. Encoder initialisation is triggered manually by MPRO_DRVCOM_Init = 1. Homing runs can also be carried out during test mode.

When homing is completed, or if an error has occurred, detection is aborted even though parameter P 0571 = 1. To reactivate test mode, parameter P 0571 must be reset from 0 to 1 and re-initialised.

To view the zero pulse with the scope function, the variable CH3-np-2 for example (index pulse length 1 ms) is recorded on the digital scope.
ATTENTION:
The pulse width of the scope signal does not match the pulse width of the actual zero pulse. The representation on the scope appears wider (1 ms when using variable CH3-np-2), enabling better detection of the zero pulse. The decisive factor here is the rising edge of the scope signal.

1.4 Distance-coded reference marks

In the case of relative encoders with distance-coded reference marks, multiple reference marks are distributed evenly across the entire travel distance. **The absolute position information, relative to a specific zero point of the measurement system, is determined by counting the individual measuring increments between two reference marks.**

The absolute position of the scale defined by the reference mark is assigned to precisely one measuring increment. So before an absolute reference can be created or the last selected reference point found, the reference mark must be passed over.

In the worst-case scenario this requires a rotation of up to 360°. To determine the reference position over the shortest possible distance, encoders with distance-coded reference marks are supported (HEIDENHAIN ROD 280C). The reference mark track contains multiple reference marks with defined increment differences. The tracking electronics determines the absolute reference when two adjacent reference marks are passed over - that is to say, **after just a few degrees of rotation.**

1.4.1 Rotary measurement system:

**Rotary encoder (figure 1.3):**

Basic increment **reference measure A:** (small increment e.g. **1000**) corresponding to parameter **P 0630 ENC_CHAN3_Nominal increment A**

Basic increment **reference measure B:** (large increment e.g. **1001**) corresponding to parameter **P 0631 ENC_CHAN3_Nominal increment B**

The number of lines is entered in parameter **P 0572 ENC_CHAN3_Lines.**

A sector increment difference of +1 and +2 is supported.

One mechanical revolution is precisely one whole multiple of the basic increment A.
Linear measurement system:

![Schematic view of a linear scale with distance-coded reference marks](image)

**A linear measurement system is not supported in firmware version 1.30.**

1.5 Homing method for distance-coded encoders

Supported encoder types:

- **Type -6:** move negative direction for distance coded encoder
- **Type -7:** move positive direction for distance coded encoder
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The German version is the original of this Operation Manual.