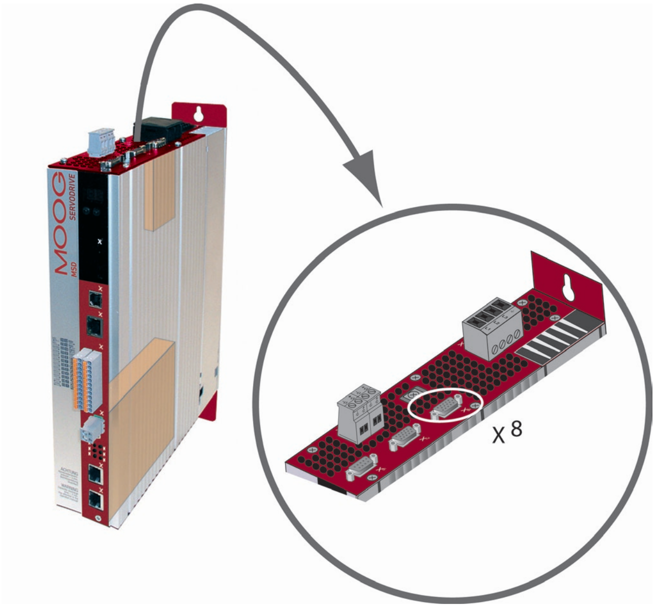
MSD Servo Drive

Specification



Option 2 - Technology

2nd Sin/Cos Encoder

Specification
Option 2 - Technology

2nd Sin/Cos encoder

ID No: CA79903-001, Rev. 1.3

Date: 04/2017

NOTE:
This document does not replace the ServoOne junior Operation Manual. Please be sure to observe the information contained in the “For your safety”, “Intended use” and “Responsibility” sections of the Operation Manual (ID no.: 1300.20B.x-xx). For information on installation, setup and commissioning, and details of the warranted technical characteristics of the MSD Servo Drive devices, 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	from Rev. C	all
MSD Servo Drive Multi-Axis System	G393-xxx-x1xxxxx G397-xxx-x1xxxxx	from Rev. C	all
MSD Servo Drive Compact	G394-xxx-x1xxxxx	from Rev. A	from V1.10

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.

Table of Contents

1 Sin/Cos / TTL encoder

1.1 Operating modes:

Sin/Cos encoders are designed as optical encoders, and meet the highest accuracy demands. They emit two sinusoidal, 90° offset signals, A and B, which are scanned by analog/digital converters. The signal periods are counted and the phase angles of signals A and B are used to calculate the rotation and count direction.

Digital interface:
The digital time-discrete interface is based on a transfer protocol. The current positional information is transmitted from the encoder to the receiver. This may be done either serially or in parallel. As the transfer only takes place at certain times, it is a time-discrete interface.
Encoders are specified in terms of their rated voltage and current consumption, and the pin assignment. Maximum permissible cable lengths are additionally specified.

Encoder interface X8 enables the evaluation of the following encoder types. For the technical specifications of the various encoder types refer to the documentation from the encoder manufacturers.

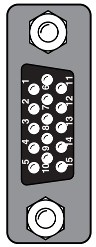
Fig.	Function
X8  Encoder/ SSI	**Sin/Cos encoder with zero pulse:** e. g. Heidenhain ERN1381, ROD486
	Heidenhain Sin/Cos encoder with EnDat interface: e. g. 13 bit single-turn encoder (ECN1313) and 25 bit multi-turn encoder (EQN1325)
	Heidenhain encoder with purely digital EnDat interface: e. g. 25 bit single- turn encoder and 12 bit multi-turn encoder (EQN 1337)
	Sin/Cos encoder with SSI interface: e. g. 13 bit Singleturn- und 25 bit Multiturn-Geber (ECN413-SSI, EQN425-SSI)
	Encoder with purely digital SSI interface: e. g. Kübler encoder 12 bit single-turn and 12 bit multi-turn (F3663.xx1x.B222)
	Sick-Stegmann Sin/Cos encoder with HIPERFACE® interface:
	TTL encoder with zero pulse: e. g. Heidenhain: ROD 426, ERN 1020

Table 1.1 Suitable encoder types on X8

ATTENTION:
Only one encoder with a purely digital EnDat or SSI interface can be used on connector X8 or X7 (see Operation Manual, page 25/26).

1.2 Technical data

1.2.1 Sin/Cos / TTL signal evaluation

	Specification		
Interface	· Differential voltage input, EIA422-compatible; Pay attention to voltage range! · Maximum cable length: 10 m (32.80 ft) · Connector: 15-pin D-SUB, High-Density, female · Surge terminating impedance built-in to device: 120 Ω		
	minimum	maximum	
Input frequency	0 Hz	500 kHz	
Input voltage			
Differential switching level "High"	+ 0.1 V		
Differential switching level "Low"		-0.1 V	
Signal level reffered to ground	0 V	+ 5 V	

Table 1.2 Sin/Cos / TTL encoder input on X8

1.2.2 Absolute value encoder

	Specification		
Interface	· EIA485-compliant · Connector: 15-pin D-SUB, High-Density, female · Surge terminating impedance built-in to device: 120 Ω		
Pulse frequency:	minimum	maximum	typ.
EnDat		2 MHz	
SSI		1 MHz	
Output voltage:	min.	max.	typ.
Signal level reffered to ground	0 V	+ 3.3 V	-
Differential output voltage IUI	1.5 V	3.3 V	Surge impedance ≥ 57 Ω
Input voltage	minimum	maximum	typ.
Differential switching level "High"	+ 0.2 V		
Differential switching level "Low"		-0.2 V	
Signal level refferd to ground	- 7 V	+ 12 V	

Table 1.3 Absolute value encoder input on X8

1.2.3 Voltage supply for external encoder

	Specification		
	minimum	maximum	typ.
Output voltage with Sin/Cos , TTL, EnDat, SSI encoders	+ 4.75 V	+ 5.25 V	+ 5 V
Output current with Sin/Cos , TTL, EnDat, SSI encoders		250 mA	
Output voltage with Hiperface		+ 12 V	
Output current with Hiperface-interface		100 mA	

Table 1.4 Voltage supply for external encoders on X8

NOTE:
The encoder supply at X8/3 is short-circuit proof in both 5 V and 12 V operation. The controller remains in operation enabling the generation of a corresponding error message when evaluating the encoder signals.
Encoders with a power supply of 5 V ± 5 % must have a separate sensor cable connection. The encoder cable detects the actual supply voltage at the encoder, thereby compensating for the voltage drop on the cable. Only use of the sensor cable ensures that the encoder is supplied with the correct voltage. The sensor cable must always be connected.
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.

1.2.4 Cable type and layout

The cable type should be chosen as specified by the motor/encoder manufacturer.

The following conditions must be met:

- Use only shielded cables.
- Shield on both sides.
- Interconnect the differential track signals A, B, R or DATA and CLK by twisted-pair cables.
- Do not separate the encoder cable, for example to route the signals via termi-nals
  in the switch cabinet.

1.3 Pin assignment

The assignment of the 15-pin D-Sub female connector on slot X8 is set out in the following table.

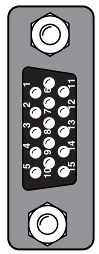
		Sin/Cos /TTL encoder	Absolute value encoder SSI, EnDat	Absolute value encoder HIPERFACE
Connection	Pin	Signal	Signal	Signal
X8 	1	Track A –		REFCos
	2	Track A +		+ Cos
	3	+5V Encoder supply		+ 12 V Encoder supply
	4	R+ / Data +		
	5	R- / Data -		
	6	Track B–		REFSin
	7	-		U_s-Switch *
	8	GND		
	9	R+ / Data+ 1)		
	10	R- / Data- 1)		
	11	Track B+		+ Sin
	12	Sense +		U_s-Switch *
	13	Sense -		-
	14		CLK +	-
	15		CLK -	–
1) from delivery week 15/2011 on and from device serial No. SN 1115 ... on				

Table 1.5 Pin assignment of the Sin/Cos module on X8

* The jumper between pins 7 and 12 produces a voltage on pins 3 and 8 of 12 V.

1.4 Configuration

1.4.1 Configuration of the encoder channel X8

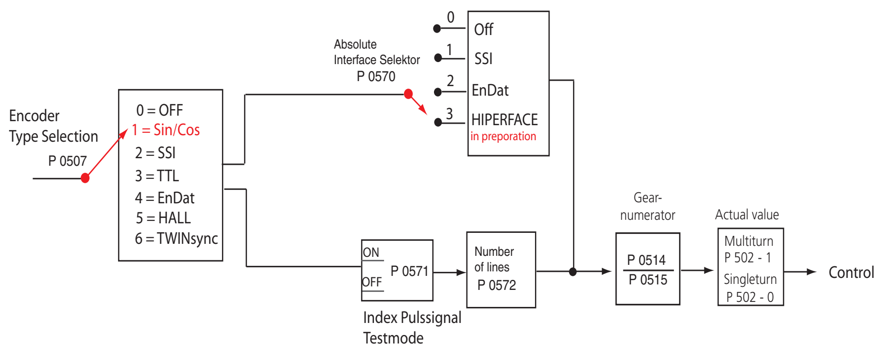


Figure 1.1 Configuration encoder channel X8

NOTE:
When using an encoder with incremental tracks (Sin/Cos signal), P 0507 must be set to (1). Selector P 0570 is set to the desired encoder interface.

Parameter no.	Setting	Designation in MDA5	Function
P 0502		ENC_CH3_ActVal	Actual value parameter: 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 scaling (see figure 1.1).
(1)	00...00hex	Multi-turn	
P 0507		ENC_CH3_ Sel	Selection of encoder
(0)	OFF	No function	No function
(1)	SinCos encoder	SinCos	Sin/Cos selection
(2)	SSI encoder	SSI	SSI selection
(3)	TTL encoder	TTL	TTL selection
(4)	EnDat 2.1/2.2	ENDAT	EnDat selection
(5)	TTL encoder with commutation signals	HALL	HALL selection (function not supported)
(6)	TWINsync	TWINsync	TWINsync selection (function not supported)
P 0514	- (2^{31})... + (2^{31}-1)	ENC_CH3_Num	Numerator of encoder gearing
P 0515	1...(2^{31}-1)	ENC_CH3_Denom	Denominator of encoder gearing
P 0570		Absolute Position Interface select	Absolute interface selector
(0)	Off		No evaluation
(1)	SSI		SSI interface
(2)	EnDat		EnDat interface
(3)	Hiperface		Hiperface interface (in prepara-tion)

Table 1.6 Basic setting of encoder channel

Parameter no.	Setting	Designation in MDA5	Function
P 0571		ENC_CH3_NpTest	Zero pulse wiring test (more details following)
(0)	OFF	No function	No function
(1)	ON	ENABLE_ISR	Zero pulse test mode active
P 0572	Input of number of lines per revolution 1 - 65536	ENC_CH3_Lines	Setting of number of lines (max. 65536) of TTL encoder per motor revolution
P 0573	Multi-turn bits 0-25 bits	Number of Multi Turn Bits	Number of bits of multi-turn information
P 0574	Single-turn bits 0-29 bits	Number of SingleTurn Bits	Number of bits of single-turn information
P 0575	ENC_CH3_Code	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 (a2+b2)	Sensitivity for encoder monitoring
P 0630	0 - 65535	Nominal increment A of reference marks	Setting of the increment-coded reference marks. These values are given on the encoder data sheet.
P 0631	0 - 65535	Nominal increment B of reference marks	

Table 1.6 Basic setting of encoder channel

1.4.2 Zero pulse wiring test

To enable evaluation for the wiring test parameter P 0571 = ON (1) is set.
On the oscilloscope it can then be depicted with the measurement variables CH3-Np .
To make the zero pulse clearly visible, the measurement variable remains at High level until the next zero pulse appears. Conversely, the measurement variable remains at Low level until another zero pulse appears.

In this, the pulse width of the scope signal does not match the pulse width of the actual zero pulse.

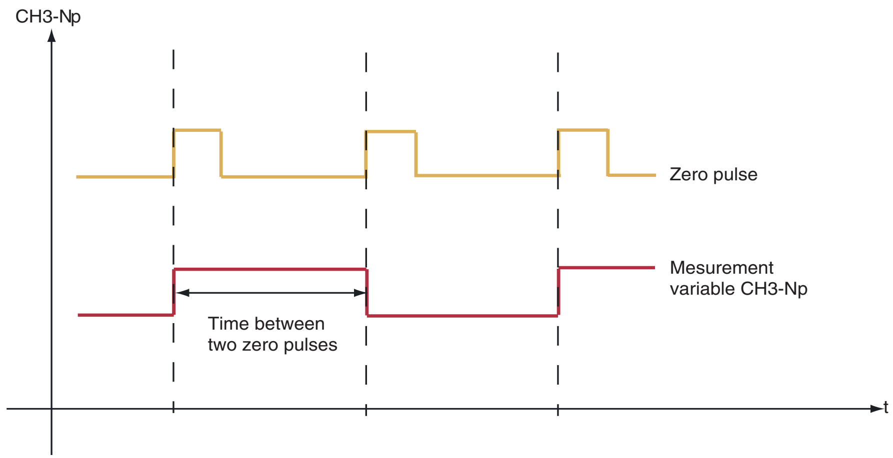


Figure 1.2 Zero pulse recording via measurement variable CH3-NP

NOTE:
In zero pulse test mode zero pulse evaluation of homing runs is disabled.

1.4.3 Interface configuration of encoder for loop control

By way of P 0520, P 0521, P 0522 the physical encoder interface is adapted to the current, speed or position controller.

Parameter no.	Setting	Designation in MDA5	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 position information. Feedback signal for position controller
Parameter settings apply to P 0520, P 0521, P 0522			
(0)	OFF		No encoder selected
(1)	CH1		Channel 1: Sin/Cos on X7
(2)	CH2		Channel 2: Resolver on X6
(3)	CH3		Channel 3: Option on X8

Table 1.7 Encoder configuration

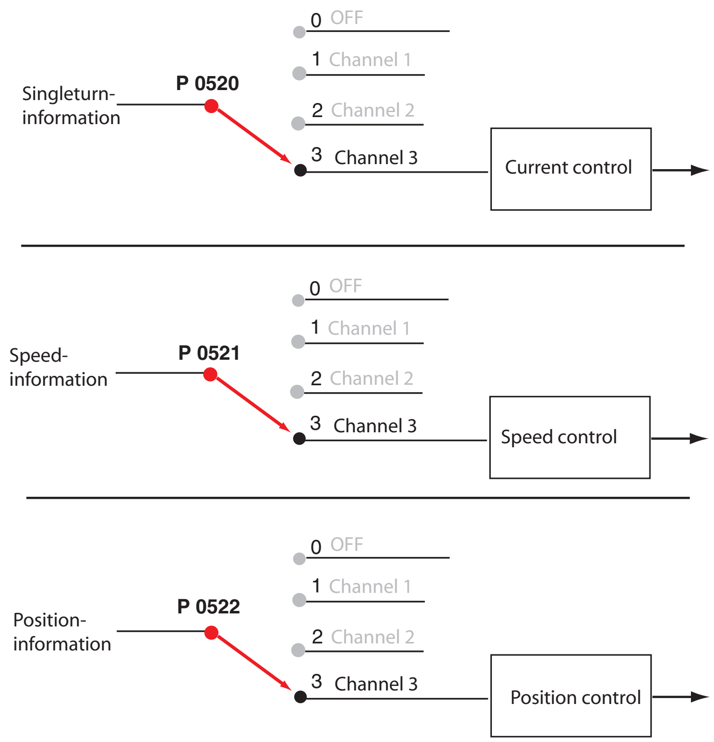


Figure 1.3 Display of encoder configuration for encoder channel X8

ATTENTION:
A parameter can only be written or read with the appropriate access rights (e.g. "Local administrator"). A changed parameter must always be saved on the device. When editable online, a parameter executes a reaction on the device immediately, so inputs must always be carefully checked.

1.5 Increment-coded reference marks

In the case of relative encoders with increment-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 positon over the shortest possible distance, encoders with increment-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.

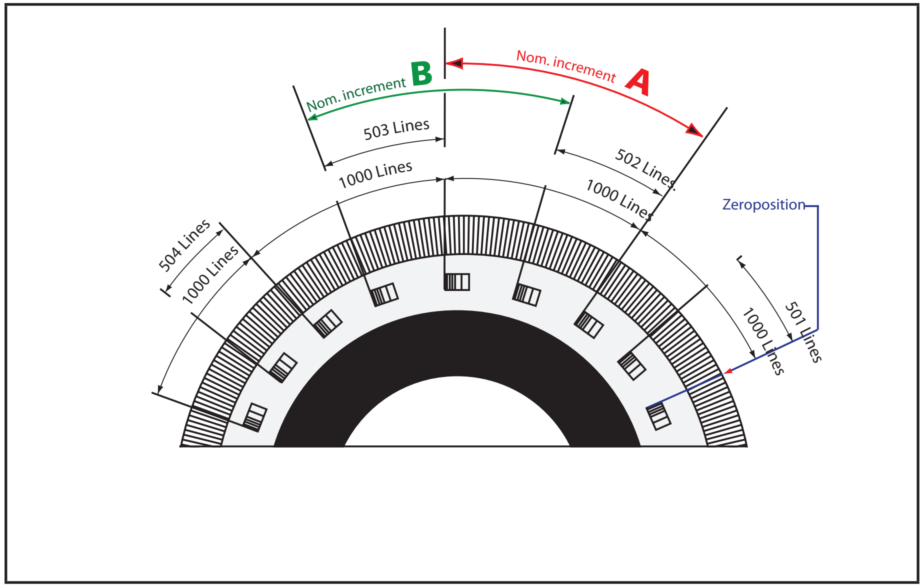


Figure 1.4 Schematic view of circular graduations with increment-coded reference marks

1.5.1 Rotary measurement system

Rotary encoder:

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 lines per revolution are 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.

Example of a rotary measurement system

Lines per revolution 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 = Σ 36	Reference measure A = 1000 lines corresponding to 20°	Reference measure B 1001 lines

Table 1.8 Example of a rotary system

Linear measurement system:

In preparation:

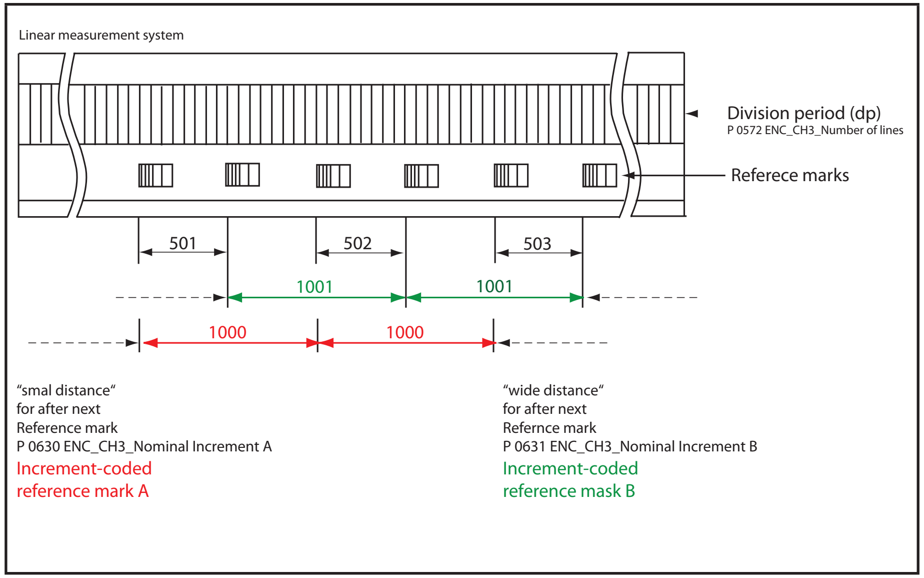


Figure 1.5 Schematic for a linear scale

Homing method for increment-coded encoders:

Supported encoder types:

Type -6:

Increment-coded encoders with negative direction of rotation

Type -7:

Increment-coded encoders with positive direction of rotation

TAKE A CLOSER LOOK.

Moog solutions are only a click away. Visit our worldwide Web site for more information and the Moog facility nearest you.

MOOG
Moog GmbH
Hanns-Klemm-Straße 28
D-71034 Böblingen Phone
+49 7031 622 0 Telefax
+49 7031 622 100

www.moog.com/industrial
drives-support@moog.com

Technical alterations reserved.

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.

ID no.: CA79903-001, Rev. 1.3
Date: 04/2017

The German version is the original of this Operation Manual.