Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

Presentation

SERCOS MMS motion control modules are used to build a distributed automation solution, tightly integrating axis command applications with control applications, based on Quantum PLCs. The motion control modules and Quantum CPUs communicate either through the Quantum backplane or via the Modbus Plus network. The data transfer is transparent, and does not need any additional application program.
The physical interface between the motion control module and speed servodrives is provided by the SERCOS network, using fiber optic cable. This optic link is entirely digital, and provides communication parameters for the tuning, diagnostics and operation of both motion control modules and servodrives.

SERCOS offer

The SERCOS offer, based on the Quantum platform contains:
■ Two multi-axis modules, 141 MMS 425 01/535 02, that can drive up to 8 real axes *(1)*, each one connected to a Lexium servodrive using the SERCOS ring network.
All these modules perform the trajectory calculation, synchronization or interpolation of several axes.
■ Lexium MHDA (with optional SERCOS card) servodrives with a SERCOS digital link from 1.5 A to 70 A. These drives manage the position, speed and torque loops, and convert the power that drives the motor. Feedback from the motor sensors or external encoders (such as usual position and actual speed) are sent to the servodrive.
■ SER/Lexium BPH brushless motors. These devices are equipped with magnets which deliver a high power-to-weight ratio, resulting in a wide range of speed within low overall dimensions.
The Lexium range includes all necessary accessories (filter chokes, braking resistors, etc.) and connection elements.

Quantum motion modules

The 141 MMS SERCOS motion modules are double-width Quantum modules. They provide high-performance motion control functions, while being integrated with the Quantum PLC and via a real-time multi-task system.
In addition to communicating with the Quantum CPU via the internal bus, each 141 MMS module has a Modbus Plus communications port. The availability of program libraries simplifies configuration of the motion controls for high-performance applications requiring highly dynamic and high-precision position tracking algorithms.

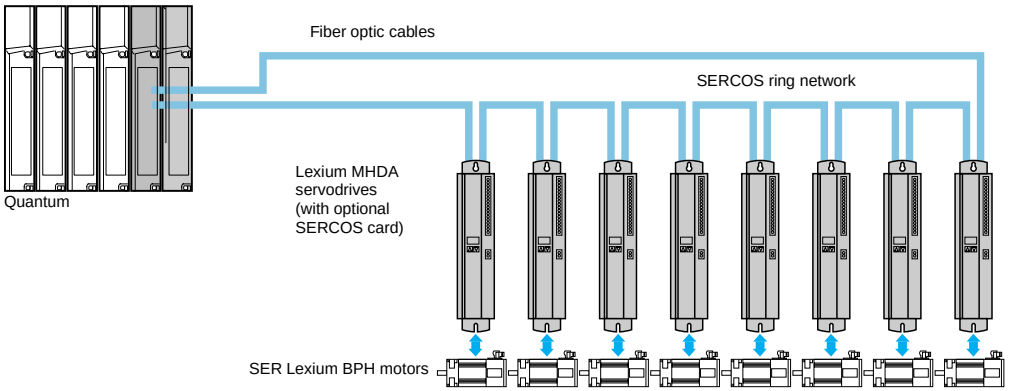
SERCOS motion control built into Quantum PLCs

This integration is used to fulfill motion control applications requiring a large number and great diversity of inputs and outputs. The solution makes it possible to share a single database between the Quantum CPU and the SERCOS motion control module. The SERCOS ring network corresponds to
a widely developed standard used in closed-loop position and speed applications. It complies with the European standard EN 61491.
The SERCOS solution, compared to analog interface solutions, offers the following benefits:
■ Efficient diagnostics, supplied in the motion control modules and the Quantum CPU, can send feedback to the upper levels of the control hierarchy for action. This minimizes machine downtime.
■ The distributed architecture significantly reduces cabling costs and simplifies the installation.
■ The SERCOS digital network eliminates the low-resolution analog interface (12 or 14-bits) between the servodrive and the motion control module.
■ Fiber optic connections increase immunity from electromagnetic interference found in harsh industrial environments.
■ It is easy to expand the number of axes in one machine using the ring network.

(1) The use of the Motion Open C kit (requiring the assistance of our applications team) enables you to extend the capacities of these modules: 141 MMS 425 01, up to 16 real axes and 141 MMS 535 02, up to 22 real axes.

Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

SERCOS architecture



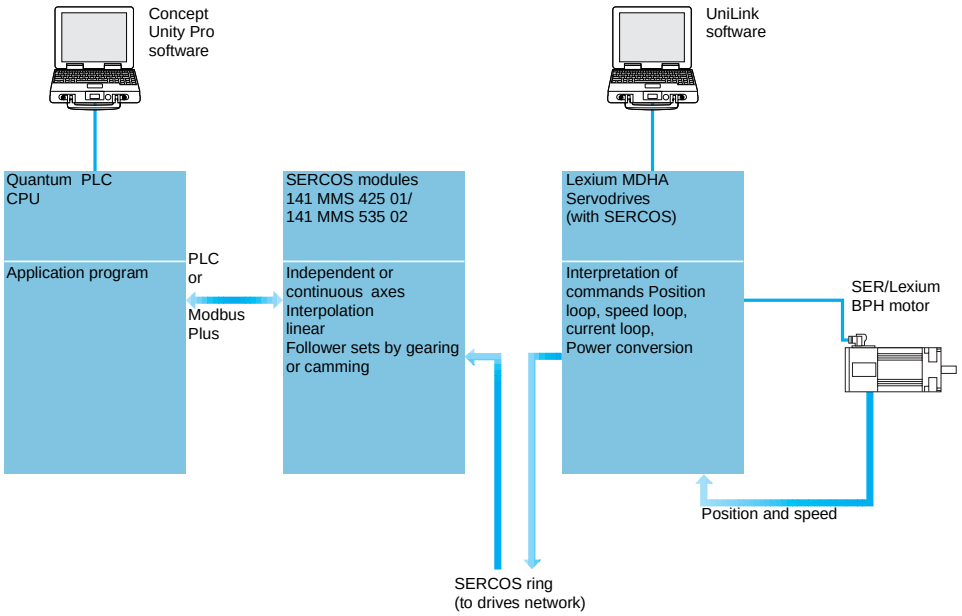
SERCOS (SERial COmmunication System) is a communication standard defining the digital link (medium and exchange protocol) between the motion control module and intelligent servodrives. It is defined by European standard EN 61491.

The use of SERCOS distributed architecture enables the connection of input/output devices (position encoder, Emergency stop, etc.) directly with the intelligent servodrives, thereby reducing connection costs.

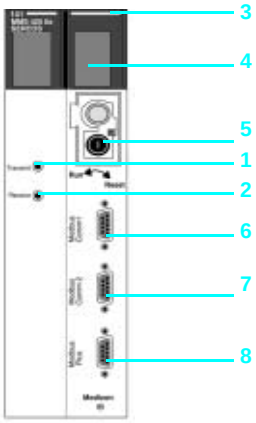
The fiber optic digital medium enables high-speed exchange (2 or 4 M bauds), yet provides a high level of noise immunity in high-interference industrial environments.

System overview

The system overview presents the various functions performed by the different parts of the multi-axis control system.



Modicon Quantum automation platform
SERCOS 141 MMS motion control modules



System overview (continued)

Concept or Unity Pro software (via the Modbus Plus communications port) enable you to:

- Register the SERCOS 141 MMS module(s) in the Quantum module configuration table.
- Configure functions and parameterize used axes.
- Program activities in the PLC application.
- Adjust parameters through operating codes (parameters for 141 MMS module, and Lexium MHDA servodrives) *(1)*.
- Test and update the application.

The UniLink software via the PC port of the Lexium MHDA servodrive allows you to:

- Define the Lexium MHDA drive and SER/Lexium BPH motor types.
- Adjust the Lexium MHDA drive parameters, save them into the drive's EEprom memory and store them on a PC.

Description

The 141 MMS ●●5 0● double-width SERCOS axis modules are equipped with:

1 A SMA-type connector, marked Tx, for connecting the servodrives using the SERCOS ring fiber optic transmission cable.

2 A SMA-type connector, marked Rx, for connecting the servodrives using the SERCOS ring fiber optic reception cable.

3 Hard outer casing, performing the following functions:
- Electronic card support.
- Attachment and locking of the module in its slot.

4 Module diagnostics indicator lamps:
- READY: when lit, indicates the module as successfully passed power-up tests.
- RUN lamp:
  - Steady, indicates the motion controller is in run mode, the SERCOS ring is complete, and the motion controller is accepting commands from the PLC to control the servodrives.
  - Blinking, indicates that the motion controller is attempting to go into run mode, but the SERCOS ring has not been established due to a physical disconnection or an incorrect address setting.
  - Off, indicates the motion controller is stopped.
- MODBUS PLUS: normal Modbus Plus indicator codes.

5 A RUN/ RESET keyswitch.

6 COM 1 port with SUB-D 9 connectors - for Schneider Electric use only.

7 COM 2 port with SUB-D 9 connectors - for Schneider Electric use only.

8 Modbus Plus port with SUB-D 9 connectors.

(1) Lexium MHDA servodrive equipped with AM0 SER 001V000 SERCOS option card.

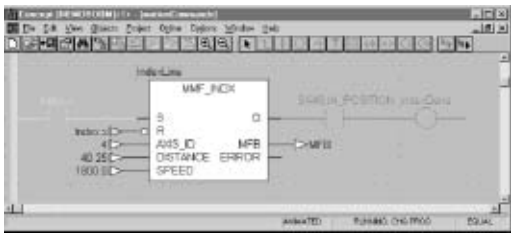
Characteristics: pages 4/46 and 4/47
References: pages 4/48 and 4/49
Connections: page 4/49

Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

Software setup

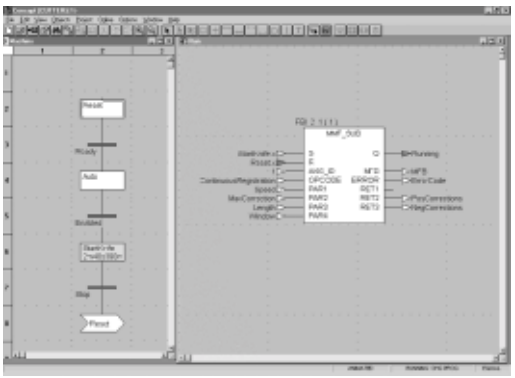
The configuration of the multi-axis motion modules are carried out by Concept or Unity Pro software and the MMFStart Programmer's kit, 396 MMC 500 04. They are used to configure the multi-axis applications by the creation of a common database (between Quantum PLC and the 141 MMS motion control modules). It simplifies the access to a library of motion-specific function blocks.

Programming motion and special functions



Movements are initiated using function blocks in the Concept or Unity Pro application program (Quantum CPU).

The function blocks can be written in IEC Ladder or Function Block Diagrams.



Function blocks are available for each specific move type: incremental, absolute, or continuous. In addition, function blocks are available to set parameters and configure objects (axes, sets, cam profiles, and special application functions).

The sequence of events or movements can be controlled by using the Sequential Function Chart (Grafcet) defined by IEC standard 61131-3.

Application-specific functions, such as Continuous Registration, are set up using the MMF_SUB function block (see screen opposite).

Descritpion: page 4/44
Characteristics: pages 4/46 and 4/47
References: pages 4/48 and 4/49
Connections: page 4/49

Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

Functional characteristics of modules 141 MMS 425 01/535 02

Type of module		141 MMS 425 01		141 MMS 535 02	
Software kit		396 MMC 500 04	With the assistance of our application services *(1)*	396 MMC 500 04	With the assistance of our application services *(1)*
Number of axes		–	22 max	–	32 max
Type of axes	Actual axes (connected to Lexium drives)	8	16	8	22
	Imaginary axes	4	Up to 22 axes/sets of axes	4	Up to 32 axes/sets of axes
	Remote axes	4, for interpretation of remote position by encoder	Up to 22 axes/sets of axes	4, for interpretation of remote position by encoder	Up to 32 axes/sets of axes
Set of axes	Coordinates	4 allowed in each group for the linear interpolation of up to 8 axes (max.)	Up to 22 axes/sets of axes	4 allowed in each group for the linear interpolation of up to 8 axes (max.)	Up to 32 axes/sets of axes
	Followers	4 groups up to 8 axes maximum	Up to 22 axes/sets of axes	4 groups up to 8 axes maximum	Up to 32 axes/sets of axes
Cam profile		8 profiles which can be changed from PLC registers	Any number up to the memory limitation of 64 K points on all cam profiles	8 profiles which can be changed from PLC registers	Any number up to the memory limitation of 64 K points on all cam profiles

Main functions

Programming	Movements	Homing, absolute, relative, or continuous Immediate movement, or queued, toward a given position Speed override possible
	Special functions	■ Point lock position and point lock time: synchronizes a Slave axis with a Slave position target and a Master position target using parameters ■ Measure part: measures the distance between two edges on a discrete input on the drive This can be applied to a real or auxiliary axis (position measurement via external encoder) ■ Count probe *(2)*: counts the edges on a discrete input on the drive within a period of time ■ Fast index *(2)*: starts a movement on an event. ■ Registration move *(2)*: position reading on the edge of a discrete input on the drive ■ Rotary knife: cuts using a rotary knife. Synchronizes a circular axis on a linear axis and controls a discrete output on the drive
	Other special functions	The development of all other special functions is possible with the use of a Motion Open C kit requiring the assistance of our application services *(1)*.
	Stop/start functions	Rapid stop, stop following configured deceleration profile Temporary stop Restart of stopped movement
Configuration/adjustment	SERCOS ring	Bus cycle time, traffic on the bus, optical power on the fiber, SERCOS loop diagnostics
	Acceleration/deceleration	Ramp values, ramp type (rectangular, triangular, and trapezoidal), unit choices, maximum acceleration adjustment
	Speed	Speed units, default speed, maximum speed, speed modulation coefficient
	Other setting	Target window, rollover, software limits
	Groups of Slave axes	Tracking of master axis by ratio or by cam (cam profile), threshold position of tracking master, value of the Bias during synchronization of an axis, monitoring of Master/Slave positions, master offset for a slave axis
	Groups of coordinate axes	Linear interpolation
	Cam profile	Values of a point existing from a cam profile, number of points (5,000 maximum), type of interpolation, table addresses
	State of an activity or axis	Movement in acceleration, in deceleration, in homing, servodrive fault…
	Diagnostics	Drive fault, tracking error, overvoltage, undervoltage, current overload, power supply fault

(1) Please consult our Regional Sales Offices.
(2) Special functions require version 1.2 of the MMFStart 396 MMC 500 04 multi-axis programming kit.

Descritpion: page 4/44
References: pages 4/48 and 4/49
Connections: page 4/49

Electrical characteristics of modules 141 MMS 425 01/535 02

Type of module				141 MMS 425 01	141 MMS 535 02
Processor			**MHz**	66	133
PLC registers				10 000	60 000
Memory		Application	**Mb**	2	4
		Static RAM	**Mb**	2	4
		Dynamic RAM	**Mb**	8	8
SERCOS network		Nature		Industrial support complying with standard EN 61491	
		Topology		Ring	
		Medium		Fiber optic cable	
		Baud rate	**M bauds**	4	
		Cycle time	**ms**	2 to 4, configurable	
		Number of segments		9 max	23 max
		Length of segment	**m**	38 max with plastic fiber optic cable 150 max with glass fiber optic cable (230 µm)	
Communication ports	Serial links	Number		2 RS 232 D	
		Protocol		Modbus slave	
		Data rate	**Bit/s**	300…9600	
	Network interface			1 Modbus Plus	
Consumption			**mA**	2000 at ⎓ 5 V	2500 at ⎓ 5 V

4

4.3

Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

141 MMS 425 01

141 MMS 535 02

References

Any of the Quantum PLC processors can be used with the SERCOS 141 MMS motion modules. To obtain optimum performances, the cycle time of the Quantum processor should not exceed 10 ms. The maximum number of 141 MMS modules in a configuration depends on the processor type:

Type of processors	140 CPU 113 02	140 CPU 113 03	140 CPU 434 12A	140 CPU 534 14A
Maximum number of MMS, NOE or NOM modules	2	2	6	6

Description	Functions	Number of axes with:		Reference	Weight kg
		396 MMC 500 04 Programmer's kit	**Motion Open C kit** *(1)*		
Multi-axis control modules	SERCOS digital servodrive control	8 real axes 4 imaginary axes 8 sets of axes	16 real axes 22 axes/sets of axes	**141 MMS 425 01**	0.520
		8 real axes 8 imaginary axes 8 sets of axes	22 real axes 32 axes/sets of axes	**141 MMS 535 02**	0.520

Connection accessories

Description	Connection	Length	Reference	Weight kg
Plastic fiber optic cables fitted with SMA-type connectors (curvature radius: 25 mm minimum)	Lexium MHDA 1●●●N00, MHDA 1●●●A00 servodrive	0.3 m (1 ft)	**990 MCO 000 01**	0.050
		0.9 m (3 ft)	**990 MCO 000 03**	0.180
		1.5 m (5 ft)	**990 MCO 000 05**	0.260
		4.5 m (15 ft)	**990 MCO 000 15**	0.770
		16.5 m (55 ft)	**990 MCO 000 55**	2.830
		22.5 m (75 ft)	**990 MCO 000 75**	4.070
		37.5 m (125 ft)	**990 MCO 001 25**	5.940

Set of plastic fiber optic connections

Description	Composition	Reference	Weight kg
Set of fiber optic cables and SMA-type connectors *(2)*	12 SMA-type connectors 12 insulating sleeves Plastic fiber optic cable, length 30 m	**990 MCO KIT 01**	–
Equipment for installation of fiber optic cables	Tools for making up cables to required length from a 990 MCO KIT 01 kit Includes stripping tool, crimping pliers, 25 W/110 V cutting tool, and instructions for use	**990 MCO KIT 00**	–

(1) The Motion Open C kit requires the assistance of our applications services. Consult our Regional Sales Offices.
(2) Connectors to be used exclusively for connecting SERCOS motion control modules in the same electrical cabinet.

Descritpion: page 4/44
Characteristics: pages 4/46 and 4/47
Connections: page 4/49

Modicon Quantum automation platform
SERCOS 141 MMS motion control modules

References (continued)

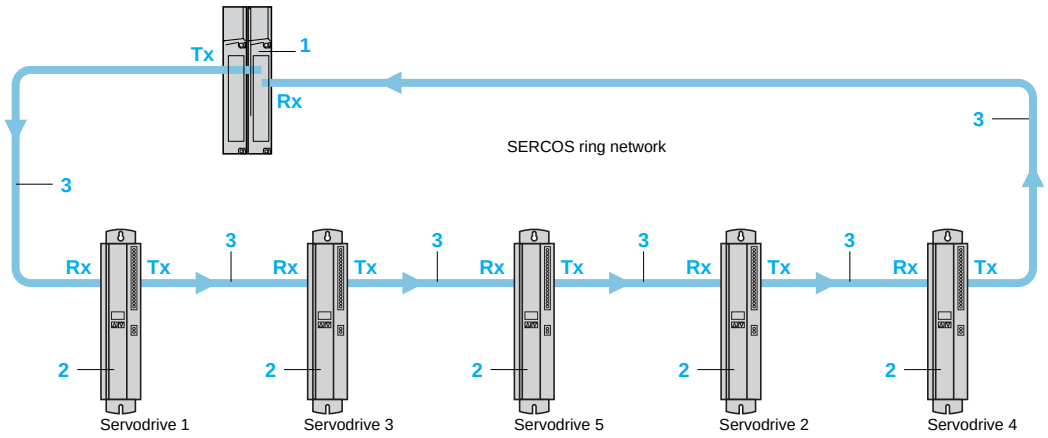
Concept programming and configuration software

Description	Type of user license	Reference	Weight kg
Concept packages Concept XL version 2.6	Single-user license	**372 SPU 474 01 V26**	–
	3-user license	**372 SPU 474 11 V26**	–
	10-user license	**372 SPU 474 21 V26**	–
	Network license	**372 SPU 474 31 V26**	–

SERCOS multi-axis motion control software

Designation	Description	Reference	Weight kg
Multi-Axis MMF start programmer's kit	Concept library and MMF Start Shared data base creation Backup and restoration functions for maintenance personnel. Configuration software.	**396 MMC 500 04**	–

Connections



1 141 MMS 425 01/535 02: Quantum multi-axis control module.

2 MHDA 1●●●N00/A00: Lexium drives (equipped with the optional SERCOS card AM0 SER 001V000) for SER/Lexium BPH motor.

3 990 MCO 000●●●: plastic fiber optic cables fitted with SMA-type connectors.

Tx Transmission.
Rx Reception.

Descritpion: page 4/44
Characteristics: pages 4/46 and 4/47