



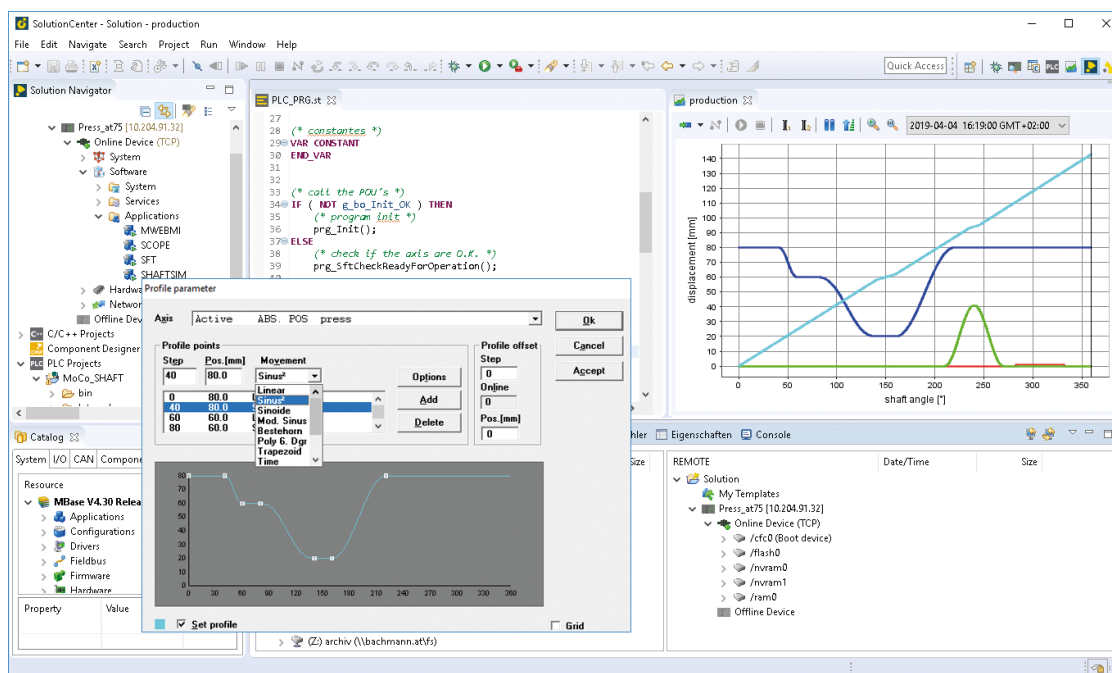
M-SHAFT Upright Shaft

Cyclically recurring production sequences mostly consist of several associated motion axes. These actuators are operated here in a precisely defined sequence. Mechanical cams were previously used for synchronization tasks. M-SHAFT makes it possible to create a virtual form of this rigid coupling. The production of an individual workpiece corresponds here to a rotation of the upright shaft. The positioning of the individual motion axes is linked to this rotation. This transformation of the motion sequence from a time value to a rotation angle offers an essential benefit: Even with a varying production speed, the set motion sequence is always performed automatically. The tedious work involved in manually changing the motion profiles thus becomes a thing of the past.

Part type designation	Part number
M-SHAFT Download	00017168-90
M-SHAFT RT	00017168-63

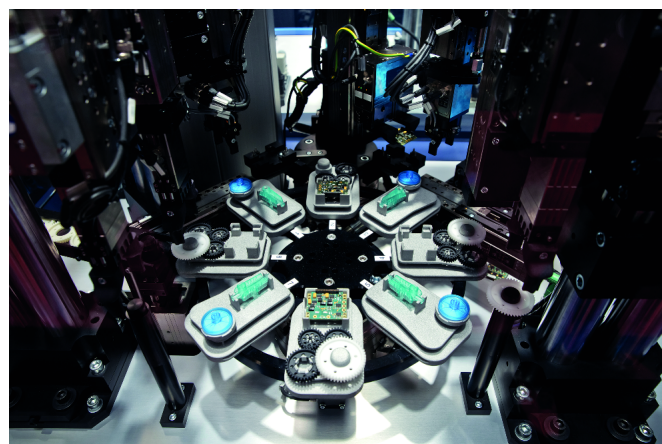
Features

- Software module for coordinating cyclically recurring motion sequences
- An upright shaft synchronizes up to 32 motion axes
- Position profile is set individually for each axis
- Production speed (speed of the upright shaft) can be changed during operation
- Configuration and diagnostics via the SolutionCenter
- Commissioning user interface (SHAFT-Monitor)
- Library for IEC 61131-3 PLC programs



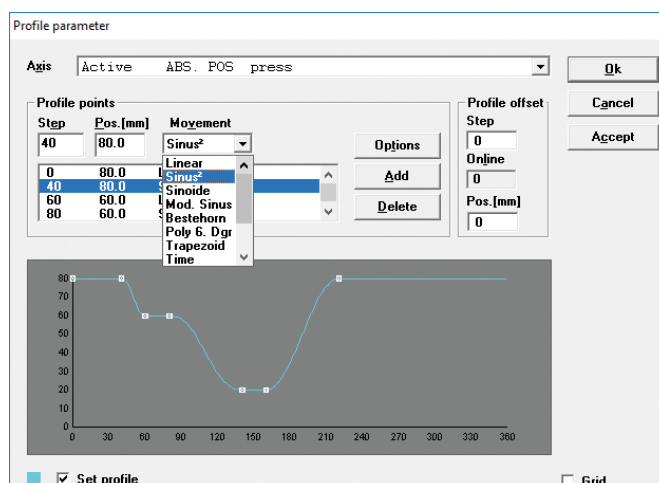
Synchronized motion sequence despite changing production speed

The upright shaft is the core of M-SHAFT. It rotates precisely 360° for the production of a workpiece. All the associated motion axes therefore complete their set profile exactly once during this cycle. The setting of set profiles relative to the upright shaft position offers an inherently key benefit: It is maintained even with a changing production speed. Higher quantities per time unit thus lead to the set profile output in shorter time frames. Thus, even complex application programs can be designed and implemented in the shortest possible time.



Motion paths individually designed

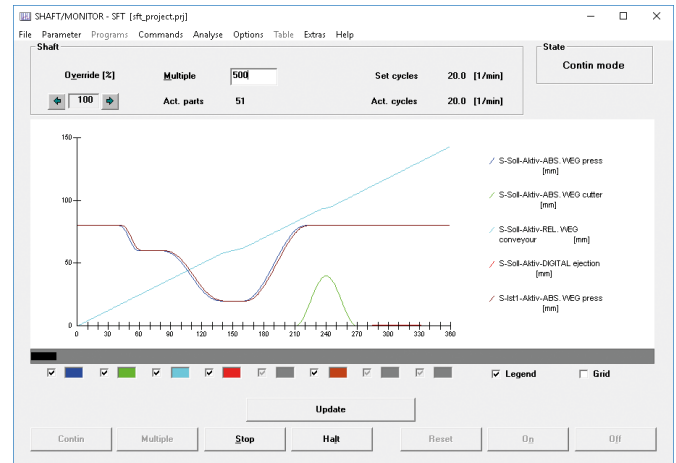
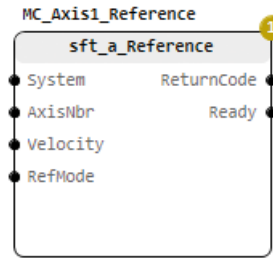
Characteristic positions of the individual axes are defined by means of individual support points distributed over the 360°. M-SHAFT interpolates between these points and forms a continuous motion path. The interpolation types used make it possible to focus on high production performance or keeping any jerks to a minimum. The system can also be automatically optimized to maximum production speed. The M-SHAFT Table Interpreter calculates the best possible distribution of the set support points over the 360° and thus relieves the user.



Creating application programs easily

A high-level sequence program mostly takes over the coordination of M-SHAFT and the supplied feed and removal systems. M-SHAFT is integrated directly in this application program via the IEC 61131-3 library. This enables starting a plant up to required production speed from one central location.

The "SHAFT Monitor" commissioning user interface permits the complete parameter assignment and manual operation of the M-SHAFT. Highly dynamic processes are recorded directly on the controller by the Scope 3 software oscilloscope and fully visualized on the PC. In this way, a complete overview is always ensured. This not only shortens the time required for the initial commissioning, but also enables fast troubleshooting during operation.



M-SHAFT

General	
Controller core	Software module on the M200 controller
Configuration	SolutionCenter
Parameterization	SHAFT-Monitors
Operation	SHAFT-Monitor, Application integration via library for IEC 61131-3
Product features	
Number of available axes	32 axes per M-SHAFT module
Number of M-SHAFT modules on one M200 controller	No limit Multiple instances can be linked as master/slave systems
Sampling time	100 µs to 5 ms
General functions	
Upright shaft structure	One shaft rotation is divided into 360 support points. The set position of the linked axes is defined at these points.
Operation modes of the upright shaft	<ul style="list-style-type: none"> Multiple: Production of a specified number of parts Continuous: Production of an unlimited number of parts Handwheel mode: Setting of the upright shaft position via a handwheel
Upright shaft start	Different interpolation types are provided for the approach to the setpoint velocity.
Upright shaft stop	The upright shaft stops: <ul style="list-style-type: none"> After reaching the number of strokes At a set rotation angle in degrees Directly on the Stop command

General functions	
Available axis types	<ul style="list-style-type: none"> • Absolute position axes (e.g. cam discs) • Relative position axes (also continuous axes, e.g. conveyor belt, feeds) • Analog axes (e.g. proportional valves) • Digital axes (e.g. switch cams)
Profile definition of the individual axes	360 support points are provided for setting the set profile. Extensive interpolation methods connect these support points.
Axis coupling to the upright shaft	<ul style="list-style-type: none"> • The coupling is based on the profile setting by means of the support points • A transmission or reduction ratio can be selected for each axis • Start and stop of the individual axes possible during operation
Parameter of the axes	Characteristic parameters such as maximum velocity, acceleration and travel path are defined for each axis.
Position setting and control	Depending on the motion axis M-SHAFT can perform various tasks: <ul style="list-style-type: none"> • M-SHAFT performs the calculation of the set position and setpoint velocity including control • M-SHAFT performs the calculation of the set position and setpoint velocity, the control is carried out in the drive
Controller structure	PID controller with feed forward branch as <ul style="list-style-type: none"> • Velocity controller • Position controller with/without subordinate velocity controller
Referencing of the axes	Various methods are available depending on the drive, encoder and initiator used.
Monitoring of the movement range	Checking of the actual axis position in relation to the defined travel limits
Blocking range definition for reset drives	In a reset drive, all axes are moved to an initial position. With rotary tables, the blocking range permits the setting of the collision-free rotation direction to the initial position.
Monitoring of the drag errors	Checks whether the motion axis actually follows its set value
Diagnostics	<ul style="list-style-type: none"> • Commissioning user interface SHAFT-Monitor • Scope 3 software oscilloscope
Special Functions	
Profile lowering/raising	The position profile of an axis can either be raised or lowered at specific points or overall.
Profile shift	The entire position profile of an axis can be shifted by a required angle of the upright shaft.
Matching of set and actual position	A correction between position set value and actual value of a relative axis can be triggered by an initiator in a defined angle window.
Variable duty cycle	Some motors must be operated at the rated speed during the startup time. If the speed of the upright shaft is reduced, the drive continues to run at the rated speed, however the switch off time is selected variably by M-SHAFT as required.
Actuation of external devices	For triggering external devices, an output is switched at a defined rotation angle of the upright shaft.
Synchronization with external systems	The upright shaft is stopped at a specific rotation angle. If the synchronization signal reaches the defined level, the upright shaft continues rotating.
Additional function with CNC commands	This is used for example to query limit switches, if the shaft is stopped for a defined period or if a specific table section is repeated several times.
Optimization of the motion profile	With this approach all individual axis set positions are set at several identical support locations. The M-SHAFT Table Interpreter calculates the minimum achievable travel speed of all axes between these support points. As a result it optimally distributes the support points over the 360°. In this way the maximum possible shaft speed is achieved.

Drive connection	
Analog	Via Bachmann hardware modules (e.g. ISI222, GIO212)
Fieldbus	By means of DriveMiddleware or another user-specific drive integration
Position detection	
By M200 via rotary encoder	The actual position is determined with Bachmann hardware modules (e.g. ISI222, CNT204).
By the drive via rotary encoder	The actual position is determined in the drive and transferred to M-SHAFT via the fieldbus.
Software interfaces	
Process communication	Internal values are provided as SVI variables and are directly available for other application programs or the visualization.
Application interface	IEC 61131-3 library for parameter assignment, operation and diagnostics of the M-SHAFT
Installation	
Installation medium for engineering PC	Installer, available by download
License protection on the M controller	License file depending on hardware
System requirements	
Engineering PC	Microsoft Windows 7 or higher, hard disk 50 MB free memory
M1 real-time system	Bachmann M200 processor modules of the MX, MC and MH series M-Base from V3.75R

Order data

Part type designation	Part number	Description
M-SHAFT Download	00017168-90	Software, PLC library, commissioning tool and user documentation for M-Shaft. Requires M-Base
M-SHAFT RT	00017168-63	License file to operate the M-Shaft software module on an M200 controller.