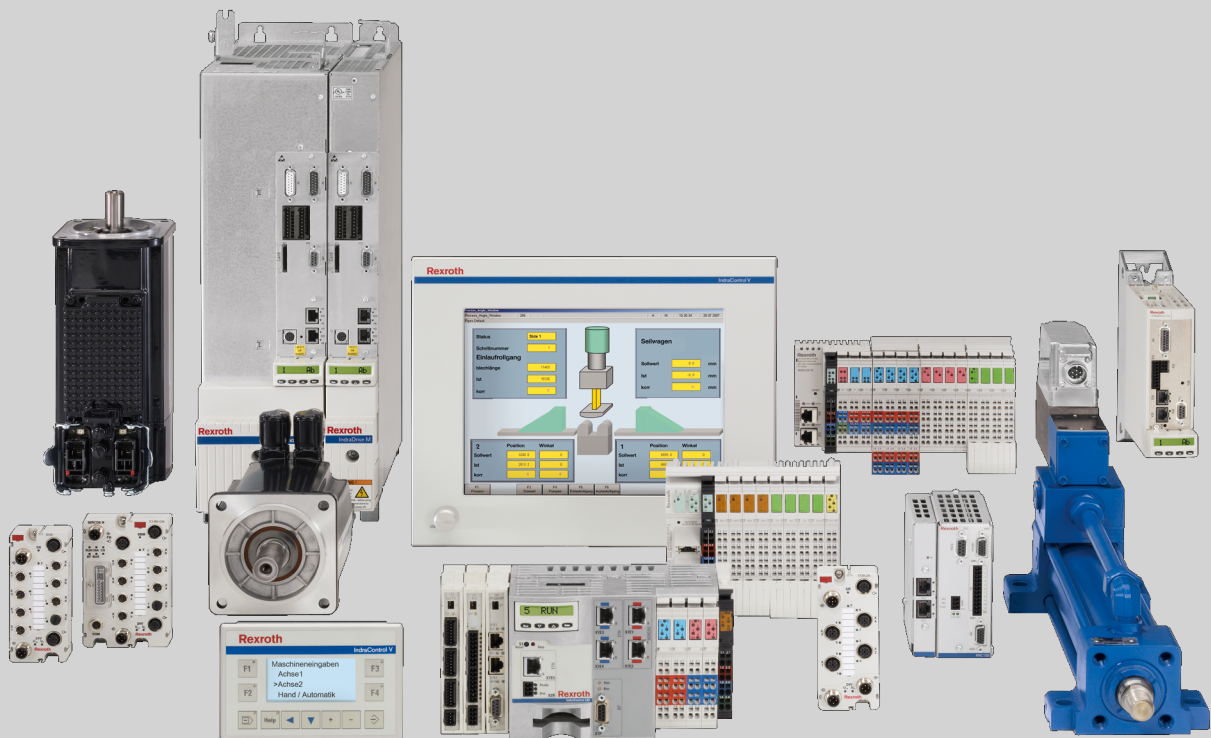


Hydraulic Functions

Edition 05



Title IndraMotion
MLC 14VRS
Hydraulic Functions

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01	2014-04	First edition
02	2015-09	MH_TechHydrMotion: Hydraulic central controller (ControlAxis)
03	2015-10	MH_TechHydrMotion: Hydraulic central controller (ControlAxis) together with MH_TechHydrBase
04	2015-11	MB_ValveControl, interface modification
05	2017-05	MH_TechHydrBase: MH_InitHydr MH_TechHydrMotion: MH_HydrCyclicBase, MH_ServiceCtrl

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Technology Functions Software (DC-IA/EHC43), HeSchl (TaDo/MePe)

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1 About this documentation

1.1 Validity of the documentation

Overview on target groups and product phases

In the following illustration, the framed activities, product phases and target groups refer to the present documentation.
Example: In the product phase "Engineering", the target group "programmer" can execute the activity "programming" using this documentation.

Required qualification: Individual who is able to assess the tasks assigned and to identify possible safety risks owing to qualification in the subject, knowledge and experience. The individual should also be familiar with the standards and regulations.

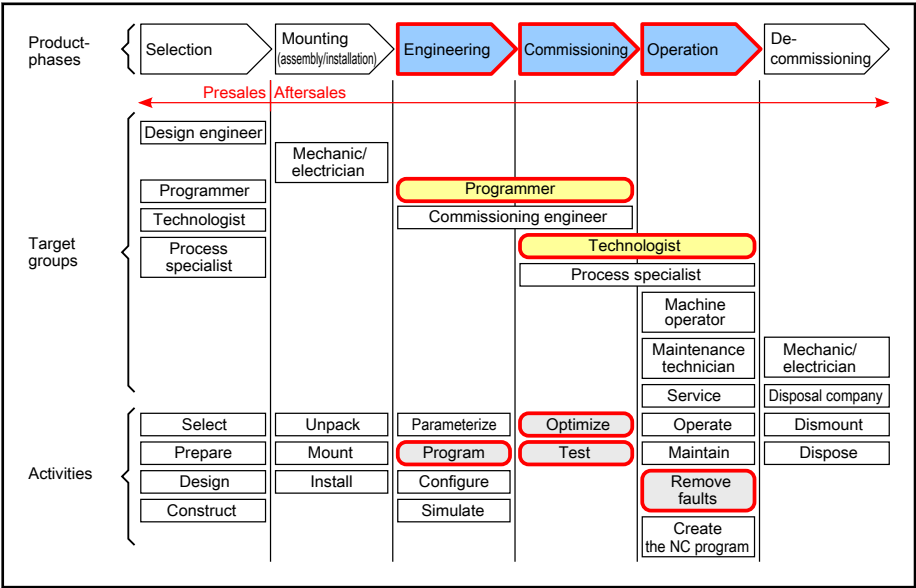


Fig. 1-1: Assigning the present documentation to the target groups, product phases and activities of the target group

1.2 Documentation structure

The documentation includes the description of the function blocks, functions and data types of the following libraries:

- [chapter 2 "MH_TechHydrBase.library" on page 13](#)
- [chapter 3 "MH_TechHydrMotion.library" on page 15](#)

1.3 Required and supplementing documentation XLC/MLC

Documentation titles with type codes and part numbers

System overview
IndraLogic XLC IndraMotion MLC 14VRS System Overview
DOK-XLCMLC-SYSTEM**V14-PRRS-EN-P, R911341504
This documentation provides an overview on the possible hardware/software components of the automation systems IndraLogic XLC and IndraMotion MLC of the mentioned version. The documentation facilitates assembling a system.

Tab. 1-1: XCL/MLC documentation overview - System overview

About this documentation

First steps
IndraMotion MLC 14VRS First Steps DOK-MLC***-F*STEP**V14-CORS-EN-P, R911341517 This documentation describes the first steps of the IndraMotion MLC and the RobotControl. It includes the hardware and software prerequisites as well as the creation of a project.
IndraLogic XLC 14VRS First Steps DOK-XLC***-F*STEP**V14-CORS-EN-P, R911341489 This documentation describes the first steps of the IndraLogic XLC. It includes the hardware and software prerequisites as well as the creation of a project.
Rexroth IndraLogic XLC IndraMotion MLC 14VRS Project Conversion DOK-XLCMLC-PROCONV*V14-APRS-EN-P, R911341494 This documentation describes the project conversion of the IndraMotion MLC.

Tab. 1-2: XCL/MLC documentation overview - First steps

Engineering
IndraWorks 14VRS Software Installation DOK-IWORKS-SOFTINS*V14-CORS-EN-P, R911344286 This documentation describes the IndraWorks installation.
IndraWorks 14VRS Engineering DOK-IWORKS-ENGINEE*V14-APRS-EN-P, R911343566 This documentation describes the application of IndraWorks in which the Rexroth Engineering tools are integrated. It includes instructions on how to work with IndraWorks and how to operate the oscilloscope function.
IndraLogic XLC IndraMotion MLC 14VRS Function Description DOK-XLCMLC-FUNC****V14-APRS-DE-P, R911341700 This documentation describes wizards, context menus, dialogs, control commissioning, device configuration and functionalities of the IndraMotion MLC.

Tab. 1-3: XCL/MLC documentation overview - Engineering

Diagnostics and service
IndraLogic XLC IndraMotion MLC 14VRS Diagnostics DOK-XLCMLC-DIAG****V14-RERS-EN-P, R911341481 This documentation includes all control diagnostics implemented in the control systems IndraLogic XLC and IndraMotion MLC.
IndraLogic XLC IndraMotion MLC 14VRS Parameters DOK-XLCMLC-PARAM***V14-RERS-EN-P, R911341479 This documentation describes the parameters of the XLC/MLC systems as well as the interaction between parameterization and programming. It includes the axis parameters, control parameters, kinematic parameters, touch probe parameters and programmable limit switch parameters.

Diagnostics and service
IndraLogic XLC IndraMotion MLC 14VRS Commissioning DOK-XLCMLC-STARTUP*V14-CORS-EN-P, R911341502 This documentation describes the steps to commission and service the IndraMotion MLC and IndraLogic XLC systems. It includes checklists for frequent tasks and a detailed description of the steps.
IndraWorks IndraMotion Service Tool DOK-IWORKS-IMST*****-APRS-DE-P, R911341383 This documentation describes the IndraMotion Service Tool (IMST). IMST is a web-based diagnostic tool used to access a control system via an Ethernet high-speed connection. The IMST allows OEMs, end users and service engineers to access and remotely diagnose a system. The PC has to use at least Internet Explorer 8, Firefox 3.5 or a higher version. The following control variants are supported: • IndraMotion MLC L25/L45/L65/L75/XM12/XM2/VPx • IndraLogic XLC L25/L45/L65/L75

Tab. 1-4: XLC/MLC documentation overview - Diagnostics and service

Firmware
Rexroth IndraDrive MPx-20, Functions ¹⁾ DOK-INDRV*-MP*-20VRS**-AP01-EN-P, R911345608 This documentation describes all functional properties of the IndraDrive firmware in the variants MPB-20, MPM-20, MPC-20 and MPE-20.
Rexroth IndraDrive MPx-16 to MPx-20 und PSB, Parameters DOK-INDRV*-GEN1-PARA**-RERS-EN-P, R911328651 This documentation contains the descriptions of all parameters implemented in the firmware for drive controllers of the IndraDrive range. It supports the drive controller parameterization.
Rexroth IndraDrive MPx-16 to MPx-20 and PSB, Diagnostic Messages DOK-INDRV*-GEN1-DIAG**-RERS-EN-P, R911326738 This documentation contains the descriptions of all diagnostic messages implemented in the following firmware products: • Drive controller firmware variants MPx-16 to MPx-20 • PSB firmware variants for "HMU05" and "KMOV03" type supply units • Firmware variants for "HMOV01" type supply units It assists machine operators and installation programmers with troubleshooting.
Hardware
Rexroth IndraDrive Control Sections CSB02, CSE02, CSH02, CDB02 DOK-INDRV*-Cxx02*****-PRRS-EN-P, R911338962
Rexroth IndraDrive Cs Drive Systems with HCS01 DOK-INDRV*-HCS01*****-PRRS-EN-P, R911322210
Rexroth IndraDrive Mi Drive Systems with KCU02, KSM02, KMS02/03, KMOV03 DOK-INDRV*-KCU02+KSM02-PRxx-EN-P, R911335703
Rexroth IndraDrive ML Drive Systems with HMU05 DOK-INDRV*-Hxx05*****-PRxx-EN-P, R911344279

¹⁾ In preparation
Tab. 1-5: Overview of documentations for drive controllers

About this documentation

PLC
IndraWorks 14VRS PLC Programming System IndraLogic 2G DOK-IWORKS-IL2GPRO*V14-APRS-EN-P, R911343571 This documentation describes the PLC programming tool IndraLogic 2G and its usage. It includes the basic use, first steps, visualization, menu items and editors.
IndraWorks 14VRS Basic Libraries IndraLogic 2G DOK-IL*2G*-BASLIB**V14-LIRS-EN-P, R911343920 This documentation describes the system-comprehensive PLC libraries.
IndraLogic XLC IndraMotion MLC 14VRS PLCopen Libraries DOK-XLCMLC-FUNLIB**V14-LIRS-EN-P, R911341491 This documentation describes the function blocks, functions and data types of the RIL_CommonTypes, ML_Base and ML_PLCopen libraries for the IndraLogic XLC/IndraMotion MLC. It also includes the error reactions of function blocks.

Tab. 1-6: XCL/MLC documentation overview - PLC

Field buses
IndraWorks 14VRS Field Buses DOK-IWORKS-FB*****V14-APRS-EN-P, R911341485 This documentation describes the field bus and local periphery connections supported by the IndraLogic XLC, IndraMotion MLC and IndraMotion MTX systems. The focus of this documentation is on the configuration, parameterization, commissioning and the diagnostics of the different periphery connections. This documentation is the basis for the online help.
IndraWorks 14VRS Field Buses Libraries DOK-IWORKS-FB*LIB**V14-LIRS-EN-P, R911343575 This documentation describes the field bus libraries: RIL_ProfibusDP_02, RIL_ProfibusDP Slave, RIL_ProfinetIO, RIL_ProfinetIODevice, RIL_EtherNetIPAdapter, RIL_MappingList, RIL_SERCOSIII, RIL_Inline including their diagnostics and error reactions of the function blocks.
Rexroth IndraWorks 12VRS FDT Container DOK-IWORKS-FDT*CON*V12-APRS-EN-P, R911334398 This documentation describes the IndraWorks FDT Container functionality. It includes the activation of the functionality in the project and working with DTMs.
Sercos System Manual for I/O Devices DOK-CONTRL-ILS3*****-APxx-EN-P, R911333512 This documentation describes the configuration, parameterization, commissioning and diagnostics of I/O devices with a Sercos interface.

xx

Corresponding edition

Tab. 1-7:

XCL/MLC documentation overview - Field buses

HMI
IndraWorks 14VRS HMI DOK-IWORKS-HMI*****V14-APRS-EN-P, R911343569 This documentation describes the functions, configuration and operation of the user interfaces IndraWorks HMI Engineering and IndraWorks HMI Operation.
IndraWorks 14VRS WinStudio 7.4 DOK-IWORKS-WINSTUD*V14-APRS-EN-P, R911341585 This "User Manual and Technical Reference Book" facilitates working with the "Rexroth WinStudio" software for optimal results. This document provides technical information and step-by-step instructions to create web-enabled HMI/SCADA programs.
Rexroth IndraLogic XLC IndraMotion MLC 14VRS HMI Connection DOK-XLCMLC-HMI*****V14-APRS-EN-P, R911341497 This documentation describes the visualization systems supported by the IndraLogic XLC and IndraMotion MLC and their connection.

Tab. 1-8: XCL/MLC documentation overview - HMI

Technology
IndraLogic XLC IndraMotion MLC 14VRS Generic Application Template DOK-XLCMLC-TF*GAT**V14-APRS-EN-P, R911341487 This documentation provides a structured template to the IndraLogic PLC programmer. This template can be used to add and edit the PLC programming code. It includes the template, the template wizard and example applications.
IndraMotion MLC 14VRS Technology Libraries DOK-MLC***-TF*LIB**V14-LIRS-EN-P, R911341511 This documentation describes the function blocks, functions and data types of the "ML_TechInterface.library", "ML_TechMotion.library", "RMB_TechCam.library" and "ML_TechBase.library". It also includes libraries for the winder functionality, register controller functionality and CrossCutter functionality.
IndraWorks 14VRS Energy Efficiency Management DOK-IWORKS-4EE*****V14-APRS-EN-P, R911339229 This documentation describes the HMI connection of the energy management system and the function blocks, functions and data types of the "RIL_4EE " library. The documentation also includes the error reactions of the function blocks.
Rexroth IndraMotion MLC 14VRS RegisterControl (Library) DOK-MLC***-REGI*CO*V14-LIRS-EN-P, R911341509 This documentation describes the inputs and outputs of the individual function blocks and provides notes on their use.
IndraMotion MLC 14VRS RegisterControl (Application Description) DOK-MLC***-REGI*CO*V14-APRS-EN-P, R911341507 This documentation describes the application of the integrated register control for a rotogravure printing machine. The components of the mark stream sensor, the HMI application and the error recovery options are described. This instruction provides information on how to operate the register control, react to errors and query diagnostics. This documentation is written for machine setters and machine operators.
Rexroth IndraMotion MLC 14VRS Winder Function Application DOK-MLC***-TF*WIND*V14-APRS-EN-P, R911341513 This application-related system documentation describes the application of the winder technology functions.

About this documentation

Technology
Rexroth IndraWorks CamBuilder 13VRS DOK-IWORKS-CAMBUIL*V13-APRS-EN-P, R911336291 This documentation describes the basic principles and operation of the CamBuilder, the cam editing tool.
IndraMotion MLC 14VRS Robot Control V2 DOK-MLC***-ROCO****V14-RERS-EN-P, R911341588 This documentation provides information about the Robot Control V2. The focus is on PLCopen programming. The program structure, variables, functions, motion statements and the required system parameters are described. This documentation also includes the description of the "ML_Robot" library. Robot Control V2 is supported by a kinematic interface. The components of this interface are described in the "ML_KinTech" library.

Tab. 1-9: XCL/MLC documentation overview - Technology

Open Core Engineering - OCE
IndraLogic XLC IndraMotion MLC 14VRS First Steps MLPI DOK-XLCMLC-MLPI****V14-CORS-EN-P, R911341033 This document describes the installation and the commissioning of the MLPI interface.
IndraLogic XLC IndraMotion MLC 14VRS Automation Interface DOK-XLCMLC-AUT*INT*V14-APRS-EN-P, R911341499 This documentation describes the script-based access to IndraWorks project data via the interface of the Automation Interface.

Tab. 1-10: XCL/MLC documentation overview - Open Core Engineering - OCE

SafeLogic
IndraWorks SafeLogic 14VRS First Steps DOK-IWORKS-SL*STEP*V14-CORS-EN-P, R911341520 This documentation describes the initial commissioning of the Safety function module and its external Safety periphery. Taking the example of a project, all required steps to commission a simple Safety application are executed.
IndraLogic XLC IndraMotion MLC 14VRS SafeLogic System Overview DOK-XLCMLC-SL**SYS*V14-PRRS-EN-P, R911341696 This documentation describes the project planning, configuration, creation and commissioning of safety-related devices.
IndraWorks 14VRS SafeLogic - Project Configuration, Version 1.2.0.0. DOK-IWORKS-SL**PRJ*V14-APRS-EN-P, R911341694 This documentation describes the configuration of Safety applications.
IndraControl CFL01.1-F1 Safety Function Module DOK-CONTRL-SL**FM*****-ITRS-DE-P, R911336576 This documentation is provided with the hardware and describes the commissioning, the installation, the decommissioning and disposal of the hardware.

Tab. 1-11: XCL/MLC documentation overview - SafeLogic

Hardware
Rexroth IndraControl L45/L65/L85 Control DOK-CONTRL-ICL45L65L85-PRxx-EN-P, R911332116 This documentation describes the IndraControl L45/L65/L85 controls.
Rexroth IndraControl L25 DOK-CONTRL-IC*L25****-PRxx-EN-P, R911328474 This documentation describes the IndraControl L25 controls.
Rexroth IndraControl Lxx 14VRS Function Modules DOK-CONTRL-FM*LXX**V14-APRS-EN-P, R911341583 This documentation describes all function modules of the Lxx controls including engineering and diagnostics.

xx Corresponding edition
 Tab. 1-12: XCL/MLC documentation overview - Hardware

Hydraulics
Rexroth IndraMotion MLC 14VRS Hydraulic Functions DOK-MLC***-TF*HMOT*V14-LIRS-EN-P, R911341907 This documentation describes the function blocks, functions and data types of the MH_TechHydrBase and MH_TechHydrMotion libraries. The documentation also includes the error reactions of the function blocks.
Rexroth IndraLogic XLC IndraMotion MLC 14VRS Sequential Programming DOK-XLCMLC-SEQPROG*V14-LIRS-EN-P, R911341909 This documentation describes the sequential programming options, also when using GAT, and the MH_HydrControlProg library.

Tab. 1-13: XCL/MLC documentation overview - Hydraulics

1.4 Use of the safety instructions

1.4.1 Structure of the safety instructions

The safety instructions are structured as follows:

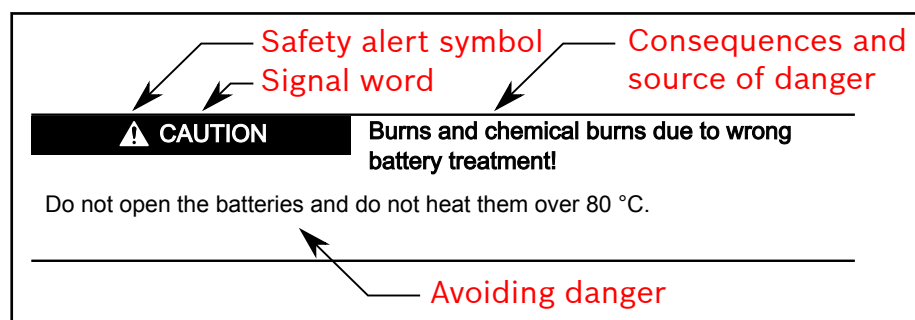


Fig. 1-2: Structure of the safety instructions

1.4.2 Explaining signal words and safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6-2006).

The signal word is used to draw attention to the safety instruction and also provides information on the severity of the hazard.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words danger, warning and caution is used to alert the reader to personal injury hazards.

About this documentation

** DANGER**

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

** WARNING**

In case of non-compliance with this safety instruction, death or serious injury **can** occur.

** CAUTION**

In case of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTICE

In case of non-compliance with this safety instruction, material damage can occur.

1.4.3 Symbols used

Hints are represented as follows:



This is an information.

Tips are represented as follows:



This is a tip.

1.4.4 Signal graphic explanation on the device



Prior to the installation and commissioning of the device, refer to the device documentation.

1.5 Terms and abbreviations

Term	Explanation
ACS	Axis coordinate system
CANopen	Field bus
CIL	Compiled instruction list
DeviceNet	Field bus
Ethernet	Communication interface
F-key	Function key
HMI	User interface
IWE	IndraWorks Engineering
IWO	IndraWorks Operation
M-key	Machine key
MBF	Machine control panel
MCS	Machine coordinate system
MDI	Manual data input
MSD	Machine status display
NC	Numerical control
OEM	Original equipment manufacturer
OP-key	Operating key
POU	Program organization unit
PROFIBUS DP	Field bus
Sercos	Sercos is a world-wide standardized interface for the communication between controls and drives
WCS	Workpiece coordinate system

Tab. 1-14: Names and abbreviations used

About this documentation

1.6 Customer feedback

Customer requests, comments or suggestions for improvement are of great importance to us. Please email your feedback on the documentations to Feedback.Documentation@boschrexroth.de. Directly insert comments in the electronic PDF document and send the PDF file to Bosch Rexroth.

2 MH_TechHydrBase.library

2.1 Introduction and overview

Prerequisites



The library requires the **HYD (hydraulics) function package** of the control.

This library includes basic function blocks to use the hydraulic-specific functions (only one function block is currently available).

The library **MH_TechHydrBase** contains the following function block:

Function block	Description
MH_InitHydr, page 13	The function block MH_InitHydr is a prerequisite when using the function blocks from the libraries MH_HydrControl, MH_SynchControl and MH_TechHydrMotion. This function block configures hydraulic-specific Sercos parameters in the user channel for each axis of the type Hydraulic Drive (FWA-HYDRV*-HDB or -HDC as of version 20) or IndraDrive with PFC technology function (as of version 2) or IndraDrive (with position mode) created in the project. Axes disabled in IndraWorks are ignored.

Tab. 2-1: Function blocks of the MH_TechHydrBase Library

2.2 MH_InitHydr

Brief description

The function block MH_InitHydr is a prerequisite when using the function blocks from the libraries MH_HydrControl, MH_SynchControl and MH_TechHydrMotion.

This function block configures hydraulic-specific Sercos parameters in the user channel for each axis of the type Hydraulic Drive (FWA-HYDRV*-HDB or -HDC as of version 20) or IndraDrive with PFC technology function (as of version 2) or IndraDrive (with position mode) created in the project.

Axes disabled in IndraWorks are ignored.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 2-2: Reference table of the MH_InitHydr

Interface description

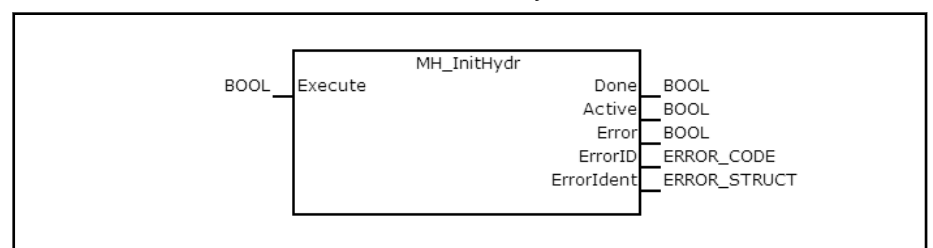


Fig. 2-1: Function block of the MH_InitHydr

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Starts the initialization
VAR_OUTPUT	Done	BOOL	Initialization completed
	Active	BOOL	Function block active, axes are initialized

MH_TechHydrBase.library

	Name	Type	Comment
	Error	BOOL	Indicates that an error occurred
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Detailed error information "Error codes" on page 14

Tab. 2-3: Function block of the MH_InitHydr

Functional description	Upon phase startup, the Sercos user channel is configured and extended by specific parameters. Subsequently, a parameter handle is created for each configured parameter and entered into the InitHydr structure. A list of parameter handles is available for each axis in this structure to write on or retrieve parameters for specific hydraulic functions (e.g. MH_ForceLimitOn or synchronous operation axis) that are transferred non-cyclically in the Sercos channel by default. The following parameters are configured for example: • S-0-0550, Torque/force command value positive • S-0-0551, Torque/force command value negative • P-0-02853, Alternating control, control word 1
Error codes	The function block uses the error table F_RELATED_TABLE, 16#0170. The function block can generate the following error messages in Additional1 or Additional2:

ErrorID	Additional1	Additional2	Description
STATE_MACHINE_ERROR, 16#0005	16#00000006	16#00000000	Runtime error in function block: Invalid state of the state machine

Tab. 2-4: Error numbers of the function block MH_InitHydr

3 MH_TechHydrMotion.library

3.1 Introduction and overview

Prerequisites

 The library requires the **HYD (hydraulics) function package** of the control.

Application

The MH_TechHydrMotion library includes important function blocks to traverse hydraulic axes.

 Some function blocks of the MH_TechHydrMotion library require a previous initialization of the MH_InitHydr function block. This function block is provided by the MH_TechHydrBase library.

The "Force" function blocks are generally used to generate force command values. In contrast to the "Torque" command, the force command values are parallelly calculated to the position command values. These commands are used to allow an "alternating control" not defined in the PLCopen state machine. "Alternating" means that force and position control can alternate and thus require their command values parallelly. A transition to the force control within the axis controller takes place following a parameterizable logic. It is also returned to the position control by using a parameterizable logic of the controller.

The "Force" function blocks are provided for axes supporting the alternating control.

- Hydraulic central controller (ControlAxis)
- HydraulicDrive: FWA-HYDRV*-HDB as of version 20 or FWA-HYDRV*-HDC as of version 20
- IndraDrive with PFC technology function (as of version 2)

 Before using the MH_ForceLimit'XXX' function blocks of the MH_TechHydrMotion library, call the function block [MH_ForceLimitBase](#) on page 39 or MH_HydrCyclicBase.

 When using the alternating control, it is reasonable to use the function block [MH_ForceLimitPosOff](#) on page 50 instead of MC_Stop.

The command disables the alternating control and stops the force command value generation.

The input parameter "IpoMode" at the "Force" command value generation function blocks ensures a defined behavior of the position IPO (= interpolator command value generation).

The "IpoMode" input can select between three values and thus determines the behavior of the position command value calculation (IPO) if the force controller controls the axis (ForceControl = true):

"Continue"	The position command value calculation is not affected.
"Break"	The position command value calculation is stopped as long as the force controller is active.
"Jump"	The position command value jumps to the target, i.e. returning to the position control is not desired.

MH_TechHydrMotion.library

In this mode, the position IPO can be affected via the "IPO interface". The interface allows a direction-dependent interruption and continuation of the position calculation as well as the specification of position command values and initiation of the IPO to set the command value to the target value.

If a "Force" function block is started, it cancels an already running "Force" function block. Thus, only one "Force" function block with a changing force command value is active per axis.



When using the MH_ForceLimit'XXX' function blocks, the alternating control has to be parameterized correctly in the axis.

Among others, the following parameters can be set for the alternating control.

P-0-2854	Alternating control, control word 2
	Bit 1: Lock for changing back (after pos. reg.)
	Bit 2: Absolute switching threshold enabled
P-0-2856.0.1	Alternating control, switching threshold
P-0-2856.0.2	Alternating control, relative switching window
P-0-2856.0.4	Alternating control, switch-on delay time
P-0-2856.0.5	Alternating control, ramp time

The library MH_TechHydrMotion contains the following function blocks:

Function block	Description
MH_ForceLimitBase, page 39	This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control. One instance of this function block has to be called cyclically per axis (motion task). The instance call has to be executed at the first position of the task to be called before all other "ForceLimit" function blocks.
MH_ForceLimitOn, page 41	The function block specifies a force command value jump or a command force ramp to the force controller. The force controller (in the alternating control) of the axis is enabled.
MH_ForceLimitOnFT, page 44	The function block specifies a force command value profile with regard to the time profile to the force controller. The force controller (in the alternating control) of the axis is enabled. Only for hydraulic central controllers.
MH_ForceLimitOnFS, page 46	The function block specifies a force command value profile with regard to the current axis position for the force controller. The force controller (in the alternating control) of the axis is enabled. Only for hydraulic central controllers.
MH_ForceLimitOnFX, page 48	The function block specifies a force command value profile with regard to an input variable for the force controller. The force controller (in the alternating control) of the axis is enabled. Only for hydraulic central controllers.
MH_ForceLimitPosOff, page 50	This function block stops the axis. The function block stops the positioning as well as the force control (when using the alternating control). Position and force value generation are stopped.
MH_ForceLimitOff, page 52	The function block stops the generation of the force command values of the function blocks MH_ForceLimitOn'XXX'. The alternating control is disabled.

Function block	Description
MH_ForceLimitBreak, page 53	The function block aborts the generation of the force command values of the function blocks MH_ForceLimitOn'XXX'. For HydraulicDrive and hydraulic central controllers
MH_ForceLimitCont, page 54	The function block continues the generation of the force command values of the function blocks MH_ForceLimitOn'XXX'. For HydraulicDrive and hydraulic central controllers
MH_ForceLimitStop, page 56	The function block stops the generation of the force command values of the function blocks MH_ForceLimitOn'XXX' and stops the currently running "Force" function block. The force controller (in the alternating control) of the controller continues running. For HydraulicDrive and hydraulic central controllers
MB_MoveAbsPDB, page 18	The function block allows a controlled positioning with a hard or soft deceleration ramp or a positioning like the command MC_MoveAbsolute. It can be switched between the two motion modes during positioning. For HydraulicDrive and hydraulic central controllers
MB_MoveProfile, page 20	The function block traverses the specified axis in a specified profile that can contain up to ten positions. A new velocity, acceleration and deceleration can be specified for each position. For HydraulicDrive and hydraulic central controllers, the command support the "path-dependent braking" (PDB).
MB_MoveAbsVRest, page 24	The function block executes an axis motion as in case of the MB_MoveAbsPDB function block. However, the axis continues approaching the end position with a remaining velocity. For HydraulicDrives and hydraulic central controllers, the command supports the "path-dependent braking" (PDB).
MB_MoveAbsVRestBase, page 28	The function block executes an axis motion as in case of the MB_MoveAbsPDB function block. However, the axis continues approaching the second position with a remaining velocity. For HydraulicDrives and hydraulic central controllers, the command supports the "path-dependent braking" (PDB).
MB_MovePositionSX, page 30	The function block can specify a command position with regard to a variable input variable to an axis.
MH_ServiceCtrl, page 34	The function block is exclusively used for axes without controller enabled and directly outputs an analog signal to the valve (controlled traversing in error case for example). The signal shape can either be a jump or a ramp. For HydraulicDrive and hydraulic central controllers. Note: For Hydraulic Drive, the signal shape "ramp" is only as good as allowed by the acyclic transmission of the service command value parameter between the MLC and the drive.
MH_ValveDirectCtrl, page 35	The function block outputs an analog signal to the valve using the operation mode "Direct valve control". The signal shape can either be a jump or a ramp. For HydraulicDrives and hydraulic central controllers.
MB_ValveControl, page 37	The function block enables the operation mode "Direct valve control" and the drive follows the command value specification.
MH_HydrCyclicBase, page 40	This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control. One instance of this function block has to be called cyclically per axis (motion task). The instance call has to be executed at the first position of the task to be called before all other "ForceLimit" function blocks.
Please do not use outdated function blocks anymore...	
MH_MoveAbsPDB	If the function block is outdated, use the function block MB_MoveAbsPDB, page 18 .

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Function block	Description
MH_MoveProfile	If the function block is outdated, use the function block MB_MoveProfile , page 20.
MH_MoveAbsVRest	If the function block is outdated, use the function block MB_MoveAbsVRest , page 24.
MH_MoveAbsVRest2	If the function block is outdated, use the function block MB_MoveAbsVRestBase , page 28.
MH_AnalogRamp	If the function block is outdated, use the function blocks MH_ValveDirectCtrl , page 35 or MH_ServiceCtrl , page 34.

Tab. 3-1: Function blocks of the MH_TechHydrMotion library

3.2 General function blocks

3.2.1 MB_MoveAbsPDB

Brief description The function block allows a controlled positioning with a hard or soft deceleration ramp or a positioning like the command MC_MoveAbsolute. It can be switched between the two motion modes during positioning.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-2: Reference table of the MB_MoveAbsPDB

Interface description

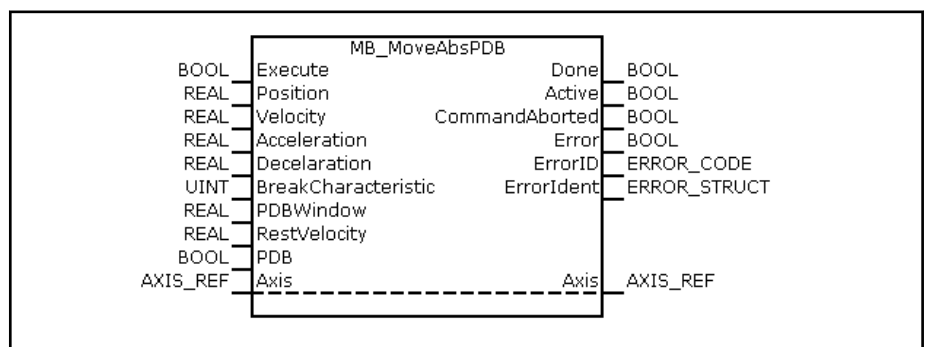


Fig. 3-1: Function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	Position	REAL	Target position acc. to unit/scaling of the axis
	Velocity	REAL	Traveling velocity acc. to unit/scaling of the axis
	Acceleration	REAL	Acceleration acc. to unit/scaling of the axis
	Deceleration	REAL	Deceleration acc. to unit/scaling of the axis
	BreakChar- acteristic	UINT	WAB (path-dependent braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
	PDBWindow	REAL	WAB (path-dependent braking) window
	RestVelocity	REAL	WAB (path-dependent braking) remaining velocity

	Name	Type	Comment
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MC_MoveAbsolute
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	Error	BOOL	An error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 20
	CommandAborted	BOOL	Command aborted by subsequent command
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-3: Function block inputs/outputs

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def.	n. def.	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def.	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			0	Rising edge at Execute
RestVelocity	REAL	0.0	n. def.	0.0	Rising edge at Execute
PDB	BOOL			FALSE	Rising edge at Execute

Tab. 3-4: Input behavior

Functional description The function block moves the axis either via MC_MoveAbsolute or controlled to the target position. While traveling, it can be switched between the two motion modes.

In the controlled motion mode, the axis travels in velocity control.

The axis is decelerated with the requested break characteristics to the point PDBWindow / RestVelocity.

The axis is in position control in the target.

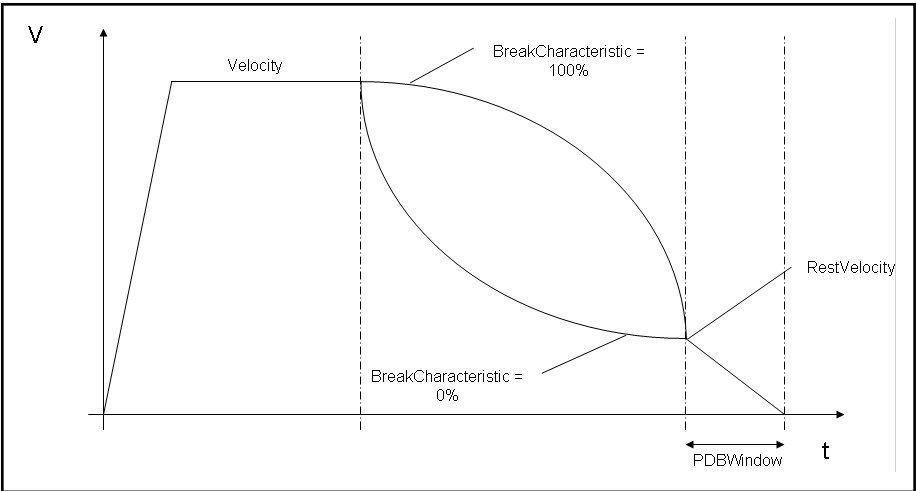


Fig. 3-2: Example of a velocity curve

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes *The error codes of the following function blocks are generated:*

- MC_MoveAbsolute
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.2.2 MB_MoveProfile

Brief description The function block traverses the specified axis in a specified profile that can contain up to ten positions.

The function block supports the path-dependent braking (PDB).

A new velocity, acceleration and deceleration can be specified for each position. There is a smooth transition between the target positions, i.e., the axis does not stop. At the next target position, it switches immediately to the new velocity and moves to the next target until the end position of the profile is reached.

To use this function block, connect power before via an instance of MC_Power (for real axis).

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-5: Reference table of the MB_MoveProfile

Interface description

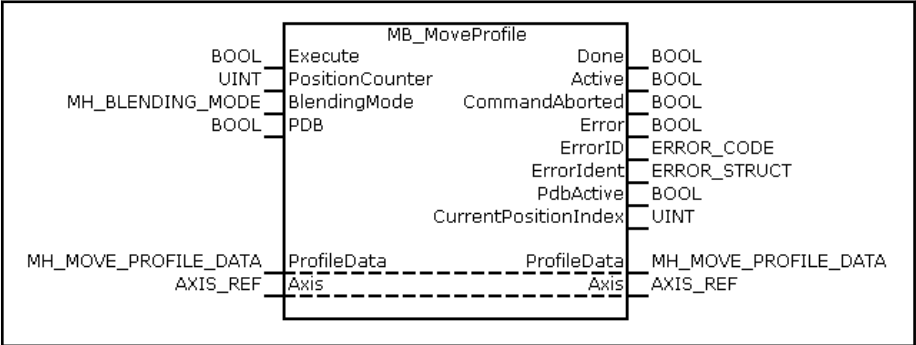


Fig. 3-3: Function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Starts the motion at a rising edge
	Position-Counter	UINT	Number of positions in the profile
	Blending-Mode	UINT	Blending mode: 0 = BlendingPrevious 1 = BlendingLow
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MoveAbs
VAR_OUTPUT	Done	BOOL	Processing completed without errors, output data valid
	Active	BOOL	Processing active, output data invalid
	CommandAborted	BOOL	The function block was aborted
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 24
	PdbActive	BOOL	WAB (path-dependent braking, PDB) is active
	CurrentPositionIndex	UINT	Current position counter
VAR_IN_OUT	ProfileData	MH_MOVE_PROFILE_DATA	Structure of position/velocity/acceleration/deceleration arrays "MH_MOVE_PROFILE_DATA" on page 21
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-6: Function block inputs/outputs

Min./max. and default values of the inputs

Name	Type	Min. value	Max. value	Default value	Effective
PositionCounter	UINT	1	10	0	Rising edge at "Execute"
BlendingMode	UINT	0	1	0	Rising edge at "Execute"

Tab. 3-7: Input behavior

MH_MOVE_PROFILE_DATA

Name	Type	Min. value	Max. value	Default value	Effective	Description
Position	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at "Execute"	Position array of the profile to be traveled.
Velocity	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at "Execute"	Velocity array for the profile to be traveled.

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Name	Type	Min. value	Max. value	Default value	Effective	Description
Acceleration	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at "Execute"	Acceleration array of the profile to be traveled.
Deceleration	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at Execute	Deceleration array for the profile to be traveled.
Break-Characteristic	UINT	0	100	0	Rising edge at "Execute"	WAB (path-dependent braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
PDBWindow	REAL	n. def	n. def	0	Rising edge at Execute	WAB (path-dependent braking) window
RestVelocity	REAL	0	n. def	0	Rising edge at Execute	WAB (path-dependent braking) remaining velocity

Tab. 3-8: Input behavior of the MH_MOVE_PROFILE_DATA structure

Functional description

1. Blending modes

The function block "MB_MoveProfile" is provided with two blending modes:

- BlendingPrevious

In this mode, it is only switched to the next velocity after the approached position was reached.

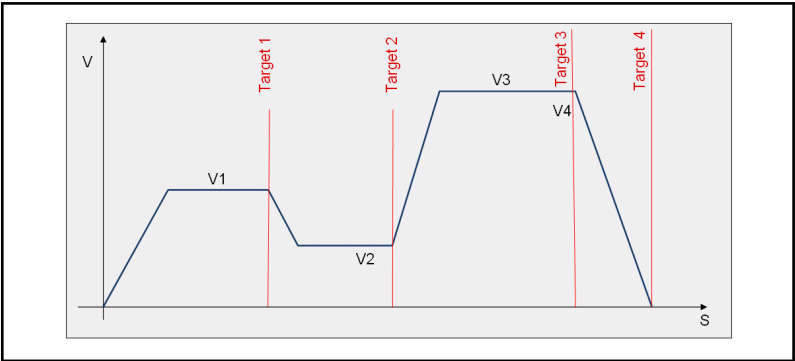


Fig. 3-4: Positioning for the velocity profile in "BlendingPrevious"

- BlendingLow

In this mode, the velocity of the following target position has already to be reached when reaching the current target position.



This mode is only for falling and not for rising velocities.

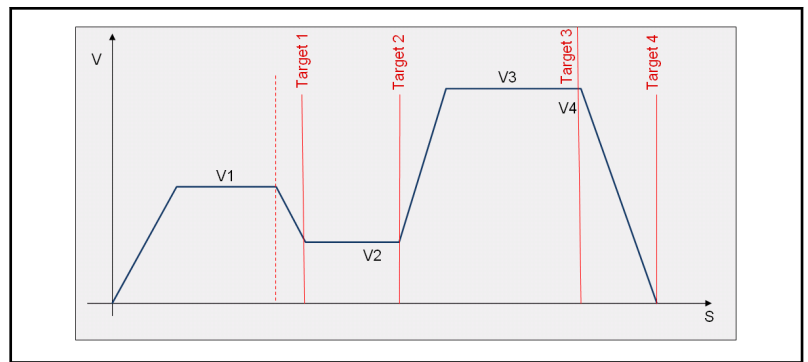


Fig. 3-5: Positioning for the velocity profile in the "BlendingLow"



The mode preset at the function block is not valid for the inflection positions, as this position has to be approached exactly.

2. Special features

- Advancing monitoring - Advancing condition -

This monitoring ensures a smooth transition between the target positions. I.e., the axis does not stop, but immediately switches to the new velocity at the target position to approach the next target position.

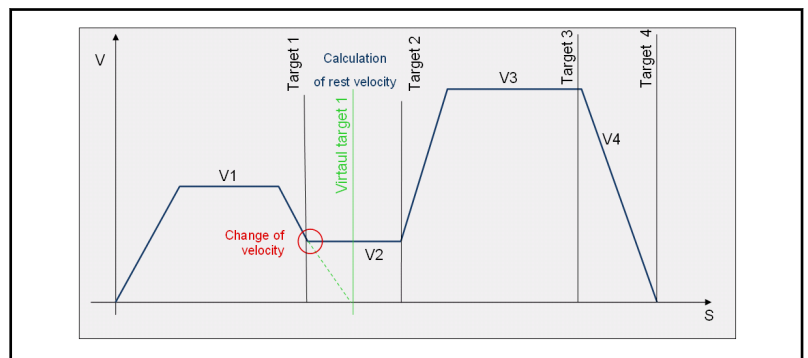


Fig. 3-6: Advancing monitoring of the MoveProfile

- Inflection point monitoring - look ahead -

In the Init phase of the MB_MoveProfile, the points of inflection are determined using the entered positions. They may not be crossed in any case. It is checked cyclically, whether the corresponding axis does not cross the points of inflection with the velocity and acceleration currently specified.



This behavior is inactive if the axis approaches a point of inflection.

If the monitoring starts, all intermediate positions are ignored and the axis approaches the point of inflection directly.

In the trace shown below, target 3 is not approached up to the end, as the monitoring has started. The point of inflection (target 4) is now directly approached.

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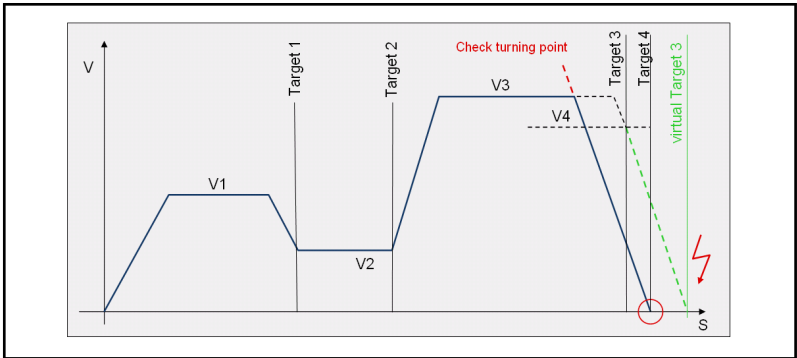


Fig. 3-7: Inflection point monitoring of the MoveProfile

- Path-dependent braking (WAB) - PDB -
The path-dependent braking can be enabled with the "PDB" input. WAB (path-dependent braking) is described in detail in the function block MB_MoveAbsPDB. [chapter 3.2.1 "MB_MoveAbsPDB" on page 18](#)

Error codes *The error codes of the following function blocks are generated:*

- MC_MoveAbsolute
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.2.3 **MB_MoveAbsVRest**

Brief description The axis can be traversed on any position via the function block MB_MoveAbsVRest. The axis then moves to the position limit value of the axis (A-0-0030 for positive and A-0-0031 for negative direction) with the specified remaining velocity.

The command can be used for rapid traverse and creep mode applications.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-9: Reference table

Interface description

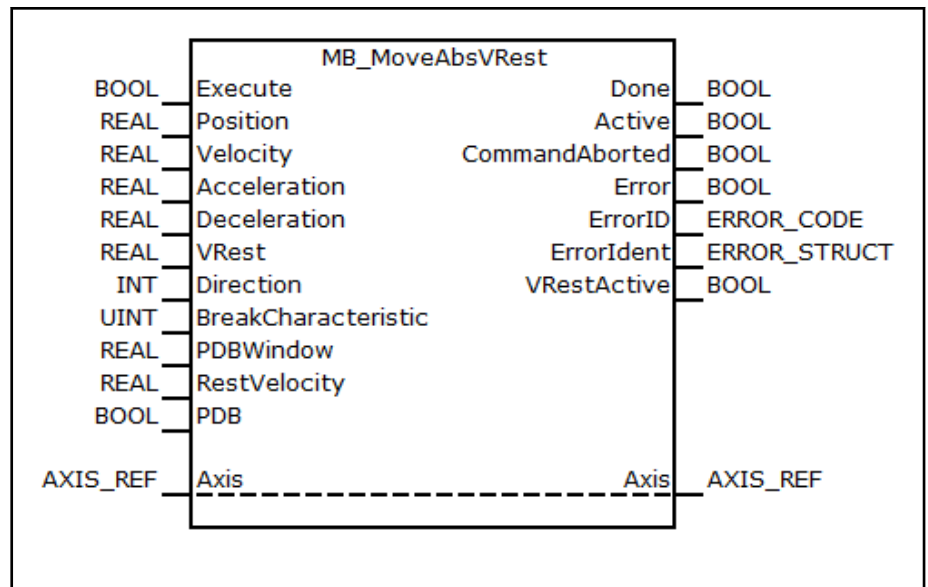


Fig. 3-8: Function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	Position	REAL	Target position 1 for the motion
	Velocity	REAL	Velocity of the axis traveling to the target position 1 (rapid velocity)
	Acceleration	REAL	Acceleration (always positive)
	Deceleration	REAL	Deceleration (always positive)
	VRest	REAL	Velocity of the axis traveling from target position 1 to the end position. (Creeping velocity)
	Direction	INT	Positioning direction 1 = positive direction, -1 = negative direction, 0 = both directions
	BreakCharacteristic	UINT	WAB (path-dependent braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
	PDBWindow	REAL	WAB (path-dependent braking) window
	RestVelocity	REAL	WAB (path-dependent braking) remaining velocity
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MB_MoveProfile
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	VRestActive	BOOL	TRUE: The remaining velocity is reached
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID

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	Name	Type	Comment
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 27.
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-10: Function block inputs/outputs

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def.	n. def.	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def.	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
VRest	REAL	0.0	n. def.	0.0	Rising edge at Execute
Direction	INT			0 (positive direction)	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			0	Rising edge at Execute
RestVelocity	REAL	0.0	n. def.	0	Rising edge at Execute
PDB	BOOL			FALSE	Continuous

Tab. 3-11: Input behavior

Functional description

The axis travels to the target position with the velocity applied. From this target position, the axis moves to its software end position with the remaining velocity. The software end position is parameterized via A-0-0030 and A-0-0031. If the axis has already exceeded its target position, it is immediately moved to the end position with the remaining velocity.

The end position to be traveled to is specified by the "Direction" input.

Positive direction (1) - The axis moves to the positive end position (A-0-0030).

Negative direction (-1) - The axis moves to the negative end position (A-0-0031).

Both directions (0) - The axis moves either to the negative or to the positive end position. This depends on the position of the axis before the function block is enabled. If the current actual position is smaller than the target position, it is traveled to the positive end position. If the current position is greater than the target position, it is traveled to the negative end position.

Example of positive direction:

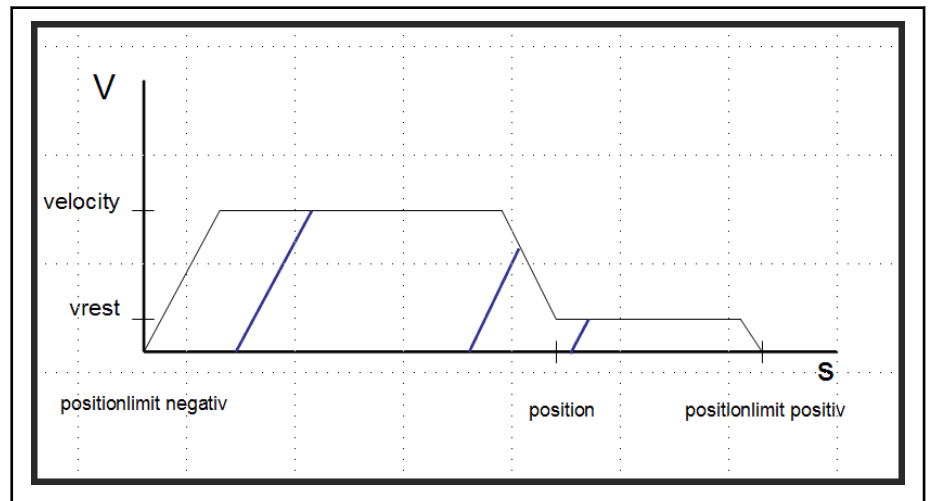


Fig. 3-9: The velocity characteristics are shown via the position, positive direction

Depending on the starting position, traveling is started with the corresponding velocity. If the command is issued in front of the "position", it is first moved to the target position with "Velocity" and then switched to "VRest". If the command is issued when the axis is located behind the position, it is directly moved to the end position with "VRest".

The function blocks responds analogously when starting with negative direction. The only difference is that it is always traveled to the negative end position.

Example of both directions:

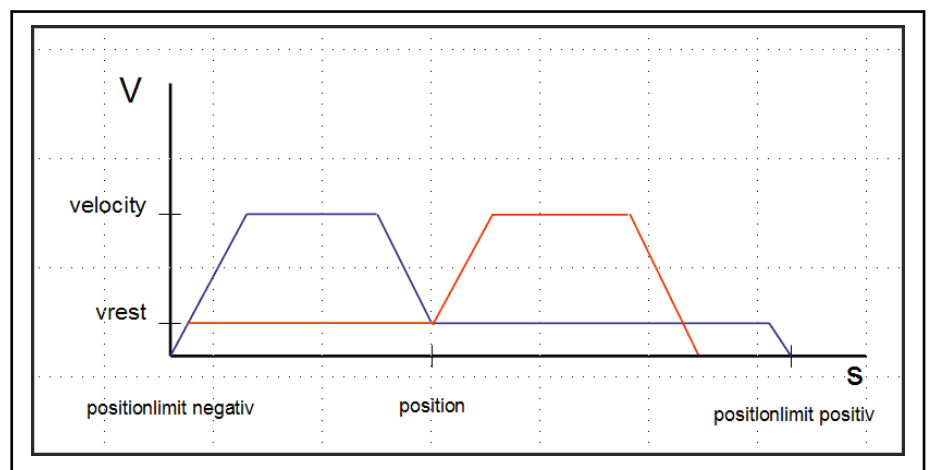


Fig. 3-10: The velocity characteristics are shown via the position, both directions

If "Direction" is set to "both directions", the axis moves from their current position to the target position with "Velocity" and then to the end position determined for the current traversing direction of the axis. Depending on the command velocity, the axis approaches the positive or negative end position.

WAB (path-dependent braking) is described in detail in the function block [MH_MoveAbsPDB on page 57](#).

Error codes The error codes of the following function blocks are generated:

- MB_MoveProfile

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- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.2.4 MB_MoveAbsVRestBase

Brief description The axis can be traversed to any position via the function block MB_MoveAbsVRestBase. The axis then moves to the second target position with the specified remaining velocity.

The command can be used for rapid traverse and creep mode applications.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-12: Reference table

Interface description

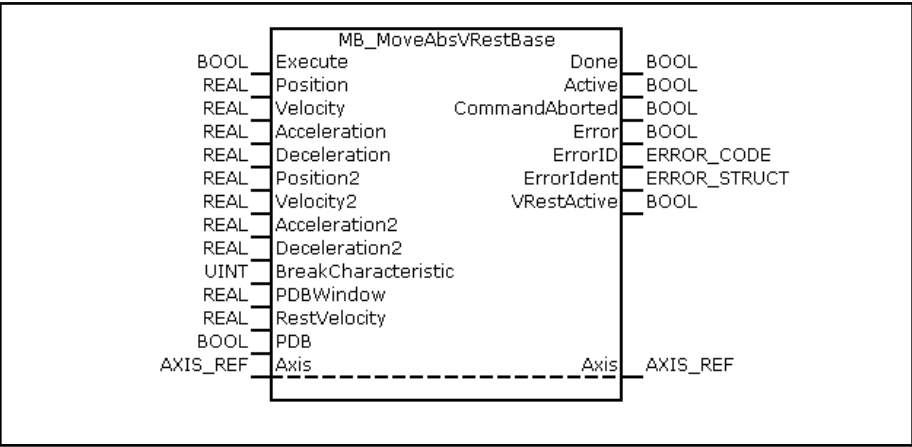


Fig. 3-11: Function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	Position	REAL	Target position 1 for the motion
	Velocity	REAL	Velocity of the axis traveling to the target position 1 (rapid velocity)
	Acceleration	REAL	Acceleration for position 1 (always positive)
	Deceleration	REAL	Deceleration for position 1 (always positive)
	Position2	REAL	Target position 2 for the motion
	Velocity2	REAL	Velocity of the axis traveling from target position 1 to target position 2. (Creeping velocity)
	Acceleration2	REAL	Acceleration for position 2 (always positive)
	Deceleration2	REAL	Deceleration for position 2 (always positive)
	BreakCharacteristic	UINT	WAB (path-dependent braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
	PDBWindow	REAL	WAB (path-dependent braking) window
	RestVelocity	REAL	WAB (path-dependent braking) remaining velocity

	Name	Type	Comment
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MB_MoveProfile
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	VRestActive	BOOL	TRUE: The remaining velocity is reached
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 30
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-13: Function block inputs/outputs

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def.	n. def.	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def.	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def.	0.0	Rising edge at Execute
Position2	REAL	n. def.	n. def.	0.0	Rising edge at Execute
Velocity2	REAL	0.0	n. def.	0.0	Rising edge at "Execute"
Acceleration2	REAL	0.0	n. def.	0.0	Rising edge at Execute
Deceleration2	REAL	0.0	n. def.	0.0	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			0	Rising edge at Execute
RestVelocity	REAL	0.0	n. def.	0.0	Rising edge at Execute
PDB	BOOL			FALSE	Continuous

Tab. 3-14: Input behavior

Functional description

The axis travels to the first target position with the applied velocity "Velocity1".

From this position, the axis moves to the second target position with the remaining velocity "Velocity2".

If the second target position is located behind the first target position (seen from the starting position), the second target position is directly approached with "Velocity2".

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WAB (path-dependent braking) is described in the function block [MB_Move-AbsPDB](#) on page 18.

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes *The error codes of the following function blocks are generated:*

- MB_MoveProfile
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.2.5 MB_MovePositionSX

Brief description The function block MB_MovePositionSX can specify a command position with regard to a variable input variable to an axis. The command positions are determined according to the created tables "InputXTable" and "PositionTable". The command values are specified cyclically for the axis. It is commanded via the function block ML_WriteCyclicPosition. Before enabling the function block, power (MC_Power) has to be added to the axis. The cyclic command value is specified when the "InOperation" output is set.

 The function block has to be called in a motion-synchronous task to ensure a control free from interferences.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-15: *Reference table of the MB_MovePositionSX*

Interface description

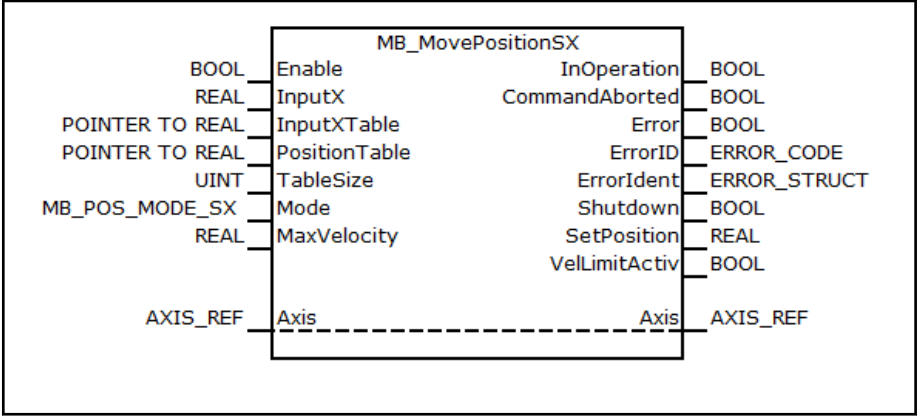


Fig. 3-12: *Overview on function blocks*

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Processing of function block enabled.
	InputX	REAL	Input value X to which the respective command position is interpolated using the position table.
	InputXTable	POINTER TO REAL	Pointer to table with input values X. Note: The tables "InputXTable" and "PositionTable" have to have the same number of elements. If one of the two tables is changed while being edited, it has an immediate effect, as it is directly internally operated with the input tables.

	Name	Type	Comment
	PositionTable	POINTER TO REAL	Pointer to table with position values [position scaling] Note: The tables "InputXTable" and "PositionTable" have to have the same number of elements. If one of the two tables is changed while being edited, it has an immediate effect, as it is directly internally operated with the input tables.
	TableSize	UINT	Table size in bytes. Use SizeOf ("Variable PositionTable") for example
	Mode	MB_POS_MODE_SX (enum)	Processing mode: 0 = MB_POS_MODE_SX.ABSOLUTE 1 = MB_POS_MODE_SX.RELATIVE_S 2 = MB_POS_MODE_SX.RELATIVE_X 3 = MB_POS_MODE_SX.RELATIVE_SX
	MaxVelocity	REAL	Maximum velocity. The velocity has to be lower than the motion limit values in the parameters A-0-0032 and A-0-0033. [velocity scaling] 0 = Disabled (default)
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	Error	BOOL	Indicates that an error occurred
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 33 .
	ShutDown	BOOL	The function block is currently in shutdown. The function block can only be restarted if the "ShutDown" output is FALSE again.
	SetPosition	REAL	Interpolated command position [position scaling]
	VelLimitActiv	BOOL	The axis is currently velocity-limited. It is limited to the velocity at the "MaxVelocity" input. While limiting, there is an abrupt acceleration or deceleration.
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis reference of the axis
PROPERTY	InvertPosition	BOOL	Inversion of position table TRUE = Enabled FALSE = Disabled
	FilterTime	REAL	Filter for command position [ms]
	Descending-Values	BOOL	Sorting the values in the x-table: FALSE = X-values ascending (default) TRUE = X-values descending
	CycleTime	REAL	Cycle time of the function block in µs. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-16: Inputs/outputs/properties

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Name	Min. value	Max. value	Default value	Effective
Enable			FALSE	Continuous
InputX			0.0	Continuous
InputXTable			IL_NULL	Continuous
PositionTable			IL_NULL	Continuous
TableSize	0		0	Positive edge at "Enable"
Mode	0	3	0 = MB_POS_MODE_SX.ABSOLUTE	Positive edge at "Enable"
MaxVelocity	A-0-0032	A-0-0033	0.0	Positive edge at "Enable"
InvertPosition			FALSE	Positive edge at "Enable"
FilterTime	0.0		0.0	Positive edge at "Enable"
DescendingValues			FALSE = X-values ascending	Positive edge at "Enable"

Tab. 3-17: Input behavior

Functional description

The main job of the function block is to specify the position command value at an axis with regard to any input variable of an x- or position table. Apart from this job, the function block has other jobs that can be enabled via "Mode" and "Properties".

The following image shows an overview on the internal functions:

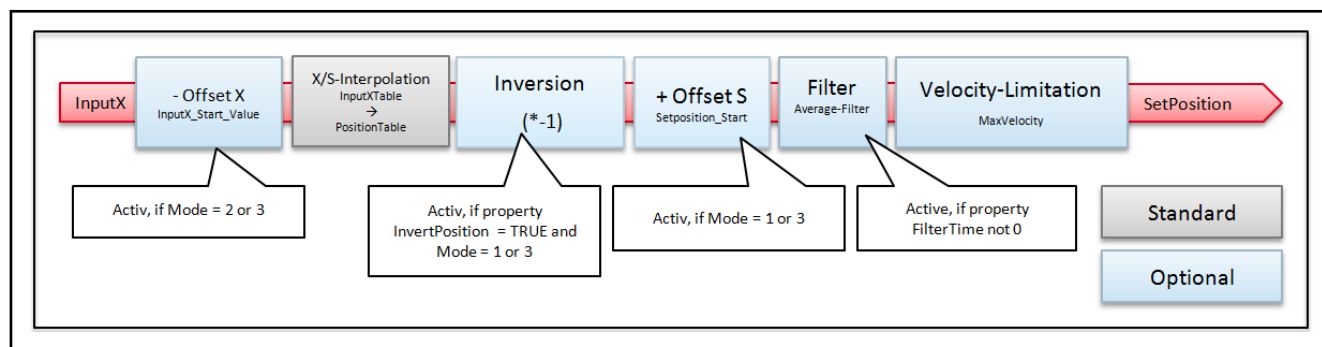


Fig. 3-13: Functional principle

Mode description

Using the mode, the user can decide whether to enable or disable the offsets:

Mode	Description
MB_POS_MODE_SX.ABSOLUTE	The values of the x-table "InputXTable" are interpreted as absolute.
MB_POS_MODE_SX.RELATIVE_S	The values of the X-table "InputXTable" are interpreted as absolute. The values of the s-table "PositionTable" are interpreted as relative. That means that when enabling the function block, the current command position of the axis is saved as s-offset value. The s-offset is added to the output value of the X/S-interpolation. If the inversion is enabled, the output value of the X/S interpolation is inverted before. Recommendation: The first value of the s-table should be 0.

Mode	Description
MB_POS_MODE_SX. RELATIVE_X	The values of the x-table "InputXTable" are interpreted as relative. The values of the s-table "PositionTable" are interpreted as absolute. That means that when enabling the function block, the current x-value "InputX" is saved as x-offset value. The X-offset is subtracted from the input value before the X/S-interpolation. Recommendation: The first value of the x-table should be 0.
MB_POS_MODE_SX. RELATIVE_SX	The values of the x-table "InputXTable" are interpreted as relative. The values of the S-table "PositionTable" are interpreted as relative. That means that when enabling the function block, the current x-value "InputX" is saved as x-offset value. The x-offset is subtracted from the input value before the X/S-interpolation. Additionally, when enabling the function block, the current command position of the axis is saved as s-offset value. The S-offset is added to the output value of the X/S-interpolation. If the inversion is enabled, the output value of the X/S interpolation is inverted before. Recommendation: The first value of the x-table and the first value of the s-table should be 0.

Tab. 3-18: Mode description



If it is fallen below the first value in the x-table or if the last value in the x-table is exceeded, the output value "SetPosition" is kept constant according to the first or the last entry in the position table.



To generate the output value deviating from the current command position when enabling the function block, a motion is executed with the velocity "MaxVelocity" to the output value of the X/S-interpolation.

Filter

The filter is active as soon as a value greater than 0 is entered into the "FilterTime" property. With the filter, it is possible that a change in command velocity is executed via a ramp and not in jumps.

Velocity limitation

The receiving position command values are monitored in the axis. If the position difference between two subsequent position command values is higher than the value in the parameter "A-0-030, Velocity limit value bipolar", the position command value monitoring of the axis is initiated and the error "F2037 Excessive position command value difference" is generated. To avoid that the axis does not generate an error, the velocity limitation can be enabled. If 0 is assigned to the property "MaxVelocity", the limitation is disabled. If the limitation is active, the output "VelLimitActiv" is set.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170. It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002420	16#00000001	Input pointer "InputXTable" invalid
ACCESS_ERROR	16#00002420	16#00000002	Input pointer "PositionTable" invalid

Tab. 3-19: Generated error numbers

The error codes of the following function blocks are output additionally:

- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

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3.2.6 MH_ServiceCtrl

Brief description The function block is exclusively used for axes without controller enabled and directly outputs an analog signal to the valve (controlled traversing in error case for example). The signal shape can either be a jump or a ramp.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-20: Reference table of the MH_ServiceCtrl

Interface description

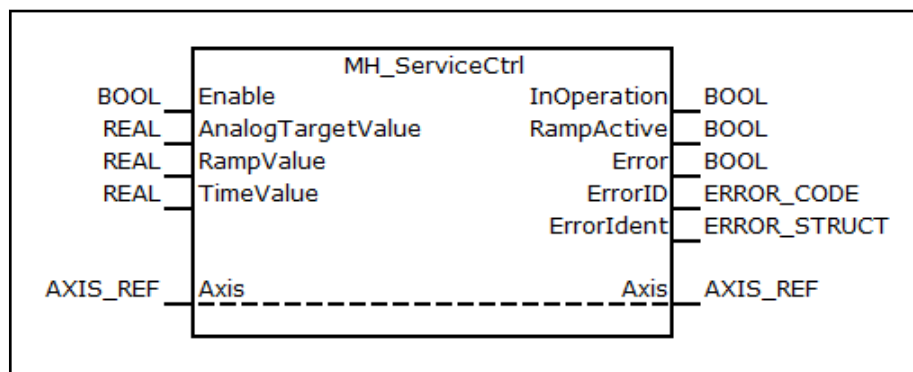


Fig. 3-14: MH_ServiceCtrl function block

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Function block processing enabled
	AnalogTargetValue	REAL	Analog target value. Unit = "%"
	RampValue	REAL	Ramp to be used for blending. Unit = "%/s"
	TimeValue	REAL	Time in seconds while blending has to take place
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid
	RampActive	BOOL	TRUE: Blending is active
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 35
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-21: MH_ServiceCtrl function block

Name	Type	Min. value	Max. value	Default value	Effective
Enable	BOOL			FALSE	Continuous
AnalogTargetValue	REAL	n. def.	n. def.	0.0	Continuous

Name	Type	Min. value	Max. value	Default value	Effective
RampValue	REAL	0.0	n. def.	0.0	Continuous
TimeValue	REAL	0.0	n. def.	0.0	Continuous

Tab. 3-22: Input behavior of the MH_ServiceCtrl

Functional description

The signal shape can either be a jump or a ramp. If a command value jump is present (both ramp values are 0), the current analog target value is output at the analog output. If a ramp value is present, a ramp to the target value is calculated and output starting from the current analog output value. The ramp can be defined via a slope "RampValue" or the time specification "TimeValue". If both inputs are set, the input "RampValue" is used for the calculation



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.



For Hydraulic Drive, the signal shape "ramp" is only as good as allowed by the acyclic transmission of the signal (P-0-2873-0-17, Control variable adjustment of command value service) between the MLC and the drive. Five motion cycles are generally required to transfer a value. However, it can take far more time depending on the load of the Sercos bus.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started

Tab. 3-23: Error numbers of the MH_ServiceCtrl function block

3.2.7 MH_ValveDirectCtrl

Brief description

The function block outputs an analog signal at the valve using the operation mode "Direct valve control". The signal shape can either be a jump or a ramp.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-24: Reference table of the MH_ValveDirectCtrl

MH_TechHydrMotion.library

Interface description

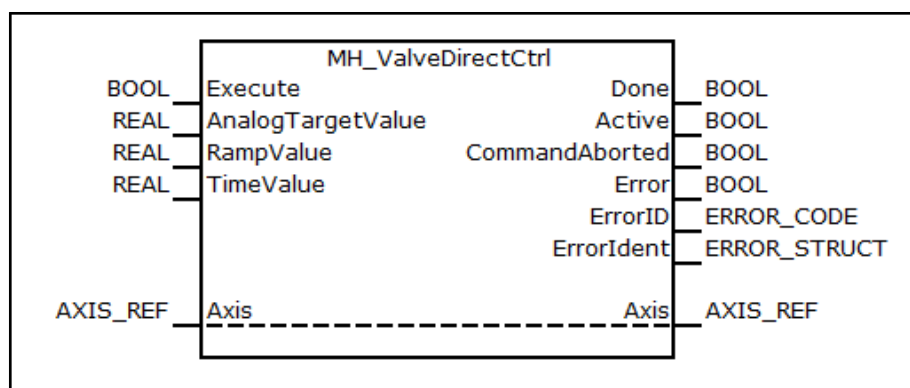


Fig. 3-15: MH_ValveDirectCtrl function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	AnalogTargetValue	REAL	Analog target value acc. to unit/scaling (valve) of the axis
	RampValue	REAL	Ramp to be used for blending. Analog unit per second
	TimeValue	REAL	Time in seconds when blending has to take place
VAR_OUTPUT	Done	BOOL	The function block operates. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 37 .
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-25: MH_ValveDirectCtrl function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
AnalogTargetValue	REAL	n. def.	n. def.	0.0	Rising edge at "Execute"
RampValue	REAL	0.0	n. def.	0.0	Rising edge at Execute
TimeValue	REAL	0.0	n. def.	0.0	Rising edge at Execute

Tab. 3-26: Input behavior of the MH_ValveDirectCtrl

Functional description

The signal shape can either be a jump or a ramp. If a command value jump is present (both ramp values are 0), the current analog target value is output at the analog output using the direct valve control mode (generally considering the control value adaptation). If a ramp value is present, a ramp to the target value is calculated and output starting from the current analog output value. The ramp can be defined via a slope "RampValue" or the time specification

"TimeValue". If both inputs are set, the input "RampValue" is used for the calculation



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. Supported axes are HydraulicDrive and hydraulic central controllers
ACCESS_ERROR	16#00002411	16#00000000	HydrInit not called/does not exist

Tab. 3-27: Error numbers of the MH_ValveDirectCtrl function block

The function block outputs error codes of the following function blocks in addition to the listed error codes:

- MB_ReadRealParameter
- MB_WriteRealParameter
- ML_OpenCyclicAnalogChannel
- ML_WriteCyclicAnalog

3.2.8 MB_ValveControl

Brief description The function block outputs an analog signal at the valve using the operation mode "Direct valve control". The signal shape can either be a jump or a ramp.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-28: Reference table of the MB_ValveControl

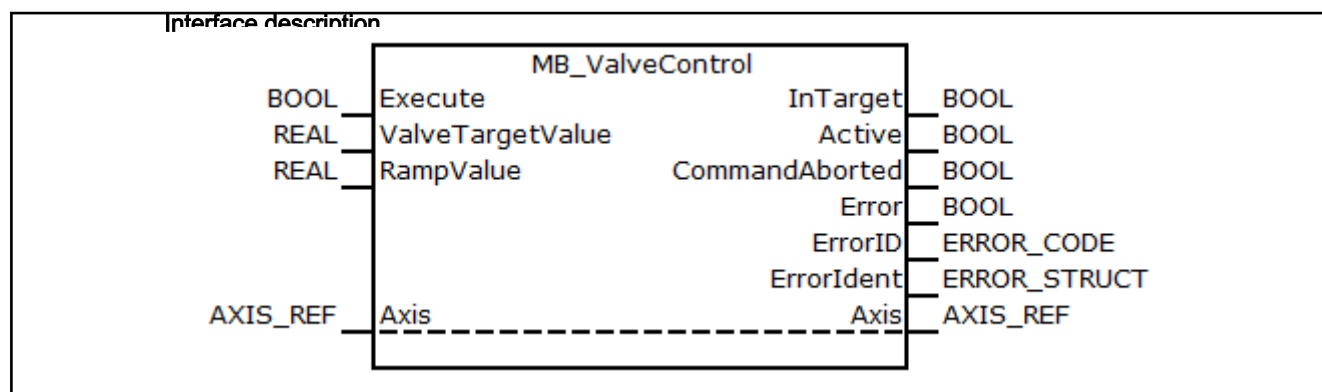


Fig. 3-16: MB_ValveControl function block

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	Name	Type	Comment
VAR_INPUT	Execute	BOOL	A rising edge starts the processing of the function block.
	ValveTargetValue	REAL	Valve command value (S-0-0860)
	RampValue	REAL	Ramp for valve command value (%/s)
VAR_OUTPUT	InTarget	BOOL	Valve command value reached (for the first time)
	Active	BOOL	Function block is operating
	CommandAborted	BOOL	Command aborted by subsequent command
	Error	BOOL	Indicates that an error occurred in the function block instance
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Error structure with further error division
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-29: Input variables of the function block "MB_ValveControl"

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
ValveTargetValue	REAL	n. def.	n. def.	0.0	Rising edge at "Execute"
RampValue	REAL	0.0	n. def.	0.0	Rising edge at Execute

Tab. 3-30: Input behavior of the MB_ValveControl

Functional description

The function block "MB_ValveControl" enables the operation mode "Direct valve control" and the drive follows the command value specification. Command value is a valve opening in % (-100% to +100%). Command value changes can be performed via a ramp. If the ramp ends or if the output of the valve command value generator is equal to the valve command value, the function block outputs the message "InTarget". If the "RampValue" input is set to 0, the valve command value is specified in jumps. The "InTarget" output is set immediately.



When using the function block, ensure a previous initialization of the function block MH_InitHydr. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. Supported axes are HydraulicDrive and hydraulic central controllers
ACCESS_ERROR	16#00002411	16#00000000	HydrInIt not called/does not exist

Tab. 3-31: Error numbers of the MB_ValveControl function block

The function block outputs error codes of the following function blocks in addition to the listed error codes:

- MB_ReadRealParameter
- MB_WriteRealParameter
- ML_OpenCyclicAnalogChannel
- ML_WriteCyclicAnalog

Parameter modes	PLC operation mode parameters
S-0-0860, Spool command value	P-0-1468, PLC/setting-up mode, valve command value
S-0-0869, Spool ramp time	P-0-1469, PLC/setting-up mode, valve ramp time
P-0-2928.0.1: Valve command value, control word, bit 1: Direct valve command value output	

Tab. 3-32: Comparing operation mode parameters

3.3 Function blocks for the alternating control

3.3.1 MH_ForceLimitBase

Brief description This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-33: Reference table of the MH_ForceLimitBase

Interface description

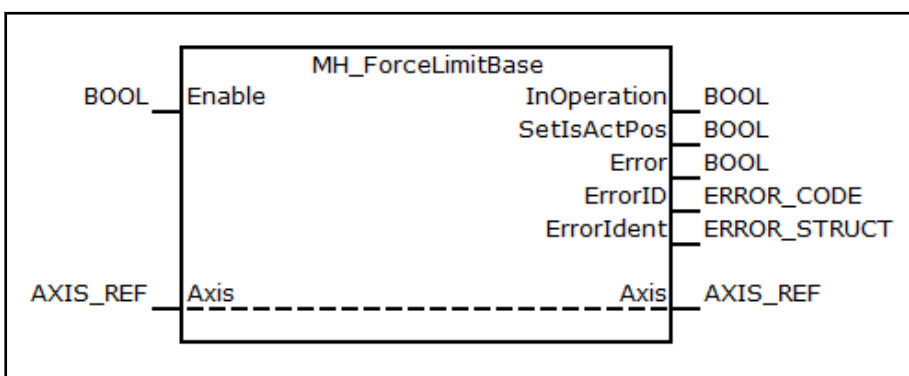


Fig. 3-17: MH_ForceLimitBase function block

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Function block processing enabled
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid

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	Name	Type	Comment
	SetIsActPos	BOOL	TRUE: Command position and actual position were equated
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 40 .
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-34: MH_ForceLimitBase function block

Functional description

This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control. One instance of this function block (or an instance of the function block MH_HydrCyclicBase) has to be called cyclically per axis (motion task). The instance call has to be executed at the first position of the task to be called before all other "ForceLimit" function blocks.

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started

Tab. 3-35: Generated error numbers

The function block outputs error codes of the following function blocks in addition to the listed error codes:

- ML_IPOImpactControl

3.3.2 MH_HydrCyclicBase

Brief description

This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control. One instance of this function block (or an instance of the function block MH_ForceLimitBase) has to be called cyclically per axis (motion task). The instance call has to be executed at the first position of the task to be called before all other "ForceLimit" function blocks.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-36: Reference table of the MH_HydrCyclicBase

Interface description

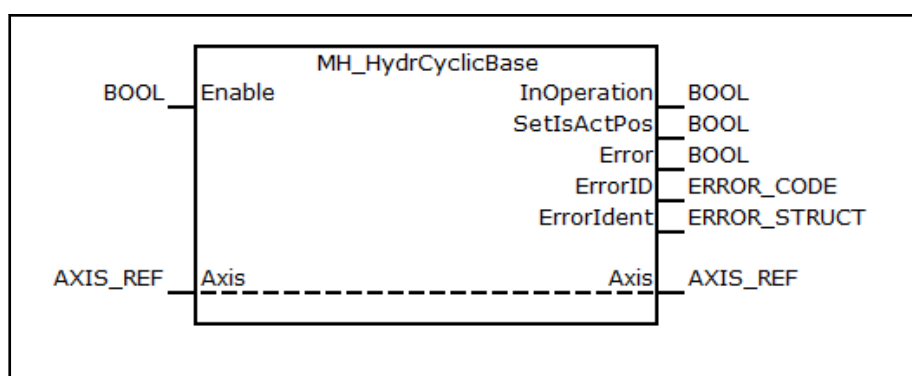


Fig. 3-18: MH_HydrCyclicBase function block

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Function block processing enabled
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid
	SetIsActPos	BOOL	TRUE: Command position and actual position were equated
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 41
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-37: MH_HydrCyclicBase function block

Functional description

This function block manages general data required to affect the interpolation of the MLC: Calling this function block allows an alternating control. One instance of this function block has to be called cyclically per axis (motion task). The instance call has to be executed at the first position of the task to be called before all other "ForceLimit" function blocks.

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started

Tab. 3-38: Error numbers of the MH_HydrCyclicBase function block

The function block outputs error codes of the following function blocks in addition to the listed error codes:

- ML_IPOImpactControl

3.3.3 MH_ForceLimitOn

Brief description

The function block enables the alternating control of the axis and specifies a (target) force command value. The command value generation is defined via a ramp or a time.

The force command value is specified by the force controller of the axis.

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Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-39: Reference table of the MH_ForceLimitOn

Interface description

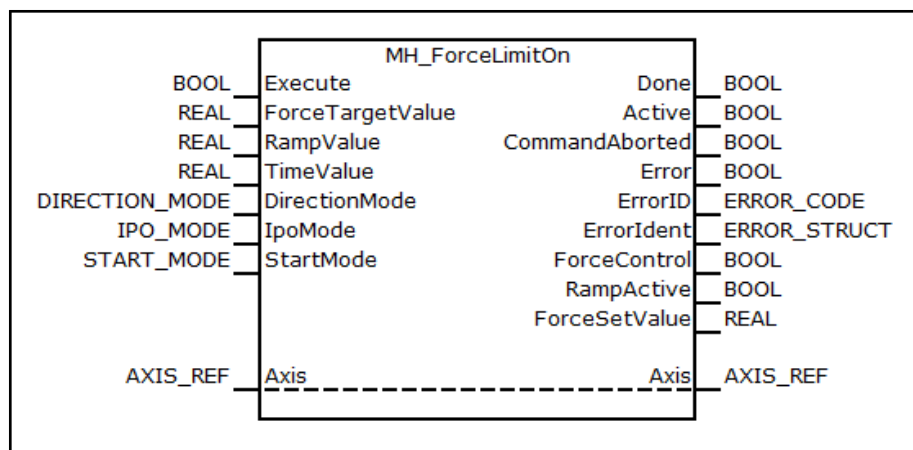


Fig. 3-19: MH_ForceLimitOn function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	ForceTarget-Value	REAL	New command force to which it is to be controlled and blended should be acc. to unit/scaling of the axis
	RampValue	REAL	Ramp to be used for blending. Force unit per second
	TimeValue	REAL	Time in seconds while blending has to take place
	Direction-Mode	DIRECTION_MODE	POSITIVE = Effective in positive direction of force NEGATIVE = Effective in negative direction of force BIPOLAR = Effective in both directions of force
	IpoMode	IPO_MODE	Interpolation mode: CONT (continue), BREAK, JUMP
	StartMode	START_MODE	NOW = Command value generation starts immediately IN_FORCE_CONTROL = The command value generation starts when the force controller is active
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	The function block was aborted by another "Force" function block
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 43
	ForceControl	BOOL	Force controller of axis effective
	RampActive	BOOL	Ramp generation running

	Name	Type	Comment
	ForceSetValue	REAL	Force command value currently sent to the force controller of the axis
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-40: MH_ForceLimitOn function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
ForceTargetValue	REAL	n. def.	n. def.	0.0	Rising edge at "Execute"
RampValue	REAL	0.0	n. def.	0.0	Rising edge at "Execute"
TimeValue	REAL	0.0	n. def.	0.0	Rising edge at "Execute"
DirectionMode	DIRECTION_MODE			POSITIVE	Rising edge at "Execute"
IpoMode	IPO_MODE			CONT	Rising edge at "Execute"
StartMode	START_MODE			NOW	Rising edge at "Execute"

Tab. 3-41: Input behavior of the MH_ForceLimitOn

Functional description

At a rising edge at the "Execute" input, the initialization phase is run through and the force limitation (alternating control) is enabled.

The starting force command value depends on whether the alternating control has already be enabled before activating the command. If the alternating command is not active before starting the function block, the actual force value is used as starting force command value. If the alternating control is already active, the latest written force command value is used as starting value.

Depending on the StartMode, the command value generation either starts immediately (NOW) or when the force controller is active (IN_FORCE_CONTROL). The parameters of the alternating control are used to set when the force controller is active.

If null is to be added to the inputs "RampValue" and "TimeValue", the force command value of the axis is set to the target value with a jump. The ramp can be defined via a slope (RampValue) or a time specification (TimeValue).

Call the function block in the Motion task to ensure a synchronous command value generation.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

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It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-42: Error numbers of the MH_ForceLimitOn function block

3.3.4 MH_ForceLimitOnFT

Brief description The function block enables the alternating control of the axis. The function block generates a force command value profile depending on a time profile. The force command value is specified by the force controller of the axis.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-43: Reference table of the MH_ForceLimitOnFT

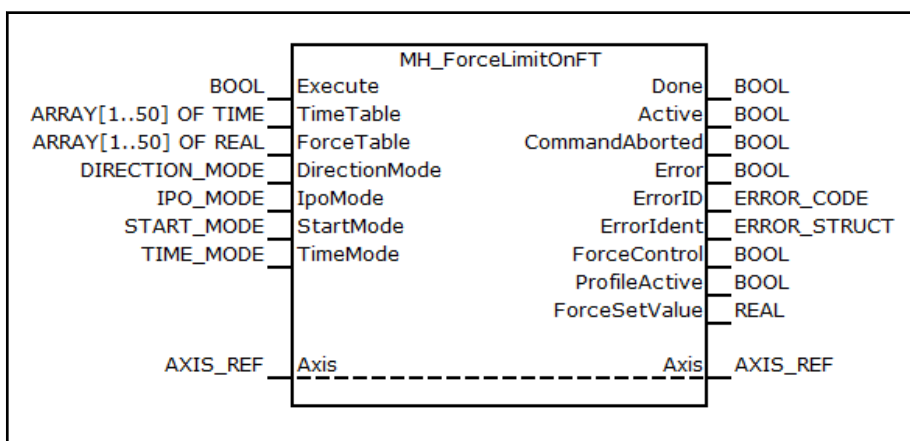
Interface description

Fig. 3-20: MH_ForceLimitOnFT function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	TimeTable	ARRAY[1..50] OF REAL	Time data points of the force command values is the unit "seconds"
	ForceTable	ARRAY[1..50] OF REAL	Force command values of time data points
	Direction-Mode	DIRECTION_MODE	POSITIVE = Effective in positive direction of force. NEGATIVE = Effective in negative direction of force BIPOLAR = Effective in both directions of force
	IpoMode	IPO_MODE	Interpolation mode: CONT (continue), BREAK, JUMP
	StartMode	START_MODE	NOW = Ramp generation starts immediately IN_FORCE_CONTROL = The ramp is only generated if the force controller is active

	Name	Type	Comment
	TimeMode	TIME_MODE	RELATIVE = The values of the "TimeTable" table are interpreted as relative ABSOLUTE = The values of the "TimeTable" table are interpreted as absolute
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	The function block was aborted by another "Force" function block
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 46
	ForceControl	BOOL	Force controller of axis effective
	ProfileActive	BOOL	Profile generation running
	ForceSetValue	REAL	Force command value currently sent to the force controller of the axis
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled
PROPERTY	CycleTime	REAL	Cycle time of the function block in μ s. If "Property" is not set, the cycle time is automatically determined while enabling. In this case, the processing is delayed by one cycle.

Tab. 3-44: MH_ForceLimitOnFT function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
TimeTable	ARRAY[1..50] REAL	n. def.	n. def.	50(0.0)	Rising edge at Execute
ForceTable	ARRAY[1..50] REAL	0.0	n. def.	ARRAY[1..50] OF REAL	Rising edge at Execute
IpoMode	IPO_MODE			CONT	Rising edge at Execute
StartMode	START_MODE			NOW	Rising edge at Execute
DirectionMode	DIRECTION_MODE			POSITIVE	Rising edge at Enable

Tab. 3-45: Input behavior of the MH_ForceLimitOnFT

Functional description At a rising edge at the "Execute" input, the initialization phase is run through and the force limitation (alternating control) is enabled.

The starting force command value depends on whether the alternating control has already be enabled before activating the command. If the alternating command is not active before starting the function block, the actual force value is used as starting force command value. If the alternating control is already active, the latest written force command value is used as starting value.

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The starting value is blended upon the first force command value point within the time specified. A ramp is used for blending. The other force points in time are processed identically.

Seconds is the unit of the times in the "TimeTable" array. The time is either relatively or absolutely interpreted using the "TimeMode" input. The unit of the force command values in the "ForceTable" array and the force scaling of the axis is the same.

Depending on the StartMode, the command value generation either starts immediately (NOW) or when the force controller is active (IN_FORCE_CONTROL). The parameters of the alternating control are used to set when the force controller is active.

Call the function block in the Motion task to ensure a synchronous command value generation.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-46: Error numbers of the MH_ForceLimitOnFT function block

3.3.5 MH_ForceLimitOnFS

Brief description The function block enables the alternating control of the axis. The function block generates a force command value profile depending on the actual position of the axis.

The force command value is specified by the force controller of the axis.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-47: Reference table of the MH_ForceLimitOnFS

Interface description

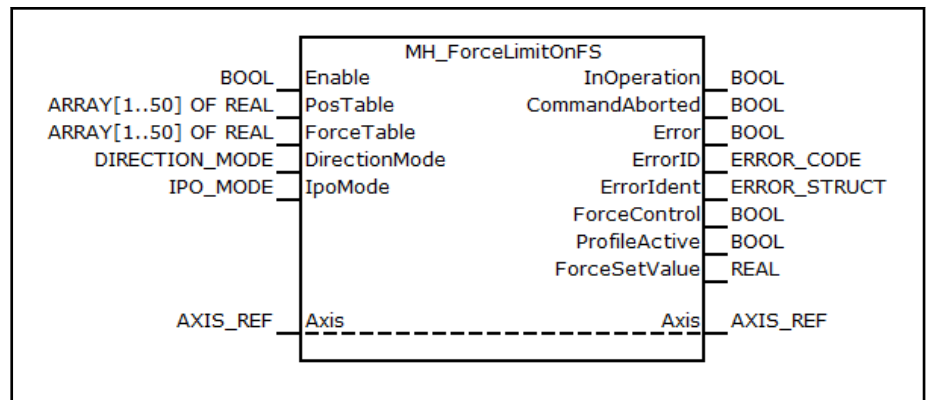


Fig. 3-21: MH_ForceLimitOnFS function block

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Function block processing enabled
	PosTable	ARRAY[1..50] OF REAL	Position data points of the force command values acc. to unit/scaling of the axis
	ForceTable	ARRAY[1..50] OF REAL	Force command values of position data points
	Direction-Mode	DIRECTION_MODE	POSITIVE = Effective in positive direction of force NEGATIVE = Effective in negative direction of force BIPOLAR = Effective in both directions of force
	IpoMode	IPO_MODE	Interpolation mode: CONT (continue), BREAK, JUMP
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	The function block was aborted by another "Force" function block
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 48
	ForceControl	BOOL	Force controller of axis effective
	ProfileActive	BOOL	Profile generation running
	ForceSetValue	REAL	Force command value currently sent to the force controller of the axis
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-48: MH_ForceLimitOnFS function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
PosTable	ARRAY[1..50] OF REAL	n. def.	n. def.	50(0.0)	Rising edge at "Enable"
ForceTable	ARRAY[1..50] OF REAL	0.0	n. def.	ARRAY[1..50] OF REAL	Rising edge at "Enable"

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Name	Type	Min. value	Max. value	Default value	Effective
IpoMode	IPO_MODE			CONT	Rising edge at "Enable"
DirectionMode	DIRECTION_MODE			POSITIVE	Rising edge at Enable

Tab. 3-49: Input behavior of the MH_ForceLimitOnFS

Functional description

At a rising edge at the "Execute" input, the initialization phase is run through and the force limitation (alternating control) is enabled.

A force-distance curve is generally used to generate a counterforce of a main axis. The main axis impresses the motion to the force-controlled axis. The counterforce is required due to the process, e.g. in case of a drawing cushion. Along the impressed motion characteristics, the counterforce can be defined using the functional dependency between path and force.

The function consisting of an input table PosTable (x-values) and a ForceTable (y-value) has to be specified in ascending order. The function starts its calculation at any point. A motion sequence can thus occur at ascending as well as at descending position values. If the actual position of the axis changes, the position table is used to send the corresponding command force to the force controller.

The force values are linearly interpolated between the two data points of the table. The starting/end point is continuously continued at the table limits.

Call the function block in the Motion task to ensure a synchronous command value generation.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-50: Error numbers of the MH_ForceLimitOnFS function block

3.3.6 MH_ForceLimitOnFX

Brief description

The function block enables the alternating control of the axis. The function block generates a force command value profile depending on any input variable.

The force command value is specified by the force controller of the axis.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-51: Reference table of the MH_ForceLimitOnFX

Interface description

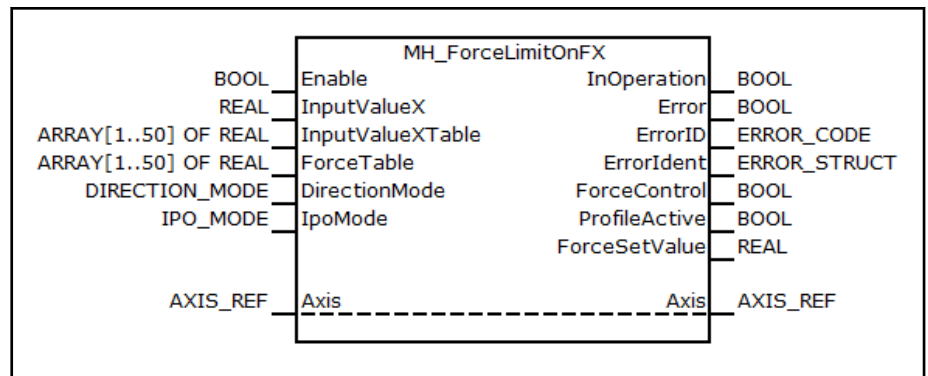


Fig. 3-22: MH_ForceLimitOnFX function block

	Name	Type	Comment
VAR_INPUT	Enable	BOOL	Function block processing enabled
	InputValueX	REAL	Input value X to which the respective command forces is interpolated using the input table (e.g. pressure)
	InputValueXTable	ARRAY[1..50] OF REAL	Input table: Data points (in same unit as the input value X, e.g. pressure data points) of the force command values
	ForceTable	ARRAY[1..50] OF REAL	Force command values of data points
	IpoMode	IPO_MODE	Interpolation mode: CONT (continue), BREAK, JUMP
	Direction-Mode	DIRECTION_MODE	POSITIVE = Effective in positive direction of force NEGATIVE = Effective in negative direction of force BIPOLAR = Effective in both directions of force
VAR_OUTPUT	InOperation	BOOL	The function block operates. The outputs are valid
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 50
	ForceControl	BOOL	Force controller of axis effective
	ProfileActive	BOOL	Profile generation running
	ForceSetValue	REAL	Force command value currently sent to the force controller of the axis
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-52: MH_ForceLimitOnFX function block

Name	Type	Min. value	Max. value	Default value	Effective
Enable	BOOL			FALSE	Continuous
InputValueX	REAL			0	Continuous
InputValueXTable	ARRAY[1..50] OF REAL	n. def.	n. def.	50(0.0)	Rising edge at "Enable"

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Name	Type	Min. value	Max. value	Default value	Effective
ForceTable	ARRAY[1..50] REAL	0.0	n. def.	ARRAY[1..50] OF REAL	Rising edge at "Enable"
IpoMode	IPO_MODE			CONT	Rising edge at "Enable"
DirectionMode	DIRECTION_MODE			POSITIVE	Rising edge at "Enable"

Tab. 3-53: Input behavior of the MH_ForceLimitOnFX

Functional description

At a rising edge at the "Enable" input, the initialization phase is run through and the force limitation (alternating control) is enabled.

The function consisting of an input table InputXValue (x-values) and a ForceTable (y-value) has to be specified in ascending order. The function starts its calculation at any point. A motion sequence can thus occur at ascending as well as at descending input values (InputValueX). If the input variable changes, the input table is used to send the corresponding command value to the force controller.

The force values are linearly interpolated between the two data points of the table. The starting/end point is continuously continued at the table limits.

Call the function block in the Motion task to ensure a synchronous command value generation.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-54: Error numbers of the MH_ForceLimitOnFX function block

3.3.7 MH_ForceLimitPosOff

Brief description

This function block implements a controlled motion stop and transfers the axis to the "Stopping" state. This stops any function block processing.

When standstill is reached, the "Done" output is set.

The alternating control is additionally disabled in case of hydraulic axes.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-55: Reference table of the MH_ForceLimitPosOff

Interface description

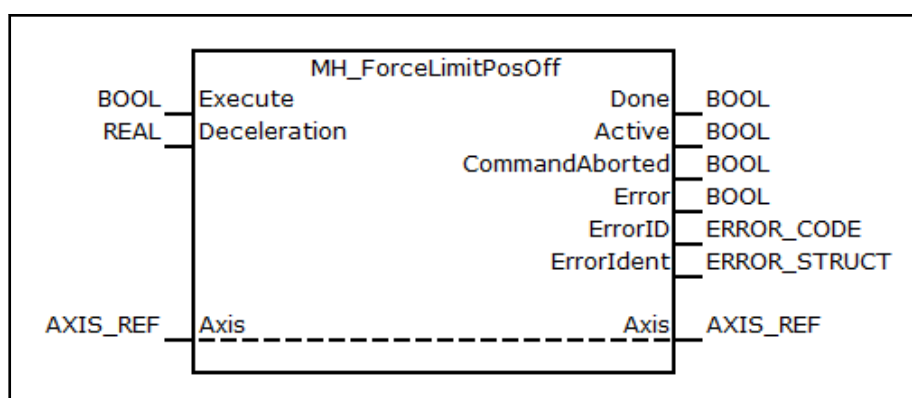


Fig. 3-23: MH_ForceLimitPosOff function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
	Deceleration	REAL	Deceleration
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 51
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-56: MH_ForceLimitPosOff function block

Functional description

The axis is set to standstill using the MC_Stop function block. For hydraulic axes, the MH_ForceLimitOff function block is additionally executed.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.



While the function block is active, no MC_Stop may be executed parallelly. Otherwise, an error is generated.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

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The function block can generate the following error messages in Additional1/
Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-57: Error numbers of the MH_ForceLimitPosOff function block

3.3.8 MH_ForceLimitOff

Brief description The function block stops the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX.

It also cancels the active force function block.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-58: Reference table of the MH_ForceLimitOff

Interface description

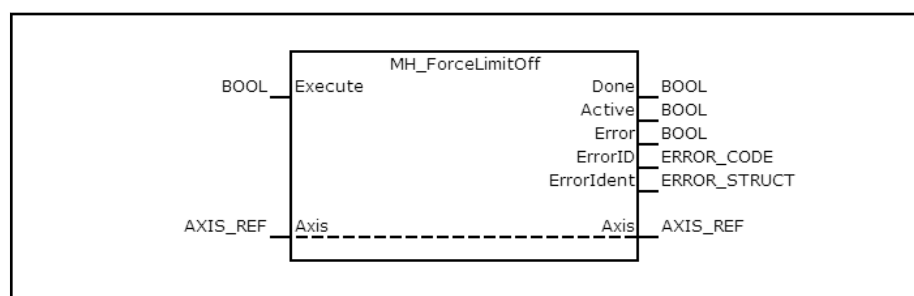


Fig. 3-24: MH_ForceLimitOff function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 53
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-59: MH_ForceLimitOff function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous

Tab. 3-60: Input behavior of the MH_ForceLimitOff

Functional description The function block aborts the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX.

It also stops the active force function block and disables the alternating control in the controller. The function block does not cancel the positioning.



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.



While the function block is active, no MC_Stop may be executed parallelly. Otherwise, an error is generated.

Error codes The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-61: Error numbers of the MH_ForceLimitOff function block

3.3.9 MH_ForceLimitBreak

Brief description The function block aborts the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX.

The alternating control remains active.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-62: Reference table of the MH_ForceLimitBreak

Interface description

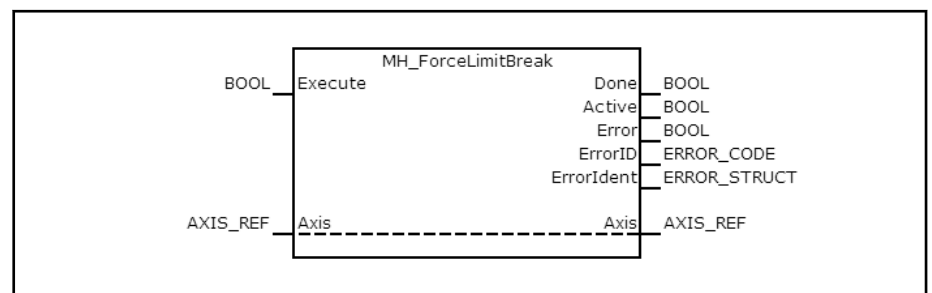


Fig. 3-25: MH_ForceLimitBreak function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid

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	Name	Type	Comment
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 54
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-63: MH_ForceLimitBreak function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous

Tab. 3-64: Input behavior of the MH_ForceLimitBreak

Functional description

The function block aborts the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX. The alternating control remains active, the command value generation is aborted and can be enabled again using the function block [MH_ForceLimitCont on page 54](#).



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-65: Error numbers of the MH_ForceLimitBreak function block

3.3.10 MH_ForceLimitCont

Brief description

The function block continues the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX.

Assignment: Target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-66: Reference table of the MH_ForceLimitCont

Interface description

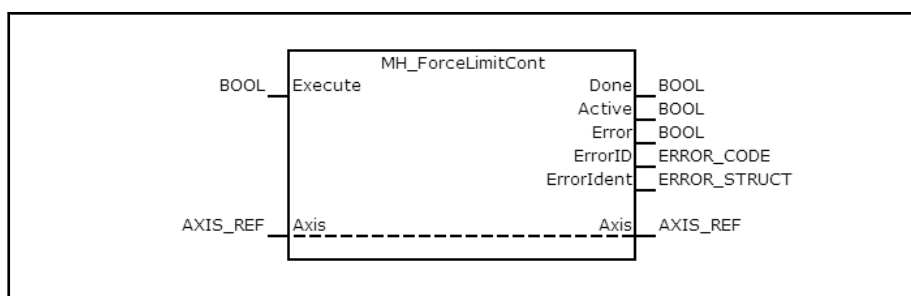


Fig. 3-26: MH_ForceLimitCont function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Function block processing enabled
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID.
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 55
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-67: MH_ForceLimitCont function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous

Tab. 3-68: Input behavior of the MH_ForceLimitCont

Functional description

The function block continues the generation of the force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS and MH_ForceLimitOnFX. However, the generation has to be canceled before by the command [MH_ForceLimitBreak on page 53](#).



When using the function block, ensure a previous initialization of the function block MH_InitHydr and the cyclic call of the function block MH_ForceLimitBase. The MH_InitHydr function block is provided by the MH_TechHydrBase library.

Error codes

The function block uses the error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to an unsupported axis. The HydraulicDrive and the hydraulic controller axis are supported
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/successfully started
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/successfully started

Tab. 3-69: Error numbers of the MH_ForceLimitCont function block

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3.3.11 MH_ForceLimitStop

Brief description The function block stops the generation of force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS, and MH_ForceLimitOnFX.

It also interrupts the force function block. Alternating control of the axis remains active.

Allocation of target/library

Target	Library
IndraMotion MLC as of version 14VRS Base package HYD	MH_TechHydrMotion

Tab. 3-70: Reference table MH_ForceLimitStop

Interface description

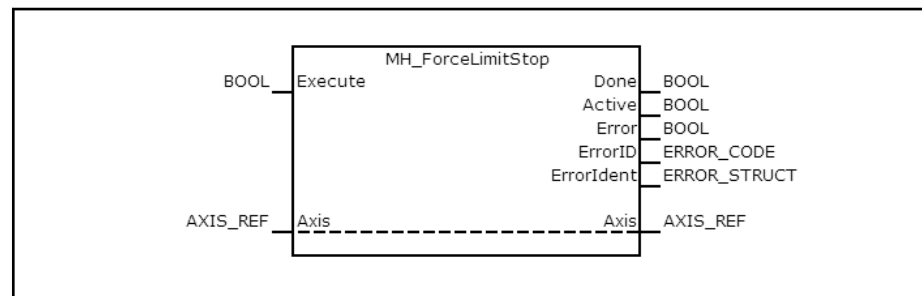


Fig. 3-27: Function block MH_ForceLimitStop

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Processing enabled for function block
VAR_OUTPUT	Done	BOOL	Processing is completed, the outputs are valid.
	Active	BOOL	The function block operates, the outputs are valid.
	Error	BOOL	Indicates that an error has occurred within the function block
	ErrorID	ERROR_CODE	Error detection
	ErrorIdent	ERROR_STRUCT	For the error structure with further error subdivision, see "Error codes" on page 57 .
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Axis to be controlled

Tab. 3-71: Function block MH_ForceLimitStop

Name	Type	Min value	Max value	Default value	Acceptance
Execute	BOOL			FALSE	Continuously

Tab. 3-72: Input behavior MH_ForceLimitStop

Functional description

The function block stops the generation of force command values of the function blocks MH_ForceLimitOn, MH_ForceLimitOnFT, MH_ForceLimitOnFS, and MH_ForceLimitOnFX. It also stops the active force function block. Alternating control of the axis remains active. The function block does not interrupt positioning.



A prerequisite for using this block is the prior initialization of the function block MH_InitHydr and cyclic calling of the function block MH_ForceLimitBase. Function block MH_InitHydr is made available by the library MH_TechHydrBase.

Error codes The function block utilizes error table **F_RELATED_TABLE**, 16#0170.

It can generate the following error messages in Additional1/Additional2:

ErrorID	Additional1	Additional2	Description
ACCESS_ERROR	16#00002410	16#00000000	Access to a non-supported axis. HydraulicDrive and the hydraulic controller axis are supported.
ACCESS_ERROR	16#00002411	16#00000000	MH_HydrInit not available/started successfully
RESOURCE_ERROR	16#00002417	16#00000000	MH_ForceLimitBase not available/started successfully

Tab. 3-73: Error numbers of the FB MH_ForceLimitStop

3.4 Obsolete

3.4.1 MH_MoveAbsPDB



If the function block is outdated, use the function block [MB_MoveAbsPDB](#), page 18.

Brief description

The function block allows a controlled positioning with a hard or soft deceleration ramp or a positioning like the command MC_MoveAbsolute. It can be switched between the two motion modes during positioning.

Assignment target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-74: Reference table of the MH_MoveAbsPDB

Interface description

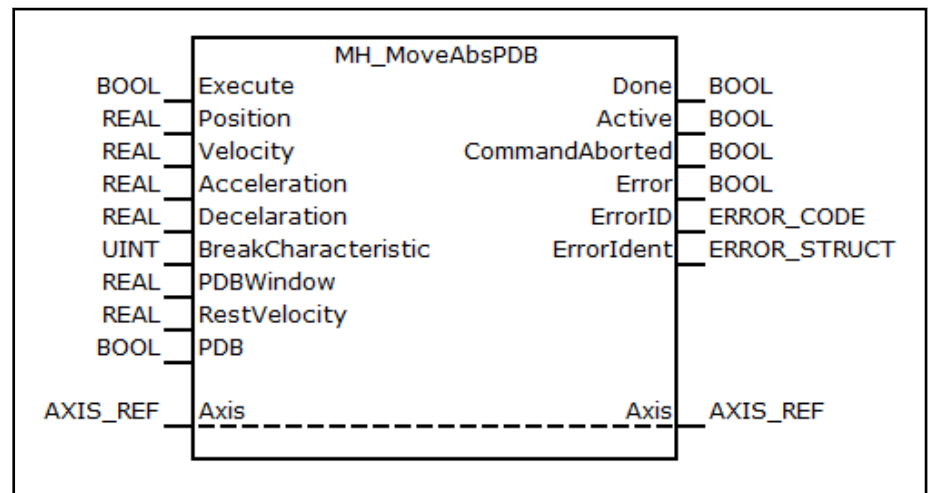


Fig. 3-28: MH_MoveAbsPDB function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Processing of function block enabled
	Position	REAL	Target position acc. to unit/scaling of the axis
	Velocity	REAL	Traveling velocity acc. to unit/scaling of the axis
	Acceleration	REAL	Acceleration acc. to unit/scaling of the axis
	Deceleration	REAL	Deceleration acc. to unit/scaling of the axis

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	Name	Type	Comment
	BreakCharacteristic	UINT	WAB (path-dependant braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
	PDBWindow	REAL	WAB (path-dependant braking) window
	RestVelocity	REAL	WAB (path-dependant braking) remaining velocity
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MC_MoveAbsolute
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	Error	BOOL	An error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 59
	CommandAborted	BOOL	Command aborted by subsequent command
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis

Tab. 3-75: MH_MoveAbsPDB function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def	n. def	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			FALSE	Rising edge at Execute
RestVelocity	REAL	0.0	n. def	0.0	Rising edge at Execute
PDB	BOOL			FALSE	Rising edge at Execute

Tab. 3-76: Input behavior of the MH_MoveAbsPDB

Functional description

The function block moves the axis either via MC_MoveAbsolute or controlled to the target position. While traveling, it can be switched between the two motion modes.

In the controlled motion mode, the axis travels in velocity control. The axis is decelerated with the requested break characteristics to the point PDBWindow / RestVelocity. The axis is in position control in the target.

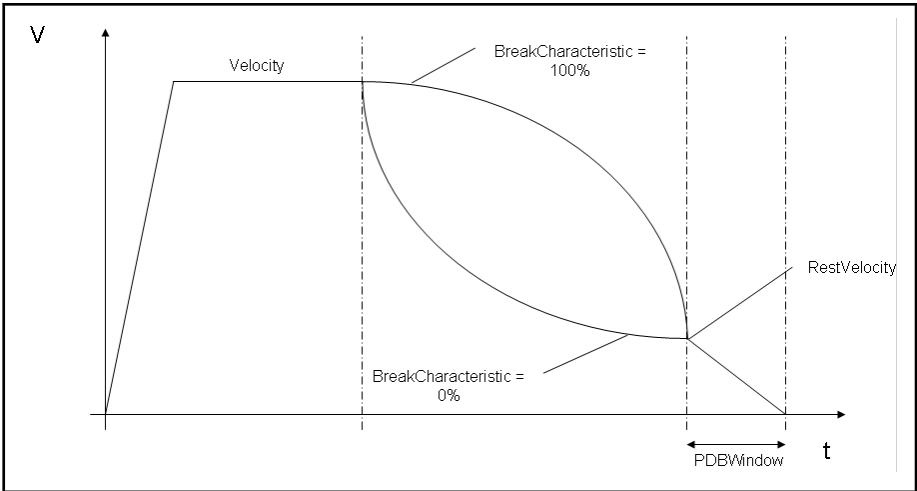


Fig. 3-29: Example of a velocity curve with MH_MoveAbsPDB

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes The error codes of the following function blocks are generated:

- MC_MoveAbsolute
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.4.2 MH_MoveProfile



If the function block is outdated, use the function block [MB_Move-Profile](#), page 20.

Brief description The function block traverses the specified axis in a specified profile that can contain up to ten positions. The function block supports the path-dependant braking (PDB).

A new velocity, acceleration and deceleration can be specified for each position. There is a smooth transition between the target positions, i.e., the axis does not stop. At the next target position, it switches immediately to the new velocity and moves to the next target until the end position of the profile is reached.

To use this function block, connect power before via an instance of MC_Power (for real axis).

Assignment target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-77: Reference table of the MH_MoveProfile

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Interface description

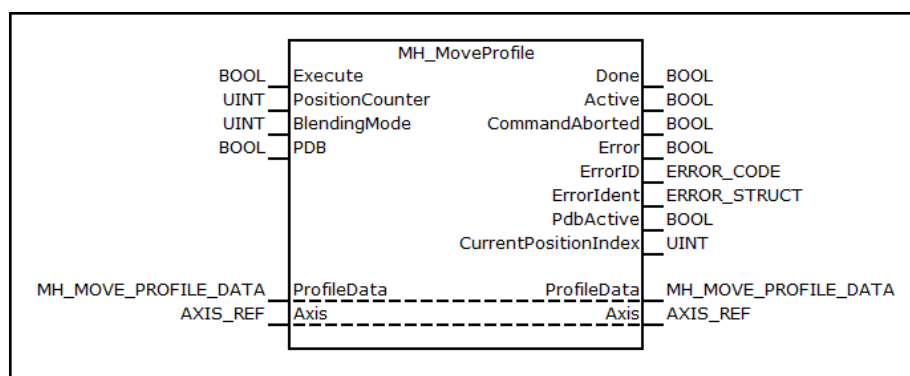


Fig. 3-30: Interface of the MH_MoveProfile function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Starts the motion at a rising edge
	Position-Counter	UINT	Number of positions in the profile
	Blending-Mode	UINT	Blending mode: 0 = BlendingPrevious 1 = BlendingLow
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves with MoveAbs
VAR_OUTPUT	Done	BOOL	Processing completed without errors, output data valid
	Active	BOOL	Processing not yet completed, output data invalid
	CommandAborted	BOOL	The function block was aborted
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Brief note on error cause
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 63
	PdbActive		WAB (path-dependant braking, PDB) is active
	CurrentPositionIndex	UINT	Current position counter
VAR_IN_OUT	ProfileData	STRUCT	MH_MOVE_PROFILE_DATA: Structure of position/velocity/acceleration/deceleration arrays
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis

Tab. 3-78: MH_MoveProfile I/O interface

Min./max. and default values of the inputs

Name	Type	Min. value	Max. value	Default value	Effective
PositionCounter	UINT	1	10	0.0	Rising edge at Execute
BlendingMode	UINT	0	1	0	Rising edge at Execute

Tab. 3-79: Min./max. and default values of the MH_MoveProfile inputs

Input structure of the
 MH_MOVE_PROFILE_DATA:

Name	Type	Min. value	Max. value	Default value	Effective	Description
Position	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at Execute	Position array of the profile to be traveled.
Velocity	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at Execute	Velocity array for the profile to be traveled.
Acceleration	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at Execute	Acceleration array of the profile to be traveled.
Deceleration	ARRAY (1..10) OF REAL	n. def	n. def	0	Rising edge at Execute	Deceleration array for the profile to be traveled.
Break-Character-istic					Rising edge at Execute	WAB (path-dependant braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
PDBWindow					Rising edge at Execute	WAB (path-dependant braking) window
RestVelocity					Rising edge at Execute	WAB (path-dependant braking) remaining velocity

Tab. 3-80: Min./max. and default values of the MH_MOVE_PROFILE_DATA structure

Functional description 1. Blending modes

The function block "MB_MoveProfile" is provided with two blending modes:

- BlendingPrevious

In this mode, it is only switched to the next velocity after the approached position was reached.

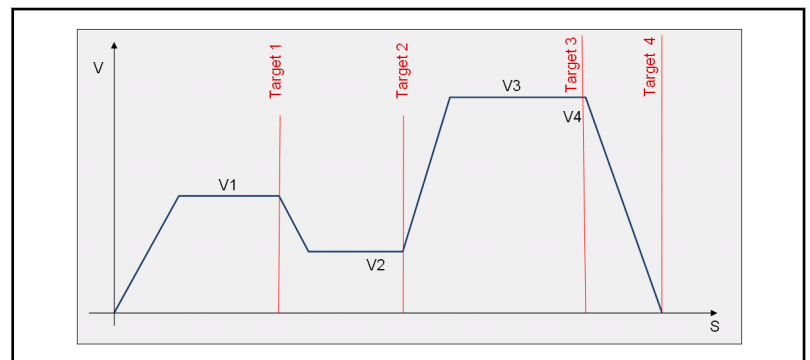


Fig. 3-31: Positioning for the velocity profile in the "BlendingPrevious"

- BlendingLow

In this mode, the velocity of the following target position has to be reached already when reaching the current target position.



This mode is only for falling and not for rising velocities.

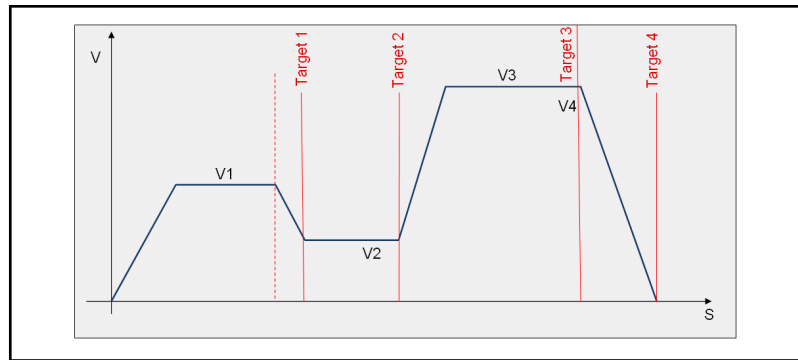


Fig. 3-32: Positioning for the velocity profile in the "BlendingLow"



The mode preset at the function block is not valid for the inflection positions, as this position has to be approached exactly.

2. Special features

- Advancing monitoring - Advancing condition -

This monitoring ensures a smooth transition between the target positions. I.e., the axis does not stop, but immediately switches to the new velocity at the target position to approach the next target position.

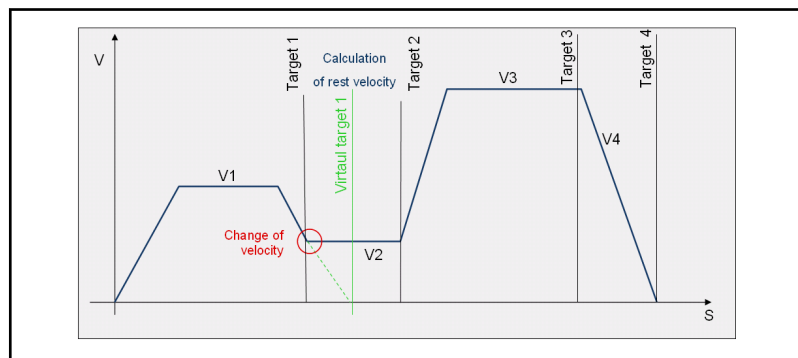


Fig. 3-33: Advancing monitoring of the MoveProfile

- Inflection point monitoring - look ahead -

In the Init phase of the MB_MoveProfile, the points of inflection are determined using the entered positions. They may not be crossed. It is checked cyclically, whether the corresponding axis does not cross the points of inflection with the velocity and acceleration currently specified.



This behavior is inactive if the axis approaches a point of inflection.

If the monitoring starts, all intermediate positions are ignored and the axis approaches the point of inflection directly.

In the trace shown below, target 3 is not approached up to the end, as the monitoring started. The point of inflection (target 4) is now directly approached.

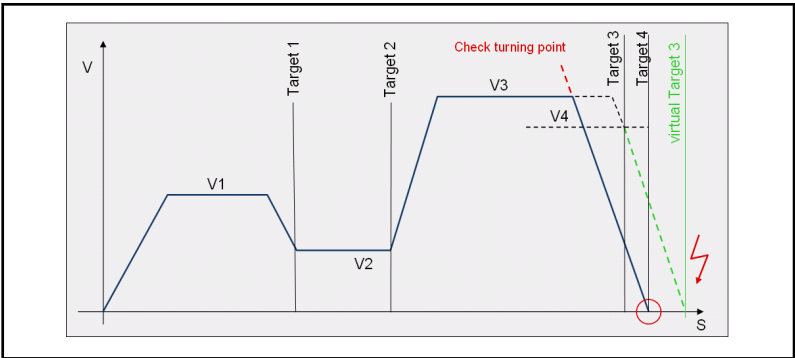


Fig. 3-34: Inflection point monitoring of the MoveProfile

- Path-dependent braking (WAB) - PDB -
The path-dependent braking can be enabled with the "PDB" input.
WAB (path-dependant braking) is described in detail in the MH_MoveAbsPDB function block (MH_MoveAbsPDB on page 57).

Error codes The error codes of the following function blocks are generated:

- MC_MoveAbsolute
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.4.3 MH_MoveAbsVRest

 If the function block is outdated, use the function block [MB_MoveAbsVRest](#), page 24.

Brief description The axis can be traversed to any position via the function block MH_MoveAbsVRest. The axis then moves to the position limit value of the axis (A-0-0030 for positive and A-0-0031 for negative direction) with the remaining velocity. The command can be used for rapid traverse and creep mode applications.

Assignment target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-81: Reference table of the MH_MoveAbsVRest

MH_TechHydrMotion.library

Interface description

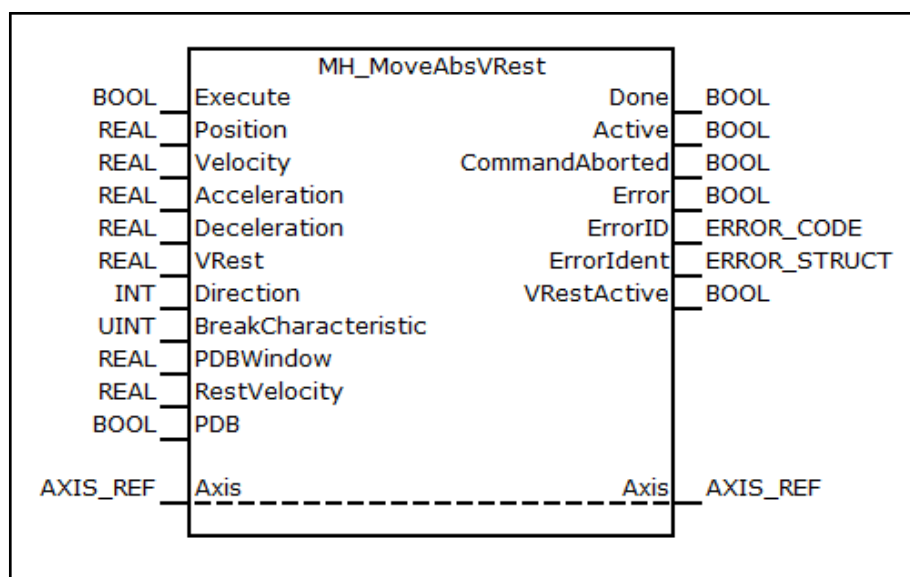


Fig. 3-35: MH_MoveAbsVRest function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Processing of function block enabled
	Position	REAL	Target position 1 for the motion
	Velocity	REAL	Velocity of the axis traveling to the target position 1 (rapid velocity)
	Acceleration	REAL	Acceleration (always +)
	Deceleration	REAL	Deceleration (always +)
	VRest	REAL	Velocity of the axis traveling from target position 1 to the end position. (Creeping velocity)
	Direction	INT	Positioning direction 1 = positive direction, -1 = negative direction, 0 = both directions
	BreakCharacteristic	UINT	WAB (path-dependant braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)
	PDBWindow	REAL	WAB (path-dependant braking) window
	RestVelocity	REAL	WAB (path-dependant braking) remaining velocity
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves MH_MoveProfile
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	VRestActive	BOOL	TRUE: The remaining velocity is reached
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID

	Name	Type	Comment
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 66 .
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis

Tab. 3-82: MH_MoveAbsVRest function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def	n. def	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
VRest	REAL	0.0	n. def	0.0	Rising edge at Execute
Direction	INT			0 (positive direction)	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			FALSE	Rising edge at Execute
RestVelocity	REAL	0.0	n. def	0.0	Rising edge at Execute
PDB	BOOL			FALSE	Continuous

Tab. 3-83: Input behavior of the MH_MoveAbsVRest

Functional description

The axis travels to the target position with the velocity applied. From this target position, the axis moves to its software end position with the remaining velocity. The software end position is parameterized via A-0-0030 and A-0-0031. If the axis has already exceeded its target position, it is immediately moved to the end position with the remaining velocity.

The end position to be traveled to is specified by the "Direction" input.

Positive direction (1) - The axis moves to the positive end position (A-0-0030).

Negative direction (-1) - The axis moves to the negative end position (A-0-0031).

Both directions (0) - The axis moves either to the negative or to the positive end position. This depends on the position of the axis before the function block is enabled. If the current actual position is smaller than the target position, it is traveled to the positive end position. If the current position is greater than the target position, it is traveled to the negative end position.

MH_TechHydrMotion.library

Example of positive direction:

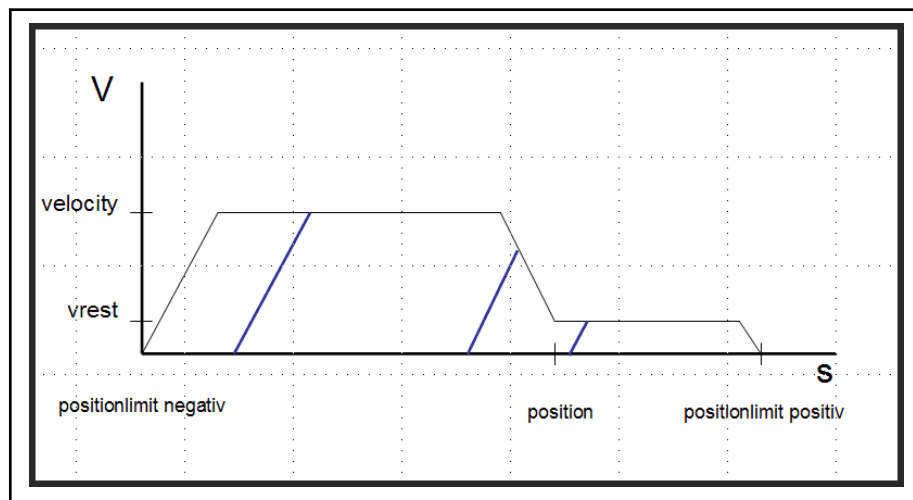


Fig. 3-36: The velocity characteristics are shown via the position, positive direction

Depending on the starting position, traveling is started with the corresponding velocity. If the command is issued in front of the "position", it is first moved to the target position with "Velocity" and then switched to "VRest". If the command is issued when the axis is located behind the position, it is directly moved to the end position with "VRest".

The function blocks responds analogously when starting with negative direction. The only difference is that it is always traveled to the negative end position.

Example of both directions:

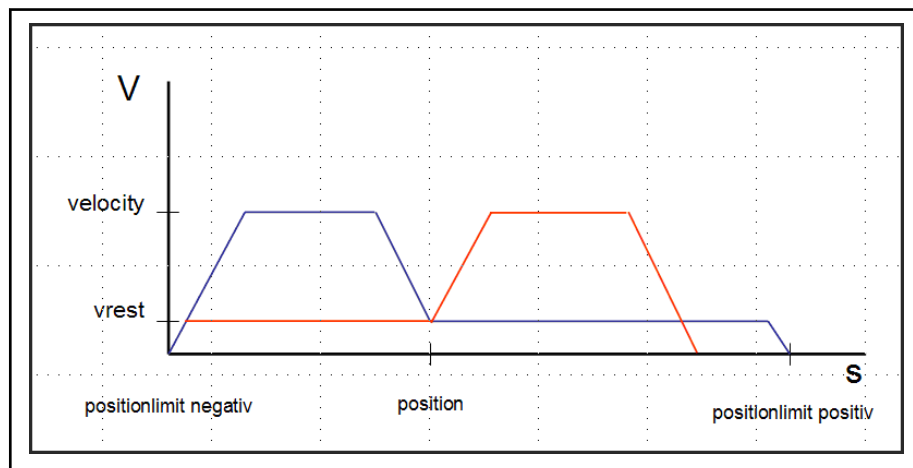


Fig. 3-37: The velocity characteristics are shown via the position, both directions

If "Direction" is set to "both directions", the axis moves from their current position to the target position with "Velocity" and then to the end position determined for the current traversing direction of the axis. Depending on the command velocity, the axis approaches the positive or negative end position.

WAB (path-dependant braking) is described in detail in the function block [MH_MoveAbsPDB](#) on page 57.

Error codes

The error codes of the following function blocks are generated:

- MH_MoveProfile

- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

3.4.4 MH_MoveAbsVRest2



If the function block is outdated, use the function block [MB_MoveAbsVRest](#), page 24.

Brief description

The axis can be traversed to any position via the function block MH_MoveAbsVRest2. The axis then moves to the second target position with the specified remaining velocity. The command can be used for rapid traverse and creep mode applications.

Assignment target system/library

Target system	Library
IndraMotion MLC from version 14VRS HYD basic package	MH_TechHydrMotion

Tab. 3-84: Reference table of the MH_MoveAbsVRest2

Interface description

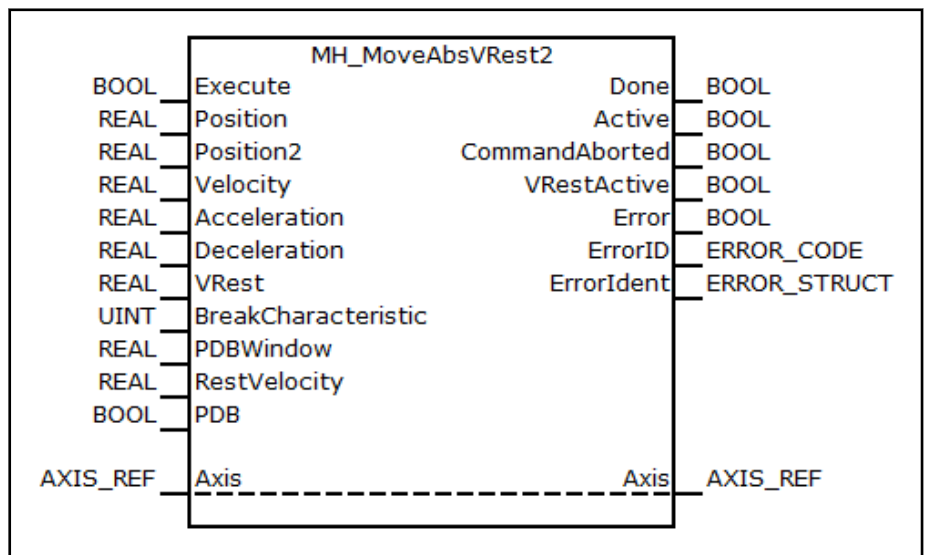


Fig. 3-38: MH_MoveAbsVRest2 function block

	Name	Type	Comment
VAR_INPUT	Execute	BOOL	Processing of function block enabled
	Position	REAL	Target position 1 for the motion
	Position2	REAL	Target position 2 for the motion
	Velocity	REAL	Velocity of the axis traveling to the target position 1 (rapid velocity)
	Acceleration	REAL	Acceleration (always +)
	Deceleration	REAL	Deceleration (always +)
	VRest (13VRS) / Velocity2 (14VRS)	REAL	Velocity of the axis traveling from target position 1 to target position 2. (Creeping velocity)
	BreakCharacteristic	UINT	WAB (path-dependant braking) break characteristics. Value range = 0-100 (0 = exponential function, 100 = root function)

MH_TechHydrMotion.library

	Name	Type	Comment
	PDBWindow	REAL	WAB (path-dependant braking) window
	RestVelocity	REAL	WAB (path-dependant braking) remaining velocity
	PDB	BOOL	TRUE = Axis moves with PDB FALSE = Axis moves MC_MoveProfile
VAR_OUTPUT	Done	BOOL	Processing completed. The outputs are valid
	Active	BOOL	The function block operates. The outputs are valid
	CommandAborted	BOOL	Command aborted by subsequent command
	VRestActive	BOOL	TRUE: The remaining velocity is reached
	Error	BOOL	Indicates that an error occurred in the function block
	ErrorID	ERROR_CODE	Error ID
	ErrorIdent	ERROR_STRUCT	Error structure with further error division, see "Error codes" on page 69
VAR_IN_OUT CONSTANT	Axis	AXIS_REF	Contains information on the specific axis

Tab. 3-85: MH_MoveAbsVRest2 function block

Name	Type	Min. value	Max. value	Default value	Effective
Execute	BOOL			FALSE	Continuous
Position	REAL	n. def	n. def	0.0	Rising edge at Execute
Position2	REAL	n. def	n. def	0.0	Rising edge at Execute
Velocity	REAL	0.0	n. def	0.0	Rising edge at Execute
Acceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
Deceleration	REAL	0.0	n. def	0.0	Rising edge at Execute
VRest	REAL	0.0	n. def	0.0	Rising edge at Execute
BreakCharacteristic	UINT	0	100	0	Rising edge at Execute
PDBWindow	REAL			FALSE	Rising edge at Execute
RestVelocity	REAL	0.0	n. def	0.0	Rising edge at Execute
PDB	BOOL			FALSE	Continuous

Tab. 3-86: Input behavior of the MH_MoveAbsVRest2

Functional description

The axis travels to the first target position with the applied velocity "Velocity". From this position, the axis moves to the second target position with the remaining velocity "VRest".

If the second target position is located behind the first target position (seen from the starting position), the second target position is directly approached with "VRest".

WAB (path-dependant braking) is described in the function block [MH_MoveAbsPDB on page 57](#).

Call the function block in the Motion task to ensure a synchronous command value generation.

Error codes *The error codes of the following function blocks are generated:*

- MH_MoveProfile
- ML_OpenCyclicVelocityChannel
- ML_WriteCyclicVelocity

4 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone: **+49 9352 40 5060**
Fax: **+49 9352 18 4941**
E-mail: service.svc@boschrexroth.de
Internet: <http://www.boschrexroth.com/>

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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