

# MSD Servo Drive

Specification



Analog Input/Output  
Option Card

Description of  
Basic Functionality

MSD Analog Input-Output Option Card

Id. no.: CB59508-001, Rev. 1.6

Date: 10/2022

### **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 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](mailto:drives-support@moog.com).

## Audience

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 (Id no.: CA65642-001). 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, UserManual, etc.).

This document provides information about how to connect and how to set-up the analog I/O option card functions.

## Referenced Documents

Title	Document No. (English)	Document No. (German)
MSD Servo Drive Device Help	CB40859-001	CB40859-002
Moog DRIVEADMINISTRATOR 5 InstallationManual	CA50726-001	CA50726-002
MSD Servo Drive AC-AC Servo Drive Operation Manual Single-Axis System	CA65642-001	CA65642-002
MSD Servo Drive DC-AC Servo Drive Operation Manual Multi-Axis System	CA97554-001	CA97554-002

# Table Of Contents

Table Of Contents .....	3
1 Availability.....	4
2 Interface description .....	4
2.1 Technical data and pin assignment .....	4
3 Configuration Analog Inputs .....	5
3.1 Cascading of analog inputs.....	5
3.2 Analog Inputs .....	5
3.3 Calibration of Analog Inputs.....	8
3.4 Weighting.....	9
3.5 Wire break detection .....	10
4 Analog Outputs.....	11

# 1 Availability


This function is available for the following MSD Servo Drive devices:

Series	Model	Hardware version	Firmware
MSD Servo Drive Single-Axis System	G392-xxx-x7xxxxx G395-xxx-x7xxxxx	From Rev. C	From 123.xx-xx
MSD Servo Drive Multi-Axis System	G393-xxx-x7xxxxx G397-xxx-x7xxxxx	From Rev. C	From 123.xx-xx

# 2 Interface description

## 2.1 Technical data and pin assignment

The following table describes the technical data of the analog inputs and outputs on the option card.

Figure	Pin	Description
	1	Analog input – IEA02+
	2	Analog input – IEA02-
	3	Analog input – IEA03+
	4	Analog input – IEA03-
	5	Analog output – OEA02+
	6	n/c
	7	Analog output – OEA03+
	8	Analog output – OEA03-
	9	Supply voltage*
	10	GND
	11	n/c
	12	n/c
	13	n/c
	14	n/c
	15	Analog output – OEA02-

\*10 V power supply (for example can be used to power a force sensor)

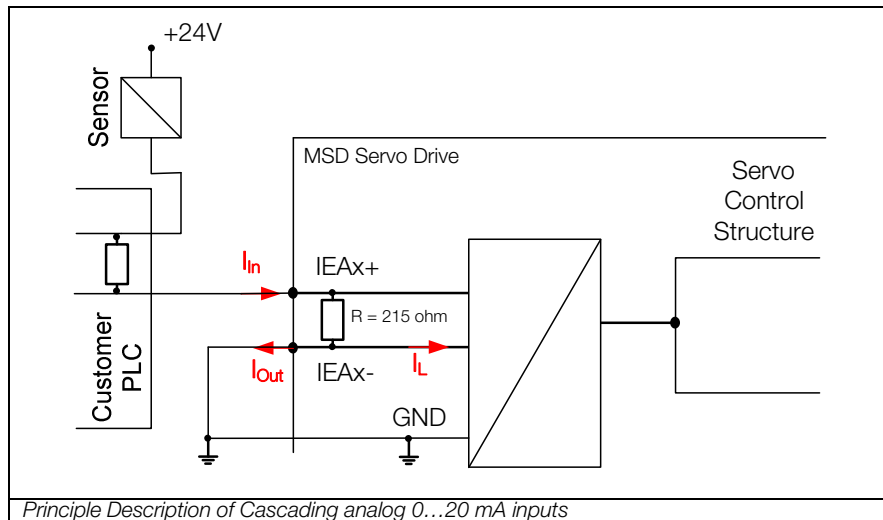
# 3 Configuration Analog Inputs

## 3.1 Cascading of analog inputs

Current inputs allow the possibility of cascading several inputs in a series connection. By doing so, the signal from a single sensor can be read by multiple devices at the same time. On the MSD Servo Drive current inputs are available on both the option card and the drive's control card, but with two important differences. Firstly, the ADC on the option card is a 16 Bit converter as opposed to 12 Bit on the control card. Secondly, with AIs on the option card it's possible to select via software whether the inputs are voltage or current whereas on the control card this is not possible, the user needs to decide beforehand whether to order a drive with voltage or current input.

This correct operation depends on the leakage currents of the used analog input circuits. The analog inputs on the MSD Servo Drive control card are as follows:  $I_{in} - I_{out} < 50 \mu A$ . For a correct operation it is recommended to place the analog inputs of the MSD Servo Drives at the end of the connection cascade.

The following principle circuit figure shows how the cascading has to be done for correct operation.



## 3.2 Analog Inputs

For this function the selections for the two channels have been increased to fulfil the extra needs of the 0...20 mA inputs. To be able to specify reference set points for the control via the two analog inputs IEA02 and IEA03 or just process them for further use in the MSD PLC or the programming interface, the following function selectors have to be set accordingly.

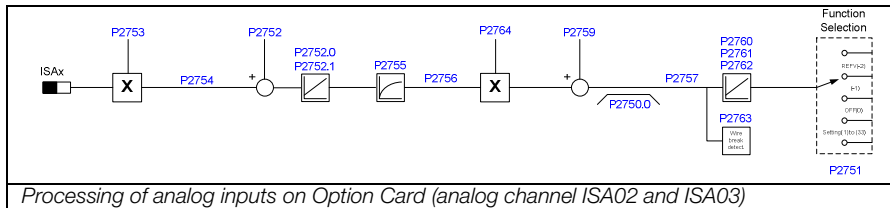
Setting of analog input IEA02/03:

**P 2751.0, P 2751.1** must each be set to REV(-2) for analog command to the internal servo loops or to (-1) for just processing them for use in the MSD PLC or the programming interface. The functions usable in analog mode are indicated by a (-) mark.

Parameter	Parameter name / Settings	Designation in MDA5	Function
<b>P2751</b>	AIO_IN_FS	Function of analog input IEA02/03	Function of the analog input
	(-14) - (48)		The options correspond to the analog inputs on X4. The complete list is described in the MSD Servo Drive Device Help, chapter 9.4.2 "Function selectors"
<b>P0165</b>	MPRO_REF_SEL	Motion profile selection	
	ANA2/3	Via analog channel IEA02/03	Selection of the analog reference source – needs only be set to this value in case of setting REFV(-2). Otherwise this parameter needs to be set to the mating value of the command source (e.g. fieldbus)
<b>P2750.0</b>	TOPT_AIO_Type	Analog current/voltage input switch	Mode selector of analog input for voltage or current mode
	0		Voltage mode +/-10 V
	1		Current mode 0 ... 20 mA

Depending on the parameterized control mode (**P 0300 CON\_CfgCon**), a speed or a torque can be set as the reference by setting above parameters accordingly. Otherwise the inputs can be set also in that way so that the inputs are only processed and then are then available for the MSD PLC, the programming interface or also just transmitted to a superimposed PLC via fieldbus.

Structure



Processing of analog inputs on Option Card (analog channel ISA02 and ISA03)

Parameter List

Parameter	Parameter name /Settings	Designation in MDA5	Function
<b>P2750</b>	TOPT_AIO_IO_Type	Extended analog inputs/outputs: current/voltage switch	Input selector (+/- 10 V = 0, 0...20 mA = 1)
0	IEA02/03	Analog current/voltage input switch	Value for input IEA02/03
<b>P2751</b>	TOPT_AIO_IN_FS	Extended analog inputs: Function selector	Function selector IEA02/03 see MSD Servo Drive Device Help
0	IEA02	Input function	Function selector IAE02
1	IEA03	Input function	Function selector IAE03
<b>P2752.0...3</b>	TOPT_AIO_IN_CAL	Extended analog inputs: AD values calibration	Calibration values for analog inputs

		calibration																					
<b>P2753</b>	TOPT_AIO_IN_ScopeGain	Extended analog inputs: scope gains	<table border="1"> <thead> <tr> <th>Parameter value</th> <th>Gain factor</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td></tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>5</td></tr> <tr><td>3</td><td>10</td></tr> <tr><td>4</td><td>20</td></tr> <tr><td>5</td><td>50</td></tr> <tr><td>6</td><td>100</td></tr> <tr><td>7</td><td>200</td></tr> <tr><td>8</td><td>500</td></tr> </tbody> </table>	Parameter value	Gain factor	0	1	1	2	2	5	3	10	4	20	5	50	6	100	7	200	8	500
Parameter value	Gain factor																						
0	1																						
1	2																						
2	5																						
3	10																						
4	20																						
5	50																						
6	100																						
7	200																						
8	500																						
0	IEA02	Scope gain	Scope gain IEA02																				
1	IEA03	Scope gain	Scope gain IEA03																				
<b>P2754</b>	TOPT_AIO_IN_Raw	Extended analog inputs: Raw values	Raw values of IEA02/03																				
0	IEA02	Raw ADC Value	Raw value of IEA02																				
1	IEA03	Raw ADC Value	Raw value of IEA03																				
<b>P2755</b>	TOPT_AIO_IN_Filt	Extended analog inputs: Filter time constants	Filter time constants for IEA02/03																				
0	IEA02	Filter time constant	Filter time constant IEA02																				
1	IEA03	Filter time constant	Filter time constant IEA03																				
<b>P2756</b>	TOPT_AIO_IN_Val_Norm	Extended analog inputs: Values (filt, norm)	IEA02/03 values filtered, norm.																				
0	IEA02	Filtered, normalized value																					
1	IEA03	Filtered, normalized value																					

<b>P2757</b>	TOPT_AIO_IN_Val_Comp	Extended analog inputs: Values (filt, norm, comp)	IEA02/03 values filtered, normalized, compensated
0	IEA02	Compensated, Filtered, normalized value	
1	IEA03	Compensated, Filtered, normalized value	
<b>P2758</b>	TOPT_AIO_IN_Val_Scaled	Extended analog inputs: Values (filt, norm, comp, scaled)	IEA02/03 values filtered, normalized, compensated, scaled
0	IEA02	Compensated, Filtered, normalized value	
1	IEA03	Compensated, Filtered, normalized value	
<b>P2759</b>	TOPT_AIO_IN_Offset	Extended analog inputs: Offset	Offset for IEA02/03
0	IEA02	Voltage/Current offset	Voltage/current offset for IEA02
1	IEA03	Voltage/Current offset	Voltage/current offset for IEA03
<b>P2760</b>	TOPT_AIO_IN_Scale_ThUpper	Extended analog inputs: upper scaling limits	Upper scaling limits for IEA02/03
0	IEA02	Upper scaling treshold	Upper scaling threshold for IEA02
1	IEA03	Upper scaling treshold	Upper scaling threshold for IEA03

<b>P2761</b>	TOPT_AIO_IN_Scale_ThLower	Extended analog inputs: lower scaling limits	lower scaling limits for IEA02/03
0	IEA02	Lower scaling treshold	lower scaling threshold for IEA02
1	IEA03	Lower scaling treshold	lower scaling threshold for IEA03
<b>P2762</b>	TOPT_AIO_IN_Scale_ThZero	Extended analog inputs: Zero scaling treshold	Zero scaling threshold for IEA02/03
0	IEA02	Zero scaling treshold	Zero scaling threshold for IEA02
1	IEA03	Zero scaling treshold	Zero scaling threshold for IEA03
<b>P2763</b>	TOPT_AIO_IN_WireBrk_Th	Extended analog inputs: Wire break treshold	Wire break threshold for IEA02/03
0	IEA02	Wire break detection treshold	Wire break detection threshold for IEA02
1	IEA03	Wire break detection treshold	Wire break detection threshold for IEA03
<b>P2764</b>	TOPT_AIO_IN_Gain	Extended analog inputs: Gain scaling	Gain scaling for IEA02/03
0	IEA02	Gain scaling	Gain scaling for IEA02
1	IEA03	Gain scaling	Gain scaling for IEA02

scope parameters

Name	Number	Description
IEA02_Val_F	5770	IEA02: input value filtered, normalized
IEA03_Val_F	5771	IEA03: input value filtered, normalized
IEA02_Val_FC	5772	IEA02: input value filtered, normalized, compensated
IEA03_Val_FC	5773	IEA02: input value filtered, normalized, compensated
IEA02_Val_FCS	5774	IEA02: input value filtered, normalized, compensated, scaled
IEA03_Val_FCS	5775	IEA03: input value filtered, normalized, compensated
IEA02_RawVal	5776	IEA02: raw data ADC
IEA03_RawVal	5777	IEA03: raw data ADC

After a new calibration value is entered, an initialization of the drive must be performed. This can be done by saving everything in the drive and perform a re-start.

As a last step it is possible to check via **parameter 2757** Sub0 for IEA02 and Sub 1 for IEA03 the actual input value. As here the value 0 is applied to the input, these parameters should show also the value 0.

For the second calibration point it is necessary to apply either 20 mA or +10 V to the analog inputs, depending on the used function, then transfer the displayed raw value from **parameter 2754** to **parameter 2752**.

In that case it is necessary to enter into **parameter 2752**, Sub1 for IEA02 or **parameter 2752**, Sub3 for IEA03 the mating calibration value so that **parameters 2757**, Sub0 and Sub1 are showing the value 1 as a maximum value. Also here it is necessary to perform a re-boot after the calibration value has been changed.

In order to be able to use the full resolution of the analog inputs, the value 1 should be entered in **parameter 2753** for the current inputs.

The value 0 in **parameter 2753** should be entered for voltage inputs. 20 mA or 10 V then corresponds to 26200 bits.

### 3.3 Calibration of Analog Inputs

With the calibration parameters **P2752** SubID 0 to 3 it is possible to adjust the minimum and maximum level of the analog input. The calibration has to be redone after a change of type selector, parameter **P2750** SubID 0.

If the analog inputs are used as voltage inputs, it is possible to define negative calibration values. When using the analog inputs as current inputs it is not possible to set negative calibration values.

For the calibration it is necessary to be able to apply currents in the range of 0 to 20 mA for the current inputs. For the voltage inputs it is necessary to be able to apply voltages for 0 and +10 V to the inputs.

As a first step it is necessary to do the calibration for the lower limit (either 0 mA or 0 V, depending on the selected input functionality). In **parameter 2752**, Subindex 0 the calibration value for input IEA02 is entered while in **parameter 2752**, Subindex 3 the value for input IEA03 is entered. The values shall be entered in the range of  $2^{15} = 32768$ .

Apply 0 V or 0 mA to the input and then transfer the displayed raw value from **parameter 2754** to **parameter 2752**.



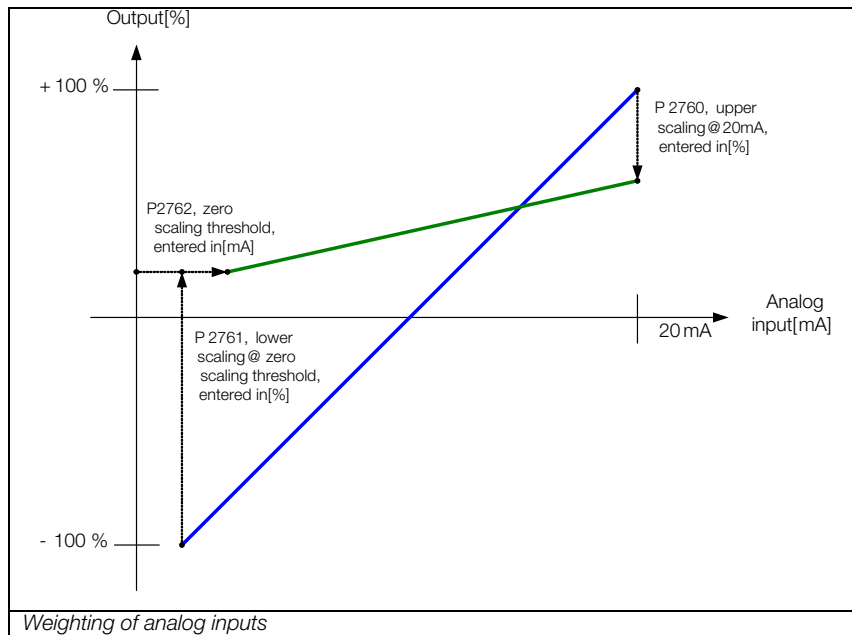
### 3.4 Weighting

It is possible to change the weighting of the two analog inputs. With the six parameters **P2760 (0/1)**, **P2761 (0/1)** and **P2762 (0/1)** the input weighting can be set. The Sub-indexes 0 are valid for analog input ISA02 while the Sub-indexes 1 are valid for analog input ISA03

Reasons for the need of changing the weighting can be:

- Change the weighting to meet the limiting range: 4...20 mA -> 0...100 % (e.g. Torque limiting, sensor scaling,...)
- Change the weighting to meet the speed / position loop command range: 4...20 mA -> +/- 100 % (e.g. reference scaling)

The following illustration shows how the weighting function works.



The following table gives a description about the weighting parameters

Parameter	Parameter name / Settings	Designation in MDA5	Function
<b>P2760</b>	TOPT_AIO_IN_Scale_ThUpper	Upper scaling threshold	Defining the output value in [%] @ 20 mA Value for input ISA02
0	ANA0		Value for input ISA03
1	ANA1		Defining the output value in [%] @ lower zero threshold
<b>P2761</b>	TOPT_AIO_IN_Scale_ThLower	Zero scaling threshold	
0	ANA0		Value for input ISA02
1	ANA1		Value for input ISA03
<b>P2762</b>	TOPT_AIO_IN_Scale_ThZero	Lower scaling threshold	Defining the input value in [mA] @ lower zero threshold
0	ANA0		Value for input ISA02
1	ANA1		Value for input ISA03

Weighting Example:

The standard measuring range is 0...20 mA, which corresponds to 0...100 %. In order to get 0...100 % at 4...20 mA, 4 mA is entered as the new 0 % value in **parameter 2762**, the new measuring range now begins at 4 mA. Then values smaller than 4 mA are no longer evaluated. To activate the new setting, a device restart is required.

### 3.5 Wire break detection

For the 4...20 mA analog inputs, a wire break detection has been implemented. Via a parameter it is possible to define the signal level which sets the drive to error mode and performs an error reaction on demand. There are separate parameters available – one for each analog input (**parameter P2763 (0/1)**).

Parameter	Parameter name / Settings	Designation in MDA5	Function
<b>P2763</b>	CON_ANA_WireBreak_Th	Wire break threshold	Defining the detection level for the wire break condition
0	ANA0		Value for input IEA02
1	ANA1		Value for input IEA03

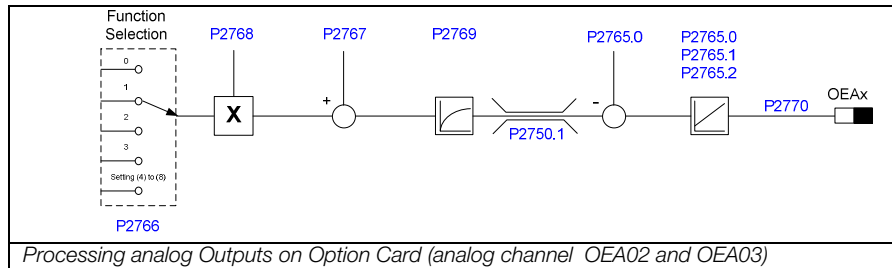
The failure reaction for this error detection is set via **parameter P0030**, Subindex 52. The following table gives an overview about the available failure reactions which can be set for the wire break error detection on an analog input.

Parameter	Parameter name / Settings	Designation in MDA5	Function
<b>P0030, Sub 52</b>	Error Reactions	Programmable reaction in case of an failure	Error Reaction
(0)	Ignore	Ignore error	The error is ignored
(1)	Specific1	Notify error, reaction is forced by internal PLC function block	A specific error reaction can be programmed via PLC.
(2)	Specific2	Notify error, reaction is forced by external control unit	Error reaction external
(3)	FaultReactionOption Code	Notify error, reaction as given by fault	The error reaction is based on the value set in object 605Eh "Fault reaction option

		reaction option code	code"
(4)	ServoStop	Notify error, execute quick stop and wait for restart of control	Quick stop, waiting for restart of control
(5)	ServoStopAndLock	Notify error, execute quick stop and wait for restart of control	Quick stop, block power stage, secure against switching on
(6)	ServoHalt	Notify error, disable power stage	Block power stage

Parameter	Parameter name/ Settings	Designation MDA5	Function
<b>P0030, Sub 52</b>	Error Reactions	Programmable reaction in case of an failure	Error Reaction
(7)	ServoHaltAndLock	Notify error, block power stage, protect against restart	Block power stage, block enable
(8)	WaitERSAndReset	Notify error, block power stage and reset only via switching off/on control voltage (24 V)	Block power stage, reset only by switching the 24 V control voltage off and back on

# 4 Analog Outputs



Parameter	Parametername / Settings	Designation in MDA5	Function
<b>P2750</b>	AIO_IO_Type	Analog current/voltage output switch	Output selector (+/-10V = 0, 0...20 mA = 1)
1	OEA02/03		Value for input ISA02
<b>P2765.0...5</b>			Calibration Parameters for OEA02/03 Function
<b>P2766</b>	TOPT_AIO_OUT_FS	Extended analog outputs: Function Selector	selector for analog outputs.
0	OEA02	Output function	OFF(0) = No function NACT(1) = actual speed TACT(2) = actual torque IRMS(3) = actual rms current PARA(4) = output value in P2770 ACTPOS(5) = actual position VDC(6) = actual DCbus voltage ACTPOS_MODULO(7) = actual modulo position
1	OEA03	Output function	
<b>P2767</b>	AIO_OUT_Offset	User-Offset	Defining the output value in [%] @ lower zero threshold
0	OEA02	Current offset	Offset for OEA02
1	OEA03	Current offset	Offset for OEA03

<b>P2768</b>	AIO_OUT_Scale		Scale factors for analog outputs
0	OEA02	Scale factor	Scale factor for OEA02
1	OEA03	Scale factor	Scale factor for OEA03
<b>P2769</b>	AIO_OUT_Filter		Filter time for analog outputs
0	OEA02	Filter time	Filter time OEA02
1	OEA03	Filter time	Filter time OEA03 Values
<b>P2770</b>	AIO_OUT_Values		of analog outputs at DAC Value of OEA02 at DAC
0	OEA02	Value DAC	Value of OEA03 at DAC
1	OEA03	Value DAC	

NOTE: It is possible to output an arbitrary value to the analog output from the internal PLC or via field bus by setting **P2766** to 4 and by writing the desired value directly in **P2770**.

Calibration of the analog outputs:

Connect the analog outputs via a multimeter and a load resistor > 250 ohms.

Set **parameter 2766** to PARA (4) then set an output value of 20 mA in **parameter 2770**. Transfer the displayed value at the multimeter in **parameter 2765** Sub1 for OEA02 and Sub 4 for OEA03.



Attention: The Analog Outputs are not short-circuit proof!

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