

Software
Reference Manual
MACCONTROLLER (MAC)

MAC4-INC

Version 4.2

MAC4-SSI

Version 4.2

MAC4-STP

Version 2.2

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MACCON GmbH
Kuehbachstr. 9
D-81543 Munich
Tel. +49 89 651220-0
Fax. +49 89 655217

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MACCON GmbH
Kuehbachstr. 9
D-81543 Munich
Tel. +49 89 651220-0
Fax. +49 89 655217
e-mail sales@maccon.de

port Automation
Antonienstr. 3
D-06749 Bitterfeld
Tel. +49 3493 743-10
Fax. +49 3493 743-15
e-mail service@port.de

General

This documentation of the motor-axis controller family MAC4 consists of a User- and a Reference Manual.

This user Manual serves as an introduction in the use of the MAC series of axis controllers. The procedure for the integration of axis controllers in the user system is described here.

This Reference Manual includes an instruction description for each command.

The page references given in the index refer to this Reference manual only. Please also refer to index of user Manual. Differentiation is made between the manuals by the roman numbers „I“ (user Manual) and „II“ (Reference Manual).

Conventions

- Parameter for the axis controllers are designated in the text as follows:
<abbreviation for parameter>
A summary of all these abbreviations is given in the appendix.
- Hexadecimal numbers are designated in the text as follows:
\$hexadecimal number
- Abbreviation for instructions in the form of mnemonics is given in capitals:
INSTRUCTION
- Instructions, which write parameters to the controller are designated with an additional "_R", if these are relative write instructions:
WRITE_R relative parameter value
- The given abbreviations for the instructions only serve to simplify documentation. Transmission of instructions to the axis controllers is performed as a number code.
- Special notes and warning indications are provided as number codes and are provided in a box with an arrow:

=> WARNING !

Descriptions of abbreviations and designations are provided in the glossary.

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1. Command Description

1.1 Overview

Table 1.1. provides an overview over the commands implemented in the MAC series of multi-axis positioning controllers. In order to improve legibility the commands are specified as their mnemonic. The command code corresponding to the mnemonics are included in the detailed command description. Moreover there is a tabular list of the command codes in the Appendix to this documentation.

General Commands		
Mnemonic	Parameter	Description
C		Acknowledge error
DEINIT		Deinitialise
E		Execute Command
INIT		Initialise

Selection of operational Mode		
Mnemonic	Parameter	Description
MB		„brake“
MC		„search index coarse“
MD		„disable“
ME		„enable“
MF		„find edge“
MH		„home“
MI		„search index“
MP		„positioning“
MR		„reset“
MS		„speed“
PT		„positioning tracking“
VT		„velocity tracking“
UE		„test“

System Set-up		
Mnemonic	Parameter	Description
FLYOFF		Turn off „on-fly“-operation
FLYON		Turn on „on-fly“-operation
TURBO		Turn on or off TURBO-operation
USN		Return direction of motion to original polarity.
USR		Invert direction of motion
WZP	<temp>	Define position new

Table 1.1: Command Overview

Read /Write system specific Parameter		
Mnemonic	Parameter	Description
RAO, WAO, WAO_R	<ao>	Axis offset
RBT, WBT, WBT_R	<bt>	Time for BOOST-Signal
RGA, WGA, WGA_R	<ga>	Proportional gain
RIRQ1, WIRQ1	<irq_vec1>	Vector for interrupt 1
RIRQ2, WIRQ2	<irq_vec2>	Vector for interrupt 2
RIRQ3, WIRQ3	<irq_vec3>	Vector for interrupt 3
RIRQ4, WIRQ4	<irq_vec4>	Vector for interrupt 4
RIRQ5, WIRQ5	<irq_vec5>	Vector for interrupt 5
RIRQ6, WIRQ6	<irq_vec6>	Vector for interrupt 6
RKI, WKI, WKI_R	<ki>	Integral amplification
RLT, WLT, WLT_R	<lt>	Torque limit
RMF, WMF, WMF_R	<mf>	Maximum following error
RPO, WPO, WPO_R	<po>	Pole position the lead/lag-filter
RSSF, WSSF, WSSF_R	<ssf>	Start-/Stop frequency of the motors
RWD, WWD	<wd>	„watchdog“-Time
RZE, WZE, WZE_R	<ze>	Zero position the lead/lag-filter
URCR, UWCR, UWCR_R	<cr>	Size (of a single revolution) for a 360° axis
UREA, UWEA	<ea>	Address of the position information
UREB, UWEB	<eb>	Bit width of the position information
UREC, UWEC	<ec>	Value range the counter/absolute encoders
URES, UWES	<es>	Effective number of encoder lines per motor revolution
URET, UWET	<et>	Type the position measurement systems
URKISC, UWKISC	<ki_sc>	Scaling factor for Integral amplification
URLN, UWLN, UWLN_R	<ln>	Negative software limit switch for linear axis
URLP, UWLP, UWLP_R	<lp>	Positive software limit switch for linear axis
URMS, UWMS, UWMS_R	<ms>	Number of steps of the motors per revolution
URNS, UWNS	<ns>	Setting the negative hardware limit switch
URPS, UWPS	<ps>	Setting the positive hardware limit switch
URRS, UWRS	<rs>	Setting the reference switch
URSC, UWSC	<sc>	Scaling factor for the SSI-encoder
URSF, UWSF	<sf>	Scaling factor for commanded velocity
URSH, UWSH	<sh>	Axis type
URSO, UWSO	<df>	Setting the „drive fault“-signal

Table 1.1: Command Overview (cont.)

Read/Write Parameters related to Operational Modes		
Mnemonic	Parameter	Description
RAA,WAA,WAA_R	<ed>	Emergency braking ramp
RAP,WAP,WRP	<ap>	Target position („positioning“)
RAT,WAT,WRT	<at>	Commanded position („positioning tracking“)
RCA,WCA,WCA_R	<ca>	Acceleration („search index coarse“)
RCD,WCD,WCD_R	<cd>	Braking acceleration („search index coarse“)
RCV,WCV,WCV_R	<cv>	Velocity („search index coarse“)
RDA,WDA,WDA_R	<da>	Direct output value („test“)
RDL,WDL	<dl>	Setting of the switch („find edge“)
RFA,WFA,WFA_R	<fa>	Acceleration („find edge“)
RFD,WFD,WFD_R	<fd>	Braking acceleration („find edge“)
RFV,WFV,WFV_R	<fv>	Velocity („find edge“)
RHA,WHA,WHA_R	<ha>	Acceleration („home“)
RHD,WHD,WHD_R	<hd>	Braking acceleration („home“)
RHV,WHV,WHV_R	<hv>	Velocity („home“)
RIA,WIA,WIA_R	<ia>	Acceleration („search index“)
RID,WID,WID_R	<id>	Braking acceleration („search index“)
RIV,WIV,WIV_R	<iv>	Velocity („search index“)
RLV,WLV,WLV_R	<lv>	Velocity limit = justification velocity (c/f USER Manual)
RPA,WPA,WPA_R	<pa>	Acceleration („positioning“)
RPD,WPD,WPD_R	<pd>	Braking acceleration („positioning“)
RPV,WPV,WPV_R	<pv>	Velocity („positioning“)
RSA,WSA,WSA_R	<sa>	Acceleration („speed“)
RSD,WSD,WSD_R	<sd>	Braking acceleration („brake“)
RSW,WSW,WSW_R	<sw>	Tolerance time in the Servomode
RSTC,WSTC,WSTC_R	<stc>	Steps creep/justification move („positioning“)
RSV,WSV,WSV_R	<sv>	Velocity („speed“)
RTR,WTR,WTR_R	<tr>	Window around target position („positioning“)
RTRT,WTRT	<trt>	Braking acceleration time for recognition of target position („positioning“)
RTV,WTV,WTV_R	<vt>	Commanded velocity („velocity tracking“)

Diagnosis Commands		
Mnemonic	Parameter	Description
RAS		Overall status
RAV		Actual velocity
RBS		user status
RCP		Actual position
RCPI		Actual position in increments (MAC4-STP)
RCT		Processed counter of the position measurement system
RED		Counter of the position measurement system
RFE		Actual following error
ROUT		Actual output value
RPS		Actual commanded velocity
RSS		System status
VER		Version number

Table 1.1: Command Overview (cont.)

1.2 Detailed Command Description

This chapter gives a detailed description about each the commands implemented in the axis controller. In order to simplify reading each command is given as its mnemonic. These abbreviations are not relevant for real communication with the axis, instead the corresponding command codes must be entered in the queue and be transferred to the serial interface (see Users Manual).

The commands are alphabetically sorted according to their mnemonics. Write- and read commands, that refer to the same parameter, are covered jointly. They are dealt with in the abbreviation of the read command (e.g. Rxx, Wxx, Wxx_R or URxx, UWxx, UWxx_R).

Write-/read commands, that begin with a "U", refer to system specific parameters.

The structure is explained by means of examples EXPL.

COMMAND CODE / MNEMONIC / DESIGNATION

The command code, the command abbreviation and a short designation the command are provided at this point:

[code] EXPL example

COMPATIBILITY

This section states for which type of axis controller the command is relevant.

● applies ○ does not apply

PARAMETER

If the command refers to a parameter implemented within the axis controller, this is given here along with default and any nominal limit value..

The permissible value range for this parameter may be further limited by global system parameter values.

DESCRIPTION

Here follows a description on the effect the command has when processed by the axis controller.

SPECIAL CONSIDERATIONS

Here attention is drawn to any special aspects the command, e.g. restrictions, that should be observed.

DIAGNOSTICS

This section includes a short description of possible error messages, that may result from using the command.

SEE ALSO

Reference is made here to commands, that are related to the command being described.

In the case of cross-references to commands using parameters, only the corresponding Read command is mentioned.

EXAMPLE

The processing sequence of the command and its effect on the axis are illustrated in this section by means of an example. This example is always independent of context; a preceding initialisation the axis is not specifically mentioned.

The command mnemonics are used instead the command codes, in order to improve the readability the examples.

The examples have the structure

```
EXPL          comment to command
```

COMMAND CODE / MNEMONIC / DESIGNATION

2	C	clear errors
---	---	--------------

COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

The command clears all axis as well as global following error flags, if set. In the case that following overflow has occurred, this is also reset. It returns the actual user status. '5' appears at the 7 segment LED display.

SPECIAL CONSIDERATIONS

Any error must first be cleared, before the axis controller can accept further commands. Exceptions are read commands, that are always executed.

DIAGNOSTICS

axis_f	• false axis number
--------	---------------------

<i>SEE ALSO</i>	RBS, RAS
-----------------	----------

EXAMPLE

UWPS 5	the level of the positive hardware limit switch is set, the value 5 lies outside the permissible range
URPS	the level of the positive hardware limit switch is read, the result was the default value 1, the invalid
write	command was ignored
UWPS 2	the level of the positive hardware limit switch is set, this valid command is not accepted because the error has not been acknowledged. A logical error is indicated.
C	It clears error, returns the user status, only now are further inputs possible
UWPS 2	the level of the positive hardware limit switch is set, the valid value 2 for the parameter <ps> is accepted and activated after the next E

COMMAND CODE / MNEMONIC / DESIGNATION

311 DEINIT deinitialisation

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The DEINIT command makes a system initialisation ineffective. After turn-on and basic initialisation the axis controller is in the deinitialised condition. The axis is braked until stand-still and "disable" activated. The controller and the profile generator are deactivated.

System parameters can only be set in the deinitialised condition.

SPECIAL CONSIDERATIONS

In the deinitialised condition only the emergency-stop signal, the Gray-/Binary coding (for MAC4-SSI) and the error signals are processed.

The position measurement system is not interrogated.

All error conditions are cleared.

The displays for the limit switches, the software limit switches and the reference (home) switch are cleared.

DIAGNOSTICS

axis_f • false axis number

SEE ALSO INIT

EXAMPLE

DEINIT deinitialise axis
UWET 3 activate external incremental encoder
UWEB 16
UWEC 50000 parameter for external incremental encoder is set

COMMAND CODE / MNEMONIC / DESIGNATION

3	E	execute
---	---	---------

COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

An execute command activates all previous parameter changes as well as the last set operational mode.

A multiple input of the same commands with different parameters, followed by an "execute" causes the last written parameter value to become effective.

SPECIAL CONSIDERATIONS

The "execute" command in the "off-fly"-operation may not be immediately executed.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement has been read

<i>SEE ALSO</i>	FLYOFF
-----------------	--------

EXAMPLE (MAC4-INC)

MS	operational mode "speed" is set
E	operational mode is activated, axis moves with 1.000 Inc/SP (default value)
WSV 2.000	new velocity 2.000 Inc/SP is set, axis continues to moves at 1.000 Inc/SP
WSV 500	new velocity 500 Inc/SP is set, axis still moves at 1.000 Inc/SP
E	last input velocity is activated, axis now moves with 500 Inc/SP

FLYOFF, FLYON

COMMAND CODE / MNEMONIC / DESIGNATION

183	FLYOFF	disable on-fly changes
182	FLYON	enable on-fly changes

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

If the axis controller receives a new command, it normally executes it immediately, even when the command, which has just been processed, has not been fully executed. This behaviour is known as "on-fly" operation.

A switch over to "off-fly" operation, in which each command must be completely processed, before a new command is executed, is possible with the command FLYOFF in the operational modes

- "positioning"
- "search index coarse"
- "search index"
- "home"
- "find edge"

All other operational modes operate exclusively "on-fly".

In the case of "off-fly" operation all received commands are entered in the queue, as long as this is still not full. This commands are normally not processed until the command E is recognised. Previous input commands, that need not be activated with an E (e.g. Read commands or FLYON) are however executed directly.

The activation of "on-fly" operation is made by the command FLYON. After switch-on the controller always selects "on-fly" operation.

SPECIAL CONSIDERATIONS

In "off-fly" operation the axis controller does not react immediately to a change to the operational mode "brake". An immediate stop can still only be commanded by means of direct DPRAM-access, which also clears all other commands in the command queue that have not yet been processed.

If the target radius has been set too small, the end of a positioning move is not recognised. In "off-fly" operation this means that the axis controller cannot execute further commands. The only solution is a stop via DPRAM-access.

DIAGNOSTICS

axis_f • false axis number

SEE ALSO E, MC, MF, MH, MI, MP, RTR

FLYOFF, FLYON

EXAMPLE (MAC4-SSI)

FLYON	"on-fly" operation is set
WAP 10000	target position 10.000 Inc is set
MP	operational mode "positioning" is set
E	positioning move is started
WAP -10000	new target position -10.000 Inc is set
E	new target position is activated, the axis is immediately moved to the new target position -10.000
Inc	
	even when the last target has not yet been reached.
	After reaching the position:
FLYOFF	"off-fly" operation is set
WAP 10000	target position 10.000 Inc is set
E	positioning move is started
WAP -10000	new target position -10.000 Inc is set
E	new target position is activated, the axis is first moved to the position 10.000 Inc, before the second positioning move begins.

COMMAND CODE / MNEMONIC / DESIGNATION

180 INIT initialisation

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The INIT command executes axis initialisation, involving the steps

- initialisation of position measurement system
- activation of parameters
- setting of the bit "init" in the user status.

SPECIAL CONSIDERATIONS

If the position encoder is connected to the peripheral connector -P2 and the parameter <et> configured, then the default values for the position measurement system (<ea>, <eb> and <ec>) are automatically loaded.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the INIT command was entered again after initialisation
	• a value was read from the position measurement system that was outside the permitted range
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement has been read

SEE ALSO E, UREA, UREB, UREC, URET, URES

EXAMPLE

UWET 3	encoder type "external relative encoder" is set
UWEA \$330A	address of the position information is set (DPRAM of axis controller)
UWEB 13	bit width of position information is set
UWEC 8000	range of values of the position information
INIT	initialise system settings

COMMAND CODE / MNEMONIC / DESIGNATION

58	MB	mode brake
----	----	------------

COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

The axis is braked with a braking acceleration of <sd>.

After braking the position is held.

SPECIAL CONSIDERATIONS

In "off-fly" operation this command is not immediately executed in the position- and justification operational modes. An immediate braking of the axis is only possible via the stop-bits in the DPRAM.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

<i>SEE ALSO</i>	RSD
-----------------	-----

EXAMPLE (MAC4-SSI)

MS	operational mode „speed“ is set
E	operational mode is activated, axis moves with a velocity of 1.000 Inc/SP
MB	operational mode "brake" is set
WSD 10	braking ramp 10 Inc/SP/SP is set
E	operational mode is activated, the axis is braked with an acceleration of 10 Inc/SP/SP

COMMAND CODE / MNEMONIC / DESIGNATION

6	MC	mode search index coarse
---	----	--------------------------

COMPATIBILITY

<input checked="" type="radio"/> MAC4-INC	<input type="radio"/> MAC4-SSI	<input checked="" type="radio"/> MAC4-STP
---	--------------------------------	---

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

This operational mode executes an approximate justification of the axis to the next index pulse of the incremental encoders.

The axis controller moves the axis with the acceleration $\langle ca \rangle$ up to the maximum permissible velocity $\langle cv \rangle$. The axis now moves with constant velocity until the next index pulse. After registration of the index pulse a braking phase with the braking acceleration $\langle cd \rangle$ follows. The axis is now near to the index pulse.

The difference between the axis position and the index pulse depends on the set parameters.

The direction of movement results from the sign the velocity $\langle cv \rangle$.

After completion of this operational mode the axis is held at the reached position. The completion of justification is indicated by the setting of the bits "jus_end" in the user status as well as the interrupt "end of positioning".

SPECIAL CONSIDERATIONS

A change to the operational mode "search index coarse" is only possible from the modes "enable" or "brake".

This operational mode is only permissible, if an incremental encoder with index pulse is connected directly to the axis controller.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• there is no position encoder with index pulse specified
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

<i>SEE ALSO</i>	MI, RCA, RCD, RCV, RIRQ4
-----------------	--------------------------

EXAMPLE

MC	operational mode "search index coarse" is set
WCV -500	negative search velocity is set
E	operational mode is activated, the axis is approximately positioned to the next index pulse in
negative	

direction

COMMAND CODE / MNEMONIC / DESIGNATION

5 MD mode disable

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The addressed axis is disabled and the value zero is output to the motor driver. The enable bit "dr_en" in the user status is cleared.

SPECIAL CONSIDERATIONS

A change to the operational mode "disable" during a movement causes the axis to brake to a stand-still without a braking ramp.

DIAGNOSTICS

- | | |
|--------|--|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • the "drive error"-signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |

SEE ALSO ME

EXAMPLE

MS	operational mode „speed“ is set
E	operational mode is activated
MD	operational mode "disable" is set
E	operational mode is activated, the motor is immediately disabled, i.e. the axis brakes without a braking ramp

COMMAND CODE / MNEMONIC / DESIGNATION

4	ME	mode enable
---	----	-------------

COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

An axis must first be enabled, before it can execute movement.

After enabling the axis the actual position is held.

SPECIAL CONSIDERATIONS

This operational mode can only be activated, if the axis has been initialised. A change to the operational mode "enable" during motion causes an immediate stop without a braking ramp. In contrast to mode "disable" the axis is not then disabled.

If the linear axis happens to be outside the permissible software limits $\langle ln \rangle$ and $\langle lp \rangle$ at the moment of enable, it is immediately disabled. The axis can be moved after enabling has been repeated, however movement is only permitted in the permissible direction.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis was not initialised
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

<i>SEE ALSO</i>	INIT, MD
-----------------	----------

EXAMPLE

MD	axis is disabled
E	disable activated
MS	operational mode „speed“ is set, results in a fault, because axis is not enabled
C	delete error
ME	enable axis
E	activate enable
MS	operational mode „speed“ is set
E	operational mode is activated, the axis begins to move

COMMAND CODE / MNEMONIC / DESIGNATION

36 MF mode find edge

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The axis is justified according to the switch identified by the parameter <dl>.

Justification is performed in two phases. The reference switch search is executed with acceleration <fa> and velocity <fv>, the axis is braked with braking acceleration <fd>.

The justification to the switch transition is made in the opposite direction at the velocity <lv>. Braking from the velocity <lv> is made without a ramp.

The direction of movement for justification to the home switch is defined by the polarity of the parameter <fv>. In the other settings the direction depends on the switch configuration.

After completion of this operational mode the position reached is held. The end of justification is indicated by setting the bit "jus_end" in the user status as well as the interrupt "end of positioning".

SPECIAL CONSIDERATIONS

A change to the operational mode "find edge" is only possible in the modes "enable" or "brake".

When justifying to a hardware limit switch, the corresponding software limit switch ignored.

Circular axes cannot be justified to a limit switch.

DIAGNOSTICS

- | | |
|--------|--|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the axis controller is not in the operational mode "enable" or "brake" |
| | • the switch for justification is defined as OFF |
| | • it was attempted to justify a circular axis to a limit switch |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • the "drive error"-signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |

SEE ALSO RDL, RFA, RFD, RFV, RIRQ4, RLV

EXAMPLE (MAC4-SSI)

WDL 1	search for negative limit switch
WV 1000	search velocity is set to 1.000 Inc/SP
WFA 100	acceleration is set to 100 Inc/SP/SP
WFD 200	braking ramp is set to 200 Inc/SP/SP
WLV 10	search velocity is set to 10 Inc/SP
MF	operational mode is set to "find edge"
E	initiate justification to switch, the axis moves automatically in a negative direction

(search for a negative limit switch) and position to the right-hand edge

COMMAND CODE / MNEMONIC / DESIGNATION

26 MH mode home

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The axis is positioned to the first index pulse to the right of the left edge of the home switch.

In the first phase a search is made for the home switch with the acceleration $\langle ha \rangle$ and velocity $\langle hv \rangle$, the axis is then braked with the braking acceleration $\langle hd \rangle$.

In the second phase the axis is positioned to the left edge of the home switch and finally in the third phase to the next index pulse (in positive direction).

In the last two phases moves are made with the velocity $\langle lv \rangle$. Braking from the velocity $\langle lv \rangle$ is without a braking acceleration.

The search direction is defined by the sign of the velocity $\langle hv \rangle$.

After completion of this operational mode the achieved position is held. The end of justification is indicated by the bit "jus_end" in the user status as well as the interrupt "end of positioning".

SPECIAL CONSIDERATIONS

A change to the operational mode "home" is only possible in the modes "enable" or "brake".

This operational mode is only permissible, if an incremental encoder with index pulse is directly connected to the axis controller and the reference switch is not declared as OFF.

In the case of linear axes the definition of the wrong search direction causes the axis to be positioned to the limit switch and held there; automatic reversal of the search direction is not implemented.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• there is no position encoder with index pulse specified
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the reference switch is defined as OFF
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

SEE ALSO RHA, RHD, RHV, RIRQ4, RLV,

EXAMPLE (MAC4-STP)

WHV -1000	velocity of 1.000 Hz is set for reference move
MH	operational mode "home" is set

MACR_ENG.DOC Status: 04.06.99

E operational mode is activated, the axis search for the home switch is in negative direction

COMMAND CODE / MNEMONIC / DESIGNATION

16	MI	mode search index
----	----	-------------------

COMPATIBILITY

● MAC4-INC	○ MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

This operational mode executes a fine justification to the next index pulse of the incremental encoder.

The first phase is the same as for the mode "search index coarse", however "search index" uses acceleration $\langle ia \rangle$, maximum velocity $\langle iv \rangle$ and braking acceleration $\langle id \rangle$.

In the first phase the axis is moved beyond the index pulse. In the second phase it moves back to the index pulse with the creep velocity $\langle lv \rangle$. On arriving at the index pulse for the second time the axis is stopped without using a braking ramp.

The direction of movement is defined by the sign of the parameter $\langle iv \rangle$.

After completion of this operational mode the position reached is held. The end of justification is indicated by setting the bit "jus_end" in the user status as well as the interrupt "end of positioning".

SPECIAL CONSIDERATIONS

A change to the operational mode "search index" is only possible in the modes "enable" or "brake".

This operational mode is only permissible, if an incremental encoder with an index pulse is connected directly to the axis controller.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• there is no position encoder with index pulse specified
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

<i>SEE ALSO</i>	MC, RIA, RID, RIV, RIRQ4, RLV
-----------------	-------------------------------

EXAMPLE

MI	operational mode "search index" is set
WIV 500	positive search velocity is set
E	operational mode is activated, the axis is positioned to the next index pulse in positive direction

COMMAND CODE / MNEMONIC / DESIGNATION

59	MP	mode positioning
----	----	------------------

COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
------------	------------	------------

<i>PARAMETER</i>	none
------------------	------

DESCRIPTION

The axis moves to the target position given by <ap>.

During movement a trapezoidal velocity profile is used. Depending on the set velocity and acceleration values and the distance to the target position, triangular or rectangular profiles may result.

In the case of MAC4-STP a creep move phase follows the braking ramp.

The direction of movement depends on the target position.

The positioning move is considered completed if the axis has remained within the target window given by <tr> for the period of time given by the parameter value <trt>.

The end of positioning is indicated by setting the bit "pos_end" in the user status and by the interrupt "end of positioning". The LED "P" at the front panel illuminates.

SPECIAL CONSIDERATIONS

A change to the operational mode "positioning" is only possible in the modes "enable" or "brake".

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis was not initialised
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the set target position lies outside the axis range
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

SEE ALSO RAP, RIRQ4, RPV, RSTC, RTR

EXAMPLE (MAC4-INC)

WPA 100	acceleration 100 Inc/SP/SP is set
WPV 500	velocity 500 Inc/SP is set
WPD 200	braking acceleration 200 Inc/SP/SP is set
WAP 10000	target position 10.000 Inc is set
MP	operational mode "positioning" is set
E	positioning move is started

COMMAND CODE / MNEMONIC / DESIGNATION

84 MR mode reset

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

All axes are braked with the emergency deceleration *<ed>* to a stand-still and transferred to the operational mode "disable". All parameter are reverted to their default values.

After a reset all axes are deinitialised.

SPECIAL CONSIDERATIONS

A reset in the mode "test" causes the axes to be switched off without a braking ramp.

The reset is initiated without an "execute" command.

The immediate execution of a reset is not guaranteed. The command is entered in the queue and is processed only after preceding commands.

After a reset the axis controller must be reinitialised with the command INIT.

DIAGNOSTICS

axis_f • false axis number

SEE ALSO

EXAMPLE

MS	operational mode „speed“ is set
E	operational mode is activated
MR	reset axis controller; all axes are braked with the braking ramp <i><ed></i> and then switched off

COMMAND CODE / MNEMONIC / DESIGNATION

48 MS mode speed

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The axis moves with the constant velocity <sv> after executing an acceleration ramp.

The sign of the velocity value <sv> determines the direction of axis movement.

SPECIAL CONSIDERATIONS

A change to the operational mode „speed“ is only possible in the mode "enable" or "brake".

DIAGNOSTICS

- | | |
|--------|--|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the axis controller is not in the operational mode "enable" or "brake" |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • a false axis number was given |
| | • the "drive error" signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |

SEE ALSO RSA, RSV

EXAMPLE (MAC4-STP)

WSSF 100	start/stop frequency is set to 100 Hz
WSA 100	acceleration is set to 100 Hz/SP
WSV 1000	velocity is set to 1.000 Hz
MS	operational mode „speed“ is called
E	operational mode is activated, the axis accelerates in 10 SP to 1.000 Hz and then continues to move with this velocity

COMMAND CODE / MNEMONIC / DESIGNATION

169 PT position tracking

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

With this operational mode the user can generate his own move trajectory. The parameter value <at> defines the target position for the next sampling period.

Velocity and acceleration limits are not active; it is the responsibility of the user to avoid excessive position steps.

SPECIAL CONSIDERATIONS

A change to the operational mode "position tracking" is only possible in the modes "enable" or "brake".

MAC4-STP: The BOOST-signal is not automatically reset in this mode. It remains activated until the modes "disable", "enable" or "brake" are called.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis controller is not in the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

SEE ALSO RAT

EXAMPLE (MAC4-INC)

WAT 0	start position 0 Inc is set
PT	operational mode "position tracking" is set
E	operational mode is activated
WAT 10	next position 10 Inc is set
E	new target position is activated
WAT 50	next position 50 Inc is set
E	new target position is activated
WAT 100	next position 100 Inc is set
E	new target position is activated

RAA, WAA, WAA_R

COMMAND CODE / MNEMONIC / DESIGNATION

106	RAA	read emergency deceleration
107	WAA	write emergency deceleration
108	WAA_R	write emergency deceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ed> emergency deceleration	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	5.000
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

Emergency deceleration serves to stop the axis in a situation of fault - or danger.
The function is used in the following cases:

- reset command,
- "watchdog"-fault ,
- hardware or software limit switch,
- following error overflow,
- signal „drive error“ active

SPECIAL CONSIDERATIONS

In the operational mode "test" the axis is not braked in the emergency situation; instead it is turned off without activating the braking ramp.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO

EXAMPLE (MAC4-INC)

UWLP 10000	positive software limit switch 10.000 Inc is set
WAA 200	emergency deceleration 200 Inc/SP/SP is set
ME	axis is enabled
E	enable is activated
MS	operational mode „speed“ is set
E	operational mode is activated, the axis move to position 10.000 and brought to a stand-still with

200 Inc/SP/SP

RAO, WAO, WAO_R

COMMAND CODE / MNEMONIC / DESIGNATION

132	RAO	read axis offset
133	WAO	write axis offset
134	WAO_R	write axis offset relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ao> axis offset	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	0	0	0
lowest value	-999.999.999	-999.999.999	-10.000.000
highest value	999.999.999	999.999.999	10.000.000

DESCRIPTION

The reference position for all position information is shifted by the value <ao>.

SPECIAL CONSIDERATIONS

The write commands WAO and WAO_R are only permissible, if the axis is at stand-still, i.e. the output command must be zero.

The new absolute value of the axis position must still lie within the permitted parameter limits after a relative Write command WAO_R.

The software limit switch values <ln> and <lp> remain valid; physically however they are shifted accordingly.

In the case of linear axes with absolute encoders the parameter <ao> must lie within the range -<ec> <ao> <ec> .

In the case of circular axes the parameter <ao> must lie within the range -<cr> <ao> <cr>.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the reference velocity is zero • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred • an invalid value for the position measurement was read
limit_f	• the given value does not lie within the range-<ec>...-<ec> for a linear axis with an absolute encoder • the given value does not lie in the circular range • the given parameter value does not lie within the permissible range

SEE ALSO UREC, URLN, URLP, WZP, URCR

EXAMPLE (MAC4-SSI)

RCP	position is read and returns e.g. the position 2.000 Inc
WAO_R 2.000	axis offset increased to 2.000 Inc
E	new axis offset is activated

RCP position is read and returns the positions value 4.000 Inc

RAP, WAP, WRP

COMMAND CODE / MNEMONIC / DESIGNATION

63	RAP	read absolute position in mode positioning
70	WAP	write absolute position in mode positioning
71	WRP	write relative position in mode positioning

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ap> absolute position

	MAC4-INC	MAC4-SSI	MAC4-STP
	[Inc]	[Inc]	[Steps]
default value	0	0	0
lowest value	-1.000.000.000	-1.000.000.000	-10.000.000
highest value	1.000.000.000	1.000.000.000	10.000.000

DESCRIPTION

The parameter <ap> gives the absolute target position for a positioning move (in the operational mode "positioning").

SPECIAL CONSIDERATIONS

A relative write access does not refer to the position values prior to applying the parameters <ap> but to the actual position of the axis allowing for following errors, i.e. the command WRP <Parameter> changes the actual target position directly.

MAC4-INC/SSI:

$\langle ap \rangle = \langle Actual\ position \rangle + \langle Following\ error \rangle + \langle Parameter \rangle.$

MAC4-STP:

$\langle ap \rangle = \langle Actual\ position \rangle + \langle Parameter \rangle.$

In the case of linear axes the parameter <ap> must lie within the set software limits:

$\langle ln \rangle \leq \langle ap \rangle \leq \langle lp \rangle$

In the case of a circular axis the parameter <ap> must lie within the range

$0 \leq \langle ap \rangle < \langle cr \rangle .$

RAP, WAP, WRP

DIAGNOSTICS

- | | |
|---------|---|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • the "drive error"-signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |
| limit_f | • the given target position lies outside the axis range |
| | • the given parameter value does not lie within the permissible range |

SEE ALSO MP, URCR, URLN, URLP

EXAMPLE (MAC4-STP)

MF	operational mode "find edge" is set
WDL 0	justification to the home switch
E	reference move is started
...	(axis justification to the home switch)
WRP 1000	target position 1.000 steps after the reference position
MP	operational mode "positioning" is set
E	positioning move is started

COMMAND CODE / MNEMONIC / DESIGNATION

120 RAS read overall status

COMPATIBILITY

● MAC4-INC ●MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The overall (or general) status for all axes is returned as a parameter. It has the following meaning:

Bit	Name	Significance
0	„h_stop“	hardware emergency stop
1	„axis_f“	false axis number
2	„watch_f“	„watchdog“ activated
3	„fcode0“	signalFC0 active
4	„fcode1“	signal FC1 active
5	„fcode2“	signal FC2 active
6	„serv_en“	internal Control Bit
7-31	„free“	not used

SPECIAL CONSIDERATIONS

none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RBS, RSS

EXAMPLE

RAS the overall status is read, returns e.g. \$00000008, i.e. signal FC0 is active

RAT, WAT, WRT

COMMAND CODE / MNEMONIC / DESIGNATION

74	RAT	read absolute position in mode tracking
77	WAT	write absolute position in mode tracking
78	WRT	write relative position in mode tracking

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<at> absolute tracking

	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	0	0	0
lowest value	-1.000.000.000	-1.000.000.000	-10.000.000
highest value	1.000.000.000	1.000.000.000	10.000.000

DESCRIPTION

The parameter <at> gives the target position for the next sampling period in the operational mode "position tracking".

The acceleration and velocity values between two sampling periods are not monitored. The parameter <at> must be set with care.

SPECIAL CONSIDERATIONS

A relative write access does not refer to the position values prior to applying the parameters <ap> but to the actual position of the axis allowing for following errors, i.e. the command WRT <Parameter> changes the actual target position directly

MAC4-INC/SSI:

$\langle at \rangle = \langle Actual\ position \rangle + \langle Following\ error \rangle + \langle Parameter \rangle.$

MAC4-STP:

$\langle at \rangle = \langle Actual\ position \rangle + \langle Parameter \rangle.$

In the case linear axes the parameter <at> must lie within the set software limits:

$\langle ln \rangle \leq \langle at \rangle \leq \langle lp \rangle$

In the case of a circular axis the parameter <at> must stay within the range $0 \leq \langle at \rangle < \langle cr \rangle$.

DIAGNOSTICS

- | | |
|---------|---|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • the "drive error"-signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |
| limit_f | • the given target position lies outside the permissible axis range |
| | • the given parameter value does not lie within the permissible range |

SEE ALSO PT

EXAMPLE (MAC4-STP)

WAT 0	start position 0 steps is set
PT	operational mode "position tracking" is set
E	operational mode is activated
WAT 10	next position 10 steps is set
E	new target position is activated
WAT 50	next position 50 steps is set
E	new target position is activated
WAT 100	next position 100 steps is set
E	new target position is activated

COMMAND CODE / MNEMONIC / DESIGNATION

260 RAV read actual velocity

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The actual velocity is returned as a parameter with the following units:

MAC4-INC: Inc/system sampling period
MAC4-SSI: Inc/system sampling period
MAC4-STP: Steps/system sampling period.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RPS

EXAMPLE (MAC4-STP)

WDA 1000 velocity 1000 Hz is set
UE operational mode "test" is set
E operational mode is activated
RAV actual velocity is read, the result was the value 8 Steps/SSP

COMMAND CODE / MNEMONIC / DESIGNATION

118 RBS read user status

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The actual user status of the addressed axis is returned as a parameter. It has the following significance:

Bit	Name	Significance (Bit = 1)
0-7	„mode“	operational mode (see below)
8	„dr_en“	axis enabled
9	„rev_o“	reverse the output
10	„pos_end“	positioning move completed, i.e. in the target radius
11	„jus_end“	justification completed
12	„init“	axis initialised
13	„syn_f“	syntax error
14	„limit_f“	limits error
15	„logo_f“	logical error
16	„encoder_f“	error of the position measurement system
17	„dr_f“	„drive error“-signal on
18	„ferr_f“	following error overflow
19	„hwl_n“	negative hardware limit switch on
20	„hwl-p“	positive hardware limit switch on
21	„swl_n“	negative software limit switch on
22	„swl_p“	positive software limit switch on
23	„ref“	home switch on
24	„free“	not used
25	„on_fly“	„on-fly“ operation on
26	„free“	not used
27	„gray“	MAC4-SSI: SSI-encoder with Gray-code, otherwise: not used
28-31	„free“	not used

The operational modes are coded according to the following table:

Code	Operational mode	Code	Operational mode
0	„disable“		
1	„enable“	7	„brake“
2	„search index coarse“	8	„positioning“
3	„search index “	9	„velocity tracking“
4	„home“	10	„test“
5	„find edge“	11	„position tracking“
6	„speed“	12	„reset“

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RAS, RSS

EXAMPLE

RBS user status is read, returns e.g. the value \$02000108, i.e.
- the axis is to the operational mode "positioning"
- the axis is enabled
- the axis is in the "on-fly" operation

RBT, WBT, WBT_R

COMMAND CODE / MNEMONIC / DESIGNATION

237	RBT	read boost time
238	WBT	write boost time
239	WBT_R	write boost time relative

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<bt> boost time

	MAC4-STP
	[ms]
default value	100
lowest value	1
highest value	10.000

DESCRIPTION

The BOOST-signal is applied before each stepper motor move and is switched off at stand-still. The activation of the BOOST-signal is indicated by setting the bit "boost" in the system status. This signal must be applied to the motor driver for a period prior to motion defined by the parameter value <bt>. The time specified is rounded up to an integer multiple of the system sampling period (SP). After expiration of the time <bt> the axis controller sets the bit "boost_en" in the system status. On turn-off this sequence is reversed.

SPECIAL CONSIDERATIONS

In the operational modes "velocity tracking" and "position tracking" as well as "test" the BOOST-signal is not automatically turned off. It remains active until the user changes to the modes "disable" or "brake".

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO PT, RSS, UE, VT

EXAMPLE

WBT 50	boost time is set to 50ms (internally rounded up to 56 ms)
WSSF 200	start/stop frequency of 200 Hz is set
MS	operational mode „speed“ is set
WSV 500	velocity 500 Hz is set
E	operational mode is activated, the BOOST-signal is activated, after 56 ms the motor moves at the start/stop frequency of 200 Hz and is then accelerated to 500 Hz

RCA, WCA, WCA_R

COMMAND CODE / MNEMONIC / DESIGNATION

8	RCA	read coarse acceleration
11	WCA	write coarse acceleration
14	WCA_R	write coarse acceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<ca> coarse acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <ca> defines the acceleration during the starting ramp of the operational mode "search index coarse".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MC

EXAMPLE (MAC4-INC)

MC	operational mode "search index coarse" is set
WCA 10	acceleration 10 Inc/SP/SP is set
WCV 50	velocity 50 Inc/SP is set
E	operational mode is activated, the velocity 50 Inc/SP is reached after 5 SP (as long as the index pulse is not found beforehand)

RCD, WCD, WCD_R

COMMAND CODE / MNEMONIC / DESIGNATION

9	RCD	read coarse deceleration
12	WCD	write coarse deceleration
15	WCD_R	write coarse deceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<cd> coarse deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <cd> defines the braking acceleration during the ramp of the operational mode "search index coarse" (coarse justification to the index pulse).

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MC

EXAMPLE (MAC4-INC)

MC	operational mode "search index coarse" is set
WCD 10	braking acceleration 10 Inc/SP/SP is set
WCV 50	velocity 50 Inc/SP is set
E	operational mode is activated, after recognition of the index pulse the axis is braked within 5 SP

COMMAND CODE / MNEMONIC / DESIGNATION

116	RCP	read current position
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COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
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PARAMETER	none
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DESCRIPTION

The actual position is returned as a parameter in the following units:

MAC4-INC:	Increments
MAC4-SSI:	Increments
MAC4-STP:	Steps

SPECIAL CONSIDERATIONS

MAC4-STP: If a position measurement system is connected with a lower resolution than the motor steps ($4 * \langle es \rangle < \langle ms \rangle$), the accuracy of the target position is reduced accordingly. The read position in increments does not give exact information about the real motor position in steps. This inaccuracy is allowed for by the controller during positioning,

DIAGNOSTICS

axis_f	• false axis number
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SEE ALSO	RCPI, RCT, RED
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EXAMPLE (MAC4-STP)

UWMS 1000	motor number of counts is set
UWES 100	encoder lines per motor revolution is set (100 lines = 400 increments, i.e. 1 increment per 2.5 steps)
INIT	initialise position measurement system
...	(axis moves)
RCPI	position is read in increments, returns e.g. the position value 100 Increments
RCP	position is read in steps, returns the position 250 steps, the actual position lies in the range 250...252 steps (the next increment is first registered at 253 steps)

COMMAND CODE / MNEMONIC / DESIGNATION

259 RCPI read current position in increments

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER none

DESCRIPTION

The actual position is returned as a parameter in increments.

SPECIAL CONSIDERATIONS

If a position measurement system is connected with a higher resolution as the number of motor counts (4 * *<es>* > *<ms>*), the actual position read is converted to the number of increments corresponding to the closest position in steps.

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RCP

EXAMPLE

UWMS 1000	motor number of counts is set
UWES 1000	encoder lines per motor revolution is set (1.000 lines = 4.000 increments, i.e. 4 increments to 1 step)
INIT	initialise position measurement system
...	(movement of the motor)
RCPI	actual position is read in increments, returns e.g. 107 increments
RCP	actual position is read in steps, returns the position 27 steps (that actually corresponds to 108 increments)

COMMAND CODE / MNEMONIC / DESIGNATION

115 RCT read counter

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The bit width of the counter registers or the range of values of the absolute encoder is defined with the parameter *<eb>*. Access to the position measurement value of the axis controller is however made as a 16/32 bit-access. In order to avoid a corruption of the value read, all set upper bits above the bit width range *<eb>* are blended out. The command RCT returns this truncated value.

SPECIAL CONSIDERATIONS

The returned value must lie within the range 0...*<ec>*-1, otherwise the fault message "Error of position measurement system" is generated.

The counter and the internal counter register set to zero on basic initialisation.

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RED, UREB, UREC

EXAMPLE

UWET 3	encoder type is set (external relative position encoder)
UWEA \$200000	encoder address is set (VMEbus-address)
UWEB 17	bit width of position information is set (17 bit, i.e. two VMEbus-accesses needed)
UWEC 100000	range of position information value is set
INIT	initialise parameters
RCT	counter is read, returns a 32-Bit value, the 15 highest bits are zero; the value must be less than 100.000.

RCV, WCV, WCV_R

COMMAND CODE / MNEMONIC / DESIGNATION

7	RCV	read coarse velocity
10	WCV	write coarse velocity
13	WCV_R	write coarse velocity relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<cv> coarse velocity	MAC4-INC [Inc/SP]	MAC4-STP [Hz]
default value	1.000	2.000
lowest value	-250.000.000	-50.000
highest value	250.000.000	50.000

DESCRIPTION

The parameter <cv> defines the velocity during the constant velocity phase of the operational mode "search index coarse".

SPECIAL CONSIDERATIONS

The sign of the parameter <cv> gives the direction of movement.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MC

EXAMPLE

MC	operational mode "search index coarse" is set
WCV -500	negative search velocity is set
E	operational mode is activated, the axis is coarsely positioned to the next index pulse in negative direction

RDA, WDA, WDA_R

COMMAND CODE / MNEMONIC / DESIGNATION

100	RDA	read direct output
101	WDA	write direct output
102	WDA_R	write direct output relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<da> direct or DAC output

	MAC4-INC	MAC4-SSI	MAC4-STP [Hz]
default value	0	0	0
lowest value	-2.047	-2.047	-50.000
highest value	2.047	2.047	50.000

DESCRIPTION

The value of the parameter <da> is directly output to the motor driver in the operational mode "test".

SPECIAL CONSIDERATIONS

MAC4-INC/SSI: Automatic limiting of the output value of the parameter <lt> is not implemented.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO ROUT, UE

EXAMPLE (MAC4-INC)

UE	operational mode "test" is set
WDA 500	output value 500 is set
E	operational mode is activated, the value 500 is output to the 12-Bit DAC

RDL, WDL

COMMAND CODE / MNEMONIC / DESIGNATION

40	RDL	read limit switch
44	WDL	write limit switch

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<dl> define limit switch

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	2	2	2

DESCRIPTION

The parameter <dl> defines to which switch justification is made in the operational mode "find edge":

<dl>	switch
0	home switch
1	negative limit switch
2	positive limit switch

SPECIAL CONSIDERATIONS

Circular axes can only justify to the home switch.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the limit switch was defined for a circular axis • the given switch was as OFF declared • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO

MF

EXAMPLE

WDL 1	negative limit switch search
MF	operational mode "find edge" is set
E	switch justification is started, the axis is automatically driven in negative direction (search negative limit switch) and positioned to the right edge

COMMAND CODE / MNEMONIC / DESIGNATION

233 RED read encoder direct

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The value of the counter register, memory or the external position encoder is returned directly unprocessed without unit conversion.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RCP, RCPI, RCT

EXAMPLE

UWET 3	encoder type "external relative position encoder" is set
UWEA \$200000	address of the position information is set (VMEbus-address \$200000)
UWEB 17	bit width of the position information is set (two 16-bit accesses needed)
UWEC 100000	range of values of the position information is set
INIT	default parameters are activated and position measurement system initialised
RED	position information is read directly, returns a 32-Bit value, the 17 lower bits contain the position measurement value; the upper 15 bits are not significant

RFA, WFA, WFA_R

COMMAND CODE / MNEMONIC / DESIGNATION

38	RFA	read find edge acceleration
42	WFA	write find edge acceleration
46	WFA_R	write find edge acceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<fa> find edge acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	500
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <fa> defines the acceleration during the start ramp in the operational mode "find edge".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MF

EXAMPLE (MAC4-SSI)

WDL 2	positive limit switch search
WV 1000	velocity 1.000 Inc/SP is set
WFA 100	acceleration 100 Inc/SP/SP is set
MF	operational mode "find edge" is set
E	switch justification is started, the axis accelerates in 10 SP to the velocity 1.000 Inc/SP

RFD, WFD, WFD_R

COMMAND CODE / MNEMONIC / DESIGNATION

39	RFD	read find edge deceleration
43	WFD	write find edge deceleration
47	WFD_R	write find edge deceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<fd> find edge deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	500
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <fd> defines the braking acceleration in the operational mode "find edge".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MF

EXAMPLE (MAC4-SSI)

WDL 2	positive limit switch search
WV 1000	velocity 1.000 Inc/SP is set
WFD 100	braking acceleration of 100 Inc/SP/SP is set
MF	operational mode "find edge" is set
E	switch justification is started, the axis is positioned after registration to the positive limit switch and brought to a stand-still in 10 SP

COMMAND CODE / MNEMONIC / DESIGNATION

121	RFE	read following error
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COMPATIBILITY

● MAC4-INC	● MAC4-SSI	● MAC4-STP
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PARAMETER	none
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DESCRIPTION

The actual following error is returned as a parameter value. The following error is given as the difference of the commanded and actual position. For a positive direction of rotation a positive following error indicates that the axis is lagging behind the command value. The returned value is in the units:

MAC4-INC:	Increments
MAC4-SSI:	Increments
MAC4-STP:	Steps.

SPECIAL CONSIDERATIONS

If the value of the following error exceeds the maximum permissible value $\langle mf \rangle$, the axis is braked with the emergency deceleration $\langle ed \rangle$ and switched to the operational mode "disable".

MAC4-STP: A following error can also occur when steps are counted internally. This effect results from time differences between position measurement and command output. After completion of movement the following error is set to zero.

DIAGNOSTICS

axis_f	• false axis number
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SEE ALSO	RAA, RMF
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EXAMPLE

MP	operational mode "positioning" is set
WAP 100	target position is set
E	positioning move is started
...	(axis moves)
RFE	following error is read, returns e.g. 5, i.e. the axis is at position 95

RFV, WFV, WFV_R

COMMAND CODE / MNEMONIC / DESIGNATION

37	RFV	read find edge velocity
41	WFV	write find edge velocity
45	WFV_R	write find edge velocity relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<fv> find edge velocity

	MAC4-INC [Inc/SP]	MAC4-SSI [Inc/SP]	MAC4-STP [Hz]
default value	1.000	1.000	2.000
lowest value	-250.000.000	-250.000.000	-50.000
highest value	250.000.000	250.000.000	50.000

DESCRIPTION

The parameter <fv> defines the velocity during the constant velocity phase in the operational mode "find edge".

SPECIAL CONSIDERATIONS

The sign of the parameter <fv> gives the direction of motion for a justification to the home switch. The sign of <fv> is ignored for a justification to the limit switch, the direction of motion depends here on the switch configuration.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MF

EXAMPLE (MAC4-SSI)

WDL 0	home switch search
WFV 1000	velocity 1.000 Inc/SP is set
MF	operational mode "find edge" is set
E	switch justification is started, a search for the home switch is made in positive direction

RGA, WGA, WGA_R

COMMAND CODE / MNEMONIC / DESIGNATION

85	RGA	read gain
86	WGA	write gain
87	WGA_R	write gain relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<ga> gain

	MAC4-INC	MAC4-SSI
default value	7	7
lowest value	0	0
highest value	255	255

DESCRIPTION

A lead/lag filter (PD- similar behaviour) with a parallel integrator (I- behaviour) is implemented as the control algorithm. The transfer function of the lead/lag filter is:

$$G_1(z^{-1}) = K \left\{ \frac{1 - A z^{-1}}{1 + B z^{-1}} \right\}$$

with the corresponding recursive form:

$$u_1(k) = K e(k) - K A e(k-1) - B u_1(k-1) .$$

The proportional amplification K of the lead/lag filter can be set with the parameter <ga>; the ratio <ga> = 4 * K applies,

i.e. amplification values in the range 0 ... 63.75 can be set in steps of 0.25.

SPECIAL CONSIDERATIONS

High amplification values can lead to stability problems.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RKI, RLT, RPO, RZE

EXAMPLE

WGA 20	Proportional amplification K is set to the value 20 / 4 = 5
E	parameter is activated

RHA, WHA, WHA_R

COMMAND CODE / MNEMONIC / DESIGNATION

28	RHA	read home acceleration
31	WHA	write home acceleration
34	WHA_R	write home acceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<ha> home acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <ha> gives the acceleration during the starting ramp of the operational mode "home".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MH

EXAMPLE (MAC4-STP)

WHV -1000	velocity -1.000 Hz is set
WHA 200	acceleration 200 Hz/SP is set
MH	operational mode "home" is set
E	operational mode is activated, the axis is accelerated in 5 SP to the velocity -1.000 Hz/SP, starting with the start/stop frequency of 200 Hz

RHD, WHD, WHD_R

COMMAND CODE / MNEMONIC / DESIGNATION

29	RHD	read home deceleration
32	WHD	write home deceleration
35	WHD_R	write home deceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<hd> home deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <hd> gives the braking acceleration for the operational mode "home".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MH

EXAMPLE (MAC4-STP)

WHV -1000	velocity -1.000 Hz is set
WHD 200	braking acceleration 200 Hz/SP is set
MH	operational mode "home" is set
E	operational mode is activated, after registration to the home switch the axis is brought to a stand-still in 5 SP

RHV, WHV, WHV_R

COMMAND CODE / MNEMONIC / DESIGNATION

27	RHV	read home velocity
30	WHV	write home velocity
33	WHV_R	write home velocity relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<hv> home velocity

	MAC4-INC [Inc/SP]	MAC4-STP [Hz]
default value	1.000	2.000
lowest value	-250.000.000	-50.000
highest value	250.000.000	50.000

DESCRIPTION

The parameter <hv> defines the velocity during the constant velocity phase of the operational mode "home".

SPECIAL CONSIDERATIONS

The sign of the parameter <hv> defines the direction the motion.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MH

EXAMPLE (MAC4-STP)

WHV -1000	velocity -1.000 Hz is set
MH	operational mode "home" is set
E	operational mode is activated, the home switch is sought in negative direction

RIA, WIA, WIA_R

COMMAND CODE / MNEMONIC / DESIGNATION

18	RIA	read index acceleration
21	WIA	write index acceleration
24	WIA_R	write index acceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<ia> index acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <ia> gives the acceleration during the starting ramp of the operational mode "search index".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MI

EXAMPLE (MAC4-INC)

WIV -1000	velocity -1.000 Inc/SP is set
WIA 200	acceleration 200 Inc/SP/SP is set
MI	operational mode "search index" is set
E	operational mode is activated, the axis is accelerated in 5 SP to the velocity - 1.000 Inc/SP, if not the index pulse is not registered previously

RID, WID, WID_R

COMMAND CODE / MNEMONIC / DESIGNATION

19	RID	read index deceleration
22	WID	write index deceleration
25	WID_R	write index deceleration relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<id> index deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	500
lowest value	1	1
highest value	2.000.000	8.000

DESCRIPTION

The parameter <id> gives the braking acceleration during the braking ramp of the operational mode "search index".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive error"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MI

EXAMPLE (MAC4-INC)

WIV -1000	velocity -1.000 Inc/SP is set
WID 200	braking acceleration 200 Inc/SP/SP is set
MI	operational mode "search index" is set
E	operational mode is activated, after registration of the index pulse the axis is brought to a stand-still in a maximum of 5 SP

RIRQ1, WIRQ1

COMMAND CODE / MNEMONIC / DESIGNATION

175	RIRQ1	read interrupt vector 1
170	WIRQ1	write interrupt vector 1

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec1> interrupt vector 1

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive). The interrupt 1 ("command buffer empty") indicates that the axis controller has read a command sent via the VMEbus to its command buffer.

SPECIAL CONSIDERATIONS

The interrupt is immediately active (without an "execute" command).

If the axis controller receives a command with a false axis number, the interrupt "command buffer empty" is not activated.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RIRQ2

EXAMPLE

WIRQ1 100 vector for interrupt 1 set to 100

RIRQ2, WIRQ2

COMMAND CODE / MNEMONIC / DESIGNATION

176	RIRQ2	read interrupt vector 2
171	WIRQ2	write interrupt vector 2

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec2> interrupt vector 2	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive). The interrupt 2 ("answer available") indicates that the axis controller has written a response to its output buffer for the command received via the VMEbus.

SPECIAL CONSIDERATIONS

A response is lost, if the queue is full. In this case no interrupt is generated.

The interrupt is immediately active (without an "execute" command).

The response to a command received with a false axis number causes the interrupt "answer available" to be generated with the interrupt vector of the last valid axis.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive error"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RIRQ1

EXAMPLE

WIRQ2 100 vector for interrupt 2 is set to 100

RIRQ3, WIRQ3

COMMAND CODE / MNEMONIC / DESIGNATION

177	RIRQ3	read interrupt vector 3
172	WIRQ3	write interrupt vector 3

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec3> interrupt vector 3

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive). The interrupt 3 ("drive fault") indicates that the signal "drive fault" is active.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO URSO

EXAMPLE

WIRQ3 100	vector for interrupt 3 is set to 100
E	parameter is activated

RIRQ4, WIRQ4

COMMAND CODE / MNEMONIC / DESIGNATION

178	RIRQ4	read interrupt vector 4
173	WIRQ4	write interrupt vector 4

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec4> interrupt vector 4

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive).

The interrupt 4 ("end of positioning") indicates that the actual positioning or justification move has been completed.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MC, MF, MH, MI, MP

EXAMPLE

WIRQ4 100	vector for interrupt 4 is set to 100
E	parameter is activated

RIRQ5, WIRQ5

COMMAND CODE / MNEMONIC / DESIGNATION

179	RIRQ5	read interrupt vector 5
174	WIRQ5	write interrupt vector 5

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec5> interrupt vector 5

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive).

The interrupt 5 ("emergency stop") indicates that an emergency stop was activated by the emergency stop switch.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO

EXAMPLE

WIRQ5 100	vector for interrupt 5 is set to 100
E	parameter is activated

RIRQ6, WIRQ6

COMMAND CODE / MNEMONIC / DESIGNATION

308	RIRQ6	read interrupt vector 6
307	WIRQ6	write interrupt vector 6

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<irq_vec6> interrupt vector 6

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	255	255	255

DESCRIPTION

The interrupt is activated by entering a non-zero interrupt vector (otherwise the interrupt is inactive).

The interrupt 6 ("encoder value") indicates, that the axis controller has read the position information from the DPRAM and a new value can be entered.

SPECIAL CONSIDERATIONS

If the start position is missing in the DPRAM and an interrupt vector was entered, the axis controller demands the start position during the axis initialisation per interrupt. After entering the start position in the DPRAM the interlock flag must be set.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO

EXAMPLE

WIRQ6 150 vector for interrupt 6 is set to 150

RIV, WIV, WIV_R

COMMAND CODE / MNEMONIC / DESIGNATION

17	RIV	read index velocity
20	WIV	write index velocity
23	WIV_R	write index velocity relative

COMPATIBILITY

● MAC4-INC ○ MAC4-SSI ● MAC4-STP

PARAMETER

<iv> index velocity

	MAC4-INC [Inc/SP]	MAC4-STP [Hz]
default value	1.000	2.000
lowest value	-250.000.000	-50.000
highest value	250.000.000	50.000

DESCRIPTION

The parameter <iv> gives the velocity during the constant velocity phase of the operational mode "search index".

SPECIAL CONSIDERATIONS

The sign of the parameter <iv> gives the direction of the movement.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MI

EXAMPLE (MAC4-INC)

WIV -1000	velocity -1.000 Inc/SP is set
MI	operational mode "search index" is set
E	operational mode is activated, the index pulse is sought in negative direction

RKI, WKI, WKI_R

COMMAND CODE / MNEMONIC / DESIGNATION

91	RKI	read integral gain
92	WKI	write integral gain
93	WKI_R	write integral gain relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<ki> integral gain

	MAC4-INC	MAC4-SSI
default value	1	1
lowest value	0	0
highest value	255	255

DESCRIPTION

The controller is a lead/lag filter (PD- related behaviour) with a parallel integrator (I- behaviour). The transfer function of the integrator is:

$$G_2(z^{-1}) = C z^{-1} / \{1 - z^{-1}\}$$

with the corresponding recursive algorithm:

$$u_2(k) = C e(k-1) + u_2(k-1).$$

The integral amplification C can set by the parameter <ki>, the relation is:

$$\langle ki \rangle = 256 * C,$$

i.e. the integral amplification values may be set in the range 0 ... (1 - 1/256) in steps of 1/256.

SPECIAL CONSIDERATIONS

The command value generated by the integrator is limited to avoid "windup".

The value entered in the parameter <ki> is shifted to the right in binary steps to allow for finer resolutions. The number of shift steps is defined in the parameter <ki_sc>.

A high I component can lead to instability problems in the controller.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO RGA, RLT, RPO, RZE, URKISC

EXAMPLE

WKI 1	integral amplification is set to the value 1/256 (before scaling)
E	parameter is activated

RLT, WLT, WLT_R

COMMAND CODE / MNEMONIC / DESIGNATION

97	RLT	read limit torque
98	WLT	write limit torque
99	WLT_R	write limit torque relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<lt> limit torque

	MAC4-INC	MAC4-SSI
default value	2.047	2.047
lowest value	1	1
highest value	2.047	2.047

DESCRIPTION

The command value calculated by the controller (sign and magnitude 12-bit value) is output via a DAC as a current command and generates a corresponding level of torque (or force). The torque can be limited in magnitude to the parameter value <lt>.

SPECIAL CONSIDERATIONS

Excessive limiting of the torque can cause a following error.

If the motor is driven in voltage mode, the command value generated by the controller at the DAC corresponds to velocity. The torque limit then has the significance of a speed limit.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RDA, RGA, RKI, RPO, RZE

EXAMPLE

WLT 1000	torque limit is set to 1.000
E	parameter is activated

RLV, WLV, WLV_R

COMMAND CODE / MNEMONIC / DESIGNATION

109	RLV	read low velocity
110	WLV	write low velocity
111	WLV_R	write low velocity relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<lv> low velocity

	MAC4-INC [Inc/SP]	MAC4-SSI [Inc/SP]	MAC4-STP [Hz]
default value	4	4	30
lowest value	1	1	1
highest value	2.000.000	2.000.000	500

DESCRIPTION

The velocity <lv> is used in the justification modes ("find edge", "search index", "home") and for a the positioning move (MAC4-STP) in order to position to the given position as accurately as possible.

SPECIAL CONSIDERATIONS

<lv> is not multiplied by ten in TURBO operation.

MAC4-STP: The parameter value for <lv> may not exceed the start/stop frequency.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MF, MH, MI

EXAMPLE (MAC4-STP)

WLV 10	search velocity is set to 10 Hz
MF	operational mode "find edge" is set
WDL 2	justification to the positive hardware limit switch
E	operational mode is activated, the axis is driven at 10 Hz during the last phase of justification to the limit switch

RMF, WMF, WMF_R

COMMAND CODE / MNEMONIC / DESIGNATION

103	RMF	read maximum following error
104	WMF	write maximum following error
105	WMF_R	write maximum following error relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<mf> maximum following error

	MAC4-INC	MAC4-SSI	MAC4-STP
	[Inc]	[Inc]	[Steps]
default value	8.000	8.000	8.000
lowest value	1	1	1
highest value	32.000	32.000	32.000

DESCRIPTION

The difference between the commanded and actual position of the axis is designated as following error. Possible causes for the axis not being able to maintain the commanded position are:

- a wiring fault,
- too large value of velocity or acceleration, the motor cannot follow,
- an error of the position measurement system,
- MAC4-INC/SSI: bad controller parameters,
- MAC4-STP: a wrong value input for the number of motor steps <ms> or the number of encoder lines <es>,
- MAC4-STP: a disadvantageous ratio of <es> to <ms>, that causes excessive rounding errors,
- poor mechanical connection between motor and encoder,
- a falsely connected motor or encoder, i.e. for positive motor movement the encoder counts downwards.
- MAC4-SSI: wrong shift factor<sc> for the position encoder.

The parameter <mf> gives the maximum permissible value of the following error. If this value is exceeded the controller brakes the axis with the emergency braking acceleration <ed> and then disables the axis.

The fault message "Following error overflow" is activated.

A following error overflow is indicated by the bit "ferr_f" in the user status.

SPECIAL CONSIDERATIONS

MAC4-STP: A following error can also result when counting steps internally (because of a time difference between position measurement and command output). The maximum following error value should therefore not be set too low.

MAC4-INC/SSI: In the operational mode "test" the controller is not active. No following error is processed.

RMF, WMF, WMF_R

DIAGNOSTICS

- | | |
|---------|---|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| | • the "drive fault"-signal is on |
| | • a following error overflow has occurred |
| | • an invalid value for the position measurement was read |
| limit_f | • the given parameter value does not lie within the permissible range |

SEE ALSO

RBS, RFE

EXAMPLE (MAC4-SSI)

- | | |
|----------|--|
| WMF 1000 | maximum following error is set to 1.000 Inc |
| E | parameter is activated, if the axis is more than 1.000 Inc from the commanded position,
it is braked with the emergency deceleration value and turned off |

ROUT

COMMAND CODE / MNEMONIC / DESIGNATION

258 ROUT read output

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The actual output value is returned as a parameter.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO

EXAMPLE (MAC4-INC)

UE	operational mode "test" is set
WDA 50	DAC- value is set to 50
E	operational mode is activated
ROUT	DAC- value is read, the result was the set value 50

RPA, WPA, WPA_R

COMMAND CODE / MNEMONIC / DESIGNATION

61	RPA	read positioning acceleration
65	WPA	write positioning acceleration
68	WPA_R	write positioning acceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<pa> positioning acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	1.000
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <pa> defines the acceleration during the starting ramp of the operational mode "positioning".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MP

EXAMPLE (MAC4-INC)

RCP	start position is 0
WPA 100	acceleration is set to 100 Inc/SP/SP
WPV 500	velocity 500 Inc/SP is set
WAP 10000	target position 10.000 Inc is set
MP	operational mode "positioning" is set
E	positioning move is started, the axis is accelerated in 5 SP to the velocity of 500 Inc/SP

RPD, WPD, WPD_R

COMMAND CODE / MNEMONIC / DESIGNATION

62	RPD	read positioning deceleration
66	WPD	write positioning deceleration
69	WPD_R	write positioning deceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<pd> positioning deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	1.000
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <pd> defines the acceleration during the braking ramp of the operational mode "positioning".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MP

EXAMPLE (MAC4-SSI)

WPD 100	braking acceleration 100 Inc/SP/SP is set
WPV 500	velocity 500 Inc/SP is set
WAP 10000	target position 10.000 Inc is set
MP	operational mode "positioning" is set
E	positioning move is started

RPO, WPO, WPO_R

COMMAND CODE / MNEMONIC / DESIGNATION

94	RPO	read pole
95	WPO	write pole
96	WPO_R	write pole relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<po> pole

	MAC4-INC	MAC4-SSI
default value	0	0
lowest value	0	0
highest value	255	255

DESCRIPTION

The controller is implemented as a lead/lag filter (with PD- related behaviour) with a parallel integrator (I-behaviour). The transfer function of the lead/lag-filter is:

$$G_1(z^{-1}) = K \left\{ \frac{1 - A z^{-1}}{1 + B z^{-1}} \right\}$$

with the corresponding recursive algorithm:

$$u_1(k) = K * e(k) - K * A * e(k - 1) - B * u_1(k - 1).$$

The pole B of the lead/lag-filter can be set with the parameter <po>, the relation applies:

$$\langle po \rangle = 256 * B,$$

i.e. the values for the pole can be set in the range 0 ... (1 - 1/256) in steps of 1/256.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RGA, RLT, RKI, RZE

EXAMPLE

WPO 64 set pole to the value 64 / 256 = 0.25
E parameter is activated

COMMAND CODE / MNEMONIC / DESIGNATION

117 RPS read speed

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The actual velocity values generated by the profile generator are returned as parameters with the following units:

MAC4-INC:	Inc/SP
MAC4-SSI:	Inc/SP
MAC4-STP:	Steps/SP.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RAV

EXAMPLE (MAC4-SSI)

WSV 500	velocity 500 Inc/SP is set
MS	operational mode „speed“ is set
E	operational mode is activated
RPS	actual commanded velocity is read, returns the value of 500 Inc/SP after completion of the starting ramp

RPV, WPV, WPV_R

COMMAND CODE / MNEMONIC / DESIGNATION

60	RPV	read positioning velocity
64	WPV	write positioning velocity
67	WPV_R	write positioning velocity relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<pv> positioning velocity

	MAC4-INC [Inc/SP]	MAC4-SSI [Inc/SP]	MAC4-STP [Hz]
default value	1.000	1.000	4.000
lowest value	1	1	1
highest value	250.000.000	250.000.000	50.000

DESCRIPTION

The parameter <pv> defines the velocity during the constant velocity phase of the operational mode "positioning".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MP

EXAMPLE (MAC4-STP)

WPV 1000	velocity 1.000 Hz is set
WAP 10000	target position 10.000 steps is set
MP	operational mode "positioning" is set
E	positioning move is started

RSA, WSA, WSA_R

COMMAND CODE / MNEMONIC / DESIGNATION

50	RSA	read speed acceleration
53	WSA	read speed acceleration
56	WSA_R	write speed acceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<sa> speed acceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	1.000
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <sa> defines the acceleration for the operational mode „speed“. This defines the acceleration ramp, with which the velocity given by the parameter <sv> is reached.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MS, RSV

EXAMPLE (MAC4-INC)

WSA 100	acceleration 100 Inc/SP/SP is set
WSV 1000	velocity 1.000 Inc/SP is set
MS	operational mode „speed“ is set
E	operational mode is activated, the axis accelerates in 10 SP to the value 1.000 Inc/SP

RSD, WSD, WSD_R

COMMAND CODE / MNEMONIC / DESIGNATION

51	RSD	read speed deceleration
54	WSD	write speed deceleration
57	WSD_R	write speed deceleration relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<sd> speed deceleration

	MAC4-INC [Inc/SP/SP]	MAC4-SSI [Inc/SP/SP]	MAC4-STP [Hz/SP]
default value	50	50	1.000
lowest value	1	1	1
highest value	2.000.000	2.000.000	8.000

DESCRIPTION

The parameter <sd> defines the braking acceleration, with which the axis brakes in the operational mode "brake".

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MB

EXAMPLE (MAC4-STP)

RPS	actual command velocity is read, returns e.g. the value 1.000 Hz
MB	operational mode "brake" is set
WSD 50	braking acceleration 50 Hz/SP is set
E	operational mode is activated, the axis is brought to a stand-still in 19 SP with a start/stop frequency of 100 Hz

COMMAND CODE / MNEMONIC / DESIGNATION

119 RSS read system status

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The actual system status of the addressed axis is returned as a parameter. It serves mainly for internal control or diagnosis. The individual bits have the following significance:

Bit	Name	Significance
0	„m_rdy“	Command ready
1	„phase1“	Internal control bit
2	„phase2“	Internal control bit
3	„phase3“	Internal control bit
4	„phase4“	Internal control bit
5	„z_irq“	Internal control bit
6	„z_stop“	Internal control bit
7	„init_weg_sys“	Synchronisation bit
8	„in_tr“	MAC4-STP: internal control bit, otherwise not used
9	„servo_on“	MAC4-STP: internal control bit, otherwise not used
10	„dr_disable“	MAC4-INC/SSI: interlocking bit
	„direction“	MAC4-STP: motion in negative direction
11	„boost“	MAC4-STP: BOOST-signal on, otherwise not used
12	„boost_en“	MAC4-STP: BOOST-signal allows motion, otherwise not used
13	„turbo“	MAC4-STP: TURBO operation activated, otherwise not used
14	„irq_line“	MAC4-STP: internal control bit, otherwise not used
15	„in_pos“	MAC4-STP: LED „P“ on, otherwise not used
16	„led_fault“	MAC4-STP: LED „F“ on, otherwise not used
17	„phase5“	MAC4-STP: internal control bit, otherwise not used
18	„boost_lock“	MAC4-STP: BOOST-signal interlocked, otherwise not used
19	„phase6“	MAC4-STP: internal control bit, otherwise not used
20	„bits_valid“	MAC4-STP: internal control bit, otherwise not used
21	„wzp_bit“	MAC4-STP: internal control bit, otherwise not used
22	„dr_disable“	MAC4-STP: internal control bit, otherwise not used
23	„brake_stop“	MAC4-STP: internal control bit, otherwise not used
24	„phase7“	MAC4-STP: internal control bit, otherwise not used
25-31	„free“	not used

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO RAS, RBS

EXAMPLE

RSS system status is read, returns e.g. the value \$00000020, i.e. the bit "z_irq" is set

RSSF, WSSF, WSSF_R

COMMAND CODE / MNEMONIC / DESIGNATION

240	RSSF	read start/stop frequency
241	WSSF	write start/stop frequency
242	WSSF_R	write start/stop frequency relative

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<ssf> start/stop frequency

	MAC4-STP
default value	[Hz] 100
lowest value	1
highest value	2.000

DESCRIPTION

The start/stop frequency gives the velocity, that the stepper motor can immediately start to or stop from without step lost. Higher velocities can only be made with an acceleration ramp. In the case of braking from higher velocities a braking ramp must be used.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MP, RSTC

EXAMPLE

WSSF 200	start/stop frequency is set to 200 Hz is set
MS	operational mode „speed“ is set
WSV 500	velocity 500 Hz is set
E	operational mode is activated, after expiration of the BOOST-time the motor is brought to the start/stop frequency of 200 Hz and from there is accelerated up to 500 Hz

RSTC, WSTC, WSTC_R

COMMAND CODE / MNEMONIC / DESIGNATION

243	RSTC	read step counts
244	WSTC	write step counts
245	WSTC_R	write step counts relative

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<stc> step counts

	MAC4-STP
default value	5
lowest value	0
highest value	1.000

DESCRIPTION

The parameter <stc> defines the number of steps, that are executed in the justification phase of a positioning move. In this slow justification phase the axis is moved at the search velocity <lv>.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MP, RLV

EXAMPLE

WSTC 50	slow/justification move phase is set to 50 steps
WAP 10000	target position is set to 10.000 steps
MP	operational mode "positioning" is set
E	positioning move is started, the last 50 steps are driven at the justification speed.

RSV, WSV, WSV_R

COMMAND CODE / MNEMONIC / DESIGNATION

49	RSV	read speed velocity
52	WSV	write speed velocity
55	WSV_R	write speed velocity relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<sv> speed velocity

	MAC4-INC	MAC4-SSI	MAC4-STP
	[Inc/SP]	[Inc/SP]	[Hz]
default value	1.000	1.000	4.000
lowest value	-250.000.000	-250.000.000	-50.000
highest value	250.000.000	250.000.000	50.000

DESCRIPTION

The parameter <sv> defines the commanded velocity for the operational mode „speed“.

SPECIAL CONSIDERATIONS

The sign of the parameter <sv> gives the direction of motion for the axis.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MS, RSA

EXAMPLE (MAC4-STP)

WSV 1000	velocity 1.000 Hz is set
MS	operational mode „speed“ is set
E	operational mode is activated, the axis moves after completion of the starting ramp at 1.000 Hz

COMMAND CODE / MNEMONIC

261	RSW	read servo mode wait time
262	WSW	write servo mode wait time

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<sw> servomode wait time

	MAC4-STP
	[ms]
default value	0
lowest value	0
highest value	3.600.000

DESCRIPTION

In the servomode the time <sw> is allowed to expire after completion a move, before the position is checked. This time allows for possible oscillations of the system to dampen down.

After expiration of the time <sw> the actual and commanded position are compared. If the axis is no longer in the tolerance band <tr> around the commanded position, the axis controller switches the "BOOST"-signal on and positions again to the commanded position. The period <sw> is reactivated after reaching the commanded position. Retriggering the waiting period <sw> at the end of each move profile ensures that a minimum period <sw> lies between direction changes.

If the axis lies in the target range after expiration of the period <sw>, the axis controller turns the "BOOST"-signal off. The axis control output goes to zero. The time measurement is restarted.

SPECIAL CONSIDERATIONS

The set parameter is automatically rounded to units of the SP.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MP, RTR

EXAMPLE

WSW 100	waiting time is set to 100 ms (internally is rounded up to 104 ms)
WTR 10	target radius is set to 10 Steps
WAP 10000	target position is set
MP	operational mode "positioning" is set
E	positioning move is started, after completion of motion, 100 ms delay occurs,

before the reached position is checked

RTR, WTR, WTR_R

COMMAND CODE / MNEMONIC / DESIGNATION

112	RTR	read target radius
113	WTR	write target radius
114	WTR_R	write target radius relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<tr> target radius

	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	0	0	0
lowest value	0	0	0
highest value	32.000	32.000	32.000

DESCRIPTION

The target radius <tr> sets a window around the target in the operational mode "positioning". If the axis remains stable within this tolerance band for the time duration given by the parameter <trt>, the bit "pos_end" in the user status is set and the interrupt "end of positioning" activated.

SPECIAL CONSIDERATIONS

MAC4-INC/SSI: If the target radius is set so small that the system cannot reach it, the end of the positioning move is not recognised. In "off-fly" operation means this that the axis controller cannot execute further commands.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO MP, RBS, RIRQ4, RTRT

EXAMPLE (MAC4-STP)

WTR 100	100 steps window around target position is set
WTRT 1000	waiting time is set to 1s (internally rounded up 1.024s)
WAP 10000	target position 10.000 steps is set
MP	operational mode "positioning" is set
E	positioning move is started, if the axis remains at least 1.024s in the range 9.900..10.100 Steps, the bit "pos_end" is set and the interrupt "end of positioning" activated

RTRT, WTRT

COMMAND CODE / MNEMONIC / DESIGNATION

300	RTRT	read target radius wait time
301	WTRT	write target radius wait time

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<trt> target radius wait time

	MAC4-INC	MAC4-SSI	MAC4-STP
	[ms]	[ms]	[ms]
default value	0	0	0
lowest value	0	0	0
highest value	3.600.000	3.600.000	3.600.000

DESCRIPTION

The parameter <trt> defines, how long the axis must lie "within the tolerance band around the target position given by <tr> in the operational mode "positioning, before the bit "pos_end" is set in the user status, the interrupt "end of positioning" is activated and the LED "P" at the front panel is set.

This facility ensures that possible oscillations of the systems after completion of positioning moves have time to decay before the move is considered completed.

SPECIAL CONSIDERATIONS

The profile generator is unaffected by this recognition mechanism of move completion.

The value 0 ms means that the end the positioning move is reported immediately on entry of the target radius.

The nominal value is internally rounded up to an integer value of the SP.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MP, RBS, RIRQ4, RTR

EXAMPLE (MAC4-INC)

WTRT 1000	waiting time is set to 1s is set
WTR 100	target radius is set to 100 Inc is set
WAP 10000	target position is set
MP	operational mode "positioning" is set

RTV, WTV, WTV_R

COMMAND CODE / MNEMONIC / DESIGNATION

73	RTV	read tracking velocity
75	WTV	write tracking velocity
76	WTV_R	write tracking velocity relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<tv> tracking velocity

	MAC4-INC	MAC4-SSI	MAC4-STP
	[Inc/SP]	[Inc/SP]	[Hz]
default value	100	100	2.000
lowest value	-250.000.000	-250.000.000	-50.000
highest value	250.000.000	250.000.000	50.000

DESCRIPTION

The parameter <tv> defines the velocity for the next sampling period (SP) in the operational mode "velocity tracking".

Monitoring of the acceleration between two sampling periods is not implemented. The parameter <tv> must therefore be set with care.

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO VT

EXAMPLE (MAC4-SSI)

```
WTV 0                      start velocity 0 Inc/SP is set
VT                          operational mode "velocity tracking" is set
E                           operational mode is activated
WTV 100                    next velocity 100 Inc/SP is set
E                           new velocity is activated
WTV 500                    next velocity 500 Inc/SP is set
E                           new velocity is activated
WTV_R 500                  next velocity 1.000 Inc/SP is set
E                           new velocity is activated
```

COMMAND CODE / MNEMONIC / DESIGNATION

166	RWD	read watchdog
167	WWD	write watchdog

COMPATIBILITY

- MAC4-INC
- MAC4-SSI
- MAC4-STP

PARAMETER

<wd> watchdog

	MAC4-INC [ms]	MAC4-SSI [ms]	MAC4-STP [ms]
default value	0	0	0
lowest value	0	0	0
highest value	3.600.000	3.600.000	3.600.000

DESCRIPTION

A "watchdog", which can be set by software, monitors the communication between the host and the axis controller.

If the axis controller receives no new commands from the host during the period set by the parameter <wd>, it brings all axes to a halt with the emergency deceleration <ed> and deactivates them.

This facility ensures that a defect in the host-system or in the connection between the host and the axis controller does not result in uncontrolled actions.

SPECIAL CONSIDERATIONS

The set value is valid for all axes. It is rounded up to the next integer multiple of the SP.

Axes, that are in the operational mode "test" are switched off without a braking ramp.

The parameter value zero (default) means a deactivation of the "watchdog" function.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• a following error overflow has occurred
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RAA

EXAMPLE(MAC4-INC)

WWD 1000	"watchdog" is set to 1s
E	"watchdog" is activated, if the axis controller receives no command from the host for more than 1s, all axes are stopped and deactivated

RZE, WZE, WZE_R

COMMAND CODE / MNEMONIC / DESIGNATION

88	RZE	read zero
89	WZE	write zero
90	WZE_R	write zero relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<ze> zero

	MAC4-INC	MAC4-SSI
default value	232	232
lowest value	0	0
highest value	255	255

DESCRIPTION

The controller is implemented as a lead/lag- filter (PD-related behaviour) with a parallel integrator (I-behaviour). The transfer function of the lead/lag- filter is:

$$G_1(z^{-1}) = K \left\{ \frac{1 - A z^{-1}}{1 + B z^{-1}} \right\}$$

with the corresponding recursive algorithm:

$$u_1(k) = K * e(k) - K * A * e(k - 1) - B * u_1(k - 1).$$

The zero A of the lead/lag- filter can be set by the parameter <ze>, the relationship is:

$$\langle ze \rangle = 256 * A,$$

i.e. the zero component can be set in the range 0 ... (1 - 1/256) in steps of 1/256.

SPECIAL CONSIDERATIONS

High values for the zero component cause a higher damping the of the control loop.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the given parameter value does not lie within the permissible range

SEE ALSO RGA, RLT, RKI, RPO

EXAMPLE

WZE 128 zero is set to the value 128 / 256 = 0.5
E parameter is activated

TURBO

COMMAND CODE / MNEMONIC / DESIGNATION

246 TURBO turbo mode on/off

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER none

DESCRIPTION

A distinction is made between two operational configurations - normal- and TURBO - in order to cover a larger velocity range.

If the axis is in TURBO operation, all velocities are multiplied internally by the factor 10. The user needs only to take account of this property when generating his own velocity profiles in the operational modes "velocity tracking" and "position tracking".

The command TURBO activates TURBO operation or turns off, if the axis happens to be in the mode "disable". The condition of the axis controller can be read via the system status.

SPECIAL CONSIDERATIONS

The justification velocity $\langle l \nu \rangle$ is not multiplied by ten.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis is not to the operational mode "disable"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• an invalid value for the position measurement was read

SEE ALSO RSS

EXAMPLE

TURBO	TURBO operation activated
ME	
E	axis enabled
MS	operational mode „speed“ is set
WSV 10000	nominal velocity 10.000 is set
E	operational mode is activated, the motor accelerates to the velocity 100.000 Hz

COMMAND CODE / MNEMONIC / DESIGNATION

82 UE enter test mode

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

In the test mode the axis can be operated by hand. The axis is automatically enabled ("enable").

The BOOST-signal (MAC4-STP) switched on and the parameter value <da> is output to the motor driver.

SPECIAL CONSIDERATIONS

A change to the operational mode "test" is only possible in the modes "enable", "disable" or "brake".

The operational mode "test" is used to test the axis configuration and during commissioning. It should be used with care!

If a hardware limit switch is recognised in the operational mode "test", the axis controller turns off the axis. Thereafter the operational mode "test" can be called with any value of <da>! This facility allows the motor to be backed away from limit switch if it was incorrectly connected.

MAC4-STP: The BOOST-signal is not automatically reset. It remains active, until another operational mode (except "position tracking" and "velocity tracking") is selected.

MAC4-INC/SSI: The controller and the profile generator are not active in the operational mode "test".

The command USR has no effect in the operational mode "test".

If a software stop is activated in the operational mode "test" by direct DPRAM-access, the axis switch automatically to the mode "disable" without a braking ramp.

An emergency situation in the operational mode "test" causes an immediate disabling of the axis without a braking ramp.

DIAGNOSTICS

- | | |
|--------|---|
| axis_f | • false axis number |
| logo_f | • the axis was not initialised |
| | • the axis controller is not in the operational mode "enable", "disable" or "brake" |

SEE ALSO RDA, USR

EXAMPLE (MAC4-STP)

UE	operational mode "test" is set
E	operational mode is activated
WDA 100	step frequency 100 Hz is set
E	step frequency is activated

URCR, UWCR, UWCR_R

COMMAND CODE / MNEMONIC / DESIGNATION

153	URCR	read circular range
154	UWCR	write circular range
155	UWCR_R	write circular range relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<cr> circular range

	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	2.000	16.777.216	2.000
lowest value	1	1	1
highest value	1.000.000.000	1.000.000.000	10.000.000

DESCRIPTION

The parameter <cr> defines the size of a circular axis (one revolution). The start of a circular axis is always zero. The permissible range of a circular axis is thus 0...<cr>-1. If the axis position reaches the value <cr>, then it set back to zero; if the position drops to zero it is set back to <cr>-1.

SPECIAL CONSIDERATIONS

Write access to the parameter <cr> (UWCR, UWCR_R) are only possible in the operational mode "disable".

If the axis is defined as linear, the parameter <cr> is ignored.

The value of <cr> overwrites the parameter <ec>, if the axis is defined as circular axis and an absolute encoder is attached. The axis must however be in the deinitialised condition.

DIAGNOSTICS

axis_f	● false axis number
logo_f	● an error condition was not acknowledged
	● <cr> was set for a circular axis with connected absolute encoder after the initialisation
	● the emergency stop switch was activated
	● the "watchdog" was activated
	● the "drive fault"-signal is on
	● a following error overflow has occurred
	● an invalid value for the position measurement was read
	● the axis controller is not in the operational mode „disable“
limit_f	● the given parameter value does not lie within the permissible range

SEE ALSO

UREC, URET, URSH

EXAMPLE (MAC4-SSI)

UWSH 3	axis type "circular-optimised" is set
UWCR 10000	size of the circular axis is set
INIT	axis initialised
ME	axis enable
E	enabling is activated
RCP	actual position is read, e.g. 1.000 Inc
WRP -2000	position 2.000 Inc in negative direction
MP	operational mode "positioning" is set
E	operational mode is activated

RCP

actual position is read, the result was the value 9.000

UREA, UWEA

COMMAND CODE / MNEMONIC / DESIGNATION

135	UREA	read encoder address
136	UWEA	write encoder address

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ea> encoder address

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	*	*	*
lowest value	\$3000	\$3000	\$3000
highest value	\$BEFFFE	\$BEFFFE	\$BEFFFE

* ...address of the internal counter register (axis specific)

DESCRIPTION

The parameter <ea> defines the address, where the axis controller should find position information.

If the internal counter is used as the position source (<et> = 0, 1, 2), the parameter <ea> is automatically set to the corresponding address during initialisation (INIT).

When using an external position encoder (<et> = 3,4) the user must enter

the DPRAM-address of the axis controllers
(The host writes position information to this address)

or

the VMEbus-address
(The axis controller reads the position information independently as VMEbus-Master)

in the parameter <ea>.

The DPRAM-address are (see Users Manual):

Axis 1	<ea> = \$330A
Axis 2	<ea> = \$370A
Axis 3	<ea> = \$3B0A
Axis 4	<ea> = \$3F0A

The VMEbus-address can lie in the standard VMEbus-range \$100000 ... \$BEFFFE.

SPECIAL CONSIDERATIONS

This parameter can only be set in the deinitialised condition.

When using an external position measurement system a significant value must be entered in the address range identified by <ea> before initialisation.

In the case of transfer of position information via the DPRAM, the host must ensure the correct interlocking procedure (see Users Manual).

UREA, UWEA

DIAGNOSTICS

- | | |
|---------|---|
| axis_f | • false axis number |
| logo_f | • an error condition was not acknowledged |
| | • it was attempted, to set the parameter after the initialisation |
| | • the emergency stop switch was activated |
| | • the "watchdog" was activated |
| limit_f | • the given parameter value does not lie within the permissible range |

SEE ALSO URET, UREB, INIT

EXAMPLE

UWEA \$330A	address of the position information is set
UWEB32	set the bit number
INIT	parameter is activated and position measurement system initialised, the axis controller reads its position information from address \$330A (DPRAM)

UREB, UWEB

COMMAND CODE / MNEMONIC / DESIGNATION

137	UREB	read encoder bit size
138	UWEB	write encoder bit size

COMPATIBILITY

- MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<eb> encoder bit size

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	15	24	15
lowest value	8	8	8
highest value	32	32	32

DESCRIPTION

The bit width of the position information must entered in the parameter <eb>. All higher bits are blended out.

If the position information is transferred from an external position measurement system via the VMEbus, the parameter <eb> defines whether the axis controller makes one or two 16-bit accesses via the VMEbus. If the position information width is greater than 16 bit, the LSW (least significant word) of the position measurement value is read at the address <ea> + 2 and then the MSW (most significant word) at the address <ea>.

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised condition.

The parameter <eb> is automatically set during initialisation for the encoder types <et> = 0, 1.

If access is made via the VMEbus to an external position measurement systems (<et> = 3,4) by means of two 16-bit-accesses, it is the responsibility of the user to that the position information is not overwritten by the axis controller during the read access.

When the position information is transferred via the DPRAM of the axis controller a 32-bit access is always made. The parameter <eb> is only used to blank out bits.

The bit width parameter <eb> does not define the range of values of the position measurement system. This value is defined separately in the parameter <ec>.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO INIT, RED, UREC, URET

EXAMPLE

UWEB 24 bit width of the position information is set

INIT parameter is activated and position measurement system initialised, the upper 8 bit of the position information read are blended out

COMMAND CODE / MNEMONIC / DESIGNATION

130	UREC	read encoder counter range
131	UWEC	write encoder counter range

COMPATIBILITY

- MAC4-INC
- MAC4-SSI
- MAC4-STP

PARAMETER

<ec> encoder counter range

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	32.768	16.777.216	32.768
lowest value	1	1	1
highest value	2.000.000.000	2.000.000.000	10.000.000

DESCRIPTION

The parameter <ec> defines the range of values for the counter or the resolution the absolute encoder. If the internal counter is used to read the position information (<et> = 0 or 1), the parameter <ec> is automatically assigned the maximum possible value of 32.768 during initialisation (INIT).

The parameter <ec> is used in the case of counter overflows for automatic correction. When using an SSI- or an external position encoder the user must define the value <ec>. <ec> allows an error to be recognised in the position measurement system (user status: "encoder_f"-bit), when the information from the encoder goes out of the range 0...<ec>-1. The axis is turned off.

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

The value of <ec> may not be greater than the bit width range given by the parameter <eb>.

In the case of a circular axis with an absolute encoder, the parameter <ec> is overwritten with the value of <cr> (the circular axis has the size of the absolute encoders).

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the parameters for a circular axis with absolute encoder cannot be set up
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO INIT, URCR, UREB, URET

EXAMPLE

UWET 4	encoder type "external absolute encoder" is set
UWEC 72000	range of values of the counter/absolute encoder is set
INIT	parameter is activated and position measurement system initialised, read values over 72.000 cause a fault message

COMMAND CODE / MNEMONIC / DESIGNATION

253	URES	read encoder steps
254	UWES	write encoder steps

COMPATIBILITY

MAC4-SSI MAC4-SSI MAC4-STP

PARAMETER

<es> encoder steps	
	MAC4-STP [Lines per rev.] *
default value	1.000
lowest value	1
highest value	1.000.000

* ...number of lines per motor revolution

DESCRIPTION

If the axis position is read from a position encoder, the measured value (increments) must be converted into motor steps (steps). The parameter <es> gives the number of effective encoder lines per motor revolution. Internally <es> is multiplied by 4 and thus allows for quadrature. If the position encoder is at the motor axis, the number of lines/rev. given by the manufacturer can be entered in the parameter <es>.

The value $4 * <es>$ gives the number of increments that correspond to the number of counts given by the parameter <ms>.

If the outputted steps are counted (<et> = 0) the parameter <es> is ignored.

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

They may be excessive rounding errors during this conversion in the case of a disadvantageous ratio of the motor number of counts to encoder resolution. As a guide value, the quotients es/ms and ms/es should only have two figures behind the decimal point.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO

URMS

EXAMPLE

UWMS 1000	motor number of steps/rev. is set
UWES 500	encoder pulses per motor revolution is set (500 pulses = 2.000 increments, i.e. 2 increments is set to 1 step)
INIT	position measurement system initialised, the counted increments are converted to steps with the factor 0.5

URET, UWET

COMMAND CODE / MNEMONIC / DESIGNATION

128	URET	read encoder type
129	UWET	write encoder type

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<et> encoder type

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	2	1
lowest value	1	1	0
highest value	4	4	4

DESCRIPTION

The position measurement system used is defined with this value:

<et>	Significance	MAC4-INC	MAC4-SSI	MAC4-STP
0	Step counting			x
1	Incremental encoder at P2	x		x
	SSI- absolute encoder at P2, operating incrementally		x	
2	SSI- absolute encoder at P2		x	
3	External incremental position encoder	x	x	x
4	External absolute position encoder	x	x	x

x ... configurable

SPECIAL CONSIDERATIONS

Write access to the parameter <et> is only permissible in the deinitialised condition.

If an external position encoder is connected, the parameters <ea>, <eb> and <ec> must be defined. When a position encoder is connected to the peripheral connector -P2 these parameters are automatically generated.

In the case of an SSI- absolute encoder the parameter <sc> must be set to indicate by how many binary places the values must be right-shifted.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO INIT, UREA, UREB, UREC, URSC

EXAMPLE (MAC4-STP)

```
UWET 0                      internal step counting is set
INIT                        parameter is activated and position measurement system initialised
```

URKISC, UWKISC

COMMAND CODE / MNEMONIC / DESIGNATION

256	URKISC	read ki scaling factor
257	UWKISC	write ki scaling factor

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ○ MAC4-STP

PARAMETER

<ki_sc> ki scaling factor

	MAC4-INC	MAC4-SSI
default value	8	8
lowest value	0	0
highest value	8	8

DESCRIPTION

In order to be able to set the integral amplification in finer steps, the parameter <ki> for integral amplification is right-shifted internally by <ki_sc> binary digits. Each shift halves the value.

SPECIAL CONSIDERATIONS

Write access to the parameter <ki_sc> is only possible in the operational mode "disable".

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis is not to the operational mode "disable"
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RKI

EXAMPLE

WKI 10	nominal integral amplification is set to the value 10/256
UWKISC 2	integral amplification is scaled, shifting by 2 binary digits means division by 4; the real integral amplification is now 10/1024.
E	parameter is activated

URLN, UWLN, UWLN_R

COMMAND CODE / MNEMONIC / DESIGNATION

150	URLN	read limit negative
151	UWLN	write limit negative
152	UWLN_R	write limit negative relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ln> limit negative

	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	-1.000.000.000	0	-10.000.000
lowest value	-1.000.000.000	-1.000.000.000	-10.000.000
highest value	999.999.999	999.999.999	9.999.999

DESCRIPTION

The parameter <ln> defines the position of the lower software limit switch for a linear axis. If this position is reached, the axis is braked and disabled.

The bit "swl_n" in the user status indicates that the axis is at the negative limit.

The axis can be enabled. Only motion in a positive direction is allowed until the negative limit is no longer active.

SPECIAL CONSIDERATIONS

Write access to the parameter <ln> is only permissible in the operational mode "disable".

The lower software limit switch must be lower than the upper: <ln> < <lp>.

If an absolute encoder is connected, the lower software limit switch position may not be less than zero.

If the axis is defined as circular, the parameter <ln> ignored.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the axis is not to the operational mode "disable" • the emergency stop switch was activated • the "watchdog" was activated • the "drive fault"-signal is on • a following error overflow has occurred
limit_f	• an invalid value for the position measurement was read • the input value lies above the positive limit <lp> • the input value is less than zero and thus lies outside the range of the absolute encoder • the given parameter value does not lie within the permissible range

SEE ALSO

URLP

URLN, UWLN, UWLN_R

EXAMPLE (MAC4-INC)

UWLN -10000	negative limit switch is set to -10.000 Inc
E	parameter is activated
UWLN_R -5000	negative limit switch is shifted by -5.000 Inc
E	parameter is activated
URLN	negative limit switch is read, the result was the value -15.000

URLP, UWLP, UWLP_R

COMMAND CODE / MNEMONIC / DESIGNATION

147	URLP	read limit positive
148	UWLP	write limit positive
149	UWLP_R	write limit positive relative

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<lp> limit positive	MAC4-INC	MAC4-SSI	MAC4-STP
	[Inc]	[Inc]	[Steps]
default value	1.000.000.000	16.777.215	10.000.000
lowest value	-999.999.999	-999.999.999	-9.999.999
highest value	1.000.000.000	1.000.000.000	10.000.000

DESCRIPTION

The parameter <lp> defines the upper software limit switch. If this position is exceeded the axis is braked and disabled.

The bit "swl_p" in the user status indicates that the axis is at the positive limit.

The axis can be enabled. Only motion in negative direction is allowed, until the positive limit is no longer active.

SPECIAL CONSIDERATIONS

The parameter can only be set, if the axis is in the operational mode "disable".

The upper software limit switch must be greater than the lower, <lp> > <ln>.

If an absolute encoder is connected, the upper software limit switch position must lie within the range of the absolute encoder <ec> (<lp> < <ec>).

If the axis is defined as circular, the parameter <lp> is ignored.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis is not to the operational mode "disable"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the input value lies under the negative limit <ln>
	• the input value exceeds the range of the absolute encoder
	• the given parameter value does not lie within the permissible range

SEE ALSO URLN

EXAMPLE (MAC4-STP)

UWLP 10000	positive limit switch is set to 10.000 steps
E	parameter is activated
UWLP_R -5000	positive limit switch is shifted by -5.000 steps
E	parameter is activated

URLP positive limit switch is read, the result was the value 5.000

URMS, UWMS, UWMS_R

COMMAND CODE / MNEMONIC / DESIGNATION

234	URMS	read motor steps
235	UWMS	write motor steps
236	UWMS_R	write motor steps relative

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<ms> motor steps

	MAC4-STP
	[Steps per rev.]*
default value	25.000
lowest value	1
highest value	10.000.000

* ...steps per motor revolution

DESCRIPTION

The parameter <ms> defines the number of steps, that the motor executes per revolution.

SPECIAL CONSIDERATIONS

The parameter <ms> is only significant, if a position measurement system is used.

There can be rounding errors during conversion in the case of a disadvantageous ratio of motor steps to encoder resolution. As a guide the quotient es/ms and ms/es may only have two significant bits behind the decimal point.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO

URES

EXAMPLE

UWET 3	external position encoder is set to relative position counting
UWMS 1000	number of motor steps per revolution is set
UWES 100	effective number of encoder pulses per motor revolution is set (100 pulses = 400 increments, i.e. 1 increment is set to 2.5 steps)
INIT	position measurement system initialised, the increments counted and converted by the factor 2.5 to
steps	

URNS, UWNS

COMMAND CODE / MNEMONIC / DESIGNATION

141	URNS	read negative limit switch
142	UWNS	write negative limit switch

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ns> negative limit switch

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	1	1
lowest value	0	0	0
highest value	2	2	2

DESCRIPTION

The active state of the negative hardware limit switch input can be configured:

<ns> = 0	OFF (not connected)
<ns> = 1	active low
<ns> = 2	active high

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

It must be insured that the hardware limit switch is active over the complete endangered region. There is no protection against incorrect operation when the axis runs over the limit switch range (i.e. the axis comes to a stand-still behind the switch).

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, the parameter after the initialisation is set
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MF, URPS, URRS

EXAMPLE

UWNS 2	the switching level of the negative limit switch is set
E	parameter is activated, the negative hardware limit switch is active high

URPS, UWPS

COMMAND CODE / MNEMONIC / DESIGNATION

139	URPS	read positive limit switch
140	UWPS	write positive limit switch

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<ps> positive limit switch

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	1	1
lowest value	0	0	0
highest value	2	2	2

DESCRIPTION

The active state of the positive hardware limit switch input can be configured:

<ps> = 0	OFF (not connected)
<ps> = 1	active low
<ps> = 2	active high

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

It must be ensured that the hardware limit switch remains active over the complete endangered region. There is no protection against incorrect operation when the axis runs over the limit switch range (i.e. the axis comes to a stand-still behind the switch).

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, the parameter after the initialisation is set
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MF, URNS, URRS

EXAMPLE

UWPS 1	the level of the positive limit switch is set
E	parameter is activated, the positive hardware limit switch is active low

URRS, UWRS

COMMAND CODE / MNEMONIC / DESIGNATION

143	URRS	read reference switch
144	UWRS	write reference switch

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<rs> reference switch

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	1	1
lowest value	0	0	0
highest value	2	2	2

DESCRIPTION

The active level of the home switch input can be configured:

<rs> = 0	OFF (not connected)
<rs> = 1	active low
<rs> = 2	active high

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, the parameter after the initialisation to is set
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO MF, MH, URNS, URPS

EXAMPLE

UWRS 0 the level of the home switch is set
E parameter is activated, there is no home switch connected

COMMAND CODE / MNEMONIC / DESIGNATION

184	URSC	read encoder scaling factor
185	UWSC	write encoder scaling factor

COMPATIBILITY

MAC4-INC MAC4-SSI MAC4-STP

PARAMETER

<sc> encoder scaling factor

	MAC4-SSI
default value	0
lowest value	0
highest value	24

DESCRIPTION

The position information to be processed must be right justified. In SSI-communication there may be a number of protocol bits that are read by the axis controller in addition to useful position data (refer to datasheet of the absolute encoder).

Due to fixed clock rate the axis controller always reads 24 bits, of which not all are significant.

The parameter <sc> gives the number of binary bits by which this information must be right-shifted.

The measured position value is first processed after right-shift justification (e.g. blending out bits, test of value range).

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

The parameter <sc> is only used for an SSI absolute encoder (<et> = 1 or 2) directly connected to the axis controller.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, the parameter after the initialisation is set
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO URET

EXAMPLE

UWSC 8	scaling factor the position measurement systems is set to 8
INIT	position measurement system initialised, the lower 8 bits of the read from the SSI-absolute encoder are shifted out

COMMAND CODE / MNEMONIC / DESIGNATION

186	URSF	read scaling factor
187	UWSF	write scaling factor

COMPATIBILITY

- MAC4-INC
- MAC4-SSI
- MAC4-STP

PARAMETER

<sf> scaling factor

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	0	0	0
lowest value	0	0	0
highest value	16	16	12

DESCRIPTION

The axis controller only accepts integer values. Using binary shifting by <sf> digits, the velocity can be scaled to fractional values. The scaling relationship is expressed as follows:

$$\langle \text{Parameter scaled} \rangle = \langle \text{Parameter} \rangle / 2^{\langle \text{sf} \rangle}$$

SPECIAL CONSIDERATIONS

The parameter can only be set, if the axis is in the operational mode "disable".

The output values are scaleable for all operational modes (velocity-, acceleration- and braking acceleration values).

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis is not to the operational mode "disable"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO

EXAMPLE (MAC4-INC)

UWSF 3	scaling factor is set
E	parameter is activated, all values are scaled by 3 binary digits, i.e. divided by 8
WPV 100	positioning velocity 100/8 = 12.5 Inc/SP is set
WPA 10	positioning acceleration 10/8=1.25 Inc/SP/SP is set
WPD 20	positioning deceleration 20/8 = 2.5 Inc/SP/SP is set
E	parameter is activated

URSH, UWSH

COMMAND CODE / MNEMONIC / DESIGNATION

126	URSH	read shaft
127	UWSH	write shaft

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<sh> shaft

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	1	1
lowest value	1	1	1
highest value	3	3	3

DESCRIPTION

The axis type is defined by this parameter:

1	linear axis
2	circular axis
3	circular-optimised axis

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

If an absolute encoder is used for position measurement, the definition of the axis to be circular (<sh> = 2 or 3) causes the parameter <ec> of the position measurement system to be overwritten with the size parameter of the circular axis <cr>.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated

SEE ALSO URCR, UREC, URLN, URLP

EXAMPLE

UWSH 1	axis defined as linear
UWLP 100000	positive software limit is set
UWLN - 100000	negative software limit is set
INIT	axis initialised

COMMAND CODE / MNEMONIC / DESIGNATION

145	URSO	read drive fault switch
146	UWSO	write drive fault switch

COMPATIBILITY

- MAC4-INC
- MAC4-SSI
- MAC4-STP

PARAMETER

<df> drive fault switch

	MAC4-INC	MAC4-SSI	MAC4-STP
default value	1	1	1
lowest value	0	0	0
highest value	2	2	2

DESCRIPTION

The active polarity of the "drive fault"-signal input can be configured:

<df> = 0	OFF (not connected)
<df> = 1	active low
<df> = 2	active high

If the axis controller recognises an active signal at the "drive fault" input, the axis brakes with the emergency deceleration <ed>, switches to the operational mode "disable", generates the interrupt "drive fault", and displays "F" at the 7-segment display.

The bit "dr_f" in the user status indicates the condition of the "drive fault"-signal.

SPECIAL CONSIDERATIONS

The parameter can only be set in the deinitialised axis condition.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• it was attempted, to set the parameter after the initialisation
	• the emergency stop switch was activated
	• the "watchdog" was activated
limit_f	• the given parameter value does not lie within the permissible range

SEE ALSO RBS, RIRQ3

EXAMPLE

UWSO 2	the level of the "drive fault"-signals is set
E	parameter is activated, the "drive fault"-signal is active high

COMMAND CODE / MNEMONIC / DESIGNATION

124	USN	set output normal
125	USR	set output reverse

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

If the motor is correctly connected, it turns clockwise for a positive velocity output signal. This polarity can be inverted by using the command USR.

With this facility it is possible to correct the synchronisation of motor rotation with the counting direction of position measurement, i.e. for a positive velocity value the actual position increases.

The original polarity can be set by reissuing the USN command.

The bit "rev_o" in the user status indicates the change of the command output polarity.

SPECIAL CONSIDERATIONS

The addressed axis must be in the deinitialised condition, when the command is given.

The command USR has no effect in the operational mode "test".

The command USR should only be used during commissioning and test. During commissioning the correct motor wiring should be selected in order that a false configuration polarity can no longer occur.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis is not in the deinitialised condition
	• the emergency stop switch was activated
	• the "watchdog" was activated

SEE ALSO RBS, UE

EXAMPLE (MAC4-SSI)

USR	negative direction of rotation for a positive velocity values is set
INIT	axis initialised
ME	axis enable
E	enabling is activated
WSV 100	velocity 100 Inc/SP is set
MS	operational mode „speed“ is set
E	operational mode is activated, the axis rotates in counter-clockwise direction

VER

COMMAND CODE / MNEMONIC / DESIGNATION

181 VER read version

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The implemented hard- and software version is read. A 32-bit-value is returned with the version coding:

Position	Significance
bit 0-7	software release number
bit 8-15	software versions number
bit 16-23	hardware release number (coded as a letter)
bit 24-31	card type
	(0..INC, 1..SSI, 2..STP, 3..UNI)

SPECIAL CONSIDERATIONS none

DIAGNOSTICS

axis_f • false axis number

SEE ALSO

EXAMPLE(MAC4-STP)

VER version is read, the result was the value \$02410201, i.e. card type STP, hardware version A, software version 2.1

COMMAND CODE / MNEMONIC / DESIGNATION

72 VT velocity tracking

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER none

DESCRIPTION

The user may generate his own ramp in this operational mode. The parameter value <tv> is output as the velocity command in the next sampling period.

The acceleration is not monitored, it is the responsibility of the user to ensure that the acceleration limits are not exceeded.

SPECIAL CONSIDERATIONS

A change to the operational mode "velocity tracking" is only possible in the operational mode "enable" or "brake".

MAC4-STP: The BOOST-signal is not automatically reset in this mode. It remains active, until the mode "disable", "enable" or "brake" is set.

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged
	• the axis controller is not to the operational mode "enable" or "brake"
	• the emergency stop switch was activated
	• the "watchdog" was activated
	• the "drive fault"-signal is on
	• a following error overflow has occurred
	• an invalid value for the position measurement was read

SEE ALSO RTV

EXAMPLE (MAC4-INC)

WTV 0	start velocity 0 Inc/SP is set
VT	operational mode "velocity tracking" is set
E	operational mode is activated
WTV 100	next velocity 100 Inc/SP is set
E	new velocity is activated
WTV 500	next velocity 500 Inc/SP is set
E	new velocity is activated
WTV_R 500	next velocity 1.000 Inc/SP is set
E	new velocity is activated

COMMAND CODE / MNEMONIC / DESIGNATION

123 WZP write zero position

COMPATIBILITY

● MAC4-INC ● MAC4-SSI ● MAC4-STP

PARAMETER

<temp> temporary parameter

	MAC4-INC [Inc]	MAC4-SSI [Inc]	MAC4-STP [Steps]
default value	none	none	none
lowest value	-999.999.999	-999.999.999	-10.000.000
highest value	999.999.999	999.999.999	10.000.000

DESCRIPTION

The actual axis position is with the parameter <temp> , allowing for following error if relevant. The axis offset <ao> thus has a changed significance:

MAC4-STP:

$$\langle ao_new \rangle = \langle ao_old \rangle + \langle temp \rangle - \langle actual\ position \rangle$$

MAC4-INC/SSI:

$$\langle ao_new \rangle = \langle ao_old \rangle + \langle temp \rangle - \langle actual\ position \rangle - \langle following\ error \rangle$$

SPECIAL CONSIDERATIONS

The velocity command must be zero, when using this command.

In the case of a linear axis with an absolute encoder the parameter <temp> must lie in the range:

$$0 \leq \langle temp \rangle < \langle ec \rangle$$

In the case of a circular axis the parameter <temp> must lie in the range

$$0 \leq \langle temp \rangle < \langle cr \rangle$$

DIAGNOSTICS

axis_f	• false axis number
logo_f	• an error condition was not acknowledged • the emergency stop switch was activated • the reference velocity is not zero • the "watchdog" was activated • the "drive fault"-signal is on • a following error has occurred
limit_f	• an invalid value for the position measurement was read • for an absolute encoder the commanded value lies out of the range <ec> • the command value lies outside of the axis range for a circular axis • the given parameter value does not lie within the permissible range

SEE ALSO RAO, UREC, URLN, URLP, URCR

EXAMPLE (MAC4-INC)

RCP	position is read, returns e.g. the position 2.000 Inc
RAO	axis offset is read, returns e.g. 0 Inc
RFE	following error is read, returns e.g. 0 Inc
WZP 1000	position is set to 1.000 Inc is set
E	new position is activated
RCP	position is read, returns as positions value 1.000 Inc
RAO	axis offset is read, returns -1.000 Inc

2. Appendix

2.1 Parameter Overview

<i>Name</i>	<i>Short description</i>	<i>Operational mode</i>	<i>Read</i>	<i>Write abs.</i>	<i>Write rel.</i>	<i>Page</i>
<ao>	axis offset	all	RAO 132	WAO 133	WAO_R 134	II-28
<ap>	target position	positioning	RAP 63	WAP 70	WRP 71	II-29
<at>	wanted position next SP	position tracking	RAT 74	WAT 77	WRT 78	II-32
<bt>	time for BOOST-signal	all	RBT 237	WBT 238	WBT_R 239	II-37
<ca>	coarse acceleration	search index coarse	RCA 8	WCA 11	WCA_R 14	II-38
<cd>	coarse deceleration	search index coarse	RCD 9	WCD 12	WCD_R 15	II-39
<cr>	circular range	all	URCR 153	UWCR 154	UWCR_R 155	II-90
<cv>	coarse velocity	search index coarse	RCV 7	WCV 10	WCV_R 13	II-43
<da>	direct DAC output	test	RDA 100	WDA 101	WDA_R 102	II-44
<df>	drive fault input	all	URSO 145	UWSO 146	-	II-108
<dl>	define limit switch	find edge	RDL 40	WDL 44	-	II-45
<ea>	encoder address	all	UREA 135	UWEA 136	-	II-91
<eb>	encoder bit size	all	UREB 137	UWEB 138	-	II-93
<ec>	counter range	all	UREC 130	UWEC 131	-	II-94
<ed>	emergency deceleration	all except disable	RAA 106	WAA 107	WAA_R 108	II-27
<es>	encoder steps	all	URES 253	UWES 254	-	II-95
<et>	encoder type	all	URET 128	UWET 129	-	II-96
<fa>	find edge acceleration	find edge	RFA 38	WFA 42	WFA_R 46	II-47
<fd>	find edge deceleration	find edge	RFD 39	WFD 43	WFD_R 47	II-48
<fv>	find edge velocity	find edge	RFV 37	WV 41	WV_R 45	II-50
<ga>	gain, proportional	all except test, disable	RGA 85	WGA 86	WGA_R 87	II-51
<ha>	home acceleration	home	RHA 28	WHA 31	WHA_R 34	II-52
<hd>	home deceleration	home	RHD 29	WHD 32	WHD_R 35	II-53
<hv>	home velocity	home	RHV	WHV	WHV_R	II-54

			27	30	33	
<i>Name</i>	<i>Short description</i>	<i>Operational mode</i>	<i>Read</i>	<i>Write rel.</i>	<i>Write abs.</i>	<i>Page</i>
<ia>	index acceleration	search index	RIA 18	WIA 21	WIA_R 24	II-55
<id>	index deceleration	search index	RID 19	WID 22	WID_R 25	II-56
<irq_vec1>	interrupt vector 1	all	RIRQ1 175	WIRQ1 170	-	II-57
<irq_vec2>	interrupt vector 2	all	RIRQ2 176	WIRQ2 171	-	II-58
<irq_vec3>	interrupt vector 3	all	RIRQ3 177	WIRQ3 172	-	II-59
<irq_vec4>	interrupt vector 4	search index coarse, search index, find edge, home, positioning	RIRQ4 178	WIRQ4 173	-	II-60
<irq_vec5>	interrupt vector 5	all	RIRQ5 179	WIRQ5 174	-	II-61
<irq_vec6>	interrupt vector 6	all	RIRQ6 308	WIRQ6 307	-	II-62
<iv>	index velocity	search index	RIV 17	WIV 20	WIV_R 23	II-63
<ki>	intergral gain	all except test, disable	RKI 91	WKI 92	WKI_R 93	II-64
<ki_sc>	ki scaling factor	all except test, disable	URKISC 256	UWKISC 257	-	II-97
<ln>	limit negative	all	URLN 150	UWLN 151	UWLN_R 152	II-98
<lp>	limit positive	all	URLP 147	UWLP 148	UWLP_R 149	II-100
<lt>	limit torque	all except test, disable	RLT 97	WLT 98	WLT_R 99	II-65
<lv>	low velocity	home, search index, positioning, find edge	RLV 109	WLV 110	WLV_R 111	II-66
<mf>	maximum following error	all except test, disable	RMF 103	WMF 104	WMF_R 105	II-67
<ms>	motor steps per revolution	all	URMS 234	UWMS 235	UWMS_ R 236	II-101
<ns>	negative limit switch	all	URNS 141	UWNS 142	-	II-102
<pa>	positioning acceleration	positioning	RPA 61	WPA 65	WPA_R 68	II-70
<pd>	positioning deceleration	positioning	RPD 62	WPD 66	WPD_R 69	II-71
<po>	pole	all, except test, disable	RPO 94	WPO 95	WPO_R 96	II-72
<ps>	positive limit switch	all	URPS 139	UWPS 140	-	II-103
<pv>	positioning velocity	positioning	RPV 60	WPV 64	WPV_R 67	II-74
<rs>	reference switch	all	URRS 143	UWRS 144	-	II-104

<sa>	speed acceleration	speed	RSA 50	WSA 53	WSA_R 56	II-75
Name	Short description	Operational mode	Read	Write rel.	Write abs.	Page
<sc>	encoder scaling factor	all	URSC 184	UWSC 185	-	II-105
<sd>	speed deceleration	speed	RSD 51	WSD 54	WSD_R 57	II-76
<sf>	scaling factor	all except test, disable, enable	URSF 186	UWSF 187	-	II-106
<sh>	axis type	all	URSH 126	UWSH 127	-	II-107
<ssf>	start/stop frequency	all	RSSF 240	WSSF 241	WSSF_R 242	II-79
<stc>	number of steps at creep velocity	positioning	RSTC 243	WSTC 244	WSTC_R 245	II-80
<sv>	speed velocity	speed	RSV 49	WSV 52	WSV_R 55	II-81
<sw>	wait time in servomode	all except test, tracking, speed	RSW 261	WSW 262	-	II-82
<tr>	target radius	positioning	RTR 112	WTR 113	WTR_R 114	II-83
<trt>	target radius wait time	positioning	RTRT 300	WTRT 301	-	II-84
<tv>	tracking velocity	velocity tracking	RTV 73	WTV 75	WTV_R 76	II-85
<wd>	watchdog	all	RWD 166	WWD 167	-	II-86
<ze>	zero	all except test, disable	RZE 88	WZE 89	WZE_R 90	II-87

2.2 Command Overview

2.2.1 In Alphabetical Order

<i>Command</i>	<i>Code</i>	<i>Description</i>	<i>Parameter</i>	<i>Page</i>
C	2	clear errors	-	II-10
DEINIT	311	deinitialisation	-	II-11
E	3	execute	-	II-12
FLYOFF	183	disable on-fly changes	-	II-13
FLYON	182	enable on-fly changes	-	II-13
INIT	180	initialisation	-	II-15
MB	58	mode brake	-	II-16
MC	6	mode search index coarse	-	II-17
MD	5	mode disable	-	II-18
ME	4	mode enable	-	II-19
MF	36	mode find edge	-	II-20
MH	26	mode home	-	II-21
MI	16	mode search index	-	II-22
MP	59	mode positioning	-	II-23
MR	84	mode reset	-	II-24
MS	48	mode speed	-	II-25
PT	169	position tracking	-	II-26
RAA	106	read emergency deceleration	<ed>	II-27
RAO	132	read axis offset	<ao>	II-28
RAP	63	read absolute position in mode positioning	<ap>	II-29
RAS	120	read common status	-	II-31
RAT	74	read absolute position in mode tracking	<at>	II-32
RAV	260	read actual velocity	-	II-34
RBS	118	read user status	-	II-35
RBT	237	read boost time	<bt>	II-37
RCA	8	read coarse acceleration	<ca>	II-38
RCD	9	read coarse deceleration	<cd>	II-40
RCP	116	read current position	-	II-40
RCPI	259	read current position in increments	-	II-41
RCT	115	read counter	-	II-42
RCV	7	read coarse velocity	<cv>	II-43
RDA	100	read direct output	<da>	II-44
RDL	40	read limit switch	<dl>	II-45
RED	233	read encoder direct	-	II-46
RFA	38	read find edge acceleration	<fa>	II-47
RFD	39	read find edge deceleration	<fd>	II-48
RFE	121	read following error	-	II-49
RFV	37	read find edge velocity	<fv>	II-50
RGA	85	read gain	<ga>	II-51
RHA	28	read home acceleration	<ha>	II-52
RHD	29	read home deceleration	<hd>	II-53
RHV	27	read home velocity	<hv>	II-54
RIA	18	read index acceleration	<ia>	II-55
RID	19	read index deceleration	<id>	II-56
RIRQ1	175	read interrupt vector 1	<irq_vec1>	II-57
RIRQ2	176	read interrupt vector 2	<irq_vec2>	II-58
RIRQ3	177	read interrupt vector 3	<irq_vec3>	II-59
RIRQ4	178	read interrupt vector 4	<irq_vec4>	II-60

RIRQ5	179	read interrupt vector 5	<irq_vec5>	II-61
Command	Code	Description	Parameter	Page
RIRQ6	308	read interrupt vector 6	<irq_vec6>	II-62
RIV	17	read index velocity	<iv>	II-63
RKI	91	read integral gain	<ki>	II-64
RLT	97	read limit torque	<lt>	II-65
RLV	109	read low velocity	<lv>	II-66
RMF	103	read maximal following error	<mf>	II-67
ROUT	258	read output	-	II-69
RPA	61	read positioning acceleration	<pa>	II-70
RPD	62	read positioning deceleration	<pd>	II-71
RPO	94	read pole	<po>	II-72
RPS	117	read speed	-	II-73
RPV	60	read positioning velocity	<pv>	II-74
RSA	50	read speed acceleration	<sa>	II-75
RSD	51	read speed deceleration	<sd>	II-76
RSS	119	read system status	-	II-77
RSSF	240	read start/stop frequency	<ssf>	II-79
RSTC	243	read step counts	<stc>	II-80
RSV	49	read speed velocity	<sv>	II-81
RSW	261	read servo mode wait time	<sw>	II-82
RTR	112	read target radius	<tr>	II-83
RTRT	300	read target radius wait time	<trt>	II-84
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UREA	135	read encoder address	<ea>	II-91
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URES	253	read encoder steps	<es>	II-95
URET	128	read encoder type	<et>	II-96
URKISC	256	read ki scaling factor	<ki_sc>	II-97
URLN	150	read limit negative	<ln>	II-98
URLP	147	read limit positive	<lp>	II-101
URMS	234	read motor steps	<ms>	II-101
URNS	141	read negative limit switch	<ns>	II-102
URPS	139	read positive limit switch	<ps>	II-103
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URSC	184	read encoder scaling factor	<sc>	II-105
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UWCR	154	write circular range	<cr>	II-90
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UWEB	138	write encoder bit size	<eb>	II-93
UWEC	131	write encoder counter range	<ec>	II-94
UWES	254	write encoder steps	<es>	II-95

UWET	129	write encoder type	<et>	II-96
UWKISC	257	write ki scaling factor	<ki_sc>	II-97
UWLN	151	write limit negative	<ln>	II-98
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UWLP	148	write limit positive	<lp>	II-100
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UWMS	235	write motor steps	<ms>	II-101
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UWNS	142	write negative limit switch	<ns>	II-102
UWPS	140	write positive limit switch	<ps>	II-103
UWRS	144	write reference switch	<rs>	II-104
UWSC	185	write encoder scaling factor	<sc>	II-105
UWSF	187	write scaling factor	<sf>	II-106
UWSH	127	write shaft	<sh>	II-107
UWSO	146	write drive fault switch	<df>	II-108
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WID_R	25	write index deceleration relative	<id>	II-56
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WIV_R	23	write index velocity relative	<iv>	II-63
WKI	92	write integral gain	<ki>	II-64
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WLT	98	write limit torque	<lt>	II-65
WLT_R	99	write limit torque relative	<lt>	II-65
WLV	110	write low velocity	<lv>	II-66
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WPA	65	write positioning acceleration	<pa>	II-70
WPA_R	68	write positioning acceleration relative	<pa>	II-70
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WPD_R	69	write positioning deceleration relative	<pd>	II-71
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WTV	75	write tracking velocity	<tv>	II-85
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8	RCA	read coarse acceleration	<ca>	II-38
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11	WCA	write coarse acceleration	<ca>	II-38
12	WCD	write coarse deceleration	<cd>	II-39
13	WCV_R	write coarse velocity relative	<cv>	II-43
14	WCA_R	write coarse acceleration relative	<ca>	II-38
15	WCD_R	write coarse deceleration relative	<cd>	II-39
16	MI	mode search index	-	II-22
17	RIV	read index velocity	<iv>	II-63
18	RIA	read index acceleration	<ia>	II-55
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20	WIV	write index velocity	<iv>	II-63
21	WIA	write index acceleration	<ia>	II-55
22	WID	write index deceleration	<id>	II-56
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24	WIA_R	write index acceleration relative	<ia>	II-55
25	WID_R	write index deceleration relative	<id>	II-56
26	MH	mode home	-	II-21
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28	RHA	read home acceleration	<ha>	II-52
29	RHD	read home deceleration	<hd>	II-53
30	WHV	write home velocity	<hv>	II-54
31	WHA	write home acceleration	<ha>	II-51
32	WHD	write home deceleration	<hd>	II-53
33	WHV_R	write home velocity relative	<hv>	II-54
34	WHA_R	write home acceleration relative	<ha>	II-52
35	WHD_R	write home deceleration relative	<hd>	II-53
36	MF	mode find edge	-	II-20
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38	RFA	read find edge acceleration	<fa>	II-47
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42	WFA	write find edge acceleration	<fa>	II-47
43	WFD	write find edge deceleration	<fd>	II-48
44	WDL	write limit switch	<dl>	II-45
45	WFV_R	find edge write velocity relative	<fv>	II-50
46	WFA_R	write find edge acceleration relative	<fa>	II-47
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52	WSV	write speed velocity	<sv>	II-81
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53	WSA	write speed acceleration	<sa>	II-75
54	WSD	write speed deceleration	<sd>	II-76
55	WSV_R	write speed velocity relative	<sv>	II-81
56	WSA_R	write speed acceleration relative	<sa>	II-75
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60	RPV	read positioning velocity	<pv>	II-74
61	RPA	read positioning acceleration	<pa>	II-70
62	RPD	read positioning deceleration	<pd>	II-71
63	RAP	read absolute position in mode positioning	<ap>	II-29
64	WPV	write positioning velocity	<pv>	II-74
65	WPA	write positioning acceleration	<pa>	II-70
66	WPD	write positioning deceleration	<pd>	II-71
67	WPV_R	write positioning velocity relative	<pv>	II-74
68	WPA_R	write positioning acceleration relative	<pa>	II-70
69	WPD_R	write positioning deceleration relative	<pd>	II-71
70	WAP	write absolute position in mode positioning	<ap>	II-29
71	WRP	write relative position in mode positioning	<ap>	II-29
72	VT	velocity tracking	-	II-111
73	RTV	read tracking velocity	<tv>	II-85
74	RAT	read absolute position in mode tracking	<at>	II-32
75	WTV	write tracking velocity	<tv>	II-85
76	WTV_R	write tracking velocity relative	<tv>	II-85
77	WAT	write absolute position in mode tracking	<at>	II-32
78	WRT	write relative position in mode tracking	<at>	II-32
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85	RGA	read gain	<ga>	II-51
86	WGA	write gain	<ga>	II-51
87	WGA_R	write gain relative	<ga>	II-51
88	RZE	read zero	<ze>	II-87
89	WZE	write zero	<ze>	II-87
90	WZE_R	write zero relative	<ze>	II-87
91	RKI	read integral gain	<ki>	II-64
92	WKI	write integral gain	<ki>	II-64
93	WKI_R	write integral gain relative	<ki>	II-64
94	RPO	read pole	<po>	II-72
95	WPO	write pole	<po>	II-72
96	WPO_R	write pole relative	<po>	II-72
97	RLT	read limit torque	<lt>	II-65
98	WLT	write limit torque	<lt>	II-65
99	WLT_R	write limit torque relative	<lt>	II-65
100	RDA	read direct output	<da>	II-44
101	WDA	write direct output	<da>	II-44
102	WDA_R	write direct output relative	<da>	II-44
103	RMF	read maximal following error	<mf>	II-67
104	WMF	write maximal following error	<mf>	II-67
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106	RAA	read emergency deceleration	<ed>	II-27

107	WAA	write emergency deceleration	<ed>	II-27
108	WAA_R	write emergency deceleration relative	<ed>	II-27
109	RLV	read low velocity	<lv>	II-66
110	WLV	write low velocity	<lv>	II-66
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111	WLV_R	write low velocity relative	<lv>	II-66
112	RTR	read target radius	<tr>	II-83
113	WTR	write target radius	<tr>	II-83
114	WTR_R	write target radius relative	<tr>	II-83
115	RCT	read counter	-	II-42
116	RCP	read current position	-	II-40
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120	RAS	read common status	-	II-31
121	RFE	read following error	-	II-49
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124	USN	set output normal	-	II-109
125	USR	set output reverse	-	II-109
126	URSH	read shaft	<sh>	II-109
127	UWSH	write shaft	<sh>	II-109
128	URET	read encoder type	<et>	II-96
129	UWET	write encoder type	<et>	II-96
130	UREC	read encoder counter range	<ec>	II-94
131	UWEC	write encoder counter range	<ec>	II-94
132	RAO	read axis offset	<ao>	II-28
133	WAO	write axis offset	<ao>	II-28
134	WAO_R	write axis offset relative	<ao>	II-28
135	UREA	read encoder address	<ea>	II-91
136	UWEA	write encoder address	<ea>	II-91
137	UREB	read encoder bit size	<eb>	II-93
138	UWEB	write encoder bit size	<eb>	II-93
139	URPS	read positive limit switch	<ps>	II-103
140	UWPS	write positive limit switch	<ps>	II-103
141	URNS	read negative limit switch	<ns>	II-101
142	UWNS	write negative limit switch	<ns>	II-10
143	URRS	read reference switch	<rs>	II-104
144	UWRS	write reference switch	<rs>	II-104
145	URSO	read drive fault switch	<df>	II-108
146	UWSO	write drive fault switch	<df>	II-108
147	URLP	read limit positive	<lp>	II-100
148	UWLP	write limit positive	<lp>	II-100
149	UWLP_R	write limit positive relative	<lp>	II-100
150	URLN	read limit negative	<ln>	II-98
151	UWLN	write limit negative	<ln>	II-98
152	UWLN_R	write limit negative relative	<ln>	II-98
153	URCR	read circular range	<cr>	II-90
154	UWCR	write circular range	<cr>	II-90
155	UWCR_R	write circular range relative	<cr>	II-90
160		fail	-	
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163		fail	-	
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166	RWD	read watchdog	<wd>	II-86
167	WWD	write watchdog	<wd>	II-86
169	PT	position tracking	-	II-26
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172	WIRQ3	write interrupt vector 3	<irq_vec3>	II-59
173	WIRQ4	write interrupt vector 4	<irq_vec4>	II-60
174	WIRQ5	write interrupt vector 5	<irq_vec5>	II-61
175	RIRQ1	read interrupt vector 1	<irq_vec1>	II-57
176	RIRQ2	read interrupt vector 2	<irq_vec2>	II-58
177	RIRQ3	read interrupt vector 3	<irq_vec3>	II-59
178	RIRQ4	read interrupt vector 4	<irq_vec4>	II-60
179	RIRQ5	read interrupt vector 5	<irq_vec5>	II-61
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181	VER	read version	-	II-110
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185	UWSC	write encoder scaling factor	<sc>	II-105
186	URSF	read scaling factor	<sf>	II-106
187	UWSF	write scaling factor	<sf>	II-106
233	RED	read encoder direct	-	II-46
234	URMS	read motor steps	<ms>	II-101
235	UWMS	write motor steps	<ms>	II-101
236	UWMS_R	write motor steps relative	<ms>	II-101
237	RBT	read boost time	<bt>	II-37
238	WBT	write boost time	<bt>	II-37
239	WBT_R	write boost time relative	<bt>	II-37
240	RSSF	read start/stop frequency	<ssf>	II-79
241	WSSF	write start/stop frequency	<ssf>	II-79
242	WSSF_R	write start/stop frequency relative	<ssf>	II-79
243	RSTC	read step counts	<stc>	II-80
244	WSTC	write step counts	<stc>	II-80
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246	TURBO	turbo mode on/off	-	II-88
253	URES	read encoder steps	<es>	II-95
254	UWES	write encoder steps	<es>	II-95
256	URKISC	read ki scaling factor	<ki_sc>	II-97
257	UWKISC	write ki scaling factor	<ki_sc>	II-97
258	ROUT	read output	-	II-69
259	RCPI	read current position in increments	-	II-41
260	RAV	read actual velocity	-	II-34
261	RSW	read servo mode wait time	<sw>	II-82
262	WSW	write servo mode wait time	<sw>	II-82
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301	WTRT	write target radius wait time	<trt>	II-84
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