

MCS2



The **MCS2** is SmarAct's most versatile and modular control system.

Its stringent modular design approach makes it the perfect choice for a all fields of applications. From single positioning stages up to the most complex multi-axes systems with up to 18 positioning stages the **MCS2** can be configured to match every setups specific requirements.

Key Features

User Friendly

- Pre-configured modular system
- Intuitive hand control module with joysticks and touchscreen
- Demo applications for a quick start
- Programming examples for LabVIEW® and C++

Upgradeable

- Sophisticated firmware modules
- Low-vibration mode to reduce vibrations caused by stick-slip motion
- Advanced sensor calibration for increased accuracy

Intuitive

- Remote Control Module with intuitive user interface
- Touchscreen
- Two configurable analog 2D joysticks
- Tactile buttons and knobs

Powerful

- Compatible with all SmarAct stages
- Support S, L and PICOSCALE position sensors
- Fast control loop with up to 50 kHz

Smart

- Synchronous motion of multiple axes
- Complex customizable trajectories
- Up to 1 kHz trajectory point frequency
- Power save mode for vacuum applications
- Scan mode for sub-nm slip-free piezo motion
- Quiet mode for life science applications.

Versatile

- Optional I/O Modules
- Trigger inputs for external synchronization
- Configurable trigger outputs for each channel
- 16-bit analog inputs e.g. as control-loop input
- 16-bit analog outputs e.g. to control external components
- High speed data reader (HSDR) module for synchronous detection of position and external signals
- High speed position data streaming

Modular Concept

The MCS2 Series is based on a highly modular system concept which allows SmarAct to provide you with a perfectly adapted and pre-configured control system. The following modules of the MCS2 modular system are available.

Main Controller Module with communication interface

This module is the core component of every MCS2 configuration. It reads the sensor data from the sensor module and performs closed-loop position control and drives the stages. It also includes the communication interface module which can offer either an USB or an Ethernet interface.

Sensor Module

This module converts the analog sensor data into digitized data which is processed by the main controller module.

Hand Control Module

The hand control module offers a touchscreen, physical buttons and two analog joysticks to manually interact with the positioning system. Physical axis of the

positioning system can be easily mapped to joystick axis for easy manual positioning. If the stages are equipped with position sensors the actual stage position can be read of the module's touchscreen.

I/O Modules

SmarAct offers a wide variety of I/O modules. From simple modules with digital outputs up to multipurpose modules with both digital and analog input and output functionality. Fast digital outputs can be used to trigger external devices on specific internal events of the main controller (e.g. Position Reached Events). 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 control light sources, 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 allowing closed-loop operation depending on external sensor signals. I/O modules double also as multifunctional data acquisition cards as the value of the connected signals is available via the SDK. Whenever it is required to stream data from a **MCS2** controller equipped with specific I/O module it is possible to equip it also with a High Speed Data Reader (HSDR) extension board. The HSDR allows to stream position and other channel data with a maximum possible frame rates of up to 50kHz via a dedicated USB port using the SmarAct API.

Please find a detailed description of the I/O Modules in the **MCS2** Download section.

MCS2 Enclosure Variants

Depending on the specific configuration of the MCS2 the modules can be integrated in one of the following enclosures:



Integrated Handheld: The integrated handheld is equipped with a main controller module including a communication interface and a human machine interface module. All together combined in a small and light enclosure.



Rack Enclosure: The modular rack enclosure with 6 slots is equipped with a main controller module including a communication interface and a backplane. It is compatible with 3-channel main control modules encapsulated into module carriers which will use up one slot. Consequently, up to six main controller modules can be mounted into the three height unit rack enclosure making it possible to control up to 18 positioning stages.



Tabletop Enclosures: Tabletop enclosures are equipped with a main controller module including a communication interface in the most basic configuration. They can also be equipped with three other main controller or I/O modules which means up to 12 positioning stages can be controlled with one compact desktop device. Manual control is optional available and realized via an external hand control module.

Firmware Modules and Features

To increase the functionality of MCS2 control system even further and to adapt driving parameters of the connected piezo stages to the application SmarAct has developed several firmware modules and features. Some of them are enabled by default in every MCS2 Controller others are available as options.

Power Save Mode

This firmware feature is especially interesting for stages that are going to be used in vacuum experiments. The mode changes the duty cycle of the position sensors LED when the stage is in an idle state and not moving. This significantly reduces the heat dissipation of the position sensor and the overall heat load on the stage and the positioning system.

Scan Mode

Enabling this firmware feature affects the control loop in a way that it exclusively uses the scan feature of the piezo drive omitting large distance steps occurring during a stick-slip motion. This feature is useful whenever the controlled stage is being used for scanning probe applications where a stick-slip motion could harm or damage samples and tools.

Quiet Mode

The Quiet Mode firmware feature was especially developed for life science applications. This mode shifts the driving frequency of the piezo motor out of the human hearing

range, significantly reducing the inevitable audible noise caused by the stick-slip motion of the piezo motor.

Zero-Voltage Mode

This firmware feature also affects the control loop in a way that it guarantees that the supply voltage after each stick-slip motion is controlled to zero Volts. This feature is especially interesting for stages that are being used in scanning electron microscopy systems, or experiments utilizing low energy electrons or ions.

Low-vibration Mode (Optional)

The Low-Vibration Mode firmware module was especially developed for ultra-high precision applications like Scanning Probe Microscopy and life science experiments. This algorithm reduces the vibrations which inevitably occur by the stick-slip driving principle. The result is a smooth motion which enables the usage of our stick-slip piezo stages even for most demanding applications.

Advanced Sensor Calibration (Optional)

SmarAct stages and systems can be equipped with integrated nanosensors (S). These are based on optical incremental encoders, which interpolate between stripes on a sensor scale. This leads to a small periodic interpolation error, with a periodicity matching the grating pattern of sensor scale, i.e. the spacing between the stripes. This error affects the absolute accuracy of the stages but not the repeatability. The Advanced Sensor Calibration firmware module reduces these periodic errors significantly. This patented feature is especially interesting for applications where absolute accuracy is crucial. These include for example highprecision scanning and stitching of microscopy images.

Embedded Control Module (ECM)

The Embedded Control Module is equipped with serial and Ethernet interfaces and uses an ASCII based command language which allows an easy integration into existing control environments like TANGO or EPICS. It can control SmarAct positioning stages connected to MCS2 controllers and does not require any driver software on the client side. Due to its powerful embedded software it is also possible to adapt the system to your requirements. The ECM is available as a rack mountable module compatible to the rack enclosure or as tabletop device.



Contact

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