

MCS2

User Manual



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1 INTRODUCTION

This document is a user manual for the SmarAct Modular Control System 2 (MCS2).

1.1 Preface

The MCS2 is designed to drive actuators with different driving principles from SmarAct (e.g. Stick-Slip piezo actuators or electromagnetic driven positioners).

This manual will help you to install and operate the MCS2 safely in its intended use scenario. Please read this manual carefully before installing and using the MCS2.



NOTICE

Read this manual carefully before operating the MCS2 for the first time. Special attention should be given to chapter 2 "Product Safety".

Any information provided to you regarding custom modifications to standard products or the combination of standard products takes precedence over the general instructions.

1.2 Technical Support

Should you experience any difficulties with your controller or need further technical information, please visit our web site (<https://www.smaract.com>) or feel free to contact our technical support:

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When communicating with our technical support, you will be asked for the model and serial numbers, which can be found on the product.

1.3 Signal Words and Symbols

This manual contains sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words and safety symbols (pictorial hazard alerts).

1.3.1 Signal Words

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and **NOTICE**. The signal words **DANGER**, **WARNING** and **CAUTION** designate the level of hazard when your own **safety**, and/or that of other people, is involved. Do **not** proceed beyond a signal word until the indicated risks of **personal injury** are fully understood and all indicated preventive measures have been taken.

DANGER

Indicates a hazardous situation that, if not avoided, **will** result in **death** or **serious injury**.

WARNING

Indicates a hazardous situation that, if not avoided, **could** result in **death** or **serious injury**.

CAUTION

Indicates a hazardous situation that, if not avoided, **could** result in **minor** or **moderate injury**.

The signal word **NOTICE** is used when there is a risk of **property damage**:



NOTICE

Indicates information considered important, but not hazard-related.

Messages relating to hazards that could result in both **personal injury** and **property damage** are considered as safety messages and not as property damage messages.

1.3.2 Symbols

The signal words **DANGER**, **WARNING** and **CAUTION** always come along with a safety symbol that indicates a special hazard, regardless of the hazard level:



This symbol is intended to alert the operator of important operating and maintenance instructions. Refer to the manual, if this symbol is depicted on the product.



This symbol is intended to alert the operator to the presence of dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electrical shock.

1.4 Warranty and Liability

The general Terms and Conditions of Sale and Delivery of SmarAct GmbH or an equivalent contract negotiated between the contracting parties shall always apply. These are available upon signing the contract, placing an order or at <https://www.smaract.com/terms-and-conditions>. No warranty or liability claims may be made in the event of injury to persons or damage to property if this has arisen from one or more of the following:

- Failure to comply with the information in the operating instructions regarding safety, transport, storage, installation, operation and maintenance of the device.
- Improper use of the product.
- Incorrect assembly and operation.
- Operation of damaged or defective devices.
- Operation with defective or deactivated safety and protective features or devices.
- Unauthorized repairs or unauthorized modifications to the device.
- Inadequate monitoring of parts which are subject to wear.
- Damage caused by exposure to water or other substances, e.g. condensation water formation.
- Damage caused by the intrusion of foreign objects.

1.5 Life Support Policy

SmarAct GmbH does not authorize or warrant any of its products for use in life support systems, without the specific written consent of SmarAct GmbH.

Life support systems are equipment intended to support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided, can be reasonably expected to result in personal injury or death.

2 *PRODUCT SAFETY*

Please read the following information, warnings and safety instructions in this section carefully before using the product.

2.1 Intended Use

The SmarAct **MCS2** controllers are designed to drive SmarAct positioners only. Never connect any other equipment than SmarAct positioners to the **MCS2** controller outputs. It is prohibited to use the **MCS2** controller in an application where a malfunction would present a health risk to humans or endanger the environment.

SmarAct **MCS2** controllers are laboratory equipment designed according to the safety requirements for electrical equipment for measurement, control and laboratory use (DIN EN 61010-1).

The following ambient conditions must be observed when operating **MCS2** controller:

- Indoor use only
- Altitude up to 2000 m
- Operation temperature range from 5 °C to 40 °C
- Storage temperature range from –10 °C to 60 °C
- Maximum relative humidity 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C
- Degree of pollution: 2

MCS2 controllers must be operated with the provided power supply only. This is required to meet all design specifications. Refer to section 5.4 "External Power Supplies" for more information about the power supply.

If the device is not used for a longer period of time disconnect it from the power supply.



NOTICE

Note that the Stick-Slip Piezo Driver of the **MCS2** controller is not designed for continuous simultaneous movement of all channels with high output frequencies. Doing so involves the risk of overheating the controller.

2.2 Personnel Qualification

The MCS2 may only be incorporated by persons (integrators) trained and able to fully assess the safety and conformity of the machine or equipment into which SmarAct components are incorporated in accordance with local laws and regulations. The integrators determine the required qualification of the end user.

2.3 General Safety Instructions

In case of a malfunction of the controller immediately disconnect the power supply from the mains supply to prevent fire or electrical shock.

2.3.1 Atmosphere with Risk of Explosion

Operate MCS2 controller in environments without risk of explosion or ignition only. The controller is operating with electrical energy and may trigger an explosion or ignition.

**WARNING**

Do not use in an atmosphere with risk of explosion or ignition. To prevent ignition of flammable or combustible atmospheres, do not operate the controller in an atmosphere with risk of explosion or ignition.

Observe all terminal ratings. To avoid damage, fire or shock hazard, observe all ratings marked on the controller or documented in this user manual.

2.4 Electrical Safety

2.4.1 Hazardous Voltage

The MCS2 controller described in this manual is capable of generating high output currents at high voltages. They may cause serious or even lethal injury if used improperly. Therefore, the equipment should only be operated by personnel that is adequately trained and educated to prevent any improper use.

**WARNING**

Risk of electrical shock. The MCS2 controller is capable of generating high output currents at high voltages. They may cause serious or even lethal injury if used improperly. In order to avoid hazards/risks that arise for the user and/or damage to the equipment observe the following practices:

- Never touch any part that might be connected to an output with a high voltage.
- Do not connect products from other manufacturers to the output connectors.
- Never use equipment that is damaged in any way.
- Prevent unsecured electrical connections. Ensure that all plugs are inserted completely and locked.
- The MCS2 controller contains no user serviceable parts. Never open the housing. Procedures which require to open the housing must only be carried out by authorized, qualified and trained personnel.

Output connectors with dangerous signals are labeled with the following symbol:

**WARNING**

This applies to all connectors carrying the hazardous drive voltage to the positioning devices such as feedthroughs and sensor modules.

2.5 Handling Precautions

2.5.1 Unpacking

Please be careful when unpacking the MCS2 controller. Inspect the MCS2 controller for signs of damage and only use equipment that shows no signs of damage. In case of any damage, contact SmarAct for replacement. Please save all packing materials in case you would like to transport or ship the product again.

2.5.2 Installation Instructions

The MCS2 controller must be installed horizontally on a desk with at least 3 cm air circulation area around and above the controller. Insufficient air flow can cause overheating, which can result in

a limited functionality of the controller. Do not block the ventilation openings or the fan of the controller.

Route cables in such a way that they do not constitute a tripping hazard.

If you are using an OEM version of an **MCS2** controller, the controller board must be installed in such a way, that free air convection can be achieved. Insufficient ventilation will cause overheating and premature failure. Therefore forced air cooling, for example in a rack with a fan, is preferred. Make sure that no part of the **MCS2** OEM controller board other than the required connectors can be touched after final installation. Please take care to meet all applicable requirements concerning electrical equipment in your regulatory domain.

**NOTICE**

Avoid touching any circuit components, pins or PCB traces, as these components are ESD-sensitive devices.

Please touch the OEM boards on their edges only during handling and installation. Discharge any static charge on your body by touching a grounded object prior to the handling of the **MCS2** controller board. If not installed, place the **MCS2** controller boards only on conductive surfaces, such as ESD- safe transport containers (envelopes or foam).

Only apply power to the **MCS2** OEM controller board if it is installed in the intended housing. Never apply power to a **MCS2** OEM controller board if any other part than the required connectors can be touched.

2.5.3 Connecting Instructions

Never use any other connecting cables than the connecting gear that you obtained from SmarAct. Never use any third party adapters or cables. This can cause failure or malfunction.

**NOTICE**

When removing the USB or Ethernet cable, all positioners will be stopped immediately as a safety precaution.

2.5.4 Note for USB Devices

Devices with a USB interface operate stable even under conditions where electric transients occur. However, the USB connection to the device may fail from the perspective of the connected host device. In this case a reconnect must be issued by the software application to continue operation.

A special API property may be configured to perform an auto-reconnect in these situations. Please refer to the **MCS2** Programmer's Guide for detailed information.

3 PRODUCT OVERVIEW

This document is a user manual for the SmarAct Modular Control System 2 (**MCS2**) which is designed to drive SmarAct actuators.

For the general concepts of controlling the **MCS2** by software as well as for a description of the application programming interface (API) please refer to the **MCS2 Programmers Guide**.

Each **MCS2** control device consists of the following components:

- **MCS2 Main Controller**

The main controller has the following tasks:

- process commands from the hand control module or from the user application software
- read in the sensor data from the integrated position sensors (via sensor module)
- perform closed-loop position control
- drive the positioners

Each **MCS2** controller is equipped with a USB or Ethernet interface and can be controlled by software running on a PC.

- **MCS2 Sensor Module**

The positioners may be equipped with integrated sensors to perform closed-loop positioning control. For this, a sensor module preprocesses the sensor data and delivers the digitized data to the main controller. Alternatively, a SmarAct PicoScale interferometer can be used as a sensor module. Each sensor module can handle up to three positioners.



NOTICE

Positioners with integrated sensors must **always** be connected to a sensor module but **never** directly to the main controller. Plugging a positioner directly to the controller may force the controller to enter the bootloader state which makes it inoperable for positioning control.

- **Hand Control Module (optional)**

The **MCS2** offers easy and ready-to-go control by joysticks and control knobs - without the need of complex installation procedures or software development. The Hand Control Module may be integrated into the main controller or placed inside a separate (external) housing.

- **I/O Module (optional)**

The **MCS2** can be equipped with I/O modules that provide digital and analog inputs and outputs. Fast digital outputs can be used to trigger external devices on specific internal events of the main controller (e.g. Position Reached). Digital device inputs allow to trigger the **MCS2** by an external device for example to perform an Emergency Stop or to synchronize data streaming. General purpose digital inputs and outputs provide control signals to switch lights, relays, dispensers, etc. or to read the state of safety switches, light barriers, etc. Analog inputs can be used to read analog voltage signals from external devices. The controller supports to feed these signals into the control loop. Closed loop operation depending on external sensor signals can be implemented with this feature. The I/O module is integrated into the main controller.

Figure 3.1 shows a structural setup of a typical **MCS2** system.

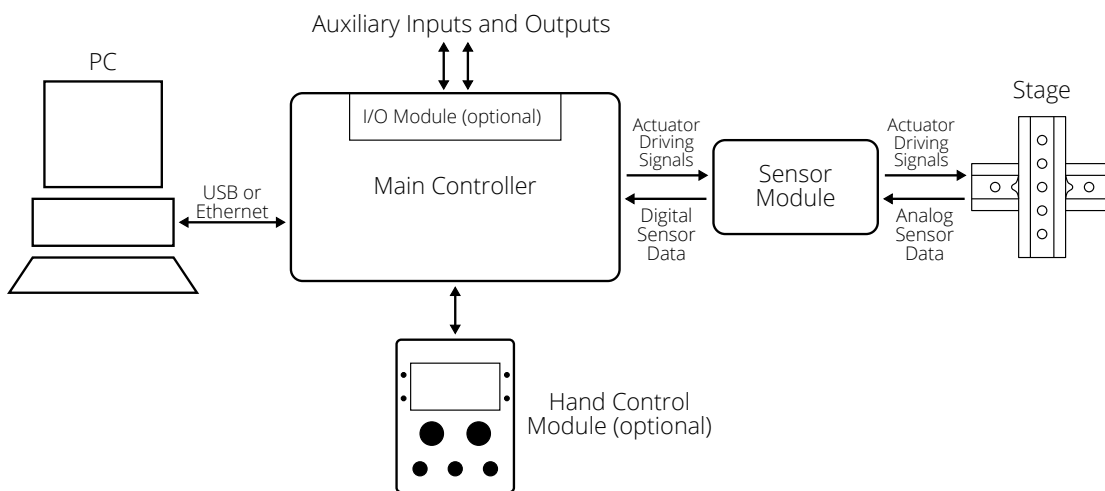


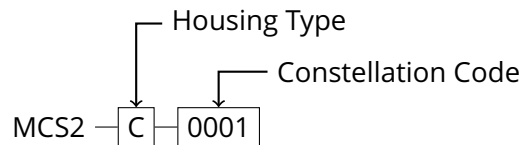
Figure 3.1: Structural Setup of an **MCS2** Device

Note that the Hand Control Module supports hot-plugging. The controller will automatically detect and report a changed configuration. If the connection to the PC or Hand Control Module is unplugged, all movements that were sent over the disconnected interface are stopped as a safety measure.

As there is a wide range of applications, many different combinations of **MCS2** main controllers and sensor modules are configurable to meet the individual needs of our customers. Sections 3.1 and 3.2 give an overview on current models.

3.1 MCS2 Main Controller

MCS2 main controllers are available with different housing, a selectable number of channels and an interface option which offers all the connectivity needed. The configuration of your product is defined by the product code below and the options listed in tables 3.1 and 3.2.



MCS2 devices are also available as OEM constellations without housing for the integration into customer systems. An additional **MCS2 OEM Guide** is available on request for these constellations.

3.1.1 Table Top Controller

The following table top controllers are available:

Table 3.1 – Product Codes Table Top Housing (Type C)

Product Code	Description	Connectors
MCS2-C-0001	3 channel Controller (Stick-Slip Piezo Driver), integrated Hand Control Module, USB interface	USB type B, D-SUB-15 female (Sensor Module)
MCS2-C-0002	3 channel Controller (Stick-Slip Piezo Driver), USB interface	USB type B, D-SUB-15 female (Sensor Module), D-SUB-15-HD female (ext. Hand Control Module)
MCS2-C-0003	6 channel Controller (Stick-Slip Piezo Driver), USB interface	USB type B, D-SUB-15 female (Sensor Module)
MCS2-C-0004	9 channel Controller (Stick-Slip Piezo Driver), USB interface	USB type B, D-SUB-15 female (Sensor Module)
MCS2-C-0005	3 channel Controller (Stick-Slip Piezo Driver), integrated Hand Control Module, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)
MCS2-C-0006	3 channel Controller (Stick-Slip Piezo Driver), Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)
MCS2-C-0007	6 channel Controller (Stick-Slip Piezo Driver), Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)
MCS2-C-0008	9 channel Controller (Stick-Slip Piezo Driver), Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)

Continued on next page

Table 3.1 – Continued from previous page

Product Code	Description	Connectors
MCS2-C-0009	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 3, USB interface	USB type B, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)
MCS2-C-0010	12 channel Controller (Stick-Slip Piezo Driver), USB interface	USB type B, D-SUB-15 female (Sensor Module)
MCS2-C-0011	12 channel Controller (Stick-Slip Piezo Driver), Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)
MCS2-C-0012	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 5, USB interface	USB type B, D-SUB-15 female (Sensor Module), 3x BNC (3 out), USB type B (HSDR)
MCS2-C-0013	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 5, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), 3x BNC (3 out), USB type B (HSDR)
MCS2-C-0014	6 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 3, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)
MCS2-C-0015	6 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 1/3, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), 7x BNC (6 out, 1 in)
MCS2-C-0016	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 3, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)
MCS2-C-0017	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 4, USB interface	USB type B, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO) 1x BNC (1 in)
MCS2-C-0018	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 4, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO) 1x BNC (1 in)
MCS2-C-0019	9 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 3, USB interface	USB type B, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)
MCS2-C-0020	9 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 3, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)
MCS2-C-0021	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 6, USB interface	USB type B, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO), USB type B (HSDR)

Continued on next page

Table 3.1 – Continued from previous page

Product Code	Description	Connectors
MCS2-C-0022	3 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 6, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO), USB type B (HSDR)
MCS2-C-0023	6 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 6, USB interface	USB type B, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO), USB type B (HSDR)
MCS2-C-0024	6 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 6, Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO), USB type B (HSDR)
MCS2-C-0025	6 channel Controller (Stick-Slip Piezo Driver), I/O Module Type 4, USB interface	USB type B, D-SUB-15 female (Sensor Module), D-SUB-37 female (IO) 1x BNC (1 in)
MCS2-C-0026	3 channel Controller (Electromagnetic Driver), integrated Hand Control Module, USB interface	USB type B, D-SUB-26HD female (Sensor Module)
MCS2-C-0027	3 channel Controller (Electromagnetic Driver), integrated Hand Control Module, Ethernet interface	RJ-45 Ethernet, D-SUB-26HD female (Sensor Module)

Figures 3.2 shows the front plates and the location of connectors of two exemplary MCS2 devices with 3 and 6 channels:

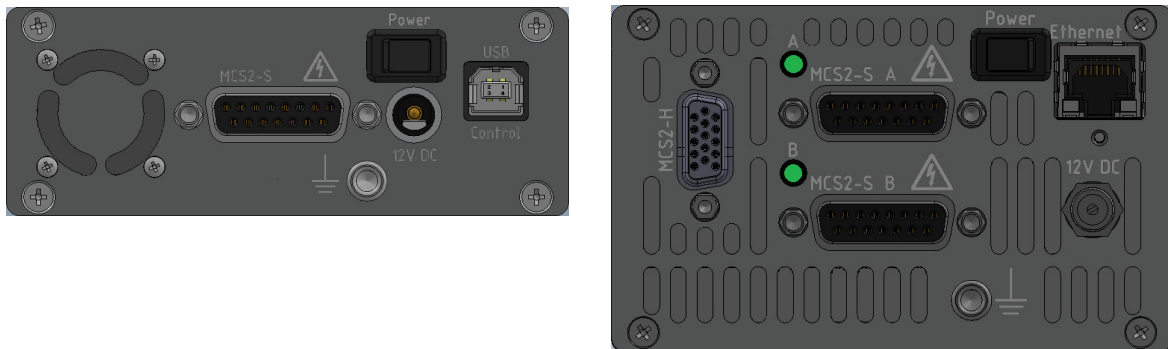


Figure 3.2: MCS2 Table Top Housing Controller, MCS2-C-0001 (left) and MCS2-C-0007 (right)

- **"12V DC"** is the power inlet. Depending on the product code different power connectors are used. See section 5.1.1 "Power Supply Connectors" for more details and 5.4 "External Power Supplies" for a list of power supplies.
- **"Power"** is the power switch to power up the controller.
- **"USB control"** or **"Ethernet"** are the communication interface connectors.
- The **"MCS2-S"** D-SUB connectors are the connections to the sensor modules which are required to connect a positioning stage to the controller. Channels are always sorted "from top

to bottom". This is indicated by additional letters (A, B, ...) if there is more than one driver module.

- The "**MCS2-H**" D-SUB connector can be used to connect an external hand control module.
- The 4 mm "**earth ground**" connector must be used to connect the ground potential of the mechanical system setup to the ground of the MCS2 controller.
- **LED "A/B/C"** are status LEDs which show the device resp. module status. See section 4.3 "Status LEDs" for more information. Note that devices with integrated hand control module do not have a status LED.

Depending on the computer interface and the type of driver the arrangement is a bit different. For more details on the used connectors please refer to chapter 5 "Technical Data".

3.1.2 Rack Controller

The following rack housings and modules are available:

Table 3.2 – Product Codes Rack Housings and Modules

Product Code	Description	Connectors
<i>Rack Housings</i>		
MCS2-R19-0001	Rack Housing 6 slots	IEC-60320-1 C14 power inlet
MCS2-R19-0002	Rack Housing 3 + 3 slots	IEC-60320-1 C14 power inlet
MCS2-R19-0003	Rack Housing 2 + 2 + 2 slots	IEC-60320-1 C14 power inlet
MCS2-R19-0004	Rack Housing 6 x 1 slot	IEC-60320-1 C14 power inlet
MCS2-R19-0005	Rack Housing 2 + 4 slots	IEC-60320-1 C14 power inlet
MCS2-R19-0006	Rack Housing 1 + 5 slots	IEC-60320-1 C14 power inlet
<i>Rack Modules</i>		
MCS2-MOD-0001	3 channel Rack Sub Module (Stick-Slip Piezo Driver)	D-SUB-15 female (Sensor Module)
MCS2-MOD-0002	3 channel Rack Host Module (Stick-Slip Piezo Driver), USB interface	USB type B, D-SUB-15 female (Sensor Module)
MCS2-MOD-0003	3 channel Rack Host Module (Stick-Slip Piezo Driver), Ethernet interface	RJ-45 Ethernet, D-SUB-15 female (Sensor Module)
MCS2-MOD-0006	3 channel Rack Host Module (Stick-Slip Piezo Driver), I/O Module Type 3, USB interface	USB type B, D-SUB-15 female (Sensor Module), 4x BNC (3 out, 1 in)

MCS2 rack devices consist of a **housing** and one or more **rack modules** which are inserted into slots at predefined locations. Each rack features six slots, therefore up to six rack modules may be operated in a rack housing. Note that some modules with integrated I/O modules use two slots, all other modules use one slot.

The housing contains a power supply and a back plane which interconnects the modules.

Back Plane Configurations

Rack housings are available with different back plane configurations. A configuration defines how many individual devices may be operated in the same housing. For configurations with more than one device the back plane is split into separate sections.

An **MCS2** module is either a host or a sub module. A host module differs from a sub module only by its integrated communication interface (USB or Ethernet). Each individual **MCS2** device must have exactly one host module with interface. Additional sub modules (without interface) may be added to extend the number of available channels. The additional sub modules connect through the back plane to the corresponding host module.

When combining modules in a rack housing the back plane configuration must be observed. E.g. a 1 x 6 slot configuration allows to combine one host module and up to five additional sub modules, a 2 x 3 slot configuration allows to operate two *individual MCS2* in one housing, each consisting of one host module and up to two sub modules, etc.

Insertion and Removal of Modules

To insert or remove modules from the housing follow the following instructions:

1. Make sure that the **power switch** is in the "**off**" position (0).
2. Remove the **mains cable**.
3. **Wait for one minute** to ensure that all electric circuits are discharged completely.
4. Unscrew the four screws at the corners of the module or blank cover to be removed.
5. Remove the module or blank cover.
6. Insert the desired module or blank cover.
7. Fasten the four screws at the corners of the module or blank cover.
8. Plug in the mains cable.

Note that unused slots must be closed with blank covers.

Fuse

The rack housing is equipped with a slow-blow fuse in the IEC 60320-1 C14 connector on the back side of the rack. To exchange the fuse follow the instructions below:

1. Make sure that the **power switch** is in the "**off**" position (0).
2. Remove the **mains cable**.
3. **Wait one minute** to ensure that all electric circuits are discharged completely.
4. Remove the fuse carrier and replace the fuse with one of the same type and value. The following fuse must be used: 5x20mm, 5A, T from ESKA (522.724)
5. Reinsert the fuse carrier.
6. Plug in the mains cable.

3.1.3 I/O Modules

Some MCS2 controllers are equipped with one or more I/O modules. I/O modules and their connectors take additional space in the housing, therefore the front plate arrangement is different compared to MCS2 devices without I/O modules. An I/O module is always located above its corresponding driver. Note that the input and output connectors vary between the different types of I/O modules. Figure 3.3 shows two typical MCS2 devices with different types of I/O modules:

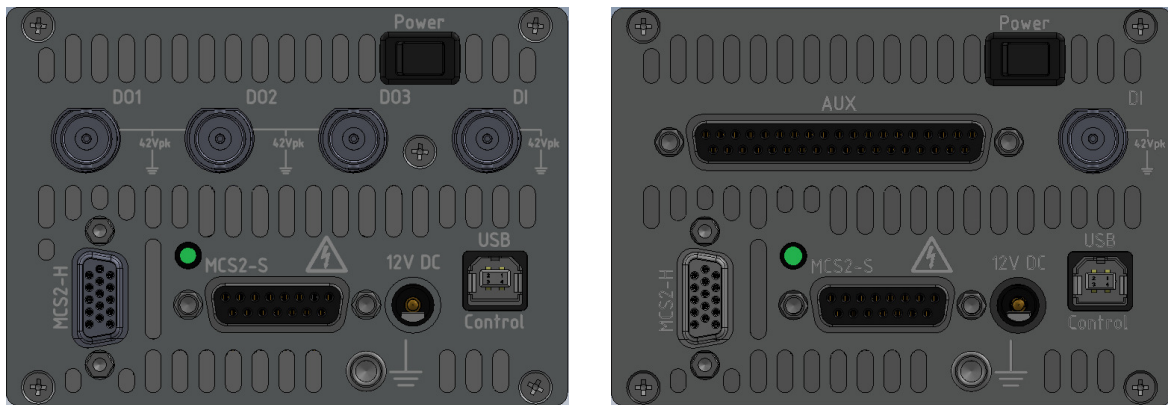


Figure 3.3: MCS2-C-0009 with I/O module type 3 (left), MCS2-C-0017 with I/O module type 4 (right)

Table 3.3 summarizes the features and specifications of the different I/O modules:

Table 3.3: I/O Module Features and Specifications Overview

Variant	Specification	Value	Function
Type 1	Type 3	Connectors	1 x BNC
		No. of digital inputs	1
		Max. sample rate	1 kHz
		Input voltage	3.3V, 5V
	Type 5	Connectors	3 x BNC
		No. of digital outputs	3
		Max. update rate	50 kHz
		Output voltage	3.3V, 5V
	Type 5	Connectors	1 x USB
		Stream rate	50 kHz
	Type 4	Connectors	1 x BNC
		No. of digital inputs	1
		Max. sample rate	1 kHz
		Input voltage	3.3V, 5V
		Connectors	1 x DSub37f
		No. of digital inputs	1
		Max. sample rate	1 kHz
		Input voltage	3.3V, 5V
		No. of digital inputs	4
		Max. sample rate	polled
		Input voltage	3.3V, 5V
Type 2	Type 6	No. of digital outputs	3
		Max. update rate	50 kHz
		Output voltage	3.3V, 5V
		No. of digital outputs	4
		Max. update rate	polled
		Output voltage	3.3V, 5V
		No. of analog inputs	6
		Resolution	16 bit
		Max. sample rate	50 kHz
		Bandwidth	15 kHz
		Input voltage	5V, 10V, +/-2.5V, +/-5V, +/-10V
	Type 6	No. of analog outputs	2
		Resolution	16 bit
	Type 6	Max. update rate	polled
		Output voltage	+/-10V
	Type 6	Connectors	1 x USB
		Stream rate	50 kHz

The following tables list the connectors and functions of the currently available I/O module types:

I/O Module Type 1

Table 3.4 – I/O Module Type 1

Name	Label	Type	Connector	Function
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	BNC	Output Trigger: Position Compare, Position Reached, Actively Moving, In Position

I/O Module Type 3

Table 3.5 – I/O Module Type 3

Name	Label	Type	Connector	Function
DIN-1	DI	1 Digital Device Input	BNC	Input Trigger: Emergency Stop, Trajectory Streaming Synchronization, Command Group Trigger
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	BNC	Output Trigger: Position Compare, Position Reached, Actively Moving, In Position

I/O Module Type 5

Table 3.6 – I/O Module Type 5

Name	Label	Type	Connector	Function
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	BNC	Output Trigger: Position Compare, Position Reached, Actively Moving
HSDR	USB Data	1 USB Interface	USB type B	High Speed Data Reader

I/O Module Type 2

Table 3.7 – I/O Module Type 2

Name	Label	Type	Connector	Function
DIN-1	DI	1 Digital Device Input	D-SUB-37	Input Trigger: Emergency Stop, Trajectory Streaming Synchronization, Command Group Trigger
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	D-SUB-37	Output Trigger: Position Compare, Position Reached, Actively Moving, In Position
GP-DIN-n	AUX	4 Digital Inputs	D-SUB-37	General Purpose Digital Input, Channel Emergency Stop
GP-DOUT-n	AUX	4 Digital Outputs	D-SUB-37	General Purpose Digital Output (Open-Collector)
AOUT-n	AUX	2 Analog Outputs	D-SUB-37	General Purpose +/-10V Analog Voltage Output
AIN-n	AUX	6 Fast Analog Inputs	D-SUB-37	General Purpose Analog Input, Control Loop Feedback

I/O Module Type 4

Table 3.8 – I/O Module Type 4

Name	Label	Type	Connector	Function
DIN-1	DI	1 Digital Device Input	D-SUB-37 / BNC ¹	Input Trigger: Emergency Stop, Trajectory Streaming Synchronization, Command Group Trigger
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	D-SUB-37	Output Trigger: Position Compare, Position Reached, Actively Moving, In Position
GP-DIN-n	AUX	4 Digital Inputs	D-SUB-37	General Purpose Digital Input, Channel Emergency Stop
GP-DOUT-n	AUX	4 Digital Outputs	D-SUB-37	General Purpose Digital Output (Open-Collector)
AOUT-n	AUX	2 Analog Outputs	D-SUB-37	General Purpose +/-10V Analog Voltage Output
AIN-n	AUX	6 Fast Analog Inputs	D-SUB-37	General Purpose Analog Input, Control Loop Feedback

I/O Module Type 6

Table 3.9 – I/O Module Type 6

Name	Label	Type	Connector	Function
DIN-1	DI	1 Digital Device Input	D-SUB-37	Input Trigger: Emergency Stop, Trajectory Streaming Synchronization, Command Group Trigger
DOUT-n	DO1 DO2 DO3	3 Fast Digital Outputs	D-SUB-37	Output Trigger: Position Compare, Position Reached, Actively Moving, In Position
GP-DIN-n	AUX	4 Digital Inputs	D-SUB-37	General Purpose Digital Input, Channel Emergency Stop
GP-DOUT-n	AUX	4 Digital Outputs	D-SUB-37	General Purpose Digital Output (Open-Collector)
AOUT-n	AUX	2 Analog Outputs	D-SUB-37	General Purpose +/-10V Analog Voltage Output
AIN-n	AUX	6 Fast Analog Inputs	D-SUB-37	General Purpose Analog Input, Control Loop Feedback
HSDR	USB Data	1 USB Interface	USB type B	High Speed Data Reader

High-Speed-Data-Reader (HSDR)

The High-Speed-Data-Reader is an extension for the **MCS2** which is integrated in the I/O module type 5 or 6. A PC may communicate with the HSDR via a dedicated USB port using the *SmarActSI* API. These USB ports are labeled with "Data" on the housing.

The HSDR allows streaming of channel data with high data rates. This makes it perfect for positioner tuning or data analyzing applications where high data rates are required. The maximum possible frame rate is 50 kHz with an **MCS2** sensor module and 39.062 kHz if a PicoScale interferometer is used as sensor module.

Note that the HSDR is connected to one driver module of the device and only gives access to the physical channels of this module. For example, if the first driver module of the **MCS2** is equipped with an HSDR the data of the channels 0 to 2 is available for streaming. The available data sources depend on the hardware of the **MCS2**.

Please refer to the *MCS2 HSDR Programmers Guide* document for more information on the usage and programming of the HSDR.

¹The signal of the BNC connector and the D-SUB-37 digital device input are internally connected.

3.2 MCS2 Sensor Module

For positioners with integrated sensors a sensor module is required to digitize the sensor data. The sensor module type depends on the sensor type, the driver type and the connector to the positioner. The configuration of the sensor module is defined by the product code below. Table 3.10 lists the available configuration options.

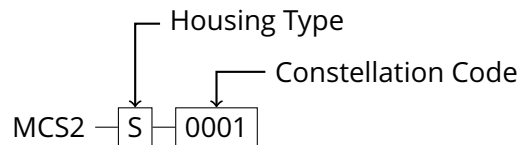


Table 3.10 – Product Codes

Product Code	Description	Connectors
MCS2-S-0001	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors	3x D-SUB-15 female
MCS2-S-0002	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, small form factor	3x LEMO 1B
MCS2-S-0003	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, small form factor	1x LEMO 2B
MCS2-S-0004	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, with mounting ears	3x D-SUB-15 female
MCS2-S-0005	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors	3x D-SUB-15 female, 1x D-SUB-15 male (no cable)
MCS2-S-0006	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, with mounting ears	3x D-SUB-15 female, 1x D-SUB-15 male (no cable)
MCS2-S-0007	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, small form factor	1x LEMO 1B
MCS2-S-0008	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, small form factor	2x LEMO 1B
MCS2-S-0009	3 channel Sensor Module for electro-magnetic driven positioners with S-sensors	3x D-SUB-26HD female, 3x D-SUB-9 female, 1x D-SUB-26HD male (no cable)
MCS2-S-0010	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M- sensors, with mounting ears	3x D-SUB-15 female, 1x D-SUB-15 male (no cable)

Continued on next page

Table 3.10 – Continued from previous page

Product Code	Description	Connectors
MCS2-S-0015	3 channel Stick-Slip Piezo Sensor Module for S-, L-, M-, I- sensors	3x D-SUB-15 female, 1x D-SUB-15 (no cable)

3.3 MCS2 Accessories

In addition to the modules above, some optional accessories may be required for specific configurations. In table 3.11 you will find a list of available accessories.

Table 3.11 – Product Codes

Product Code	Description	Connectors
MCS2-A-PS-CABLE-1.5M-1.5M	Adapter cable for MCS2 and PICOSCALE	3x D-SUB-15 female

4 INSTALLATION AND OPERATION

4.1 Setting up the Device

Before initial operation be sure to read the safety notes in chapter 2 "Product Safety". To set up your MCS2 device please follow the instructions below:

1. Make sure that the **power switch** of your MCS2 controller is in the **off** position (0). or that the MCS2 control module is not supplied with power, respectively.
2. **Connect the sensor modules**, which may be integrated into the manipulator base plate, to the D-SUB-15 / D-SUB-26HD female connector(s) of the MCS2 controller. If the connectors are labeled, their labels must match.
3. If the cables from the positioners or sensor modules are delivered with feed-throughs, **install the feed-throughs** at a flange of the vacuum chamber and connect the matching connectors to both sides of the feed-through. If the connectors are labeled, their labels must match.
4. If the sensor modules are delivered in a separate housing, **connect the positioners** to the D-SUB-15 / D-SUB-26HD female connectors of the sensor modules. If the connectors are labeled, their labels must match.
5. If the hand control module is delivered in a separate housing, connect the **hand control module** to the D-SUB-15HD female connector of the MCS2 main controller using the enclosed cable.
6. If desired, **connect the ground potential** of the mechanical system setup to the ground pin of the MCS2 controller. This is recommended for applications in scanning electron microscopes where the ground potential of the system setup should be equivalent to the ground potential of the controllers.
7. **Connect the power supply**, which has been delivered with the controller, to the power supply connector of the MCS2 controller. Refer to section 5.4 "External Power Supplies" for more information about the power supply.
8. **Connect the MCS2 controller** with one of the following **interface** cables:
 - USB cable to the PC
 - Ethernet cable to a switch or PC (Cat 5 or higher recommended)Only use high quality cables to guarantee proper communication.
9. Power up the controller by switching the **power switch** to the **on** position (I).
10. The positioning system now can be controlled by software. Make sure that the correct **positioner types** and **maximum closed-loop frequencies** are configured for your positioners and perform the **calibration routine** on the controller for each channel.

**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 **MCS2 Service Tool** allows to easily configure and setup the **MCS2** controller and to test your positioning stage. For detailed information on this program please refer to its specific manual.

To create your personal software SmarAct delivers flexible and well documented Windows® and Linux libraries as well as Python packages. For those who like to use LabVIEW™, we provide ready-to-use VIs based on the Windows® DLL. Programming examples for C, Python and LabVIEW™ allow the developer a quick start into the application programming with the **MCS2**.

For more information on the available software please refer to the **MCS2** Software Installation documentation.

4.2 Ethernet Interface Configuration

While devices with USB interface do not need any interface configuration, the ethernet interface must be configured with the network parameters: DHCP mode, IP address, subnet mask and gateway IP address. The **MCS2** is delivered with a default IP configuration which may be adjusted to match the users network settings.

The following table lists the default configuration:

Parameter	Default Value
DHCP Mode	disabled
IP Address	192.168.1.200
Subnet Mask	255.255.0.0
Gateway IP	192.168.1.1
Pass-Key	smaract

The **MCS2** offers several ways to configure the network parameters. These are described in detail in the following sections.

In general, the interface may be configured to use DHCP to obtain an IP address from a DHCP-server or to use a static IP configuration.

4.2.1 Integrated Web Server

The built-in web server is accessible with any internet browser (e.g. Firefox®). Obviously, the current IP address of the controller must be known to be able to connect to the web server. Furthermore, the MCS2 and the PC need to be on the same network to enable the browser to load the configuration web page.

- Open the internet browser and type the IP address of the controller in the address bar. The default IP is: 192.168.1.200.
- Press 'Enter' to access the webserver.

The following webpage should be displayed:

The screenshot shows the 'Information' tab of the 'MCS2 Interface Configuration' web page. The page has a green header with 'Information' and 'Configuration' tabs. The 'Information' tab is active. Below the header, there is a section titled 'Device Information'. It contains several input fields with their current values: Device Serial Number (MCS2-00000000), Device Name (MCS2-00000000), Number of Channels (3), Current IP Address (192.168.1.200), MAC Address (00:00:00:00:00:00), Client IP Address (192.168.1.100), and Protocol / Port (BINARY / 55550). At the bottom of the page, there is a footer with 'MCS2 Interface Configuration' and the 'SmarAct' logo.

Figure 4.1: Device Information Tab of the Webpage

The '**Information**' tab gives some general information about the device, like serial number, device name, number of channels, etc.

The screenshot shows the 'Configuration' tab of the 'MCS2 Interface Configuration' web page. The page has a green header with 'Information' and 'Configuration' tabs. The 'Configuration' tab is active. Below the header, there is a section titled 'Network Configuration'. It contains radio buttons for 'Static IP' (selected) and 'DHCP'. Below these are input fields for IP Address (192.168.1.200), Gateway (192.168.1.1), and Subnet Mask (255.255.0.0). There is a 'Save Configuration' button. Below the network configuration, there is a section titled 'Default Configuration' with input fields for IP Address (192.168.1.200), Gateway (192.168.1.1), and Subnet Mask (255.255.0.0), and a 'Reset to Default' button. A modal dialog box is open in the center with the text 'Enter pass-key to proceed:' and 'Ok' and 'Cancel' buttons. On the right side, there is a 'Warning' box with the text: 'Warning: The configuration is saved permanently and the interface will restart with the new configuration! Make sure that the given parameters match your network setup, otherwise this configuration page may become unreachable!'. At the bottom of the page, there is a footer with 'MCS2 Interface Configuration' and the 'SmarAct' logo.

Figure 4.2: Configuration Tab of the Webpage

The '**Configuration**' tab shows the current network configuration and allows to configure the interface. Note that changes only become effective after the configuration was saved. The configuration is protected against unintentional modification by a pass-key.

- To enable the **DHCP** mode, select the 'DHCP' option. No further settings are required in that case. After saving the configuration, the controller will try to get an IP address automatically from a DHCP server. If no server is available for a certain period of time, the interface will fall-back to the static IP settings. Click the 'Save Configuration' button, enter the pass-key ('smaract') in the upcoming dialog window and click 'Ok'.
- To configure a **static IP**, select 'Static IP' and enter the IP address, the gateway IP and the subnet mask in the designated input fields. Click the 'Save Configuration' button, enter the pass-key ('smaract') and click 'Ok'.
- To **reset** the interface to the factory **default** settings click the 'Reset to Default' button, enter the pass-key ('smaract') and click 'Ok'.

Note that the timeout for the DHCP client is configurable with the *Network DHCP Timeout* property. Please refer to the *MCS2 Programmer's Guide* for more information.



NOTICE

The configuration is saved permanently and the interface will restart with the new configuration! Make sure that the given parameters match your network setup, otherwise the configuration page may become unreachable!

4.2.2 Hand Control Module

The hand control module of the **MCS2** may be used to configure the network interface settings. Enter the 'Main Menu' -> 'Settings' -> 'Network Config.' menu and modify the parameters as desired. Select 'Save Config.' to apply the changes.

4.2.3 SmarActNetConfig Tool

The **SmarActNetConfig** tool may be used to find and configure **MCS2** devices.

The tool is installed with the **MCS2** Software Installer. See the *SmarAct NetConfig User Manual* document for more details on the tool.

4.2.4 Finding an unknown IP Address

There are two methods to find an unknown IP address of a **MCS2** controller:

1. Use the **SmarActNetConfig** tool
2. Set the **MCS2** to default configuration with the 'default config' **push button**

The **SmarActNetConfig** tool is able to find devices regardless of its actual network configuration, even if the parameters do not match the current network settings.

Note that the device cannot be found if the discovering was disabled with the *Network Discover Mode* property. Note further that it cannot be found while the DHCP IP address allocation is running in case the DHCP mode is enabled. If no DHCP server is available the interface will fall-back to the static IP settings after the configured DHCP timeout has expired. After that the device can be found again by the discovering.

For the second method the **MCS2** device has a **push button** on the front panel which may be used to reset the interface configuration to the static default configuration temporarily. The button is located behind a small hole below the ethernet connector on the front panel. Use a pen or a paper-clip to press the button for minimum 5 seconds. The right amber status LED in the ethernet socket will start to flash to confirm the operation. Note that this IP setting is volatile, meaning that a power cycle will restore the original settings assumed they have not been reconfigured in this session.

Now connect to the **MCS2** configuration webpage with an internet browser by using the default IP address: 192.168.1.200. Use the configuration tab to configure a new IP address as desired. For this method the **MCS2** must be connected to a network in the address range: 192.168.xxx.xxx. The easiest way to do this is to connect the **MCS2** directly to the PC ethernet interface and to configure a static IP address for the PC. (For example 192.168.1.100).

4.3 Status LEDs

MCS2 controllers without an integrated Hand Control Module are equipped with a status LED. This LED shows the current device state. Usually the LED is permanently on signaling the normal operation. A sensor module attach or detach process is indicated by fading the LED down and up for ca. 1 second. According to the following table different flashing patterns may occur.

Table 4.1 – Device LED States

LED Pattern	Frequency	Description
On	-	Regular operation
Flashing	2 Hz	Over-temperature of min. one amplifier
Flashing	5 Hz	High-voltage / Power-supply overload
Flashing	10 Hz	High-voltage / Power-supply failure
Flashing	15 Hz	The device is in the bootloader state and has no valid application
Fading up and down	1 Hz	The device is in the bootloader state
Fading up and down	2 Hz	The sensor module initialization failed due to a configuration or firmware mismatch

Ethernet Interface Status LEDs

Devices with ethernet interface have two additional status LEDs in the ethernet socket that provide connection information. The following flashing patterns may occur.

Table 4.2 – Ethernet Interface LED States

LED Pattern	Frequency	Description
<i>Left Green LED (Activity)</i>		
On / Flashing	-	A client is connected to the device and data is being transferred
Off	-	No connection is established
<i>Right Amber LED (Link)</i>		
On	-	There is a physical link and - a static IP address is configured or - the DHCP client obtained a valid IP from a DHCP server
Flashing	1 Hz	DHCP is enabled and the device is busy obtaining an IP address from a DHCP server
Flashing	5 Hz	- DHCP is enabled but no server is available, the DHCP client timed out and the interface was configured with the static IP settings as a fall-back or - the push button on the front panel was pressed for min. 5 seconds and the interface was temporarily configured with the static default IP configuration
Off	-	No physical link, e.g. no ethernet cable is connected

4.4 Resetting to Factory Defaults

The MCS2 controller may be reset to factory defaults to set it to a defined initial state, e.g. when starting with the configuration for a new setup. Doing so resets all properties to their default values.

Note that the controller must be **reconfigured** after that before it can be used again to control a positioning system. The configuration includes e.g. setting of the correct positioner types and maximum closed-loop frequencies for your positioners and performing the calibration routine for each channel.

The *MCS2 Service Tool* offers a configuration wizard which makes it easy to perform the factory reset, for this:

- Start the MCS2 Service Tool
- Connect to the device
- Click the "Configuration Wizard..." button
- Select the "Perform Factory Reset" task and follow the given instructions

Alternatively, when programming your own software, the "factory-reset" may be initiated when opening the device for communication. Refer to the *MCS2 Programmers Guide* for more information.

4.5 Updating the Firmware

The MCS2 controller is equipped with a bootloader system that allows customers to update the firmware of the device to apply bug fixes and feature upgrades. Please refer to the user guide "MCS2-UG00001_PerformingAFirmwareUpdate" for detailed information about the firmware update process. In order to get the latest firmware please contact the SmarAct technical sales team.

The update state of the device is indicated by a slowly up and down fading status LED (see section 4.3 "Status LEDs") or displayed by the hand control module.

5 TECHNICAL DATA

5.1 MCS2 Main Controller Connectors

5.1.1 Power Supply Connectors

Depending on the type of driver the controller is supplied by a 12 V or 48 V power supply. Please use the power supply that has been shipped with the **MCS2** controller and make sure it matches the current and power rating which is specified on the label of the controller (on the bottom or back side of the housing). The following connector types are used:

3-/6-Channel Controller (Stick-Slip Piezo Driver)

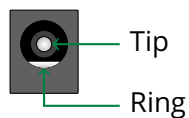


Figure 5.1: DC power connector for power supply

Note that the used barrel power connector must have a pinhole diameter of 2.1mm and an outside diameter of 5.5mm.

Table 5.1 – DC Power Connector Pin Assignment

Pin	Signal	Function
Tip	12V	+12V ($\pm 5\%$) DC Controller Power Supply
Ring	RTN	Power Supply Return

9-Channel Controller (Stick-Slip Piezo Driver)

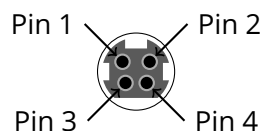


Figure 5.2: Female KPPX-4P connector for power supply

Table 5.2 – KPPX-4P Pin Assignment

Pin	Signal	Function
1, 2	12V	+12V ($\pm 5\%$) DC Controller Power Supply
3, 4	RTN	Power Supply Return
Shielding	PE	Protective Earth

12-Channel Controller (Stick-Slip Piezo Driver)

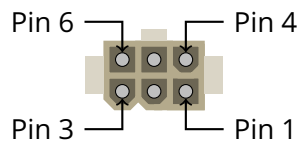


Figure 5.3: Female Mini Fit Jr. connector for power supply

Table 5.3 – Mini Fit Jr. Pin Assignment

Pin	Signal	Function
1, 2, 3	12V	+12V ($\pm 5\%$) DC Controller Power Supply
4, 5, 6	RTN	Power Supply Return

3-Channel Controller (Electromagnetic Driver)

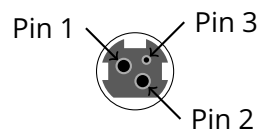


Figure 5.4: Female KPPX-3P connector for power supply

Table 5.4 – KPPX-3P Pin Assignment

Pin	Signal	Function
1, 3	48V	+48V ($\pm 5\%$) DC Controller Power Supply
2	RTN	Power Supply Return
Shielding	PE	Protective Earth

5.1.2 D-SUB-15 Connector for Sensor Module (Stick-Slip Piezo Driver)

The sensor module(s) for piezo driven stick-slip positioners must be connected to the D-SUB-15 female connector(s) of the MCS2 controller. The pin assignment is described below.

Shielded twisted-pair cable must be used for this connection. Observe the matching signal pairs which are indicated with different colors in the table. Consecutively colored lines show the matching signal pairs.

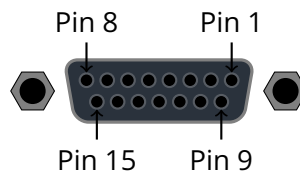


Figure 5.5: D-SUB-15 connector for sensor module

Table 5.5 – D-SUB-15 Pin Assignment

Pin	Signal	Function
1	HV-OUT-1	Positioner driving signal, channel 1, 4, 7, ... ⚠
9	HV-GND-1	Ground for positioner driving signal, channel 1, 4, 7, ... ⚠
2	HV-OUT-2	Positioner driving signal, channel 2, 5, 8, ... ⚠
10	HV-GND-2	Ground for positioner driving signal, channel 2, 5, 8, ... ⚠
3	HV-OUT-3	Positioner driving signal, channel 3, 6, 9, ... ⚠
11	HV-GND-3	Ground for positioner driving signal, channel 3, 6, 9, ... ⚠
4	SM-GND	Ground for sensor module and sensor
15	SM-VCC	Power supply for sensor module, 5V/12V DC
5	SM-TX-D-	RS-422 D- signal from sensor module
12	SM-TX-D+	RS-422 D+ signal from sensor module
6	SM-RX-D-	RS-422 D- signal to sensor module
13	SM-RX-D+	RS-422 D+ signal to sensor module
7	reserved	Reserved for future use
8	d.n.c.	Internal signal line, DO NOT CONNECT
14	SyncB	Internal sync line
Shielding	SM-Shield	Shielding for sensor module and sensor

5.1.3 D-SUB-26HD Connector for Sensor Module (Electromagnetic Driver)

The sensor module(s) for electromagnetic driven positioners must be connected to the D-SUB-26HD female connector(s) of the MCS2 controller. The pin assignment is described below.

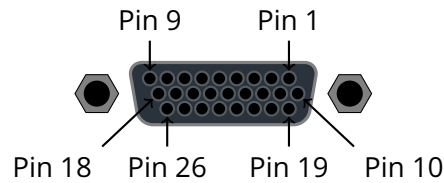


Figure 5.6: D-SUB-26HD connector for sensor module

Table 5.6 – D-SUB-26HD Pin Assignment

Pin	Signal	Function
1	W-OUT-1	Positioner W-phase driving signal, channel 1, 4, 7, ... ⚠
2	d.n.c.	DO NOT CONNECT
3	W-OUT-2	Positioner W-phase driving signal, channel 2, 5, 8, ... ⚠
4	V-OUT-2	Positioner V-phase driving signal, channel 2, 5, 8, ... ⚠
5, 6	SM-VCC	Power supply for sensor module, 5V/12V DC
7	V-OUT-3	Positioner V-phase driving signal, channel 3, 6, 9, ... ⚠
8	SM-TX-D-	RS-422 D- signal from sensor module
9	SM-TX-D+	RS-422 D+ signal from Sensor Module
10	d.n.c.	DO NOT CONNECT
11	V-OUT-1	Positioner V-phase driving signal, channel 1, 4, 7, ... ⚠
12	U-OUT-1	Positioner U-phase driving signal, channel 1, 4, 7, ... ⚠
13	d.n.c.	DO NOT CONNECT
14	U-OUT-2	Positioner U-phase driving signal, channel 2, 5, 8, ... ⚠
15	SM-GND	Ground for sensor module and sensor
16	W-OUT-3	Positioner W-phase driving signal, channel 3, 6, 9, ... ⚠
17	U-OUT-3	Positioner U-phase driving signal, channel 3, 6, 9, ... ⚠
18	EXT_STATE	Internal signal line
19	d.n.c.	DO NOT CONNECT
20	d.n.c.	DO NOT CONNECT
21	SM-RX-D+	RS-422 D+ signal to sensor module
22	SM-RX-D-	RS-422 D- signal to sensor module
23	SM-GND	Ground for sensor module and sensor
24	SyncB	Internal sync line
Shielding	SM-Shield	Shielding for sensor module and sensor

5.1.4 D-SUB-15HD Connector for External Hand Control Module

An external hand control modules may be connected to the D-SUB-15HD female connector. The pin assignment is described below.

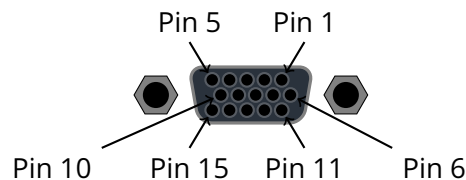


Figure 5.7: D-SUB-15HD connector for external hand control module

Table 5.7 – D-SUB-15HD Pin Assignment

Pin	Signal	Function
1	GND	Ground
2	d.n.c.	DO NOT CONNECT
3	d.n.c.	DO NOT CONNECT
4	d.n.c.	DO NOT CONNECT
5	d.n.c.	DO NOT CONNECT
6	3.3V	Power supply, 3.3V DC
7	d.n.c.	DO NOT CONNECT
8	GND	Ground
9	SyncB	Internal sync line
10	5V	Power supply, 5V DC
11	Switch	Power switch
12	RXD+	Differential data for receiving
13	RXD-	Differential data for receiving
14	TXD+	Differential data for transmitting
15	TXD-	Differential data for transmitting
Shielding	GND	Ground

5.1.5 USB Connector

The USB Type B connector offers direct connectivity e.g. to a PC for software control of the MCS2. The USB interface is galvanically isolated to the internal ground of the controller.

5.1.6 RJ-45 Connector for Ethernet Communication

The RJ-45 connector at the MCS2 main controller provides a standard 10BaseT / 100BaseTX ethernet interface for software control of the MCS2.

5.1.7 BNC Connectors for Fast Digital Input/Outputs

The BNC connectors provide fast digital outputs (DOUT-1, DOUT-2, DOUT-3) and digital device inputs (DIN-1). The connectors are labeled with DO1, DO2, DO3 and DI1 on the front panel of the controller.

Note that the voltage applied to these connectors must not exceed $42 V_{pk}$ to earth / ground. Please refer to the sections 5.3.3 and 5.3.4 for the electrical characteristics.

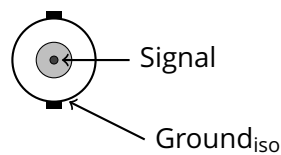


Figure 5.8: BNC connector of auxiliary I/O

5.1.8 D-SUB-37 Connector of Auxiliary I/O

The D-SUB-37 female connector provides analog and digital auxiliary inputs and outputs. All signals are galvanically isolated to the internal ground of the controller. The pin assignment is described below.

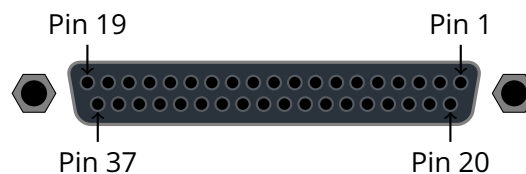


Figure 5.9: D-SUB-37 connector of auxiliary I/O

Table 5.8 – D-SUB-37 Pin Assignment

Pin	Signal	Function
25	DIN-1 ¹	Digital Device Trigger Input
24	GNDiso	Corresponding GNDiso for DIN-1
21	GP-DIN-1	General Purpose Digital Input 1
22	GP-DIN-2	General Purpose Digital Input 2
23	GP-DIN-3	General Purpose Digital Input 3

Continued on next page

Table 5.8 – Continued from previous page

Pin	Signal	Function
6	GP-DIN-4	General Purpose Digital Input 4
20	GNDiso	Corresponding GNDiso for GP-DIN-1/-2/-3/-4
7	GP-DOUT-1	General Purpose Digital Output 1, Open Collector
8	GP-DOUT-2	General Purpose Digital Output 2, Open Collector
27	GP-DOUT-3	General Purpose Digital Output 3, Open Collector
9	GP-DOUT-4	General Purpose Digital Output 4, Open Collector
26	GNDiso	Corresponding GNDiso for GP-DOUT-1/-2/-3/-4
10	DOUT-1	Fast Digital Output 1
29	DOUT-2	Fast Digital Output 2
11	DOUT-3	Fast Digital Output 3
28	GNDiso	Corresponding GNDiso for DOUT-1/-2/-3
12	AIN-6	Fast Analog Input 6
30	GNDiso	Corresponding GNDiso for AIN-6
13	AIN-5	Fast Analog Input 5
31	GNDiso	Corresponding GNDiso for AIN-5
14	AIN-4	Fast Analog Input 4
32	GNDiso	Corresponding GNDiso for AIN-4
15	AIN-3	Fast Analog Input 3
33	GNDiso	Corresponding GNDiso for AIN-3
16	AIN-2	Fast Analog Input 2
34	GNDiso	Corresponding GNDiso for AIN-2
17	AIN-1	Fast Analog Input 1
35	GNDiso	Corresponding GNDiso for AIN-1
18	AOUT-2	General Purpose Analog Output 2
36	GNDiso	Corresponding GNDiso for AOUT-2
19	AOUT-1	General Purpose Analog Output 1
37	GNDiso	Corresponding GNDiso for AOUT-1
1	d.n.c	DO NOT CONNECT, Internally Used
2-5	NC	Not Connected
Shielding	GND	Ground

¹Note that the DIN-1 trigger input is only available on the first I/O module for devices with more than one module.

5.2 MCS2 Sensor Module Connectors

Depending on the type of driver and positioner different sensor modules must be used. See section 3.2 "MCS2 Sensor Module" for a list of available models of the sensor module. The following housings and connectors are used:

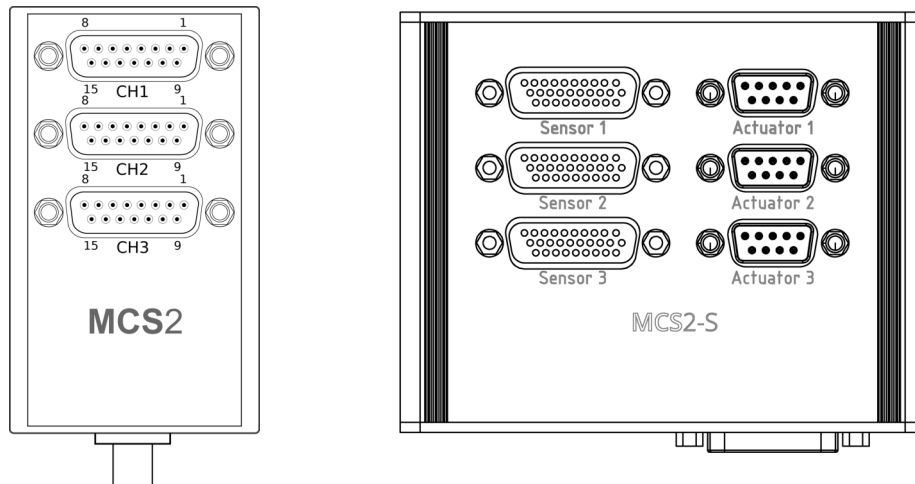


Figure 5.10: Sensor modules for piezo driven positioners (left) and for electromagnetic driven positioners (right)

5.2.1 D-SUB-15 Stick-Slip Piezo Positioner Connectors

Piezo driven positioners must be connected to the D-SUB-15 female connector(s) of the sensor module. The pin assignment is described below.

Shielded twisted-pair cable must be used for this connection. Observe the matching signal pairs which are indicated with different colors in the table. Consecutively colored lines show the matching signal pairs.

Table 5.9 – Pin Assignment

Pin	Signal	Function
1	HV-OUT-x	Positioner driving signal, channel x ⚠
9	HV-GND-x	Ground for positioner driving signal, channel x ⚠
2	d.n.c.	DO NOT CONNECT
10	d.n.c.	DO NOT CONNECT
3	d.n.c.	DO NOT CONNECT
11	d.n.c.	DO NOT CONNECT
4	S-GND	Ground for sensor
15	S-VCC	Power supply for sensor

Continued on next page

Table 5.9 – Continued from previous page

Pin	Signal	Function
5	S-SIN+	sin+ signal from sensor
12	S-SIN-	sin- signal from sensor
6	S-COS+	cos+ signal from sensor
13	S-COS-	cos- signal from sensor
7	S-REF+	ref+ signal from sensor
14	S-REF-	ref- signal from sensor
8	d.n.c.	DO NOT CONNECT
Shielding	S-Shield	Shielding for positioner

*The HV-OUT-x signals are identical to the HV-OUT-x signals from the MCS2 controller.

5.2.2 D-SUB-26HD Electromagnetic Positioner Connectors (Sensor)

The sensor of electromagnetic driven positioners must be connected to a D-SUB-26HD female connector of the sensor module. Note that the sensor *and* the actuator connector of a positioner must be connected to the *same* channel of the sensor module. The pin assignment is described below.

Table 5.10 – Pin Assignment

Pin	Signal	Function
1	d.n.c.	DO NOT CONNECT
2	d.n.c.	DO NOT CONNECT
3	d.n.c.	DO NOT CONNECT
4	d.n.c.	DO NOT CONNECT
5	S-VCC	Power supply for sensor
6	S-VCC-LIM	Positioner present detection
7	d.n.c.	DO NOT CONNECT
8	S-ID-CLK	Positioner ID clock
9	S-ID-DATA	Positioner ID data
10	d.n.c.	DO NOT CONNECT
11	d.n.c.	DO NOT CONNECT
12	d.n.c.	DO NOT CONNECT
13	d.n.c.	DO NOT CONNECT
14	d.n.c.	DO NOT CONNECT

Continued on next page

Table 5.10 – Continued from previous page

Pin	Signal	Function
15	S-GND	Ground for sensor
16	d.n.c.	DO NOT CONNECT
17	d.n.c.	DO NOT CONNECT
18	S-REF+	ref+ signal from sensor
19	S-PRESENT	Positioner present detection
20	d.n.c.	DO NOT CONNECT
21	S-SIN-	sin- signal from sensor
22	S-SIN+	sin+ signal from sensor
23	S-GND	Ground for sensor
24	S-COS-	cos- signal from sensor
25	S-COS+	cos+ signal from sensor
26	S-REF-	ref- signal from sensor
Shielding	S-Shield	Shielding for positioner

5.2.3 D-SUB-9 Electromagnetic Positioner Connectors (Actuator)

The actuator of electromagnetic driven positioners must be connected to a D-SUB-9 female connector of the sensor module. Note that the sensor *and* the actuator connector of a positioner must be connected to the *same* channel of the sensor module. The pin assignment is described below.

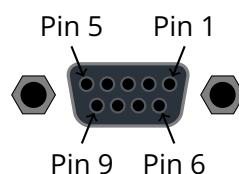


Figure 5.11: D-SUB-9 connector for electromagnetic positioner actuator

Table 5.11 – Pin Assignment

Pin	Signal	Function
1	d.n.c.	DO NOT CONNECT
2	d.n.c.	DO NOT CONNECT
3	d.n.c.	DO NOT CONNECT
4	d.n.c.	DO NOT CONNECT

Continued on next page

Table 5.11 – Continued from previous page

Pin	Signal	Function
5	d.n.c.	DO NOT CONNECT
6	d.n.c.	DO NOT CONNECT
7	W-OUT	Positioner W-phase driving signal ⚠
8	V-OUT	Positioner V-phase driving signal ⚠
9	U-OUT	Positioner U-phase driving signal ⚠
Shielding	A-Shield	Shielding for positioner

5.3 MCS2 Electrical Specifications

5.3.1 Stick-Slip Piezo Driver Output

The following table lists the driver output specifications of the Stick-Slip Piezo Driver.

Table 5.12 – Driver Output Specification

Parameter	Value	Unit
<i>Driving Signal (HV-OUT-x)</i>		
Signalform	sawtooth (step mode) constant (scan mode)	
Output voltage range	0 to 100	V
Average current per channel	330	mA
Peak current per channel, < 10 µs, max. speed	30	A

5.3.2 Electromagnetic Driver Output

The following table lists the driver output specifications of the Electromagnetic Driver.

Table 5.13 – Driver Output Specification

Parameter	Value	Unit
<i>Driving Signal (U/V/W-OUT-x)</i>		
Signalform	3-phase PWM	
Output voltage	48	V
Max current per channel	2	A
Max current per driver module	4	A

5.3.3 Auxiliary Fast Digital Inputs

Digital device trigger inputs are available on I/O modules (DIN-1) as well as in the form of a global device input in a rack housing (G-DIN).

While both behave the same regarding the available features and software configuration the electrical interface is different between a digital device input of an I/O module and the global device input of a rack housing. Figure 5.12 shows simplified schematic circuit diagrams of the different inputs.

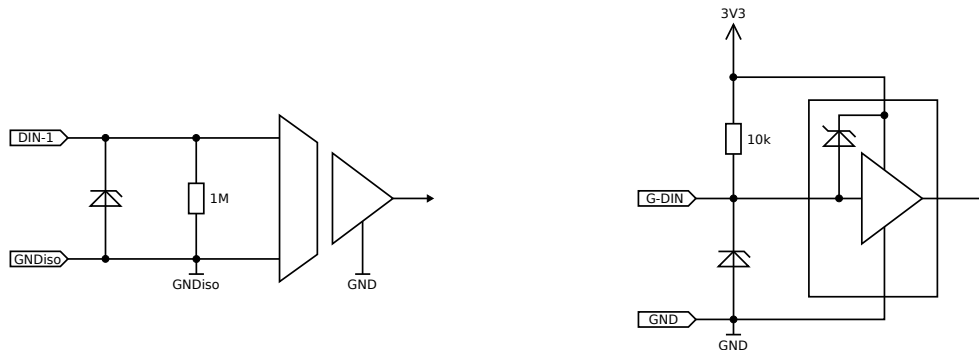


Figure 5.12: Input Circuit of I/O Module Input DIN-1 (left) and Global Device Input G-DIN (right)

I/O Module Device Trigger Input (DIN-1)

This input is available on I/O modules. It is galvanically isolated to the internal ground of the controller. The input features a weak internal pull-down resistor to the isolated ground. The idle level is low and therefore an external voltage must be fed into the input to activate it. The input has schmitt-trigger characteristics. Refer to table 5.14 for the threshold voltage levels.

Table 5.14 – DIN-1 Fast Digital Input Specification

Parameter ¹	Vcc	MIN	TYP	MAX	Unit
V_{iso}				60	V
R_{iso}			10		MΩ
V_i		-0.3	0 .. 5	5.5	V
V_{ih}	3.3V/5V		1.9	2.1	V
V_{il}	3.3V/5V	1.0	1.2		V
R_i			1		MΩ

¹Refer to section 5.3.8 for a description of the used abbreviations.

Global Device Trigger Input (G-DIN)

This input may be present in a rack housing. Note that it is **not** galvanically isolated to the internal ground of the controller. It features an internal pull-up resistor to the 3.3V supply voltage of the controller. The idle level is high and therefore the pin must be tied to GND with a switch or open-collector output to activate the input. An external voltage must not be fed into this input. The input has schmitt-trigger characteristics. Refer to table 5.15 for the threshold voltage levels.

Table 5.15 – G-DIN Fast Digital Input Specification

Parameter ¹	Vcc	MIN	TYP	MAX	Unit
V _i		-0.3	0 .. 3.3	3.6	V
V _{ih}	3.3V			2.0	V
V _{il}	3.3V	0.8			V
R _i			10		kΩ



CAUTION

Note that the global device input of a rack housing has only limited input protection. Applying a higher voltage than specified results in damage of the controller.

5.3.4 Auxiliary Fast Digital Outputs

All **fast digital outputs** (DOUT-1, DOUT-2, DOUT-3) of an I/O module are galvanically isolated to the internal ground of the controller. The output voltage level can be configured to 3.3V or 5V by software. This setting is global for all digital outputs of an I/O module. Note that the digital outputs are in a high-impedance state by default, therefore the output driver must be explicitly enabled.

Table 5.16 – Fast Digital Output Specification

Parameter ¹	Condition	Vcc	MIN	TYP	MAX	Unit
V _{iso}					60	V
R _{iso}				10		MΩ
I _o		3.3V			8	mA
I _o		5V			3	mA
V _{oh}	I _{oh} = 20uA	3.3V/5V	Vcc-0.1			V
V _{oh}	I _{oh} = 2mA	3.3V	3.05			V
V _{oh}	I _{oh} = 3mA	3.3V	2.90			V
V _{oh}	I _{oh} = 5.5mA	3.3V	2.60			V
V _{oh}	I _{oh} = 8mA	3.3V	2.50			V

Continued on next page

Table 5.16 – Continued from previous page

Parameter ¹	Condition	Vcc	MIN	TYP	MAX	Unit
V _{oh}	I _{oh} = 2mA	5V	4.75			V
V _{oh}	I _{oh} = 3mA	5V	4.60			V
V _{oh}	I _{oh} = 5.5mA	5V	4.30			V
V _{oh}	I _{oh} = 8mA	5V	4.20			V
V _{ol}	I _{ol} = -20uA	3.3V/5V			0.10	V
V _{ol}	I _{ol} = -2mA	3.3V			0.20	V
V _{ol}	I _{ol} = -3mA	3.3V			0.26	V
V _{ol}	I _{ol} = -5.5mA	3.3V			0.49	V
V _{ol}	I _{ol} = -8mA	3.3V			0.71	V
V _{ol}	I _{ol} = -2mA	5V			0.20	V
V _{ol}	I _{ol} = -3mA	5V			0.25	V
V _{ol}	I _{ol} = -5.5mA	5V			0.48	V
V _{ol}	I _{ol} = -8mA	5V			0.70	V

5.3.5 Auxiliary GP Digital Inputs/Outputs

The **general purpose digital inputs** (GP-DIN-1 to GP-DIN-4 and GP-DOUT-1 to GP-DOUT-4) are galvanically isolated to the internal ground of the controller. All signals have schmitt-trigger characteristics. Table 5.17 lists the threshold voltage levels. The **general purpose digital outputs** are designed as open-collector outputs. This means that the output logic is inverted. Writing a one to an output switches the output transistor on which leads to a low signal level at the output pin.

Table 5.17 – General Purpose Digital Inputs/Outputs Specification

Parameter ¹	Condition	Vcc	MIN	TYP	MAX	Unit
<i>Common</i>						
V _{iso}					60	V
R _{iso}				10		MΩ
<i>General Purpose Digital Inputs</i>						
V _i			-0.3		5.5	V
V _{ih}		3.3V/5V		1.9	2.1	V
V _{il}		3.3V/5V	1.0	1.2		V
R _i				1		MΩ
<i>General Purpose Digital Outputs</i>						

Continued on next page

Table 5.17 – Continued from previous page

Parameter ¹	Condition	Vcc	MIN	TYP	MAX	Unit
I _{ol}	Open Collector				700	mA
I _{oh}	Open Collector			2		μA
V _{oh}	Open Collector				24	V
R _{on}	Open Collector			400		mΩ

5.3.6 Auxiliary GP Analog Outputs

The **analog outputs** (AOUT-1, AOUT-2) feature a DAC with 16bit resolution. All outputs are galvanically isolated to the internal ground of the controller. The corresponding GND signals of the specific outputs should be used to archive the best performance.



NOTICE

Note that the analog outputs may generate a short random voltage peak in the range of $\pm 10V$ while powering up or down the controller before the level stabilizes at its default level of 0V. External equipment must be capable of standing this or must be disconnected while power-up / power-down.

Table 5.18 – General Purpose Analog Outputs Specification

Parameter ¹	Condition	MIN	TYP	MAX	Unit
V _{iso}				60	V
R _{iso}			10		MΩ
V _o		-10		10	V
I _o				10	mA
R _o			10		Ω
INL	Using line passing through codes 512 and 65024		±4		LSB
DNL			±0.2		LSB
V _{offset}			±4		mV
V _{noise}			860		μV _{pp}
t _{settling}			290		μs
Slew rate	measured btw. 10 to 90 % of a full-scale transition		0.163		V/μs
DC crosstalk	channel to channel		60		μV

5.3.7 Auxiliary Fast Analog Inputs

The **fast analog inputs** (AIN-1 to AIN-6) feature an ADC with 16bit resolution and a build-in 2nd-order low pass filter. All inputs are galvanically isolated to the internal ground of the controller. The corresponding GND signals of the specific inputs should be used to archive the best performance. The input range of the analog inputs is configurable for unipolar as well as bipolar operation. Note that this setting is global for all analog inputs. The total number of six analog inputs are mapped in groups of two to the channels of the corresponding driver module.

Table 5.19 – Fast Analog Inputs Specification

Parameter ¹	Condition	MIN	TYP	MAX	Unit
V_{iso}				60	V
R_{iso}			10		MΩ
V_{ovp}		-11		11	V
R_i			500		kΩ
F_{co}	-3dB		15		kHz
F_{sample}	per channel		50		kHz
INL			±1	2	LSB
DNL			±0.5	1.5	LSB
SINAD			91.5		dB
E_{gain}			0.1		% FSR
E_{offset}			±0.5		mV
V_i	input range=5.12V	0		5.12	V
V_i	input range=10.24V	0		10.24	V
V_i	input range=±2.56V	-2.56		2.56	V
V_i	input range=±5.12V	-5.12		5.12	V
V_i	input range=±10.24V	-10.24		10.24	V

5.3.8 Abbreviations

The following abbreviations are used to describe the electrical specifications.

- V_{iso} : allowed voltage difference from isolated ground to internal ground
- R_{iso} : isolation resistance from isolated ground to internal ground
- V_{cc} : configured common supply voltage
- V_{oh} : minimal output value if output is set high
- V_{ol} : maximal output value if output is set low
- V_o : output voltage range
- I_o : allowed output current
- I_{oh} : output current during high state (source current)
- I_{ol} : output current during low state (sink current)
- V_i : allowed input voltage
- V_{ovp} : overvoltage protection voltage
- V_{ih} : input voltage that is interpreted as high level
- V_{il} : input voltage that is interpreted as low level
- R_i : input impedance value
- R_o : output impedance value
- F_{co} : input filter cut-off frequency
- INL: integral nonlinearity
- DNL: differential nonlinearity
- SINAD: signal-to-noise ratio
- E_{gain} : gain error
- E_{offset} : offset error in % full-scale-range (FSR)
- V_{offset} : offset error
- V_{noise} : DAC output noise
- $t_{settling}$: output voltage settling time (transition time between 1/4 scale and 3/4 scale, including settling to ± 0.024 % within FSR)

5.4 External Power Supplies

The **MCS2** controller must be operated with a suitable power supply to ensure reliable operation. The required voltage and power ratings depend on the configuration of the controller which is defined by the product code. The product code can be found on the label attached to the housing of the controller. Refer to table 3.1 in section "3.1 MCS2 Main Controller" for a list of **MCS2** product codes.

When using rack mounted **MCS2** modules, the power supply is integrated in the rack housing. All other **MCS2** controller require an external power supply. Table 5.20 lists the **MCS2** product codes and their corresponding power supply models.



CAUTION

Always use the appropriate power supply for a specific **MCS2** according to table 5.20. Contact SmarAct if it is required to use a different power supply for the controller.

Table 5.20 – MCS2 External Power Supplies

MCS2 Product Codes ¹	Manufacturer	Model	Voltage Rating	Current Rating	Power Rating
MCS2-C-0001	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0001	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0002	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0002	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0003	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0003	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0004	XP Power	AHM150PS12	12V	12,5A	150W
MCS2-C-0005	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0005	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0006	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0006	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0007	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0007	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0008	XP Power	AHM150PS12	12V	12,5A	150W
MCS2-C-0009	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0009	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0010	Mean Well	GST280A12-C6P	12V	21A	252W
MCS2-C-0011	Mean Well	GST280A12-C6P	12V	21A	252W
MCS2-C-0012	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0012	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0013	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0013	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0014	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0014	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0015	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0015	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0016	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0016	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0017	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0017	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0018	HN Power	HNP65-120	12V	5A	60W

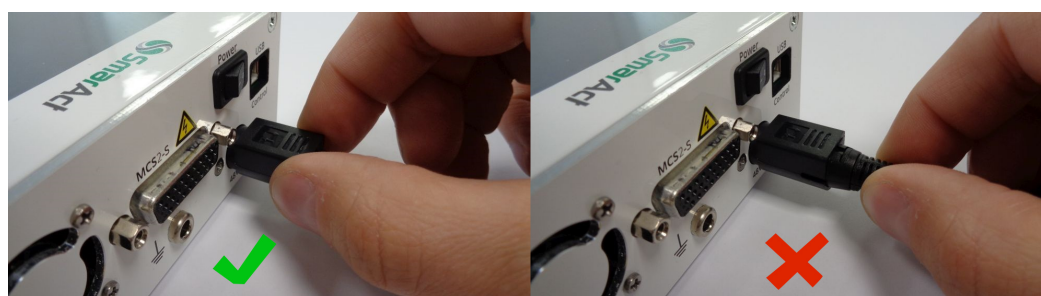
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Table 5.20 – Continued from previous page

MCS2 Product Codes ¹	Manufacturer	Model	Voltage Rating	Current Rating	Power Rating
MCS2-C-0018	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0019	XP Power	AHM150PS12	12V	12,5A	150W
MCS2-C-0020	XP Power	AHM150PS12	12V	12,5A	150W
MCS2-C-0021	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0021	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0022	HN Power	HNP65-120	12V	5A	60W
MCS2-C-0022	Sunny	SYS 1548-6512-T2	12V	5,41A	65W
MCS2-C-0023	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0023	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0024	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0024	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0025	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0025	RS	Pro 11012D	12V	8,33A	100W
MCS2-C-0026	Mean Well	GST220A48-R6B	48V	4,6A	221W
MCS2-C-0027	Mean Well	GST220A48-R6B	48V	4,6A	221W
MCS2-C-0029	Protec	PMP120-12-B1-S	12V	8A	96W
MCS2-C-0029	RS	Pro 11012D	12V	8,33A	100W

**NOTICE**

When detaching the power supply plug from the device be sure to grab the plug by its housing (not the cable) while pulling. The plugs of some power supplies have a mechanical locking mechanism which is unlocked this way.



¹If several power supplies are specified for a product code, these can be used alternatively.

6 DISPOSAL OF OLD EQUIPMENT

According to the EU directive 2012/19/EU, as of August 13th, 2012, electrical and electronic equipment may not be disposed with other wastes in the member states of the European Union.

SmarAct respects the manufacturer's product responsibility and will take care of environmentally correct disposal of old SmarAct products free of charge.

To dispose old SmarAct equipment, you can return it to SmarAct GmbH to the following address postage-free:

SmarAct GmbH
Schuette-Lanz-Strasse 9
26135 Oldenburg, Germany



WEEE-Reg.-Nr.: DE 47992153

7 MANUFACTURER DECLARATIONS

7.1 Declaration of Conformity

according to DIN EN ISO/IEC 17050-1:2010

Manufacturer: SmarAct GmbH
Manufacturer's Address: Schuette-Lanz-Strasse 9
26135 Oldenburg, Germany



The manufacturer hereby declares that the product

Product name: MCS2
Model Numbers: MCS2-C-xxxx, MCS2-S-xxxx, MCS2-H-xxxx,
MCS2-R19-xxxx, MCS2-MOD-xxxx
Product Options: all

complies – if installed in a compatible chassis from SmarAct and connected to a power supply provided by SmarAct – with the following European directives:

2014/35/EC	Low Voltage Directive
2014/30/EC	EMC Directive
2011/65/EU	RoHS Directive

The applied standards are listed below:

EMC:	EN 61326-1:2013 (Group 1, Class A)
Safety (Low Voltage Directive):	EN 61010-1:2010

July 3, 2018
Oldenburg, Germany


Axel Kortschack
Managing Director

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