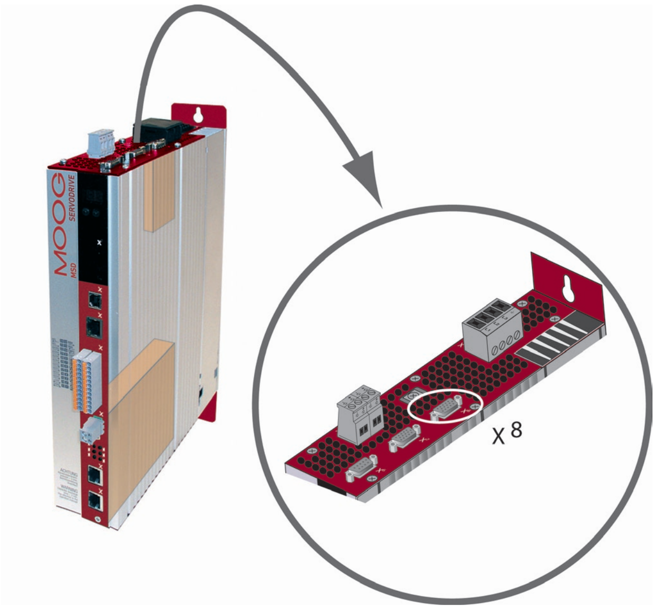


MSD Servo Drive

Specification

Option 2 - Technology

Sin/Cos Encoder

Specification
Option 2 - Technology

Sin/Cos Encoder

ID No: CB13516-001, Rev. 1.1

Date: 04/2017

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.).

This documentation applies to:

Series	Model	Hardware version	Firmware version
MSD Servo Drive Single-Axis System	G392-xxxxx1xxxxx G395-xxx-x1xxxxx	to Rev. B	from V1.10
MSD Servo Drive Multi-Axis System	G393-xxx-x1xxxxx G397-xxx-x1xxxxx	to Rev. B	from V1.10
MSD Servo Drive Compact	not available	-	-

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.

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.

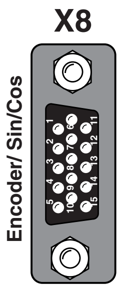
Connection	Function
	Sin/Cos encoder with zero pulse without absolute information • e.g. Heidenhain ERN1381, ROD486 • U_v = 5 V +/- 5%, 150mA
	Heidenhain Sin/Cos encoder with EnDat2.1 interface. Encoder data are recorded just once on initialisation e. g. • 13 bit single-turn encoder ECN1313-EnDat01 25 bit multi-turn encoder EQN1325-EnDat01 • Uv=5 V (+/-) 5 %, I_{max} = 150mA

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.

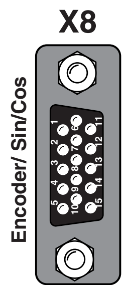
Connection	Terminal X8 pin no.	Function Sin/Cos encoder	Absolute value encoder EnDat
	1	A-	A-
	2	A+	A+
	3	+5V (+/-) 5 %, I_{max} = 150 mA regulated; a voltage variation on the encoder is passed on via the sense cables to the voltage regulator.	
	4	-	Data +
	5	-	Data -
	6	B -	B -
	7	-	-
	8	GND	GND
	9	R -	-
	10	R +	-
	11	B +	B +
	12	+ Sense cable	
	13	- Sense cable	
	14	-	CLK +
	15	-	CLK -

Table 1.2 Pin assignment Sin/Cos encoder / EnDat encoder

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.

1.2 Encoder configuration with encoder channel 3

Interface configuration of encoder for loop control

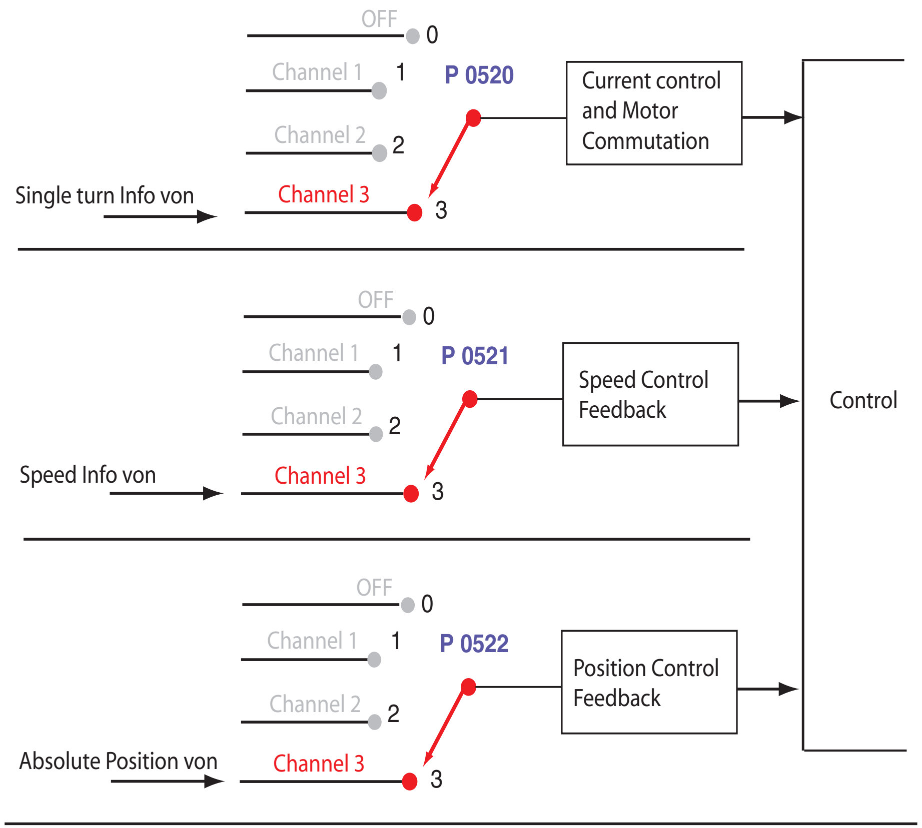


Figure 1.1 Display of encoder configuration for encoder channel 3

Parameter no.	Designation	MDA5 designation	Function
P 0520	ENC_MCon	Encoder: Channel Select for Motor Commutation and Current control	Selection of encoder channel for commutation angle and current control. Feedback signal for field-oriented regulation.
P 0521	ENC_SCon	Encoder: Channel select for Speed Control	Selection of encoder channel for speed configuration. Feedback signal for speed controller
P 0522	ENC_PCon	Encoder: Channel select for Position Control	Selection of encoder channel for speed configuration. Feedback signal for speed controller
P 0523	ENC_RefCon	Encoder: Channel select for Master „IN“	Selection of channel to act as master encoder
Parameter setting for: P 0520, P 0521, P 0522, P 0523			
(0)	OFF (0)	No Encoder selected	No encoder selected
(1)	CH 1 (1)	Channel 1 (SinCos encoder X7)	Channel 1: For Sin/Cos encoder on X7
(2)	CH 2 (2)	Channel 2 (Resolver X6)	Channel 2: For resolver X6
(3)	CH 3 (3)	Channel 3 (SinCos encoder X8)	Channel 3: For Sin/Cos encoder on X8

Table 1.3 Encoder configuration

1.2.1 Configuration of encoder channel 3

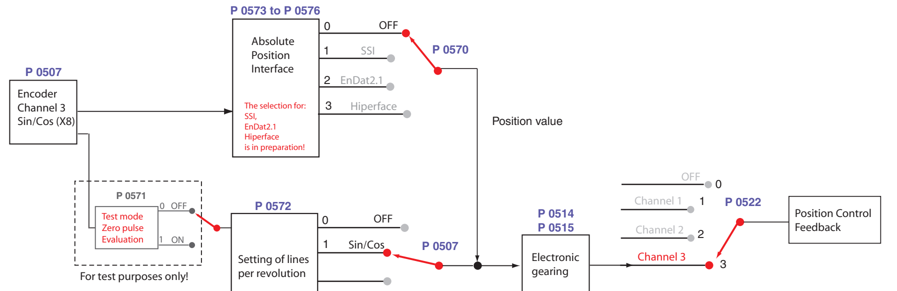
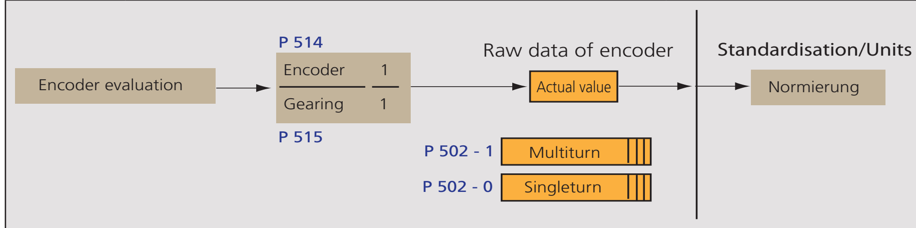


Figure 1.2 Configuration of encoder channel 3

1.2.2 Overview of parameters:

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

Table 1.4 Basic setting of encoder channel



No.	Field index	Setting	Designation in MDA5	Function
P 0507			Encoder Channel 3 Select	Selection of encoder
	(0)	OFF (0)	No function	No evaluation
	(1)	SinCos encoder (1)	SinCos encoder	Sin/Cos encoder without absolute information and zero pulse Sin/Cos encoder with absolute information without zero pulse
P 0514		Numerator	Gear Numerator	Numerator of encoder gearing
P 0515		Denominator	Gear Denominator	Denominator of encoder gearing
P 0570		OFF	Absolute Position Interface Select	IIncremental encoder with zero pulse evaluation
P 0571			Index Pulse Test Mode	Zero pulse evaluation
	(0)	OFF (0)	No function	No function
	(1)	ON (1)	Function active	Zero pulse evaluation active
P 0572		Input of number of lines per revolution 1 - 65535	Number of lines (SinCos encoders/TTL encoders)	Setting of number of lines per motor revolution (maximum 65535) of optical encoder

Table 1.4 Basic setting of encoder channel

No.	Field index	Setting	Designation in MDA5	Function
Absolute interface X8: These parameters are set manually!				
P 0573		Multi-turn bits 0 - 25	Number of MultiTurn Bits	Number of bits of multi-turn information
P 0574		Single-turn bits 0 - 25	Number of SingleTurn Bits	Number of bits of single-turn information
P 0575			Code Select (SSI Absolut Position Interface)	Selection of code with which the SSI encoder is to be evaluated.
	(0)	BINARY (0)	Binary coded data	Evaluation of the binary code
	(1)	GRAY (1)	Gray coded data	Evaluation of the gray code
P 0577		0 - 0,5	Encoder Observation Minimum sqrt(a^2+b^2)	Setting of the sensitivity for the encoder signal monitoring
P 0630		0 - 65535	Nominal increment A of reference marks	Setting of the distance-coded reference marks. These values are given on the encoder data sheet.
P 0631		0-65535	Nominal increment B of reference marks	

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_CH3_Nominal increment A

Basic increment **reference measure B:** (large increment e.g. **1001**) corresponding to parameter P 0631 ENC_CH3_Nominal increment B. The number of lines is entered in parameter P 0572 ENC_CH3_Lines.

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

One mechanical revolution is precisely one whole multiple of the basic increment A.

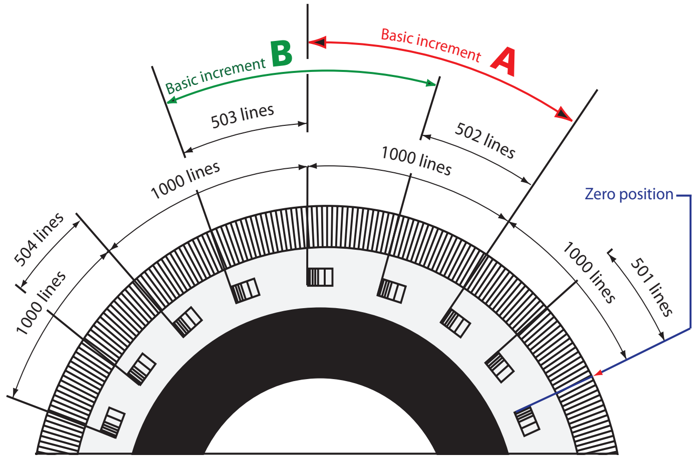


Figure 1.3 Schematic view of circular graduations with distance-coded reference marks.

Example of a rotary measurement system

No. of lines P 0572	Number of reference marks	Basic Increment G Nominal Increment A P 0630	Basic Increment G Nominal Increment B P 0631
18 x 1000 lines	18 Basic marks + 18 coded masks = ∑36	Reference measure A = 1000 lines corresponding to 20°	Reference measure B 1001 lines

Table 1.5 Example of a rotary system

Linear measurement system:

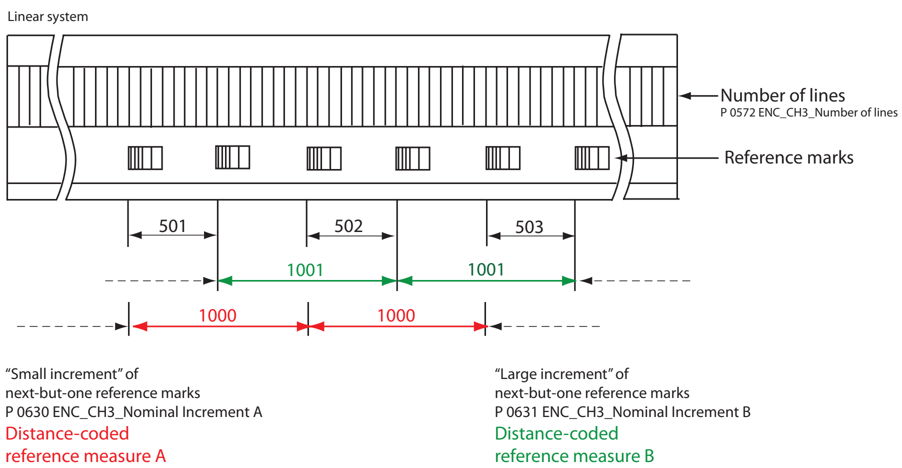


Figure 1.4 Schematic view of a linear scale with distance-coded reference marks

A linear measurement system is not supported in fimware 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 contents of our documentation have been compiled with greatest care and in compliance with our present status of information.

Nevertheless we would like to point out that this document cannot always be updated parallel to the technical further development of our products.

Information and specifications may be changed at any time. For information on the latest version please refer to drives-support@moog.com.

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The German version is the original of this Operation Manual.