

Motion Coordinator Application Note

Number:MC-1031, Revision X, 2/28/2007

Subject: SERCOS Interface Commands

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SERCOS Basics:

A SERCOS ring consists of a single master and 1 or more slaves daisy-chained together using fibre-optic cable. During initialisation the ring passes through several 'communication phases' before entering the final cyclic deterministic phase in which motion control is possible. In the final phase, the master transmits control information and the slaves transmit status feedback information every cycle time.

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MC BASIC SERCOS Support:

MCBASIC includes a 'SERCOS' keyword which is of the following format :

Function Definitions:

Sercos Function 0 – SERCOS(0, slot , ram/reg, address)

Read Sercos ASIC memory. This low-level function will return the value at the given RAM location (RAM/reg flag=0) or register (RAM/reg flag = 1) in the Sercos ASIC memory.

Sercos Function 1 – SERCOS(0, slot , ram/reg, address, value)

Write Sercos ASIC memory. This low-level function will write to the required Sercos ASIC RAM location or register.

Sercos Function 2 – SERCOS(2, slot [, intensity [, baudrate [,period]]])

Initialisation command. This function resets the Sercos ASIC register configuration to the default values. Phase 0 is set. The optional "intensity" parameter sets the light transmission intensity from the SERCOS daughter board and should be in the range of 1..6 (default is 3). The optional baudrate should be set to 2,4,8 or 16 for the baudrate in MBAUD (default is 16). The optional period parameter is the SERCOS ring cycle time for the cyclic phases (phases 3 & 4) in usec (default is 1000usec). The available values are 8000,4000,2000,500, and 250usec.

Sercos Function 3 – SERCOS(3, slot, slave addr, axis[,slave drive type])

Used to link a SERCOS drive to an axis of the Motion Coordinator. The command associates an axis number to a particular slave (drive) on the sercos network connected to the controller via the daughterboard in the given slot number. The user's BASIC program can confirm the existence of these slaves on the network at startup. Therefore if any slaves are not found there must be an error on the network. The configuration stored by the controller is reset (all recorded definitions removed) when the command is called with the slave address and axis both equal to zero (since this is not a valid slave address). The optional final parameter identifies the slave drive type :

0	Generic Drive
1	Sanyo-Denki
2	Yaskawa + MC P730
3	Indramat/Rexroth
4	PacSci
5	Kollmorgen

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Sercos Function 4 – SERCOS(4, slot , slave address, parameter ID [, parameter size[, element type [, list length offset]]])

Read parameter command. Parameter size values include 2 (default) for a 2 byte parameter, 4 for a 4 byte parameter, 6 for a list of parameter IDs, and 7 for an ASCII string. Element type refers to the SERCOS definition of the element types in the data block, namely :

1	ID Number
2	Name
3	Attribute
4	Units
5	Minimum Input Value
6	Maximum Input Value
7	Operational Data

This is an optional parameter, where number 7 (operational data) is the default.

The list length offset parameter is used to compensate for different interpretations of the list length indicators. Some drives give the list length as the number of 2-byte parameters in the list (this is the functions default - in which case the parameter can be omitted). However, other drives appear to include the size of the list length indicator (2 words) in the overall length value. To allow for the latter case, an offset of -2 should be used. Note that this function will return 2 & 4 byte parameters, but print lists.

Sercos Function 5 – SERCOS(5, slot , slave address, parameter ID, parameter size, parameter value [, parameter value ...])

Write parameter command. Parameter size values are as for function 4. There must be between one and 7 parameter values (>1 is used for list parameters.)

Sercos Function 6 – SERCOS(6, slot , slave address, parameter ID [, time-out,[command type]])

Run sercos procedure command. This function will run the procedure command given by Parameter ID, and return 1 if the command runs successful, -1 if the command ran and failed, or 0 if there was a comms timeout error. The default time allowed for a command to complete is 10 seconds, since some commands can take a long time to execute on the drive. If this time is exceeded the function will return a -2.

There is an optional time out (in msec) parameter, which can be passed to this function if a value other than the default is required.

The second optional parameter is a command type – which defines whether the command should be run, cancelled, or run and cancelled. The latter is the default. The values used are:

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-1	Run & cancel command (default value)
0	Cancel command
1	Run command

Sercos Function 7 – SERCOS(7 , slot , slave address)

Used in Phase 1: Returns 1 if drive is detected, 0 if no drive detected.

Sercos Function 8 – SERCOS(8 , slot , required parameter)

Print required network parameter. This function will print the required network parameter, where the possible 'required parameter' values are

0: to print a semi-colon delimited list of 'slave Id, axis number' duples for the registered network configuration (as defined using function 3). Used in Phase 1: Returns 1 if drive is detected, 0 if no drive detected.

1: to print the baud rate (either 2, 4, 6, or 8), and

2: to print the intensity (a number between 0 and 6).

Sercos Function 10 – SERCOS(10,<slot>)

Function checks whether the fibre optic loop is closed in phase 0. Return value is 1 if network is closed, -1 if it is open, and -2 if there is excessive distortion on the network.

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SERCOS Ring Commissioning:

MotionPerfect2 now contains (version 2.1.4.3 & above) support for commissioning SERCOS rings. Please see 'MotionPerfect SERCOS Support' below. This tool simplifies the creation of a MCBASIC startup program which initialises the SERCOS ring following power-on.

The startup program will consist of MCBASIC SERCOS statements which initialise the ring following power-on, and configure the ring in the deterministic cyclic phase. The startup program will bring the ring through the following phases:

1. Phase 0 - check the ring is closed. This ensures all slaves are powered on and repeating the network messages.
2. Phase 1 - check all expected drives are responding. This section ensures that the drives identified during commissioning are in the ring and responding to messages from the master.
3. Phase 2 – Send timing & setup information to each slave. Clear any startup errors (if possible). Ensure each slave executes and passes the phase change function.
4. Phase 3 - Ensure each slave executes and passes the phase change function.
5. Phase 4 – the motion control phase.

SERCOS Debugging

1. Network Open/distorted

Check the master and all slaves are powered-on, the ring is correctly connected in a daisy-chain, with the fibre-optic cables connected from the transmit of one node to the receive of the next. Check slave is not in test mode.

Check the intensity levels of each slave – perhaps the intensity is too low (ring open) or too high (ring messages distorted).

The ring-open error LED will be illuminated on the slave which is not receiving a signal.

2. Drive not responding (in Phase 1)

Is the drive powered-on ?

Has the drives address switches been set correctly.

Is the drives baud rate switches set correctly.

Is the drives (and that of the neighbouring drives) intensity level set correctly.

3. Drive not responding (in Phase 3)

Most probably the drives timing information is incorrect. Also, an intensity level problem might not reveal itself until this cyclic data transmission phase.

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SERCOS Cycle Times

The following SERCOS cycle times are available for CP3 and 4:

SERCOS Cycle Time (usec)	Notes
2000	
1000	Default value.
500	
250	

The Sercos(2,<>) statement has an optional fifth parameter which is used to define the SERCOS cycle time, and must be used if any value other than the default is required for the ring.

SERCOS Slave Operation Modes

The MC Master supports the Velocity & Position modes of operation, using standard or application telegrams.