

MCS2 SERVICE TOOL

USER MANUAL



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1 INTRODUCTION

This document is a user manual for the SmarAct Modular Control System 2 (MCS2) Service Tool. Each MCS2 device has a set of persistent configuration parameters. These parameters are loaded on power up of the device. The *MCS2 Service Tool* may be used to change default values for these configuration parameters. The tool displays hardware and firmware versions of a connected device and also offers diagnostic functions to perform device and positioner tests.

2 OVERVIEW

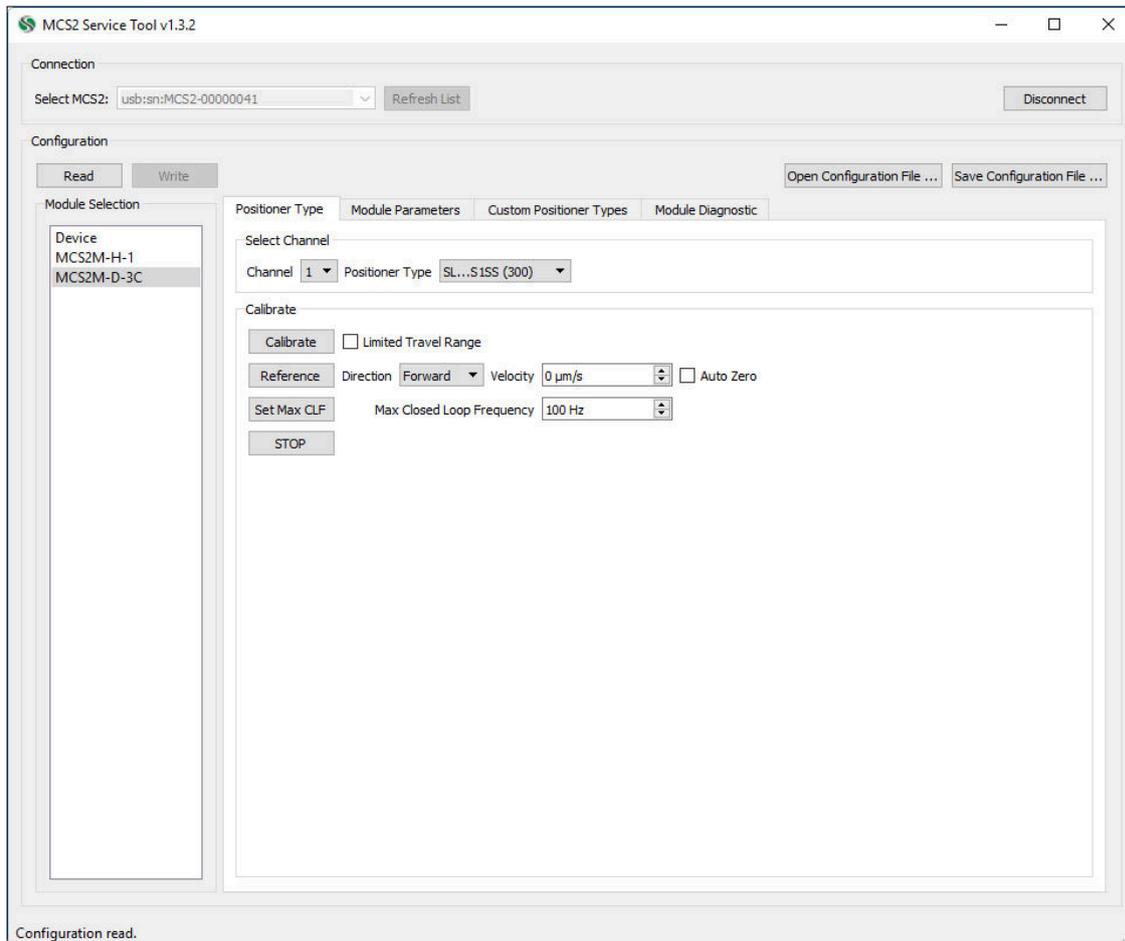


Figure 2.1: Initial View of the MCS2 Service Tool

The *MCS2 Service Tool* is divided into distinct groups which are shown in figure 2.1 "Initial View of the MCS2 Service Tool".

The upper part is the "Connection" group. Here a connection to the MCS2 device may be established, further described in chapter 3 "Connecting to the Device".

Right below is the "Configuration" group. After connecting to a device, the "Configuration" group is used to configure parameters of the device.

On the left side of the tool is the "Module Selection". All modules of a device are listed here. Which configuration tabs are shown on the right side depends on the selected module in this list. The different tabs, their different purposes and their usage are described in chapter 4 "Configuring the Device".

Information, errors and actions taken by the tool are displayed in the statusbar at the lower border.

3 CONNECTING TO THE DEVICE

Connect the device to the PC and power it up to establish a connection. Usually the device is found and entered in the list as soon as the PC recognizes it. Press the *Refresh* button to manually update the list. If no device was found, the last known locator will be displayed. The user can alternatively enter a locator in the following format:

- For USB devices a locator is defined as "usb:sn:<deviceSerialNumber>" (e.g. "usb:sn:MCS2-12345678").
- For Ethernet devices a locator can be defined as "network:sn:<deviceSerialNumber>" or as "network:<deviceIP>" (e.g. "network:sn:MCS2-12345678" or "network:192.168.1.200").

After selecting the device, press the *Connect* button to establish a connection. As the tool reads the current configuration of the connected device right after connecting, this may take several seconds. If this step was successful the formerly disabled options in the "Configuration" group will become available. If this step failed an error will be displayed in the statusbar.

4 CONFIGURING THE DEVICE

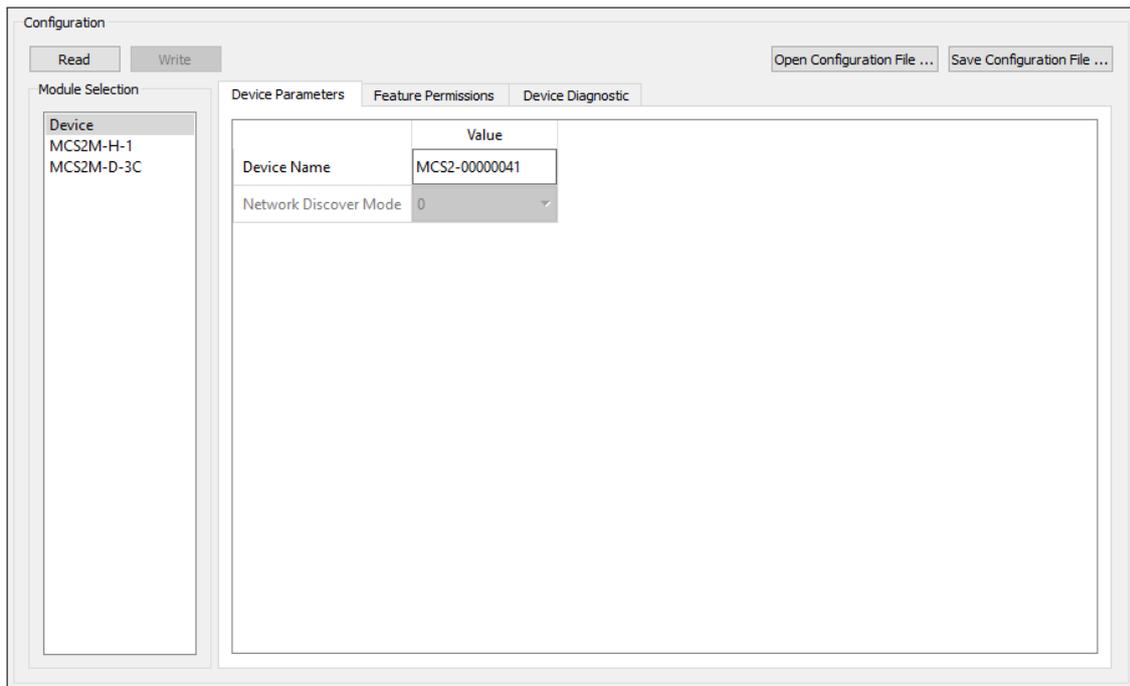


Figure 4.1: Configuration group

Figure 4.1 "Configuration group" displays a part of the tool.

The upper left part of the "Configuration" group contains buttons to respectively read and write the current configuration of the device.

If the *Read* button is pressed all parameters for the device will be reloaded, discarding possible changes made in the *MCS2 Service Tool*.

The *Write* button will only be available if changes were made to the configuration (indicated by an asterisk (*) behind a modified tab). When pressed it will write the contents of modified tabs. Note that only modified values will be written to the device, thus this function is not useful for resetting the device to a specific default state.

The *Open/Save Configuration File...* buttons may be used to read or write a configuration file. Saving to a configuration file allows to store, restore or duplicate a configuration which can then be loaded and written to several MCS2 devices.

The *MCS2 Service Tool* arranges different functions in several tabs. These tabs are grouped by module types which can be selected on the left. Note that only connected modules are shown in the list. The purpose and functionality of each tab is described in detail in the following sections.

4.1 Positioner Type

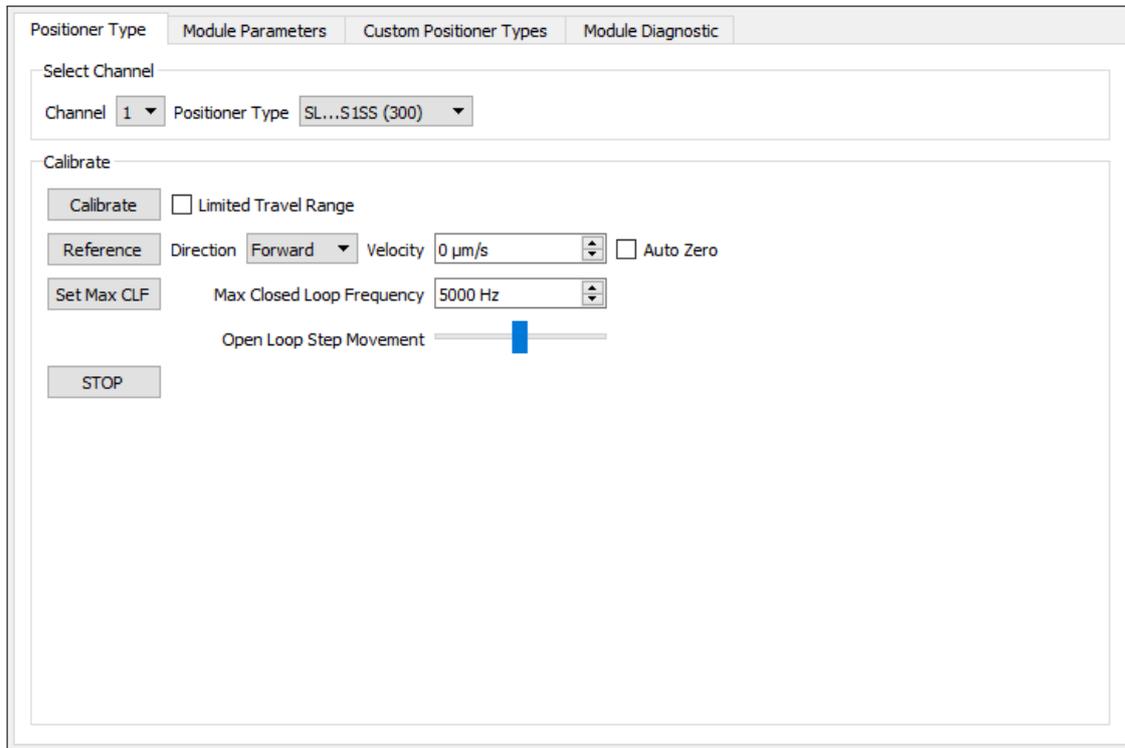


Figure 4.2: Positioner Type tab

The "Positioner Type" tab is used to configure the positioner type for the selected channel of the current device. The positioner type implicitly gives the controller information about how to calculate positions, handle the referencing, configure the control-loop, etc.



NOTICE

When the positioner type of a channel is changed, the channel must be calibrated to ensure proper operation of the positioner.

The tool allows to choose from all positioner types that are supported by the connected device. Each channel stores the positioner type setting to non-volatile memory. Consequently, there is no need to configure the positioner type for each session. Only when changing the physical setup (switching positioners etc.) you must reconfigure (and calibrate) the channel again.

To configure the type select a channel and the corresponding positioner type from the drop down list. Note that the *Write* button must be pressed to apply the configuration to the device. Please refer to the *MCS2 Positioner Types* document for a list of available positioner types.



NOTICE

When using positioners with **M- or L-sensor** on *at least one* channel of a specific driver module *all* positioner types of *this* module must be set to a **M- or L-sensor** type too to configure the correct sensor supply voltage. This rule applies even if the other channels of the driver module are unused, respectively no positioners are connected.

The "Calibrate" group can be used to perform the calibration and referencing sequences for the selected channel. Please refer to the *MCS2 Programmers Guide* document for detailed information on the calibration and referencing of a positioner.

4.1.1 Calibrating

During the calibration routine the positioner will perform a movement of up to several mm in the configured direction to optimize the position calculation for the sensor signals of the positioner. The signal correction calibration should not be started near a mechanical end stop. Nonetheless the calibration sequence automatically detects an endstop and reverts the movement direction to continue the calibration in the opposite direction. If more than one endstop is detected the calibration sequence is aborted with an error.

Some positioners (e.g. micro grippers) have a very **limited travel range**. For these positioners the movement distance may be too small to successfully finish the calibration. Enable the *Limited Travel Range* option to increase the number of allowed endstops while calibrating. The calibration sequence then moves back and forth between the two endstops to perform the signal corrections.

Note that positioners that are referenced via a **mechanical end stop** are moved to the end stop as part of the calibration routine.

4.1.2 Referencing

Press the *Reference* button to instruct the positioner to determine its physical position. It will start to move with the configured velocity in the configured search direction and look for a reference. The *Auto Zero* option may be used to automatically set the current position to zero upon finding the reference position.

Note that the move direction for positioners that are referenced via a **mechanical end stop** is defined by the (persistent) *SafeDirection* instead of this *Direction* setting. (See section 4.2 "Device and Module Parameters"). Note further that when changing the *SafeDirection* the end stop must be calibrated again for proper operation.

In some cases the detection of the physical position might yield false results for positioners with **multiple reference marks**. In these cases a special calibration routine must be performed to correct the absolute position calculation. Press the *Detect Dist Code Inversion* button to start the routine. This option can also be changed in the *Module Parameters* tab described in section 4.2. Note that the button is only displayed if a positioner type with multiple reference marks is configured.

The max closed-loop frequency (MaxCLF) defines the upper limit for the generated driving signal. The maximum allowed frequency that is generated by the control-loop depends on the actual positioner as well as the environment. (E.g. HV and UHV requires lower allowed frequencies.)

Note that a high velocity may not be reached due to a limitation by the max closed-loop frequency. Therefore the *Max CLF* may be changed here. Note that this setting is not held in non-volatile memory but the default value at device startup is configurable. (See "Default Max CLF" parameter in *Module Parameters*, described in section 4.2).

4.2 Device and Module Parameters

	Global Value	Separate Values	Channel 1	Channel 2	Channel 3
Physical Scale Offset	0	<input type="checkbox"/>	0	0	0
Logical Scale Offset	0	<input type="checkbox"/>	0	0	0
Logical Scale Inversion	Inverted	<input type="checkbox"/>	Inverted	Inverted	Inverted
Safe Direction	Forward	<input type="checkbox"/>	Forward	Forward	Forward
Sensor Power Mode	Enabled	<input type="checkbox"/>	Enabled	Enabled	Enabled
Sensor Power Save Delay	100	<input type="checkbox"/>	100	100	100
Position Mean Shift	1	<input type="checkbox"/>	1	1	1
Default Max CLF	5000	<input type="checkbox"/>	5000	5000	5000
Following Error Limit	0	<input type="checkbox"/>	0	0	0
Distance Code Inversion	Normal	<input type="checkbox"/>	Normal	Normal	Normal
Sensor Input Select	Position	<input type="checkbox"/>	Position	Position	Position
Control Loop Input	Sensor	<input type="checkbox"/>	Sensor	Sensor	Sensor
	<input type="checkbox"/> Accumuli		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 4.3: Module Parameters tab

Configuration of device and channel specific parameters can be done in the "Device Parameters" and "Module Parameters" tabs. (Displayed in figure 4.3).

Select "Device" or one of the listed modules in the "Module Selection" on the left side of the tool to display the corresponding set of parameters. The tabs mainly consist of a table, where each row represents a parameter and each column a different channel. As values can either be set for all channels at once or one by one. The table has two additional columns for this purpose. The *Global Value* which defines a default parameter value and the *Separate Values* checkboxes which define whether the global default value or each separate parameter is used. Note that some values are always global and the *Separate Values* checkboxes are not available.

Parameters which are not supported by the current firmware are disabled and can not be written. All values displayed in the table are checked for their respective range limits.

Please refer to the *MCS2 Programmers Guide* document for more information on the meaning and the valid ranges of the different parameters.

4.3 Custom Positioner Types

Positioner Type	Device Parameters	Custom Positioner Types			
Channel 1					
	Custom Slot 0 (250)	Custom Slot 1 (251)	Custom Slot 2 (252)	Custom Slot 3 (253)	
Movement Type	Linear	Linear	Linear	Linear	
Base Unit	Meter	Meter	Meter	Meter	
Base Resolution	-12	-12	-12	-12	
Head Type	C01	C01	C01	C01	
Reference Type	Single Coded	Single Coded	Single Coded	Single Coded	
P Gain	120	120	120	120	
I Gain	0	0	0	0	
D Gain	10	10	10	10	
PID Shift	10	10	10	10	
Anti Windup	0	0	0	0	
ESD Distance Threshold	1000000	1000000	1000000	1000000	
ESD Counter Threshold	100000	100000	100000	100000	

Figure 4.4: Custom Positioner Types tab

In some cases it may be necessary to modify tuning parameters of a positioner type to adapt to an application perfectly. The MCS2 controller offers this possibility by giving access to the tuning parameters. Figure 4.4 shows the "Custom Positioner Types" tab. Each channel has four custom positioner type slots. Each row of the table represents a positioner type parameter which is displayed for each of the custom slots.

When tuning a positioner type the first step should be to select one of the predefined positioner types to act as a template. Note that this step is important to define several internal parameters which are not user accessible. The predefined positioner type defines e.g. the sensor type (S, L, M, etc.) and sensor supply voltage as well as the position calculation parameters. After this, tuning parameters may be modified. Refer to the *MCS2 Programmers Guide* document for detailed information on the tuning parameters.



CAUTION

Configuring inappropriate values may result in unstable or unexpected behavior of the positioners and potential damage of the stage. Custom tuning must be used with caution!

Select the *Channel* and the *Positioner Type Template* in the top section of the tab and press the *Load Template* button in the *Custom Slot* columns of the table to load the template into the custom

slot. Now additional parameters may be configured in the table. Press the *Write* button in the "Configuration" group to apply the changes on the device.

4.4 Module Diagnostic

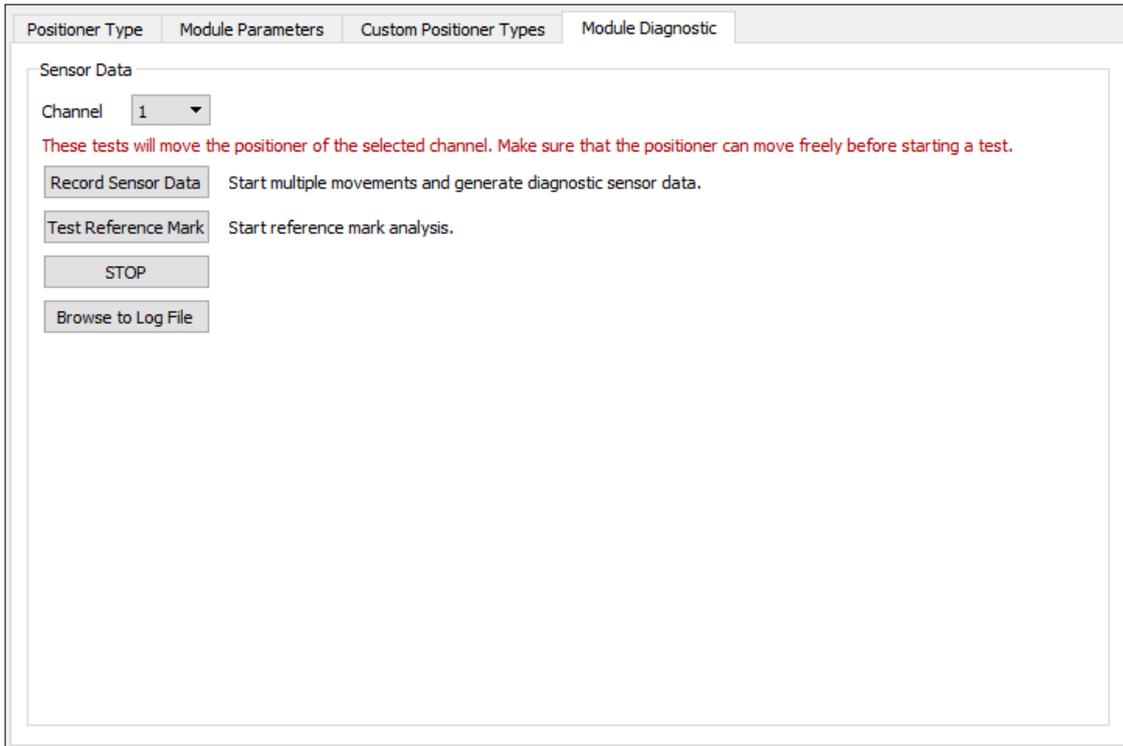


Figure 4.5: Module Diagnostic tab

Select one of the listed modules in the "Module Selection" on the left side of the tool. The "Module Diagnostic" tab (Figure 4.5) then offers several tools to analyze issues with positioners connected to the MCS2 device. The *Record Sensor Data* button triggers multiple open loop movements on the selected channel and records the raw sensor data during the movements. The *Test Reference Mark* similarly moves the positioner to a reference mark and measures its position.

The data of the diagnostic tests is written to a logfile named *SmarActCTL.log*, which is located in the same directory as the service tool. After finishing the tests the generated logfile needs to be sent to SmarAct for further analysis. Use the *Brows to Log File* button to open the directory of the log file in a file explorer.

4.5 Hand Control Module Configuration

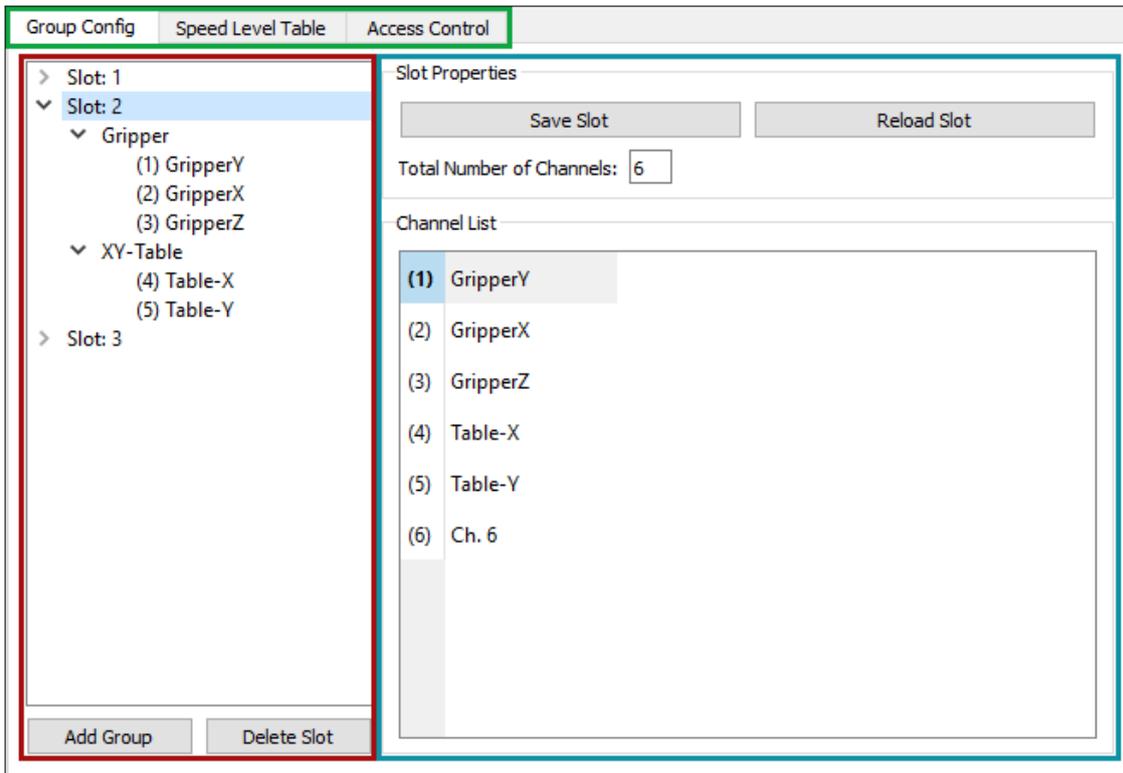


Figure 4.6: HCM Configuration tabs

Each MCS2 Hand Control Module (HCM) has a set of configuration slots, which are saved to the non-volatile memory. If a HCM is connected to the device, the *MCS2 Service Tool* can be used to configure these slots. The "HCM Configuration" is organized into several tabs (green highlight in figure 4.6). For further information regarding the HCM and its configuration refer to the *MCS2 HCM User Manual*.

The left side of the "Group Config" sub-tab (red highlight in figure 4.6) is used to display the hierarchical structure the HCM uses to save slots. Inside this GUI-element a tree is drawn, where each node level contains a single type of node:

- Top most node is the HCM itself which is not displayed here.
- The second level are three slots.
- Each slot can contain up to ten groups.
- Each group can contain up to three 'groupchannels' - a mapping between groups and channels with additional properties.

The tree allows to modify, copy, paste, add and delete nodes. This can be used to generate a multitude of different configurations for the HCM. It is possible to define different amounts of channels per slot, which can be useful if one HCM is used for multiple devices.



NOTICE

When copying one node and pasting it somewhere else, the actual copy happens not until the paste action is triggered. Therefore, if copying one group, changing some parameters and then pasting it, will have the changes inside the pasted group.

Depending on the selection in the left side of the tab (the tree), the context sensitive area (blue highlight in figure 4.6) displays different options:

- Figure 4.7 displays the right area, when a slot node is selected in the tree. Having selected a slot, the context sensitive area contains two buttons (*Save Slot* and *Reload Slot*), a box to set the amount of channels and a list of these channels. The *Reload Slot* button will reload only the selected slot, unlike the global *Read* button (in the top section of the "Configuration" group) which reads all slots at once. The *Save Slot* button will write the slot, regardless if it was modified or not, unlike the global *Write* button (in the top section of the "Configuration" group), which will only write a slot if it was modified. Setting the amount of channels for a slot is not dependent on the connected device, as slots can be configured for different devices this way. The list of channels gives an overview as to how many channels the slot configuration has and their names.

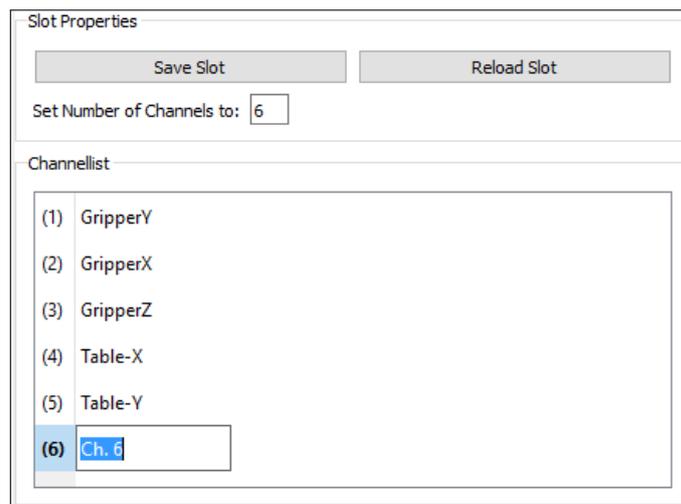


Figure 4.7: Context area when a slot node is selected

- Figure 4.8 displays the right area, when a group node is selected in the tree. The only option available for a group is to change its name. Adding and deleting groups or channels within the group is done through the tree itself, not the context area.
- Figure 4.9 displays the right area, when a channel node is selected in the tree. When a channel is selected, the context area displays all configurable properties for the group channel. Properties which are not available in the current firmware are disabled.

The second "Speed Level Tables" sub-tab contains four tables. The first two define the parameters to be used when selecting a specific speed level in simple mode or scan mode. The last two



Figure 4.8: Context area when a group node is selected

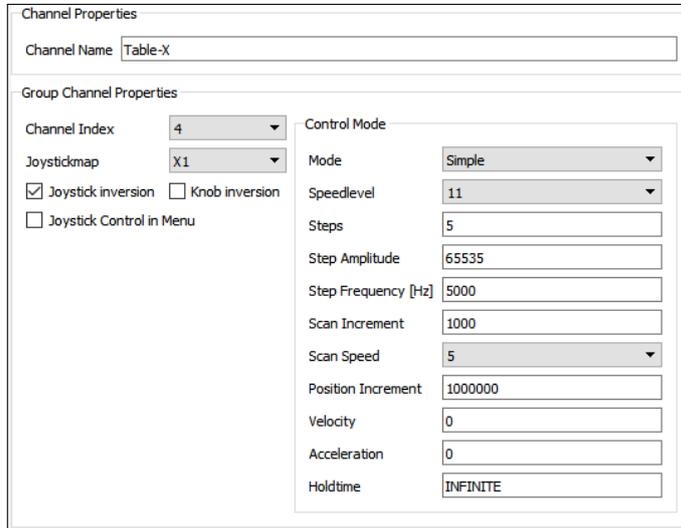


Figure 4.9: Context area when a channel node is selected

tables define the selectable position increments in closed-loop mode. The increment tables can be defined for linear and rotary positioners separately.

The last "Access Control" sub-tab allows disabling of individual HCM features. For a description of each feature see the *MCS2 Programmers Guide* document.



NOTICE

Changing values inside the HCM Configuration tab has no effects on the HCM until either the global *Write* button or a *Save Slot* button was pressed.

4.6 Feature Permissions

Device Parameters				Feature Permissions	Device Diagnostic	
Apply Feature Upgrade ...						
Module Type	Module ID	Enabled Features			Status	
MCS2M-I-U	00000020	None			Idle	
MCS2M-H-1	00000017	None			Idle	
MCS2M-D-3C	00000027	Low Vibration Mode, Advanced Sensor Correction			Idle	
MCS2M-S-3C	00000051	None			Idle	

Figure 4.10: Feature Permissions tab

Select "Device" in the "Module Selection" on the left side of the *MCS2 Service Tool* to display the "Feature Permissions" tab.

The table shows all features currently enabled for a specific module. New features can be unlocked by clicking the *Apply Feature Upgrade...* button and selecting an upgrade file. After selecting the file the *MCS2 Service Tool* performs the upgrades on the corresponding modules and reports the status of each module in the *Status* column.

In order to get feature upgrades please contact the SmarAct technical sales team.



NOTICE

Verify that the correct upgrade file is selected for the device. In case of upgrades for external modules, e.g. sensor module or hand control modules, they must be connected for the upgrade.

4.7 Device Diagnostic

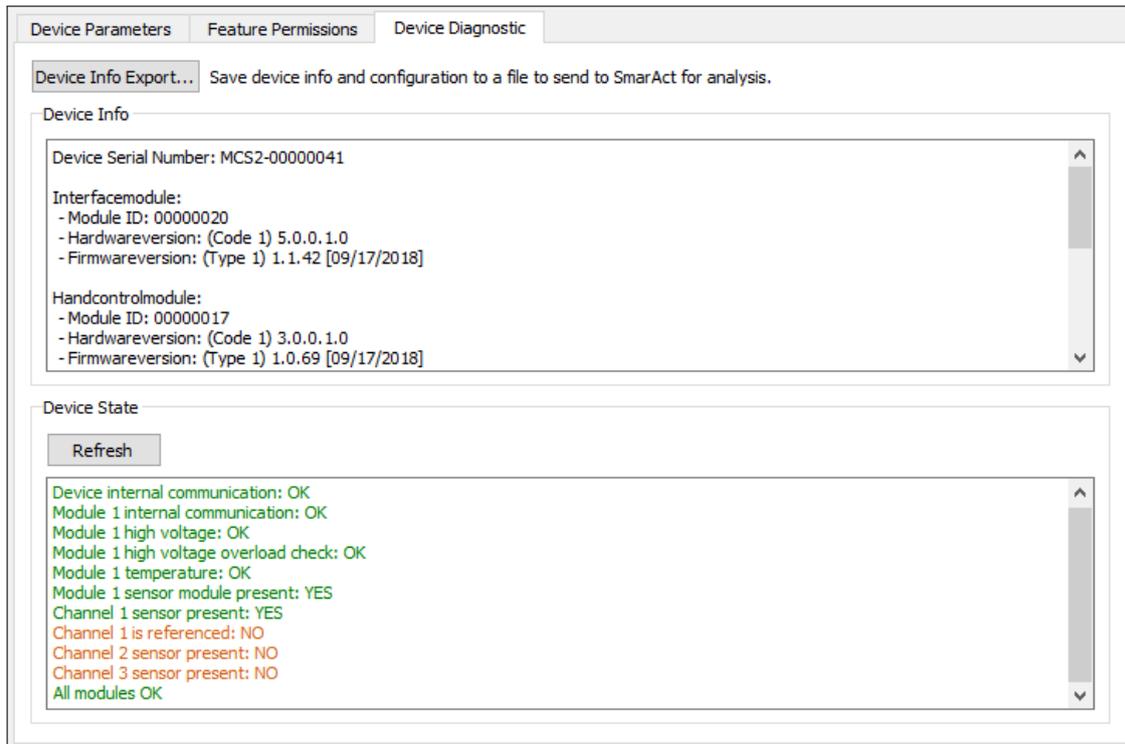


Figure 4.11: Device Diagnostic tab

Select "Device" in the "Module Selection" on the left side of the *MCS2 Service Tool* to display the "Device Diagnostic" tab.

The *Device Info Export...* button may be used to save the device info and configuration of the connected device to a file. This file may then be sent to SmarAct for analysis. It allows the SmarAct support team to get a comprehensive view of the device which affords them to find potential failures or a misconfiguration in a fast and easy way.

The "Device Info" group gives a general overview of the device. It displays information on firmware and hardware versions of all modules of the connected device. Please note that hot-pluggable components (like sensor modules and hand control module) must be connected to the device to display the information.

The "Device State" group allows a quick self-test of MCS2 devices. Click the *Refresh* button to read the state of all available modules. In case of an error this helps finding the affected module and gives information about the type of problem. Fatal failures are displayed in red. Warnings about not connected modules and possible problems are shown in orange. For warnings it should be verified that they match the expected result. E.g. a channel state reporting *no sensor present* while a sensor is actually connected indicates a problem.

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