



Single-axis controller MC1-10

Programming the MC1-10 via the isel-@-protocol

The information, technical data and measurements contained in this publication are based on the state of the art at the time of publication. However, any printing errors and errors that may be present cannot be excluded. We would be grateful for any suggested improvements or references to errors.

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Manufacturer: **isel Germany AG**
Bürgermeister-Ebert-Str. 40,
D-36124 Eichenzell

Tel.: (06659) 981-0
Fax: (06659) 981-776
Email: automation@isel.com
<http://www.isel.com>

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1 Commands overview

The following commands of the isel-@-format have been implemented for the MC1:

DNC - commands

<i>Command</i>	<i>Meaning</i>
@01	Initialising the axis
@0a / @0A	Movement relative
@0b	Read port
@0B	Write port
@0d	Adjusting reference speed
@0D	Diagnostics (only for commissioning / debugging)
@0F	Retract
@0G	Change device number (future extension)
@0h	Read inputs (only for commissioning / debugging)
@0H	Read status (only for commissioning / debugging)
@0i	Save CNC programme
@0I	Initialising of parameters (future extension)
@0k	Delete CNC programme
@0l	Display, delete line
@0L	Write display
@0m / @0M	Movement absolute
@0n	Set zero point
@0N	Simulate reference run
@0P	Check position
@0r / @0R	Reference run
@0s / @0S	Start CNC programme or movement
@0T	Switch test mode on/off
@0V / @0?	Version query
@0Z	Movement up to input port

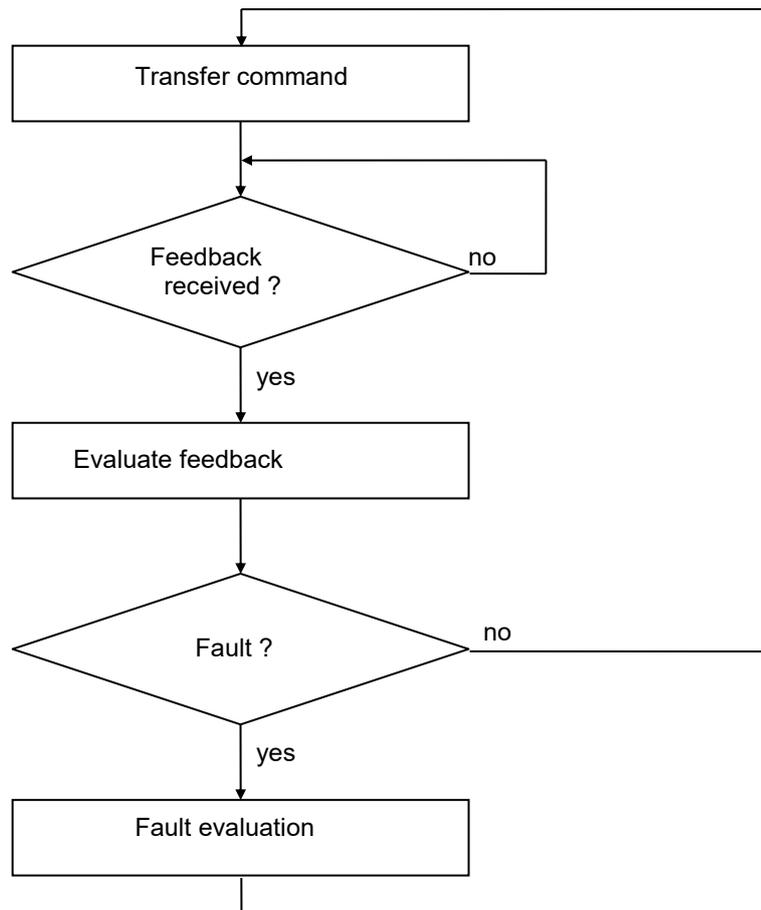
CNC - commands

<i>Command code</i>	<i>Meaning</i>
0	Movement relative
1	Send synchronisation character
2	Wait for synchronisation character
3	Loop, branching
5	Time delay
6	Movement up to input port
7	Reference run
9	CNC programme end
k	Read keyboard and branch
l	Delete display line
L	Write display
m	Movement absolute
n	Set zero point
N	Simulate reference run
o	Read port and branch
P	Write port
T	Switch test mode on/off

2 The DNC mode and its commands

2.1 Command structure of the DNC commands

Operating in DNC mode, the data sets or commands transferred by a control computer are evaluated and executed directly. For this purpose, a so-called initialisation is necessary at the beginning of data communication. It consists of the data opening character @, the device number (0=standard) and the number of axes to be moved. The individual programme steps are then transferred to the controller and executed directly by it. To check the data transfer or to report errors that have occurred, corresponding ASCII characters are sent back to the control computer via the interface. This so-called software handshake procedure is implemented as follows:



First, a command is transmitted to the controller. The command is decoded and processed by the controller, and then the controller generates a corresponding acknowledgement or fault sign.

This feedback is evaluated by the control computer. If an error has occurred, a corresponding fault evaluation and correction must be carried out. The next command can then be transmitted to the controller in the same way.

The following describes the command scope of the DNC mode of the MC1-10 controller.

2.2 The commands of the MC1-10 in the DNC mode

2.2.1 Initialisation, setting the number of axes

Command: Setting the number of axes

Purpose: The controller is reinitialised by transferring the number of axes.

Structure: @<GN>1<CR>

@	= data opening character
<GN>	= device number, Standard=0
1	= Axis information, see below.
<CR>	= Carriage Return as command termination

Application: @01

Explanation: The controller is addressed by "@0", the following numerical value contains the axis configuration. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

2.2.2 Executing a relative movement

Command: Movement relative

Purpose: The control generates a relative movement based on the travel distance and the speed. The run movement is carried out immediately.

Structure: @<GN>A<S>,<G><CR>

@	= data opening character
<GN>	= device number, Standard=0
A or a	= command movement relative
<S>	= Path
<G>	= Speed
<CR>	= Carriage Return as command termination

Application: @0A5000,900

Explanation: The controller is addressed by "@0"; "A" or "a" indicates that a relative movement is to take place. The controller now expects a pair of numbers consisting of travel path and speed. The movement is carried out relative to the last position. After execution, the controller responds with the handshake character ("0"). The controller cannot process new commands until after the command has been executed.

2.2.3 Reading of ports

Command: Read port

Purpose: The command allows the current state of logical or physical input ports to be determined via the serial interface.

Structure: @<GN>b<Portnr><CR>

@ = data opening character
<GN> = device number, Standard=0
b = command read port
<Portnr> = Port number see below.
<CR> = Carriage Return as command termination

Application: @0b0

Explanation: The controller is addressed by "@0", "b" indicates that the status of an input port is to be determined.. Subsequently, the port number is transmitted and the command is completed with carriage return. The controller responds with software handshake "0" followed by two characters indicating a hexadecimal value corresponding to the current status of the input port.

Port	Status	Function
0	00 - FF	User E/A
		Bit0 UserInput1
		Bit1 UserInput2
		Bit2 UserInput3
		Bit3 UserInput4
		Bit4 UserInput5
		Bit5 UserInput6
		Bit6 UserInput7
		Bit7 UserInput8
1	00 - 0F	Function keys
		Bit0 F1
		Bit1 F2
		Bit2 F3
		Bit3 F4

2.2.4 Writing of ports

Command: Write port

Purpose: The command can be used to describe logical or physical output ports with defined values via the serial interface.

Structure: @<GN>B<Port No>,<Value><CR>

@	= data opening character
<GN>	= device number, Standard=0
b	= command write port
<Portnr>	= Port number see below.
<Wert>	= new port value
<CR>	= Carriage Return as command termination

Application: @0B0,1

Explanation: The controller is addressed by "@0", "b" indicates that the status of an output port is to be determined.. Subsequently, the port number and the new port value are transmitted separated by commas and the command is completed with carriage return. The controller responds with the software handshake "0" if the execution was successful, or with a fault message if incorrect port numbers and/or values were transferred.

Port	Value	Function
0	0 - 255	User E/A
		Bit0 UserOutput1
		Bit1 UserOutput2
		Bit2 UserOutput3
		Bit3 UserOutput4
		Bit4 UserOutput5
		Bit5 UserOutput6
		Bit6 UserOutput7
		Bit7 UserOutput8

2.2.5 Establishing reference speed

Command: Setting reference speed

Purpose: The command defines the speed at which a reference movement is carried out.

Structure: @<GN>d<G><CR>

@	= data opening character
<GN>	= device number, Standard=0
d	= command set reference speed
<G>	= reference speed
<CR>	= Carriage Return as command termination

Application: @0d2500

Explanation: If no information on the reference speed is transferred to the controller, the execution takes place with a default value. A changed value is not retained when switched off.

Restriction: The specified speed must be within the valid range of values for speeds.
If the reference speed is set too high, this can damage the reference switches in conjunction with a large spindle pitch due to the existing mass inertia. The controller requires a switching hysteresis of the connected zero position switch. This must be observed when connecting electronic zero sensors!

2.2.6 Retract

Command: Retracting a connected axis

Purpose: The control moves the axis out of the reference switch.

Structure: @<GN>F1<CR>

@	= data opening character
<GN>	= device number, Standard=0
F	= command retract
1	= Axis information, see below.
<CR>	= Carriage Return as command termination

Application: @0F1

Explanation: The controller is addressed by "@0", "F" indicates that a connected axis is to be "released" from the limit switch. The subsequent numerical value defines the axis to be referenced. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After a movement is completed, the controller sends its acknowledgement signal and waits for the next commands. The controller cannot process new commands until after the reference run has been executed.

2.2.7 Save CNC data field

Command: Save CNC data field

Purpose: This instruction serves as an initialisation for the transmission of storable commands and is mandatory at the beginning of the CNC mode.

Structure: @<GN>i<CR>

@	= data opening character
<GN>	= device number, Standard=0
i	= command save CNC data field
<CR>	= Carriage Return as command termination

Application: @0i

Explanation: The controller is addressed by "@0", "i" indicates that a CNC data field is to be stored. The command ends with a carriage return. The controller then accepts only CNC commands up to the command "data field end" or until an error occurs. The command is acknowledged with a corresponding response. All subsequent storable commands are stored in the FlashPROM.

2.2.8 Delete CNC programme

Command: Delete CNC programme in the FlashPROM

Purpose: This instruction deletes a CNC programme stored in the FlashPROM.

Structure: @<GN>k<CR>

@	= data opening character
<GN>	= device number, Standard=0
k	= command delete FlashPROM
<CR>	= Carriage Return as command termination

Application: @0k

Explanation: The controller is addressed by "@0". "k" indicates that the FlashPROM memory of the controller is to be deleted. The command ends with a carriage return. The control confirms the successful deletion with a response "0".

2.2.9 Clear display line

Command: Delete display line

Purpose: This instruction deletes a line in the display of the MC1.

Structure: @<GN>I<Z><CR>

@	= data opening character
<GN>	= device number, Standard=0
I	= command delete display line
<Z>	= Line numbers (1-4)
<CR>	= Carriage Return as command termination

Application: @0I1

Explanation: The controller is addressed by "@0". "I" indicates that a line in the display of the controller is to be deleted. The command ends with a carriage return. The control confirms the successful deletion with a response "0".

2.2.10 Write display

Command: Write display

Purpose: This instruction is used for writing in the display of the MC1.

Structure: @<GN>L<Z>,<S>,<Text><CR>

@	= data opening character
<GN>	= device number, Standard=0
L	= command write display
<Z>	= line numbers (1-4)
<S>	= column numbers (1-20)
<Text>	= text to be outputted
<CR>	= Carriage Return as command termination

Application: @0L1,2,MC1 Display Test

Explanation: The controller is addressed by "@0". "L" indicates that writing should be done in the display of the controller. The control will output the text „MC1 Display Test“ in the display in line1 from position2 on. The command ends with a carriage return. The control confirms the successful writing with a response "0".

2.2.11 Executing an absolute movement

Command: Movement to the absolute position

Purpose: The controller moves to the specified position at the specified speeds. The movement is carried out immediately.

Structure: @<GN>M<S>,<G><CR>

@ = data opening character
<GN> = device number, Standard=0
M = command movement absolute
<S> = Position
<G> = Speed
<CR> = Carriage Return as command termination

Application: @0M 5000,900

Explanation: The controller is addressed by "@0", "M" indicates that an absolute position follows. After execution, the controller responds with the handshake character. The controller cannot process new commands until after the command has been executed.

2.2.12 Set zero point

Command: Setting zero point on current point

Purpose: The controller saves the current position as a virtual zero point. The next "Move absolute" instructions see this virtual zero point as the new reference point.

Structure: @<GN>n1<CR>

@ = data opening character
<GN> = device number, Standard=0
n = command set zero point
1 = axis information, see below.
<CR> = Carriage Return as command termination

Application: @0n1

Explanation: The controller is addressed by "@0", "n" indicates that a zero offset is to be made. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After execution, the controller responds with a response.

2.2.13 Simulate reference run

Command: Setting reference point on current point

Purpose: The control system simulates a reference movement, no axis movement is carried out.

Structure: @<GN>N1<CR>

@	= data opening character
<GN>	= device number, Standard=0
N	= command simulate reference run
1	= axis information, see below.
<CR>	= Carriage Return as command termination

Application: @0N1

Explanation: The controller is addressed by "@0", "n" indicates that a reference run is to be made. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After execution, the controller responds with a response.

2.2.14 Requesting the actual position

Command: Querying position

Purpose: The controller returns the current actual position of the axis to the higher-level computer.

Structure: @<GN>P<CR>

@	= data opening character
<GN>	= device number, Standard=0
P	= command position query
<CR>	= Carriage Return as command termination

Application: @0P

Explanation: The controller is addressed by "@0", "P" indicates that a position request is made. The controller confirms this with the handshake character and then outputs in hexadecimal format.

The structure of the confirmed item is as follows:

e.g. 000100

Position = 000100, hexadecimal in 2's complement, corresponds to 256 decimal.

2.2.15 Reference run

Command: Reference run

Purpose: The control moves the axis to its zero point (reference points. In isel systems, the reference point of the axis is always defined in a reasonable default arrangement.

Structure: @<GN>R1<CR>

@ = data opening character
<GN> = device number, Standard=0
R or r = command reference run
1 = axis information, see below.
<CR> = Carriage Return as command termination

Application: @0R1

Explanation: The controller is addressed by "@0", "R" indicates that a reference run is to be made. The subsequent numerical value defines the axis to be referenced. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After a reference run is completed, the controller sends its acknowledgement signal and waits for the next commands. The controller cannot process new commands until after the reference run has been executed by the mechanics.

ATTENTION! If the reference switch is not connected, the axis is permanently controlled, i.e. the axis can move up to the mechanical limit stops.

2.2.16 Starting a stopped motion or CNC programme

Command: Start

Purpose: A stopped movement should be continued or a CNC programme started.

Structure: @<GN>S<CR>

@ = data opening character
<GN> = device number, Standard=0
S or s = command start
<CR> = Carriage Return as command termination

Explanation: The controller is addressed by "@0", "S" indicates that a stopped movement is to be started and thus the rest of the actual movement is to be executed. If no movement has been stopped, a stored CNC programme is started. The controller responds after execution with the handshake character ("0") or with a fault message, if no movement rest is present in the memory or no CNC programme is stored.

2.2.17 Switch test mode on/off

Command: Switch test mode on/off

Purpose: The test mode can be switched on and off by using the command.

Structure: @<GN>T<Status><CR>

@	= data opening character
<GN>	= device number, Standard=0
T	= command switch test mode on/off
<Status>	= 0 --> switch off, 1 --> switch on
<CR>	= Carriage Return as command termination

Application: @0T1, @0T0

Explanation: The controller is prepared for a new command with the data opening part "@0". "T1" switches the test mode on "T0" switches the test mode off. After execution, the controller responds with the handshake character ("0"). In test mode, the controller treats the reference run and limit switches differently from in the normal operation. If a reference run command is received in test mode, the control does not execute a reference run in the true sense of the word, but sets the current point as the reference point. The limit switches are still monitored but can be overridden. This is very useful if an axis is in a limit switch after switching on the system and has to be retracted.

2.2.18 Requesting the version data of the controller

Command: Request version data

Purpose: Requesting important version data of the controller

Structure: @<GN>V<CR> or @<GN>?<CR>

@	= data opening character
<GN>	= device number, Standard=0
V	= command request version data
<CR>	= Carriage Return as command termination

Application: @0V, @0?

Explanation: The controller is prepared for a new command with the data opening part "@0". "V" causes the controller to send back information about the version of the controller in plain text format. At the end of this information, the controller responds with the handshake character ("0"). The information is already formatted in ASCII format, so that it can be displayed e. g. in a terminal window directly on the screen of a control computer.

2.2.19 Executing a movement until port event

Command: Movement until port event

Purpose: Movement relatively linear until port event or end of movement

Structure: @<GN>Z<A>,<M>,<W>,<G>,<S><CR>

@ data opening character
<GN> device number, Standard=0
Z Command movement to port
<A> Port address
<M> Mask for masking the bits
<W> Set point as condition for end of movement
<G> Speed
<S> Path
<CR> Carriage Return as command termination

Application: @0Z0,8,8,600,3000

Explanation: The controller is addressed by "@0"; Z indicates that a relative movement is to take place, which can be terminated by a port event. The movement is executed at the specified speed. The movement is terminated when the specified path has been traversed, or when bit 3 is set to 1 at input port 0.

2.2.20 Checking and control codes

Checking and control codes allow direct access to the control function sequence via the serial interface. The commands sent are evaluated without delay directly in the receiving routine of the controller and then executed. Special control codes are available for the following functions:

Function: Software stop char(253)

A positioning movement in DNC mode (relative or absolute) can be ended by a stop command without any step loss. A start command executed afterwards terminates the interrupted function sequence. In addition, the current position reached can be read back after a stop command by means of the command "Position request". This functionality can also be achieved by pressing the stop button. If a movement has been stopped successfully, the controller generates an additional acknowledgement "F".

The function is called by transferring a char (253) via the serial RS232 interface.

Function: Software reset char(254)

The controller immediately interrupts all activities and performs an internal software reset. Afterwards, the system must be reinitialised and a reference run must be carried out.

The function is called by transferring a char (254) via the serial RS232 interface.

Function: Software break char(255)

A positioning movement in DNC mode (relative or absolute) can be ended by a break command. This means that the rest of the movement is forgotten.

The function is called by transferring a char (255) via the serial RS232 interface.

3 The CNC mode and its commands

3.1 Command structure of the CNC commands

Operating in CNC mode, the controller stores all transmitted commands in the internal data memory. For activation, the command "Save CNC data field" must be transmitted after the standard initialisation. The data field is then transferred and terminated with the "End of data field" command.

The programme can now be activated without further communication with the control computer by an external start command (pressing the start button).

In the following, the storable commands of the controller MC1 are listed and briefly explained. A detailed explanation can be found for some commands under the corresponding command of the DNC mode, since the meaning and number of parameters correspond to those of the DNC mode.

If an error has occurred during the transfer and storage of a CNC data field, the previously stored CNC programme is marked as invalid and cannot be executed.

3.2 The commands of the MC1 in the CNC mode

3.2.1 Save CNC data field

Command: Save CNC data field

Purpose: This instruction serves as an initialisation for the transmission of storable commands and is mandatory at the beginning of the CNC mode.

Structure: @<GN>i<CR>

@	= data opening character
<GN>	= device number, Standard=0
i	= command save CNC data field
<CR>	= Carriage Return as command termination

Application: @0i

Explanation: The controller is addressed by "@0", "i" indicates that a CNC data field is to be stored. The command ends with a carriage return. The controller then accepts only CNC commands up to the command "data field end" or until an error occurs. The command is acknowledged with a corresponding response. All subsequent storable commands are stored in the FlashPROM.

3.2.2 Relative movement in the CNC mode

Command: Movement relative

Purpose: The control saves a relative movement based on the travel distance transferred and the speed.

Structure: 0<S>,<G><CR>

0 = command code movement relative
<S> = Path
<G> = Speed
<CR> = Carriage Return as command termination

Application: 05000.900

Explanation: "0" indicates that a relative movement is to take place. The controller now expects a pair of numbers consisting of path and speed. The movement is indicated relatively, i.e. based on the last position. After saving, the controller responds with the handshake character ("0").

3.2.3 Send synchronisation character

Command: Send synchronisation character

Purpose: The controller sends an ASCII character via the serial interface.

Structure: 1<Z><CR>

1 = command code reference run
<Z> =ASCII code (decimal number between 33 and 126)
<CR> = Carriage Return as command termination

Application: 133

Explanation: "1" indicates that a synchronisation character is to be sent. "33" stands for the ASCII character "!". After saving, the controller responds with the handshake character ("0").

3.2.4 Wait for synchronisation character

Command: Wait for synchronisation character

Purpose: The controller wait for reception of an ASCII character.

Structure: 2<Z>,<Offset><CR>

2 = command code reference run
<Z> =ASCII code (decimal number between 33 and 126)
<Offset> =Offset, jump target when receiving the correct character
<CR> = Carriage Return as command termination

Application: 133-10

Explanation: "1" indicates that one is awaiting a synchronisation character. "33" stands for the ASCII character "!". The control interrupts the command processing until a character is received. If the received character corresponds to the given synchronisation character (in this case "!"), the offset (here -10 commands) will be branched, otherwise the command processing will be continued with the next command in the CNC programme. After saving, the controller responds with the handshake character ("0").

3.2.5 Loops, branching in the CNC mode

Command: Loop, branching

Purpose: Saving loops and branches Loops are used to combine similar motion sequences. This makes better use of the controller's available memory. You can branch to a specific block within the programme after a logical decision has been made.

Structure: 3<Number>,<Offset><CR>

3	= Command code loop, branching
<Number>	= Number of loops
Loop:	0 < number of loops
Branching:	always 0
<Offset>	= jump target
Loop:	-1 >= jump target
Branching:	-Offset <= jump target <= +Offset
<CR>	= Carriage Return as command termination

Application: 3 25, -1 Repeat last command 25 times
3 0, -5 Always branch 5 steps back
3 0,5 Skip the next 4 commands
3 6, -5 Repeat the last 5 commands 6 times

Explanation: If the controller encounters the "loop/branch" command within the CNC programme sequence, the first step is to check the number of loops to determine whether it is a loop or a branch command. With a loop command, a loop counter is set up, pre-set and the command counter is corrected by the specified offset. The commands up to the loop counter are now repeated and the loop counter is decremented until it reaches zero. The first command is then executed after the loop. Loops can be nested with a nesting depth of 15. The necessary counters are then managed on a corresponding loop stack. When branching, the offset is understood as a relative jump target within the CNC programme and the command counter is corrected accordingly by the offset.

You must not branch before the beginning or behind the end of the data field. Forward loops are not permitted. A loop always repeats the last n

commands. At least one command must be repeated. Loops may be nested, the maximum nesting depth is 8. A loop may not be exited by branching.

3.2.6 Time delays in the CNC mode

Command: Time delay

Purpose: Saving time delays.

Structure: 5<time><CR>

5 = command code time delay
<Zeit> = time in 1/10 sec
<CR> = Carriage Return as command termination

Application: 350 delay 5 seconds

Explanation: If the controller encounters the "Time delay" command within the CNC programme sequence. Then, the next command is executed in the CNC programme only after the delay time has elapsed. The time is given in 1/10 of a second.

3.2.7 Movement up to port event in the CNC mode

Command: Setting the port condition for movement to port event

Purpose: The controller stores the condition for a movement until port event. This condition is applied to the next movement that follows.

Structure: 6<Port No.>,<Bit No.>,<Value><CR>

6 = command code port condition
<Portnr> = Port number
<Bitnr> = Bit number, 1 - 8 --> bit-wise, 128 --> byte-wise
<Wert> = comparative value
<CR> = Carriage Return as command termination

Application: 60,128,1 next movement is terminated if port 0 == 1
60,1,0 next movement is terminated if port0, is Bit1 == 0

Explanation: "6" indicates that the condition for a movement until port event is to be specified. This condition is applied to the next movement command that follows. During the next movement, the corresponding port is queried and compared byte-wise or bit-wise logically with the given value. If the logical comparison is true, the movement ends.

Port	Bit	Status	Function
0	0 - 7	00 - FF	User E/A (also possible with 65531)
1	0 - 4	00 - 0F	Function keys F1 – F4

3.2.8 Reference run in the CNC mode

Command: Reference run

Purpose: The controller saves a movement of the axes to their zero point (reference point).

Structure: 71<CR>

7	= command code reference run
1	= axis information, see below.
<CR>	= Carriage Return as command termination

Application: 71

Explanation: "7" indicates that a reference run is to be made. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

3.2.9 Data field end in the CNC mode

Command: Data field end

Purpose: The command marks the end of a CNC data field and is used to terminate the data transfer and save storable commands.

Structure: 9<CR>

9	= command code data field end
<CR>	= Carriage Return as command termination

Application: 9

Explanation: "9" indicates that the end of the transferred CNC data field has been reached. The command ends with a carriage return. The controller responds with the software handshake "0" if the saving was successful, or with a fault message. In addition to marking the data field as a valid CNC programme, status information (e. g. the current reference speed) is stored in the FlashProm. The controller then returns to DNC mode and accepts the corresponding commands.

A CNC data field must be terminated with the command end of data field, otherwise the stored CNC programme is not valid and cannot be executed.

3.2.10 Read keyboard and branch in the CNC mode

Command: Read keyboard and branch

Purpose: Read keyboard and branch in the programme sequence. You can branch to a specific block within the programme after a keyboard request has been made.

Structure: k<F>,<Offset><CR>

o = command code set port
<F> = function key number (1 – 4)
<Offset> = jump target
<CR> = Carriage Return as command termination

Application: k4,10 if F4 activated 10 commands forwards
K3,-5 if F3 activated 5 commands backwards
k1,-1 wait until F1 has been released

Explanation: "k" indicates that the keyboard should be queried and branched based on the input. Subsequently, the number of the function key and the command offset are transmitted separated by commas and the command is completed with carriage return. The controller responds with the software handshake "0" if the saving was successful, or with a fault message if incorrect function key numbers and/or values were transferred. The keyboard is queried while the programme is running. If the specified function key is pressed, the offset is branched, otherwise the next command is executed in the programme sequence.

3.2.11 Delete display line in the CNC mode

Command: Delete display line

Purpose: This instruction deletes a line in the display of the MC1.

Structure: l<Z><CR>

l = command delete display line
<Z> = line numbers (1-4)
<CR> = Carriage Return as command termination

Application: l1

Explanation: "l" indicates that a line in the display of the controller is to be deleted. The command ends with a carriage return. After saving, the controller responds with the handshake character ("0").

3.2.12 Write display line in the CNC mode

Command: Write display

Purpose: This instruction is used for writing in the display of the MC1.

Structure: L<Z>,<S>,<Text><CR>

L	= write display
<Z>	= line numbers (1-4)
<S>	= column numbers (1-20)
<Text>	= text to be outputted
<CR>	= Carriage Return as command termination

Application: L1,2,MC1 Display Test

Explanation: "L" indicates that writing should be done in the display of the controller. The control will output the text „MC1 Display Test“ in the display in line1 from position2 on. The command ends with a carriage return. After saving, the controller responds with the handshake character ("0").

3.2.13 Absolute movement in the CNC mode

Command: Movement to the absolute position

Purpose: The control saves an absolute movement based on the speeds given and positions.

Structure: m<P>,<G><CR>

m	= command code movement absolute
<P>	= Position
<G>	= Speed
<CR>	= Carriage Return as command termination

Application: m5000,900

Explanation: "M" indicates that an absolute position follows. The controller now expects a pair of numbers consisting of position and speed. The distance is indicated in the absolute measurement, i.e. based on the current zero point. After saving, the controller responds with the handshake character.

3.2.14 Setting the zero point in the CNC mode

Command: Setting zero point on current point

Purpose: The control saves a command to set the current position during execution of the CNC programme as a virtual zero point for the indicated axis (s). The following "Travel absolute" instructions then refer to this virtual zero point.

Structure: n1<CR>

n	= command code set zero point
1	= axis information, see below.
<CR>	= Carriage Return as command termination

Application: n1

Explanation: "n" indicates that a zero offset is to be made. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After saving, the controller responds with a response.

3.2.15 Simulate reference run in the CNC mode

Command: Simulate reference run

Purpose: The control saves a command to set the current position during execution of the CNC programme as a reference point.

Structure: N1<CR>

n	= command code set zero point
1	= axis information, see below.
<CR>	= Carriage Return as command termination

Application: N1

Explanation: "n" indicates that a reference run is to be made. The MC1 is a single-axis control, so only the value 1 is possible for the axis specification.

After saving, the controller responds with a response.

3.2.16 Read port and branch in the CNC mode

Command: Read input port and branch

Purpose: Read input port and branch in the programme sequence. You can branch to a specific block within the programme after a logical comparison has been made.

Structure: o<Portnr>,<Bitnr>,<Wert>,<Offset><CR>

o = command code set port
<Portnr> = Port number
<Bitnr> = Bit number, 0 - 7 --> bit-wise, 128 --> byte-wise
<Wert> = comparative value
<Offset> = jump target
<CR> = Carriage Return as command termination

Application: o0,128,1,-1 wait until Port 0 <> 1
o0,0,1,-1 wait until Port0, Bit0 = 0
o0,0,1,3 if Port0, Bit0 == 1, command counter += 3

Explanation: "o" indicates that the value of an input port is to be read and the programme sequence adapted to the value. Subsequently, the port number, the bit number, the comparable value and the command offset are transmitted separated by commas and the command is completed with carriage return. The controller responds with the software handshake "0" if the saving was successful, or with a fault message if incorrect port numbers and/or values were transferred. During the programme sequence, the corresponding port is queried and compared byte-wise or bit-wise logically with the given value. If the logical comparison is true, the offset is branched, otherwise the next command is executed in the programme sequence.

Port	Bit	Status	Function
0	0 - 7	00 - FF	User E/A (also possible with 65531)
1	0 - 4	00 - 0F	Function keys F1 – F4

The port inputs are queried within the controller according to the programme sequence. This means that it is not possible to query inputs during command processing, e. g. during a positioning movement.

3.2.17 Setting port in the CNC mode

Command: Set output port

Purpose: Defined switching on/off of existing output ports.

Structure: p<Portnr>,<Bitnr>,<Wert><CR>

p = command code set port
<Portnr> = Port number

<Bitnr> = Bit number, 0 - 7 --> bit-wise, 128 --> byte-wise
<Wert> = new value
<CR> = Carriage Return as command termination

Application: p0,128,1 Port 0, set byte-wise to 1
p0,0,1 Port 0 , set Bit 0 to 1

Explanation: "p" indicates that the value of an output port is to be set. Subsequently, the port number, the bit number and the new port value are transmitted separated by commas and the command is completed with carriage return. The controller responds with the software handshake "0" if the saving was successful, or with a fault message if incorrect port numbers and/or values were transferred.

Port	Bit	Value	Function
0	0 - 7	0 - 255	User E/A (also possible with 65529)

The port outputs are set within the controller based on the programme sequence. This means that it is not possible to set or delete outputs during command processing, e. g. during a positioning movement.

3.2.18 Switching test mode on/off in the CNC mode

Command: Switch test mode on/off

Purpose: The test mode can be switched on and off by using the command.

Structure: T<Status><CR>

T = command switch test mode on/off
<Status> = 0 --> switch off, 1 --> switch on
<CR> = Carriage Return as command termination

Application: T1, T0

Explanation: "T1" switches the test mode on "T0" switches the test mode off. After execution, the controller responds with the handshake character ("0"). In test mode, the controller treats the reference run and limit switches differently from in the normal operation. If a reference run command is received in test mode, the control does not execute a reference run in the true sense of the word, but sets the current point as the reference point. The limit switches are still monitored but can be overridden. This is very useful if an axis is in a limit switch after switching on the system and has to be retracted.

4 The fault reports of the MC1

After each transmitted command, the controller responds with a corresponding response. These codes are transmitted as ASCII characters and can therefore be evaluated easily. Sources and causes of errors can be identified on the basis of the transmitted character. The individual error codes are described below.

Code	Description
0	Handshake character - No fault, the command was executed correctly. - The next command can be transmitted.
1	Error in transferred number - The controller has received a numerical value which could not be interpreted correctly. - The transferred numerical value is out of the permissible range or the transferred numerical value contains invalid characters.
2	Limit switch fault - A limit switch was activated by the traversing movement. The current movement has been aborted. This is done by stopping the movement without a deceleration ramp. As a result, the actual positions of the controller are no longer correct, and step losses have probably occurred. - The reference run of a stepper motor axis has not been carried out correctly or not yet. ATTENTION! After a limit switch fault, the controller must be re-initialised and a reference run must be carried out.
3	inadmissible axis specification - The control has been sent an axis specification for a command to be executed which contains an undefined axis. - Use in the commands, the axis specifications contain only combinations of axes that are also initialised.
4	no axes defined - Before the movements or general commands which have a number of parameters depending on the number of axes are transmitted to the controller, the command "Set number of axes" must be transmitted in order to set the internal axis parameters correctly.
5	Syntax error - A command was transmitted incorrectly. - The command used does not exist or cannot be processed by this controller. - Check that all commands transmitted are correct.
6	Memory end - An attempt has been made to transmit more commands in CNC mode than can be stored in the controller.
7	inadmissible parameter number - The controller has received more or fewer parameters for the command than are required. - Check that the number of parameters for the command in conjunction with the number of axes is correct.
8	command to be stored incorrect - A command that is not available as a CNC command has been passed to the controller.

9	<p>System fault</p> <ul style="list-style-type: none"> -The supply to the system has not yet been switched on. - The safety circuit of the system is not active. - The power amplifiers and/or the safety circuit could not be switched on because the cover is still open. - An emergency stop situation has occurred. <p>ATTENTION! After an emergency stop situation, the controller must be re-initialised and a reference run must be carried out.</p>
A	not used by this controller
B	not used by this controller
C	not used by this controller
D	<p>inadmissible speed</p> <ul style="list-style-type: none"> - The permissible limits for speed specifications were not complied with. - Check that all speed information is correct.
E	not used by this controller
F	<p>User stop</p> <ul style="list-style-type: none"> - The user has pressed the stop button on the control, the current movement has been stopped. The command execution can be resumed with the start button or the start command "@0s".
G	<p>invalid data field</p> <ul style="list-style-type: none"> - A start command has been transmitted to the controller, although there is no movement residue in the memory, i. e. although no stop function has been executed before. - An attempt has been made to transfer a CNC programme although there is still a programme or parts of a programme in the memory.
H	not used by this controller
=	not used by this controller