# MSD Servo Drive MSD PLC Function Package

Quick Start Guide

Programming in IEC 61131 for

MSD Servo Drive AC-AC Single-Axis System MSD Servo Drive DC-AC Multi-Axis System MSD Servo Drive Single-Axis Compact





MSD Servo Drive AC-AC Single-Axis System MSD Servo Drive DC-AC Multi-Axis System MSD Servo Drive Single-Axis Compact

MSD PLC Function Package Quick Start Guide

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Subject to technical change without notice.

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

We should nevertheless point out that this document cannot always be updated simultaneously with the on-going technical development of our products.

Information and specifications may be subject to change at any time. Please obtain information on the latest version at drives-support@moog.com.

# Using this document

#### Dear user,

This manual is aimed at you as a project engineer, commissioning engineer or programmer of drive and automation solutions.

It is a prerequisite that you are already familiar with CODESYS® as a result of attending an appropriate training course. We assume that your drive has already been commissioned - otherwise you should refer to the operation manual first.



#### Note:

This manual is valid for the servo drives MSD Servo Drive Single-Axis/Multi-Axis System and MSD Servo Drive Compact, which is why in the following you will only find the term MSD Servo Drive for short.

#### Pictograms







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# 1 Introduction

This documentation provides an overview of the functionality and usage of MSD PLC programming. By developing their own programs, users can expand the functionality of the MSD Servo Drive and MSD Servo Drive Compact.

# 1.1 PLC general

A PLC is a computer-based controller for the automation of electromechanical processes, as well as for controlling machines, assembly lines, fairground rides or lights. Unlike standard computers, the PLC has multiple inputs and outputs, expanded temperature ranges, immunity to electromagnetic interference and resilience to vibration and knocks. Programs for operating the machine are generally saved in non-volatile memory. The PLC is an example of a hard real-time system with states on the outputs that must be set with a limited time as a reaction to conditions on the inputs, as otherwise undesirable effects may occur [translated from Wikipedia in German].

## 1.1.1 MSD PLC characteristics

- No additional hardware is required.
- No additional firmware is required.
- The usage of MSD PLC in a device is only possible in conjunction with a valid licence key. Each device has a dedicated licence key. This key cannot be transferred to other devices.

# 1.1.2 Programming environment

MSD PLC programming is undertaken in the development environment CODESYS 3.5 SP10 using the programming languages from IEC 61131-3.

## 1.1.3 MSD PLC functions

- Standard functions such as timers, triggers, flip-flops, counters, etc. can be added using freely available libraries.
- Functions for single-axis positioning (absolute, relative and endless positioning).
- Motor control (start, stop, quick stop, hold)
- Status query and diagnostics
- Read and write access to all parameters
- Access to all inputs and outputs



Introduction

## 1.1.4 Performance

The cycle time for cyclic tasks is dependent on the spare computing time available in the servo controller's CPU (cycle time min. 1 ms, typically 5 ms).

The CPU's spare computing time is dependent on the drive functions used (control mode, type of profile generation, bus communication and bus cycle time, etc).

Cyclic access to pre-defined parameters: analog I/O, digital I/O and MSD PLC parameters (memory parameters & input variables).

The MSD PLC input variables are used to exchange data between the runtime system and higher level controllers. They can be read and written via a bus system. Direct access to IEC variables is not possible.

# 1.1.5 Further documentation

You will find further documentation at: www.moogsoftwaredownload.com/msd.html

3S-Smart Software Solutions GmbH provides "online help" for the CODESYS programming system.



Figure 1.1 CODESYS online help

# 2 MSD PLC system requirements

# 2.1 System requirements for the usage of MSD PLC

- MSD Servo Drive with MSD PLC licence
- "Moog DRIVEADMINISTRATOR 5" user software
- CODESYS 3.5 programming system: V3.5 SP10
- MSD Servo Drive device description file 2.0.1.1 or later
- MSD Servo Drive basic motion library 1.5.1.1 or later
- MSD Servo Drive standard library 1.3.0.0 or later

#### Software download from: www.moogsoftwaredownload.com/msd.html

#### NO COL

NOTE:

CODESYS version V3.5 SP10 is only compatible with the above-stated versions of the device description file, the basic motion library and the standard library. Appropriate software applications must be used with subsequent versions of CODESYS.

#### Backward compatibility as of firmware version 124.20-xx

As of firmware version 124.20-xx (MSD Servo Drive/Compact/Safety), CODESYS 3.5 SP10 is basically always usable with the libraries and device description associated with the firmware used. The CODESYS runtime version has been updated from firmware version 124.20-xx. Backward compatibility with older projects with older libraries and device descriptions is therefore no longer ensured. With dif-ferent versions, errors in program translation and/or transmission can occur. If an older project is to run on the newer CODESYS runtime, the project (archive) is required. This must be re-compiled and transmitted with CODESYS 3.5 SP10 and with the firmware and the associated libraries and device descriptions.

## MSD PLC licence key

The MSD Servo Drive must be ordered with the iPIc licence key. If a licence is included, the digit "1" is included in the article number. The licence can also be ordered separately. The article number for an individual licence is CA93105-001. The licence key must be entered with the aid of Moog DRIVEADMINISTRATOR 5 in the "Software Licence" dialog box.

Example article numbers for devices with PLC function package:

MSD Servo Drive Single-Axis System/Multi-Axis System/FS:G39X-XXX-XXXPXXXMSD Servo Drive Compact:G394-XXX-XXXPXXX

# 2.2 Licence key entry in Moog DRIVEADMINISTRATOR 5

If the PLC licence key is ordered subsequently, the key must be entered manually in the related dialog box in Moog DRIVEADMINISTRATOR 5.

Procedure:

- Open the project tree in Moog DRIVEADMINISTRATOR 5.
  In ▶ Drive Settings ▶ Administration ▶, open the "Software Licence" window.
- Set Licence level ▶ iPlc basic......
- Type the PLC licence key in the dialog box.
- Save the setting in the device (RAM to ROM).
- Restart the device.

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Serial number:	100300899	
Licence level:	iPlc basic(1) = iPlc basic licence	
Licence key:		AD13h

Figure 2.1 Software licence

# 2.3 Parameter settings in MSD Servo Drive

If the MSD PLC is not used for starting the control or the specification of reference values, no further settings are required. If the motor is controlled or reference values specified via the PLC, the related settings must be changed in the "Basic settings" window on the "Motion profile" tab.

Setting on the "Motion profile basic settings" tab

et control and reference	
Control via	PLC(4) = via IEC61131 program
Reference via	PLC_BASIC(4) = Profile via PLC definition (including IP Table)
Motor control start condition	ON(1) = Start/restart drive automatically in case of power or fault
rofile	
Profile mode	PG(0) = reference acts on profile generator
Profile type	LinRamp(0) = Linear ramp (trapeziodal profile)
terpolation	
Interpolation type	SplineII(3) = Cubic spline interpolation
mit	
Speed override	100 %
Reversing lock (Motor speed)	OFF(0) = No locking

Figure 2.2 Motion profile basic settings

Setting for the control mode on the "Control" tab:



Figure 2.3 Setting for the control mode

#### Summary of the settings:

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Parameter name	Parameter no.	Setting
MPRO_CTRL_SEL	P-0159 sub 0	PLC(4) = via IEC61131 program
MPRO_REF_SEL	P-0165 sub 0	PLCbasic(4) = profile via PLC definition
CON_CfgCon	P-0300 sub0	PCON(3) = position control mode
CON_REF_Mode	P-0301 sub 0	PG(0) = reference acts on profile generator
MPRO_DRVCOM_AUTO_START	P-0144 sub 0	ON(1) = start/restart drive automatically in case of power of fault
Table 2.1 Summary of MSD Serv	o Drive parameters settings	

# 2.4 CODESYS PLC application

## 2.4.1 Starting CODESYS

Click the icon to start CODESYS.



# 2.4.2 Installation of MSD Servo Drive device description file

The device description file must be installed once and contains device-specific information that is imperative for the connection between CODESYS and the MSD Servo Drive.

Installation:

- Open the Device Repository window (Tools Device Repository).
- Click the "Install..." button.
- Select the devdesc.xml file.
- Close window.

# MSD PLC system requirements

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on: System Repository				~	Edit Locatio
(C:\ProgramData\CODESYS\Dev	vices)				
ed device descriptions:					
ne	Vendor	Version	Description		Install.
Fieldbusses					Uninsta
HMI devices					
PLCs					Export.
SoftMotion PLCs					
CODESYS Control for x64	35 - Smart Software Solutions GmbH	3.5.2.0	CODESYS Soft-PLC for Windows with non realtime capabilities (CODESYS Control Win V3 x64)		
CODESYS Control RTE V3	35 - Smart Software Solutions GmbH	3.5.2.0	A CODESYS 3.x Soft PLC for Win32		0 1
CODESYS Control RTE V3	3S - Smart Software Solutions GmbH	3.5.10.30	A CODESYS 3.x Soft PLC with hard realtime for Win32		reposite
CODESYS Control RTE V3 x64	3S - Smart Software Solutions GmbH	3.5.10.30	A CODESYS 3.x Soft PLC for Win64		
- 🗐 CODESYS Control Win V3	3S - Smart Software Solutions GmbH	3.5.2.0	CODESYS Soft-PLC for Windows with non realtime capabilities (CODESYS Control Win V3)		
CODESYS Control Win V3	3S - Smart Software Solutions GmbH	3.5.10.30	CODESYS V3 Soft-PLC for Windows with non realtime capabilities (CODESYS Control Win V3)		
CODESYS Control Win V3 x64	3S - Smart Software Solutions GmbH	3.5.10.30	CODESYS V3 Soft-PLC for Windows with non realtime capabilities (CODESYS Control Win V3 x64)		
- 🔟 CODESYS HMI	3S - Smart Software Solutions GmbH	3.5.2.0	HMI runtime system		Deteile
🗐 MC600	Moog	1.8.0.0	Programmable Logic Controller Moog MC600		Details
MSD Servo Drive	Moog	2.0.0.5	MSD Servo Drive with internal PLC control		
SoftMotion drives			<b>∧</b>		
			<u> </u>		
					Close

Figure 2.4 Device repository

## 2.4.3 Installation of the "basic motion library"

The "basic motion library" must be installed once.

#### Installation

- Open the Library Repository window (Tools >Library Repository).
- Click the "Install..." button.
- Select the library file.
- Close window.

Location:	System	~	Edit Locations
	(C: \ProgramData\CODESYS\Managed Libraries)		
Installed libr	aries:		Install
Company:	(All companies)	$\sim$	Uninstall
Ap	plication	^	
<b>⊡</b> - <b>0</b>	Common		Export
• • • •	Composer		
<b>B</b>	Fieldbus		
<b>₽</b> 8	MOOG		
8	MSD Servo Drive		
	■ • MSD basic motion library Moog		
	MSD CAMlibrary Moog		
	Moog		Find
	Moog Moog		0.1.1
	MSD standard library Moog	~	Details
Group b	y category		Dependencies

Figure 2.5 Library repository

## 2.4.4 Creating a project

On the creation of a new project, all information necessary for the program download is assembled. A project contains the program code, the libraries used and the task configurations.

- Open new project using ► File ► New Project
- Click the "Standard project" icon (circle)
- Accept using "OK"



Figure 2.6 Creating a new project

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Standard P	roject		×
	You are abour objects within - One program - A program F - A cyclic task - A reference f	t to create a new standard project. This wizard will create the following a this project: nmable device as specified below LC_PRG in the language specified below .which calls PLC_PRG to the newest version of the Standard library currently installed.	
	Device:	MSD Servo Drive (Moog)	$\sim$
	PLC_PRG in:	Structured Text (ST)	$\sim$
		OK Cancel	

Figure 2.7 Standard project

The MSD Servo Drive must then be selected as the destination device.

The programming language can also be selected.

After you click the "OK" button, the workspace (column on the right) is displayed:

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### Illustration of the workspace



Figure 2.8 Workspace

- 1. Menu bar: selection of functions
- 2. Toolbar: quick access to individual tools.
- 3. **Devices:** project tree
- 4. Editor: for creating a project
- 5. **Messages:** errors, warnings, messages

Project tree for the PLC project:

#### 1. Device (MSD Servo Drive)

Programmable device with CODESYS runtime.

#### 2. Library Manager:

Management of all libraries that are used in a project. Libraries can provide functions, function blocks, data types, global variables and data displays.

#### 3. PLC\_PRG (PRG):

Contains the source code.

#### 4. Task Configuration:

The task configuration contains one or more tasks that control the execution of an application program.



Figure 2.9 Project tree

## 2.4.5 Adding the basic motion library

To be able to use to the full the functions provided by Moog, the "basic motion library" must be added to the CODESYS project:

- Double-click Library Manager on the project tree.
- Using the
  Add library

button, open the "Add Library" window.

inter a string for a fulltext search in all libraries	
Library	Company
• MAC_Alarming	3S - Smart Software Solutions GmbH
AC_DeviceDiagnosis	3S - Smart Software Solutions GmbH
••• AC_ModuleBase	3S - Smart Software Solutions GmbH
•100 AC_Persistence	3S - Smart Software Solutions GmbH
• M CANbus	3S - Smart Software Solutions GmbH
∾100 CommFB	3S - Smart Software Solutions GmbH
• EtherNetIP Services	3S - Smart Software Solutions GmbH
*100 File Access	3S - Smart Software Solutions GmbH
→100 iParServer	3S - Smart Software Solutions GmbH
•100 M_BB	Moog
• M_BB_HMI	Moog
•™ M_Can	Moog
M_Control	Moog
•™ M_IoDriver	Moog
M_License	Moog
M_MC600Hmi	Moog
M_MC600Specific	Moog
•10 M Orione	Moon

Figure 2.10 Adding a library

• Use the "Advanced..." button to open the expanded options. Select "Moog" as the company; the libraries from Moog installed in the library repository appear.

Select the "basic motion library" and accept your selection using the "OK" button; the library is added to the project tree.

Library p	Incoholder	
Elbrary P	laceholder	
Compan	y: Moog	~
	lication	
9	Moog	
	MOOG	
	MSD Servo Drive	
	•100 MSD basic motion library 1.5.1.1 Moog	
	MSD CAMlibrary 1.8.0.0 Moog	
	MSD CAM tools library 1.6.1.0 Moog	
	MSD communication library 1.2.0.0 Moog	
	MSD standard library 1.3.0.0 Moog	
🔋 Inte	ern	

Figure 2.11 Adding a library

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## 2.4.6 Configuration of the communication channel (gateway)

After creating the program, the communication channel must be selected and activated to log onto the device with CODESYS runtime.

- Via the project tree ► Device (MSD Servo Drive), open the "Device" dialog box.
- On the "Communication" tab, click the "Scan network..." button.
- Select the required destination device and set as the active device using "OK".



Figure 2.12 Communication settings

## 2.4.7 Device user logon

Device user logon is necessary after changing the active destination device and on logging onto the destination device for the first time.

Log onto device:

User name: = "root" Password: = "root"

Geräte	-Benutzeranmeldu	ng	×	
Sie sind im Moment nicht autorisiert, diese Aktion auf dem Gerät durchzuführen. Bitte geben Sie Benutzername und Passwort eines Benutzerkontos ein, das die entsprechenden Zugriffsrechte besitzt.				
	Gerätename:	Device (MSD Servo Drive)		
	Geräte-Adresse:			
	Benutzername:	root		
	Passwort:	••••		
		OK Abbreche	en	

Figure 2.13 Device user logon

## 2.4.8 Logging onto the destination device

Once the application is running correctly and the communications settings have been configured, you can connect the application to the destination system (MSD Servo Drive) using the "Logon" command and the stabilished button or the keyboard shortcut "Alt +F8". Online operation is then established.

## 2.4.9 Program start

After downloading the application to the destination device, the program is in the "STOP" state.

STOP	Program loaded

Figure 2.14 "STOP" program state

Start the program using the button on the toolbar or the keyboard shortcut "F5". The state indication changes correspondingly:

RUN	Program loaded

Figure 2.15 "RUN" program state

# 2.4.10 Program stop

Program execution can be stopped using the  $\blacksquare$  button or the keyboard shortcut "Shift + F8".

# 2.4.11 Creating a boot application

So that the application starts automatically when the destination device starts, there must be a boot application (<Applicationname>.app) on the destination device.

Downloading a boot application for the MSD PLC must be started explicitly.

For this purpose, connect to the destination system as described in the chapter "Logging onto the destination device".

The boot application is created using the menu  $\blacktriangleright$  "Online"  $\triangleright$  "Create boot application" and transmitted to the destination device.

# 2.4.12 I/O image incl. firmware input and output variables

Device input and output channels can be linked to IEC variables in the project via the I/O image.

Along with the digital inputs and outputs and the analog inputs, it is also possible to access firmware input and output parameters in the MSD PLC.

The firmware input and output variables are available for the data types INT, DINT as well as REAL to exchange data between the runtime system and higher level controllers.



The firmware inputs and output variables are in the volatile memory area and therefore lose their values on restarting the device!

The following device parameter areas are used in the MSD Servo Drive for this purpose:

#### Firmware output variables

Channel (CODESYS)	Data type	Device parameter number (DriveAdministrator 5)
PARA_INT_0 - PARA_INT9	INT	P-0850 – P-0859
PARA_INT_10 - PARA_INT19	INT	P-0880 – P-0889
PARA_DINT_0 - PARA_DINT9	DINT	P-0860 – P-0869
PARA_DINT_10 - PARA_DINT19	DINT	P-0890 – P-0899
PARA_REAL_0 - PARA_REAL9	REAL	P-0870 – P-0879
Table 0.0 Firmware output veriables		

Table 2.2Firmware output variables

#### Firmware input variables

	Channel (CODESYS)	Data type	Device parameter number (DRIVEADMINISTRATOR 5)
	PARA_IN_INT_0 - PARA_IN_INT19	INT	P-2450 - P-2469
	PARA_IN_DINT_0 - PARA_IN_DINT19	DINT	P-2470 - P-2489
	PARA_IN_REAL_0 - PARA_IN_REAL9	REAL	P-2490 - P-2499
1	T I I 0 0 E' I I I I I I		

Table 2.3 Firmware input variables

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# MSD PLC system requirements



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## 2.4.13 MSD PLC memory parameters

Along with the firmware input and output variables, for which the values are lost on restarting the device, parameters can also be saved in the MSD Servo Drive for usage in the MSD PLC.

The 20 INT, 20 DINT and 10 REAL parameters can be read using the functions

- MCB\_ReadIntParameter
- MCB\_ReadDintParameter
- MCB\_ReadRealParameter

in the Moog basic motion library and written using the functions

- MCB\_WriteIntParameter
- MCB\_WriteDintParameter
- MCB\_WriteRealParameter

The following device parameter areas are used in the MSD Servo Drive for this purpose:

#### MSD PLC memory variables

Name (DriveAdministrator 5)	Data type	Device parameter number (DriveAdministrator 5)
RTS_ITF_mem_Para_INT_0 - RTS_ITF_mem_Para_INT_19	INT	P-2500 - P-2519
RTS_ITF_mem_Para_DINT_0 - RTS_ITF_mem_Para_DINT_19	DINT	P-2520 - P-2539
RTS_ITF_mem_Para_REAL_0 - RTS_ITF_mem_Para_REAL_9	REAL	P-2540 - P-2549

Table 2.4 iPIc memory variables

The actual values for the MSD PLC memory parameters can be saved in non-volatile memory in the device using the function MCB\_CTR\_SaveDataSet.

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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.