rho 3

Description of machine parameters (MPP)

Version 106

BOSCH

Automationstechnik

rho 3

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C O N T E N S

1 General

1.1 rho 3 documentation

The description of the machine parameters is part of the overall documentation for the robot and handling control **rho 3**. The following manuals are available:

- **rho 3 PHG operation**
- **rho 3 Programming instructions BAPS 2.0**
- **roh 3 BAPS2 brief description**
- **rho 3 Interface conditions**
- **rho 3 Machine parameters**
- **rho 3 Signal description**
- **rho 3 ROPS3/IQpro brief description**
- **rho 3 Releases**
- **rho 3.0 Interface conditions and projecting hints**

1.2 Target group

This manual is primarily intended for the setter of a robot or handling unit. Since some machine parameters can also be modified by the user, the manual should also be read by the programmer.

1.3 The machine parameter program (MPP)

The operating system of the rho 3 control contains a program for system-specific data. This data is set by the service engineer when the installation is commissioned and is characteristic for the installation in question. Each change must be carefully considered and must be implemented only after consultation with the installation supplier.

1.4 Machine parameter groups

The machine parameters of the rho 3 are divided into the following groups

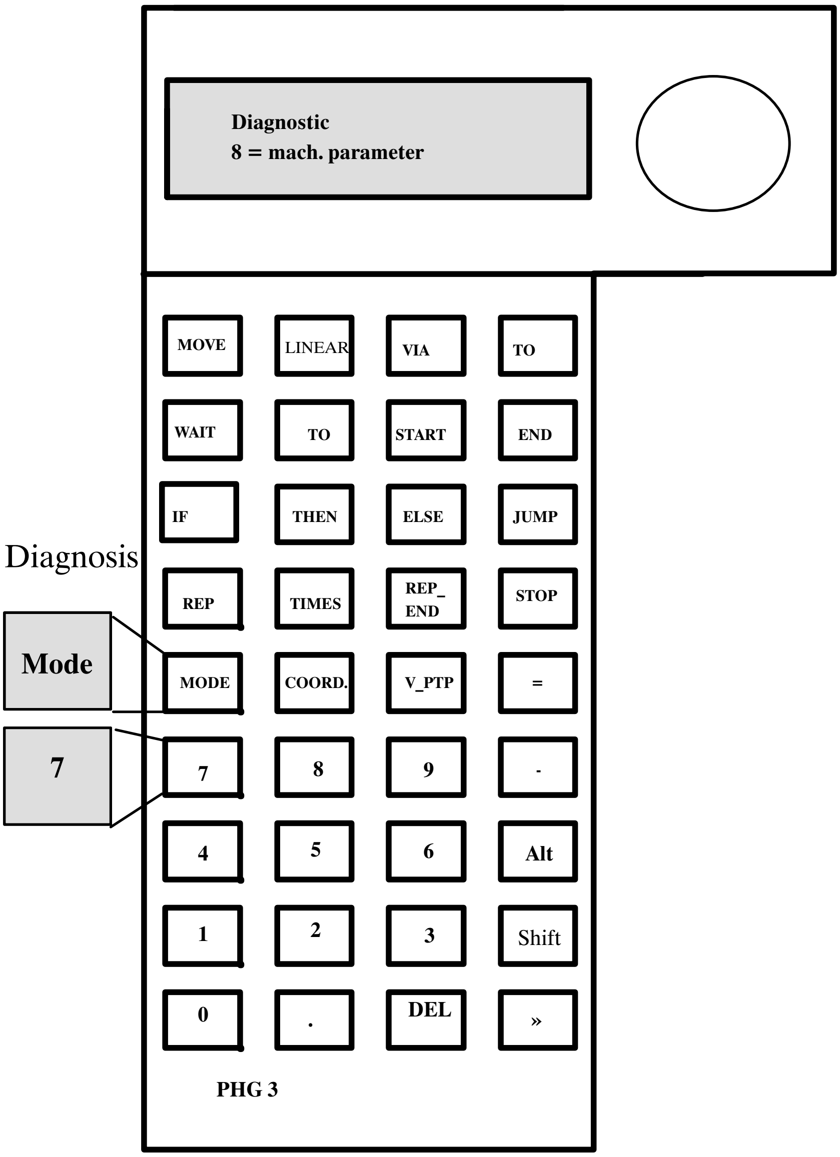
P0	:	General system parameters
P100	:	Speeds, measuring system evaluation, acceleration parameters
P200	:	Positions, software limit switches
P300	:	Kinematic-related parameters
P400	:	Measuring system configuration, reference point parameters, analog – I/O
P500	:	Belt and sensor parameters
P600	:	Drive parameters (CAN)

2 Using the machine parameters

2.1 Input or display of the machine parameters via the PHG

The machine parameters can be displayed and edited with the hand-held programmer PHG in automatic and set-up modes.

- The sub-mode **diagnosis** is selected by pressing the keys Mode and 7 (successively).
- Renewed operation of the Mode-key and the 8-key (successively) results in selection of the sub-mode **machine parameters**.
- The key assignment of the 1st PHG level is shown below:



- Renewed operation of the Mode-key followed by 1 or 2 activates display or setting of the machine parameters.

2.2 Machine parameter input with the PHG

- Using the PHG in DIAGNOSIS mode, the user can change machine parameters as well as display them.
  However, changes to machine parameters must satisfy several conditions:
- The robot must be stationary for safety reasons. The EMERGENCY-STOP signal is set as a criterion for this.
- The valid password must be used.
- All machine parameters can be displayed.
- Selecting a parameter is performed by selecting the parameter set (0,100,200,300,400,500,600) or by entering the parameter number directly.
  Note: Parameters of group 600 are only accessible when at least 1 CAN axis is applied in P401!
- It is possible to page in the parameter groups with the keys

  Shift + ↑↓
- Editing of the corresponding parameter is selected with the key

  Enter
- If a parameter contains several items of information, it is possible to page through these by pressing

  Shift + ↑↓
- The correct password must be entered before a machine parameter can be changed (see 2.3).
- Parameters which are enabled via **P12** can be changed without password input. No parameter is enabled in this way upon delivery (see P12).
- The machine parameter program is quit by simultaneous operation of the keys

  Shift + ←
- After leaving "Set machine paramters" mode you are prompted (if a parameter was selected previously) whether the changed parameters should be stored. Entering "1" stores the new parameters and causes a control "start–up". If "0" is entered the changes are not saved and you return to the "Machine parameters" menu.

2.3 Machine parameter password and version number

2.3.1 Procedure for changing machine parameters

−1− Press EMERGENCY-STOP

−2− Select DIAGNOSIS mode (PHG mode = 7)

−3− Select machine parameter (PHG mode = 8)

−4− With rho 3.1: Cancel write protection (switch S1 on the front panel of the CP/MEM, see rho 3 interface conditions)

−5− Select ”Set” mode (PHG mode = 2)

−6− The following display appears on the PHG:

```
                    MP SET
Parameter No:#
Mode=2
```

Note: A machine parameter is enabled (after a correctly entered password) until the user quits the machine parameter program.

−7− Enter “Minus” symbol

−8− Enter password (5-digit number) and press ENTER (“*” appears in line 2 in order to acknowledge every entered digit)

−9− The following display appears on the PHG if the password input is correct:

```
                    MP SET

MP000000000000
```

The 12-digit machine parameter identification number is displayed in line 3. The text “?:#” now appears in line 4 of the PHG display.

It is now possible to enter a new identification number with a maximum of 12 digits. Inputs are possible with the numbers “0” to “9” and “.”. The existing number is preserved if “ENTER” is pressed without input of an identification number.

The machine parameter identification number is displayed only when “Set” or “Display” machine parameters is selected for the first time in diagnosis mode. The identification number is not displayed again as a result of change-over between “Set” and “Display” modes.

−10− Enter the number of the parameter it is wished to set.

2.3.2 Schematic procedure for changing the password

- It is possible to change the password only in machine parameter “Enable” condition, i.e. a valid password must have been entered previously.
- Input on the PHG:

1) – 9) as described in “1. Schematic procedure for password input”.

☞ Steps 1) – 9) may be omitted if a valid password has already been entered and the user is in “Set” mode.

–11– Enter the character string “===” followed by ENTER instead of a parameter number.

–12– The text “Address =#” then appears in line 2 of the PHG..

- Enter the “Minus” symbol
- Enter the “new” password (5-digit number)
(an ”*” appears in line 2 in order to acknowledge every entered digit).

–13– After completion of the input by “ENTER”, the character string “*****” appears in line 4 of the PHG in order to acknowledge the change.

–14– It is now possible to quit “Set” mode by simultaneously pressing the keys “Shift” and “<–” or change a parameter by input of a parameter number.

Note:
The password “00000” is predefined in the operating system of the rho 3. This is valid until a new password is entered. The **predefined** password is active again in the event of software replacement or EPROM backup

Caution!

Although the password is stored when parameters are stored, it is not overwritten by the loaded password where machine parameters are loaded, i.e. a password entered at the rho 3 control remains active.

2.4 Kinematik selection in MPP

- All parameter sets with the exception of P0 (general system parameter) contain kinematic-specific parameters.
  The kinematic selected in the MPP appears on the PHG display top left in the first line, if the selected parameter contains kinematic-specific values.

Example display on the PHG:

```
ROBI_1          MP SET
P201 <IN POS> -RANGE
A_1  4000
#
```

- The kinematic can be changed over by pressing the keys

  Shift + [Kin Space Coordinates]

  simultaneously.

Example display on the PHG:

```
KINEMATIC_2  MP SET
P201 <IN POS> -RANGE
B_1  6000
#
```

- **Note:**
  The 1st kinematic is always selected when the machine paramter program is called.

3 Definition of machine parameters

3.1 General system parameters

P0	General system parameters
P1	Number of kinematics
P2	Machine configuration
P3	Number of timers and counters
P4	Parity for INTEGER inputs at interface
P5	CLOCK start time
P6	Delay monitoring P1 - P2 - logic
P7	Subdivision of the user memory
P8	Strobe times for INTEGER user outputs [ms]
P9	Stobe times for system outputs [ms]
P10	Language selection
P11	Measuring probe inputs
P12	Access authorization for machine parameters
P13	PIC times in ms
P14	PIC counter
P15	Servo card type
P16	IRDATA stack size
P17	High-speed input bytes
P18	High-speed output bytes
P19	Definition of PHG key groups
P20	I/O module configuration
P21	Address areas for PLC bit coupling
P22	Global A-factor and D-factor range limit
P23	Global V-factor range limit P1
P24	Delete user outputs
P25	Resetting the A/D/V factors
P26	Memory test on/off
P27	Strobe INTEGER inputs
P28	Display available options
P29	Fast servo card software
P30	I/O configuration CAN
P31	CAN inputs addresses
P32	CAN outputs addresses
P33	rho 3.0 configuration
P34	number of characters in serial output buffer

P1
Number of kinematics

Up to 10 different kinematics can be controlled.

The number of kinematics can be changed in steps of one; the default number is 1.

If the number of kinematics is changed, parameter 301 and 306 are selected automatically.

Example display on the PHG:

```
              MP SET
P1   NUMB.OF KINEMAT.
              2
#
```

P2
Machine configuration

The value of P2 (0..15) is output coded at the RC-internal interface. This information you can use in your PLC-program for control specific processes.

Example display on the PHG:

```
              MP SET
P2  MACHINE-CONFIG.
machine type: 0
#
```

P3
Number of timers and counters

The number of timers and counters usable in the PIC250 program is set with P3.
Permissible entries are: 8, 16, 24, 32

The maximum number of permissible timers and counters is specified with the options byte. The default value is 8 when the controller is delivered.

Example display on the PHG:

```
          MP SET
P3 DIS. TIMER/COUNTER
(Dis. 8,16,24,32) : 8
#
```

P4
Parity for INTEGER inputs at the interface

The parity for the INTEGER-BAPS input data channels and for external program selection is defined with parameter “P4”.

Input possibilities: 0 = none (default)
1 = odd
2 = even

Example display on the PHG:

```
          MP SET
P4 PARITY INTERFACE
       no
#
```

P5
Clock start time in ms (coarse interpolation cycle, transformation cycle)

The sampling time for coarse interpolation and the transformation ratio for all system kinematics are defined with “P5”.

Further inputs must be made if a Servo-i module is installed.

The clock time is a multiple of the servo controller clock time of the Servo-i module. The Clock Time is therefore a multiple of the position controller cycle time.

The following sub-queries are made:

☞ *P2 clock time in ms*
☞ *Divisor of P2 clock time for servo card*

With rho 3.0 (Stand alone) the cycle time of the integrated PLC has to be added (see PHG−Mode 3.2.5)

Note on CAN axes:

When coupling axes via the CAN interface, the max. adjustable Clock Start Time is 32 ms (limited by drive booster).
If the control unit is driven without additional SERVO I, the max. Clock Start Time is reduced to 26 ms.
The Clock Start Time must correspond to parameter “rho Sample Period [ms]” of the Servodyn GC module (see Servodyn GC manual).
During system configuration it should be noted that if the above times are exceeded a CP/MEM5 module with 30MHz processor will be employed.

☞Example:
P2 clock time 20 ms
Divisor 4 => Clock time Servo i = 5 ms

Caution:
The default value for this parameter must not be changed without consulting BOSCH.

Example display on the PHG:

```
              MP SET
P5 CLOCK START-TIME
        20 ms
#
```

```
              MP SET
P5 CLOCK START-TIME
Divisor P2-clock
Servo-B. 2    4 #
```

P6
Runtime monitoring in ms

The delay between the operating and initialization logic (P1) and the servo loop logic (P2) is monitored with "P6".
The following error messages appear if the delay time is exceeded:
"CP1 not updated",
"P1 delay error",
"System error 2 P2 not running" or
"Delay error".

Caution:
The parameter default value must not be changed without consulting BOSCH.

Example display on the PHG:

```
              MP SET
P6 RUNT. MONITORING
P1      200 ms
#
```

```
              MP SET
P6 RUNT. MONITORING
P2      200 ms
#
```

P7
Subdivision of the user memory

Caution:
This parameter should be changed only after consulting BOSCH. The stored files are deleted if the parameter block is edited.

Using “P7”, the customer can divide up the user memory available to him individually in 0.01 kByte steps for the respective file groups.

The applied total user memory is displayed in the third line when the parameter “P7” is selected.

The following groups must be entered:

- *System heap*
- *EMX heap*
- *Program memory (cannot be changed, is used for control only)*

☞ **Caution:**
The sum of the values for system heap and EMX heap must remain constant, i.e. it is not permitted to reduce the heap in favour of the program memory.

Example display on the PHG:

```
                MP SET
P7 SUBDIV. USER MEM
There are 256k-Byte
any key --> continue
```

```
                MP SET
P7 SUBDIV. USER MEM
available
any key --> continue
```

```
                MP SET
chang. partition will
destroy user files
any key --> continue
```

```
                MP SET
do you want to
change ?  (Y=1/N=0)  #
```

```
                MP SET
P7 SUBDIV. USER MEM
   64.00 kB SYS.-Heap
#
```

```
                MP SET
P7 SUBDIV. USER MEM
  64.00 kB EMX.-Heap
#
```

```
                MP SET
P7 SUBDIV. USER MEM
  128.00 kB PROG.-Mem
#
```

P8
Strobe times for INTEGER user outputs in ms

The strobe time for the maximum of 8 INTEGER user outputs is defined with “P8”. Each INTEGER output consists of 8 bits.

The user output is programmable by BAPS: e.g. output of coded control information. In other words, if an INTEGER output is active in the BAPS user program, the data is available to the user at the RC-internal interface together with the corresponding strobe signal at least for the duration of the strobe time.

The strobe signal is present together with the information of the INTEGER data channel.

The minimum strobe time should not be less than 100 ms, otherwise signals may not be recognized.

The value must be a multiple of “P5”.

The shortest time corresponds to the value of “P5”, while the longest time is 10000 ms.

An input value of “−1” disables the strobe time.

Example display on the PHG:

```
                 MP SET
P8 STRB. INT. US.OUT
Output  0        110 ms
#
```

The strobe times must be entered for the outputs 1 − 8.

P9
System strobe time change in ms

The strobe time for system outputs is defined with “P9”. This affects the following:

– Strobe for coded error output
– Acknowledgement of program selection
– Error signal for program selection
– Acknowledgement of coded text output
– Error in coded text output
– Control reset selected
– Coded pause

Example display on the PHG:

```
                 MP SET
P9 STRB. SYS.OUTPUTS
          110 ms
#
```

P10
Language

The language for BAPS programming and all operating and message texts is set with the parameter “P10”

0 = German
1 = English
2 = Italian

Example display on the PHG:

```
          MP SET
P10 SELECT LANGUAGE
English: 1
#
```

P11
Number of measuring probe inputs and high speed inputs

With “P11” the number of probe inputs and high speed inputs is set for each servo board.
Input possibilities:
probe input 0 = no probe input
1 = probe input is used
high speed inputs = 0..9

The numbers must be set for each servo board.

Example display on the PHG:

```
          MP SET
P11 SERVOBOARD-INPUT
SB1 No.of ProbeIn: 0
#
```

```
          MP SET
P11 SERVOBOARD-INPUT
SB1 No.of HS-Inp.: 0
#
```

P12
Changing machine parameters

"P12" can be used to define which machine parameters can be changed without a password (1) and which parameters can be changed only with a password ("0").
"P12" can only be changed with a password.

Example:

P100	**Speeds**	
P101	Required lag	0
P102	Max. path speed rate	0
P103	Max. axis speed	0
P104	Slope acceleration in JC	0
P105	Slope point PTP and JOG in JC	1
P106	Slope point in path mode	1
P107	Slope point JOG in WC	1
P108	Reference point speed	0
P109	1st reduced reference point speed	0

Example display on the PHG:

```
               MP SET
P12  MOD. MACH.PARAM.
P1   NUMB. OF KINEMAT.
#              0
```

☞ Note: The default setting is "0" for all parameters

P13
Times for PIC 250 in ms

The time values for the times (specified in P3) of the integrated PLC, the PIC 250, can be set with parameter "P13".

The input range is between 0 and 999999 ms.The shortest time corresponds to the value of "P5".

Inputs are made with the time intervals of parameter "P5".

Example display on the PHG:

```
               MP SET
P13 TIMER PIC250
 T0      500 ms
#
```

P14
Counters for PIC 250

The counting values for the counters (specified in P3) of the integrated PLC, the PIC 250, can be set with "P14".

The input range is between 0 and 999999.

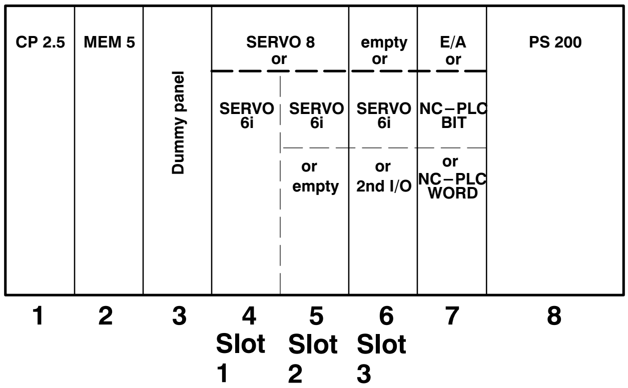
Example display on the PHG:

```
               MP SET
P14 COUNTER PIC250
 C0    100
#
```

P15
Servo card combinations

Up to 3 servo cards can be installed.
The slots are numbered consecutively from 1 to 3 from left to right.

Example: Rack with 8 slots



There are SERVO modules which require one or two slots. A maximum of one “SERVO narrow” (1 slot: SERVO 5) or a maximum of one “SERVO wide” (2 slots: SERVO 8 or SERVO 8 modular) can be installed.

A maximum of three “SERVO i” can be installed if no “SERVO narrow” and no “SERVO wide” is fitted.

“SERVO narrow” or “SERVO wide” are always fitted in servo card slot 1.

Interrogation takes place for each slot to establish whether a servo card is present and, if yes, which one.

The permitted combinations are shown in the following table:

	Des.	Inp.	Des.	Inp.	Des.	Inp.	Des.	Inp.	Des.	Inp.	Des.	Inp.	Des.	Inp.	Des.	Inp.
Slot 1	SS	1	SB	2	SI	4	SI	4	SI	4	SS	1	SB	2	SS	1
Slot 2	k	0	k	0	k	0	SI	4	SI	4	SI	4	SI	4	SI	4
Slot 3	k	0	k	0	k	0	k	0	SI	4	k	0	k	0	SI	4

SI = SERVO i , SB = Servo wides, SS = Servo narrow, k = No Servo
Des. = Designation, Inp. = Input

Installed servo cards

There are different servo cards types in the rho3 control; the individual types are listed below. The servo card type parameter, P15, is set on delivery; this parameter only needs to be changed if the rho3 configuration is altered.

Servo card Type:

0: no card installed in this slot.

1: narrow non-intelligent servo card (occupies one slot). There are 3 Axis and 5 Axis versions of this card. Only one may be installed in slot 1.

2: wide non-intelligent servo card (occupies two slots). There are 5 Axis and 8 Axis versions of this card. Only one may be installed in slot 1.

3: CAN-Module. At the moment this module must be connected to the I/O card (via a CP/MEM 4). Identification for the CAN-Module can be given for any slot (in combination with narrow and wide servo cards see 5 and 6).

4: narrow servo card with local intelligence in order to decrease the servo loop time. There are 4 Axis (Servo 4i) and 6 Axis (Servo 6i) versions of this card. 3 cards can be installed in a system with 3 Servo slots.

5: combination of narrow non-intelligent servo card and CAN-Module. Only valid for slot 1.

6: combination of wide non-intelligent servo card and CAN-Modul. Only valid for slot 1.

7: narrow servo card with 3 SSI-protocol absolute position encoder interfaces. This card has local intelligence like card type 4, and up to 3 cards can be installed, independent of the card rack.

8: Servo card type 8 is a wide servo card. This card can be equipped with up to 9 interfaces in modular fashion for absolute, incremental or potentiometer systems. Like cards 4 and 7, it has local intelligence.

9: rho 3.0
In order to keep the machine parameter structure as it was, the complete rho 3.0 controller is defined as a servoboard.

With CAN (type 3,5,6), the remaining places can in addition be equipped with any other servo cards. An assignment with 2 CAN modules is not possible.

Example display on the PHG:

```
          MP SET
P15 TYPE SERVOBOARDS
 Servo-B. 1:   1
#
```

```
          MP SET
P15 TYPE SERVOBOARDS
 Servo-B. 2:  0
#
```

```
          MP SET
P15 TYPE SERVOBOARDS
 Servo-B. 3:  0
#
```

P16
IRDATA stack size

A separate memory area is required for buffering variables, e.g. for subroutine calls.

Input in kByte

The area defined here is made available for every user process by the system heap.

Example display on the PHG:

```
          MP SET
P16 SIZE IRD-STACK
    1.000 k-Byte
#
```

P17
Direct inputs

Direct inputs are BAPS user inputs, which are transmitted directly from the peripherals (I/O card) to the RC, i.e. there is no PIC processing time.

The three areas of the **BAPS user inputs** which are used as direct inputs, are defined with P17.

− 2 areas for user inputs of the type **BINARY**,
− 1 area for user inputs of the type **INTEGER**.
The following inputs are required for each area for user input areas of the type BINARY:

- Number of the 1st BAPS user input
- Number of bits for this sub-area (1...32), the possible number is reduced if the first bit is not located at the first bit of the byte.
- Input address of the 1st bit of the sub-area on the I/O card.

The following inputs are necessary for the user input area of the type INTEGER:

- Number of the 1st BAPS user input
- Number of user inputs (1...4)
- Input address on the I/O card for data
- Input address on the I/O card for strobe bit
- Input address on the I/O card for parity bit

When transferring INTEGER variables via direct input bytes, a strobe bit and a parity bit must be transferred per byte. If the parity bit is not required, it can be set to the same address as the strobe signal for instance.

☞ **Note:**
When entering the input address on the I/O card, the same bit number must be selected as the input information on the internal interface.

☞ **Example:**
The strobe input for the integer input 2 is set to PIC address 50.1 on the internal interface and may thus be set only to XX.1 on the I/O card (e.g. 91.1).
All inputs for P17 are shown by way of example below:

Definition 1st BINARY-Input (Range 1 and 2)

```
          MP SET
P17 DIRECT INPUTS
1.BAPS BIN.no.:    13
#
```

```
          MP SET
P17 DIRECT INPUTS
2.BAPS BIN.no.:    51
#
```

Definition number of BINARY-Inputs (Range 1 and 2)

```
          MP SET
P17 DIRECT INPUTS
no. BIN.inputs:     4
#
```

```
          MP SET
P17 DIRECT INPUTS
no. BIN.inputs:     9
#
```

Definition 1st address of BINARY-Inputs (Range 1 and 2)

```
          MP SET
P17 DIRECT INPUTS
addr.BIN.  inp.:  91.4
#
```

```
          MP SET
P17 DIRECT INPUTS
addr.BIN.  inp.:  89.2
#
```

Definition 1st INTEGER-Input

```
          MP SET
P17 DIRECT INPUTS
BAPS INT.-inp.n     3
#
```

Definition number of INTEGER-Inputs

```
          MP SET
P17 DIRECT INPUTS
no. INT.-inputs:    1
#
```

Definition 1st address data INTEGER-Inputs

```
          MP SET
P17 DIRECT INPUTS
val.addr. INT.:   93.0
#
```

Definition address strobe INTEGER-Inputs

```
          MP SET
P17 DIRECT INPUTS
str.addr INT.     92.2
#
```

Definition address parity INTEGER-Inputs

```
          MP SET
P17 DIRECT INPUTS
par.addrINT.      92.2
#
```

☞**Note:** If a BAPS input has been defined as a DIRECT input, this input can no longer be influenced by the (internal) PLC. However, the signal of the I/O card may be used for further logic operations if applicable on PIC250.

P18
Direct outputs

Direct outputs are BAPS user outputs which are transferred directly from the RC to the periphery past the (internal) PLC. The RC outputs are also made available to the PLC. The peripheral addresses used by the direct outputs may, however, no longer be used by the PLC.

Note:
For direct outputs, all peripheral addresses are used from the first BYTE address used for them through to the end of the address range.

P18 is used to define 4 areas of the BAPS user outputs used as direct outputs:

- 2 areas for user outputs **BINARY**
- 1 area for user outputs **INTEGER**
- 1 area for **IOL** outputs

The following entries are required for the areas of the user outputs of type BINARY:

- Number of the 1st BAPS output
- Number of bits for the same sub-area (1..120)
- Output address for the first output of this sub-area

In the case of configurations with bit coupler (CL300 etc.), the direct outputs are located directly on the I/O card integrated in the RC rack. The address defined for the second I/O card in the case of a configuration with 2 I/O cards must be used as the base address.

The following entries are required for the area user outputs of type INTEGER:

- Number of the 1st BAPS user output
- Number of user outputs (1..8)

for each user output:

- Output address for data
- Output address for strobe
- Output address for parity

The following entries are required for area IOL signals:

- Number of the 1st IOL signal
- Number of IOL signals
- Output address for each IOL signal

Peripheral addresses may be assigned more than once, e.g. for parity or strobe signals not used or double assignment of binary user outputs with IOL signals.
All entries for P 18 are shown by way of example below:

Definition 1st BINARY-Output (Range 1 and 2)

```
          MP SET
P18 DIRECT OUTPUTS
1.BAPS BIN.no.:        9
#
```

```
          MP SET
P18 DIRECT OUTPUTS
2.BAPS BIN.no.:       47
#
```

Definition number of BINARY-Outputs (Range 1 and 2)

```
             MP SET
P18 DIRECT OUTPUTS
no. BIN.outputs:        2
#
```

```
             MP SET
P18 DIRECT OUTPUTS
no. BIN.outputs:        2
#
```

```
             MP SET
P18 DIRECT OUTPUTS
addr.BIN. O009:      90.4
#
```

```
             MP SET
P18 DIRECT OUTPUTS
addr.BIN. O047:      90.6
#
```

Definition 1st INTEGER-Output

```
             MP SET
P18 DIRECT OUTPUTS
1.BAPS INT.-no.:        1
#
```

Definition number of INTEGER-Outputs

```
             MP SET
P18 DIRECT OUTPUTS
no.INT.outputs:         2
#
```

Definition address data INTEGER-Outputs 1 and 2

```
             MP SET
P18 DIRECT OUTPUTS
val.addrINT.O1:      91.0
#
```

```
             MP SET
P18 DIRECT OUTPUTS
val.addrINT.O2:    92.0
#
```

Definition address strobe INTEGER-Outputs 1 and 2

```
             MP SET
P18 DIRECT OUTPUTS
str.addrINT.O1:      90.0
#
```

```
             MP SET
P18 DIRECT OUTPUTS
str.addrINT.O2:      90.1
#
```

Definition address parity INTEGER-Outputs 1 and 2

```
             MP SET
P18 DIRECT OUTPUTS
par.addrINT.O1:      90.0
#
```

```
             MP SET
P18 DIRECT OUTPUTS
par.addrINT.O2:      90.1
#
```

Definition 1st IOL-Output

```
              MP SET
P18 DIRECT OUTPUTS
1.IO-Logic no.:          1
#
```

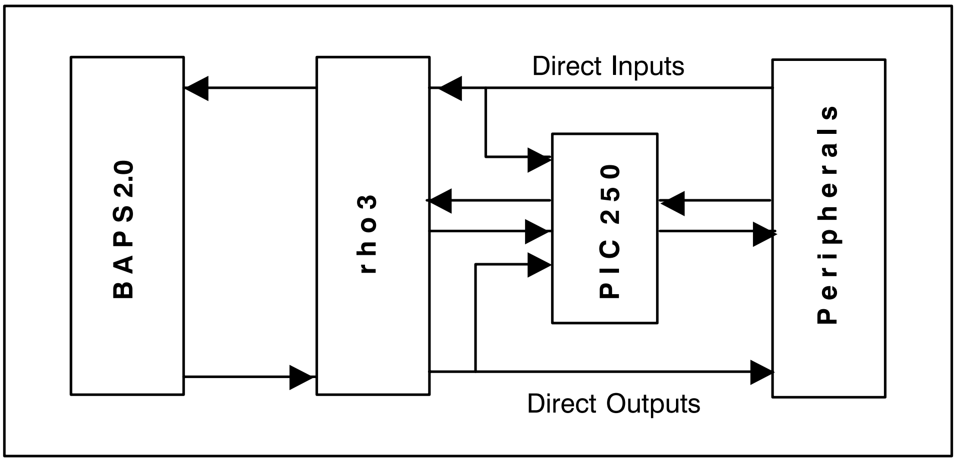
Definition number of IOL-Outputs

```
              MP SET
P18 DIRECT OUTPUTS
no.IOL outputs:          2
#
```

Definition address IOL-Outputs 1 and 2

```
              MP SET
P18 DIRECT OUTPUTS
addr IOLogic 2:     90.3
#
```

Schematic diagram of the data flow of direct I/O:



P19
Number of PHG key groups

It is necessary to divide the keys for axis traversing into groups in order to permit control of several kinematics in manual mode using one PHG.

The 12 keys marked red on the PHG are provided for traversing up to 6 axes in positive or negative direction.
These 12 keys can be divided up into groups.
More than one group must be defined if more than 6 axes belong to a kinematic. A maximum of 10 keygroups is possible.

☞ Example 1:

1 kinematic with 7 axes and 2 groups
Group 1: Axes 1 – 6 (keys 1 – 6 +/–)
Group 2: Axis 7 (key 1 +/–)

Example display on the PHG:

```
                MP SET
P19   PHG-KEY-GROUPS
        2
#
```

☞ Example 2:
3 kinematics with 2 axes each and **one** group

Axis keys 1 and 2 (+/–) kinematic 1
Axis keys 3 and 4 (+/–) kinematic 2
Axis keys 5 and 6 (+/–) kinematic 3
In this example, 3 kinematics are controlled by means of **one** group.

Example display on the PHG:

```
                MP SET
P19   PHG-KEY-GROUPS
        1
#
```

☞ Example 3:
3 kinematics with 2 axes and 3 groups each

Axis keys 1 and 2 (+/–) Selection: group 1 and kinematic 1
Axis keys 1 and 2 (+ – -) Selection: group 2 and kinematic 2
Axis keys 1 and 2 (+/–) Selection: group 3 and kinematic 3

Example display on the PHG:

```
                MP SET
P19   PHG-KEY-GROUPS
        3
#
```

P20
I/O module configuration

There are various possibilities of I/O coupling with the peripheral devices. The following configurations are permitted:

Configuration 0: Automatic module recognition
The following are recognized:
- 1st I/O card with PIC
- 2nd I/O card (only on rho 3.1)
- PC-I/O coupling card
- NC-PLC-bit coupling card

Configuration 1: I/O card with PIC 250 (64 I/40 O to the outside)

Configuration 2: NC-PLC-bit coupling card (bit coupling to PC600)

☞ **Note:** Use configuration 12 for CL300, CL400, CL500

Configuration 7: PIC 250 and 2nd I/O card
Configuration 8: PC-I/O coupling card with PIC 250 (320I/320O) to the outside
Configuration 12: CL300, CL400, CL500 area coupling
Configuration 13: CL300, CL400, CL500 area coupling and additional 2nd I/O card (for direct In-/Outputs)
Configuration 14: Bit coupling to PC600 and additional 2nd I/O card (for direct In-/Outputs)
Configuration 17: rho 3.0 PLC board
Configuration 18: rho 3.0 Stand alone

Example display on the PHG:

```
              MP SET
P20   I/O-HW-CONFIG.
          0
#
```

P21
Address area for PLC bit coupling

The start and end addresses of the rho 3 interface inputs and outputs are defined with “P21”.
The parameter acts only for bus coupling to the external PLC CL300, PC400, PC600.
The location of the RC input/output area in the address area of the PLC can be defined with P21.
The start and end addresses for data transfer to and from the PLC are interrogated successively.

Default values:

START O:	0	Start address of RC outputs in the PLC input area.
END O:	44	End address of the RC outputs in the PLC input area.
START I:	0	Start address of the RC inputs in the PLC output area.
END I:	44	End address of the RC inputs in the PLC output area.

(Maximum 255)

This means that 45 bytes can normally be copied from the RC to the PLC and 45 bytes from the PLC to the RC.

This exchange takes place after each PLC program cycle.

Note: The end address can be reduced if more free signals are required from the peripherals/to the peripherals. However, the number of possible User Inputs and Outputs is reduced correspondingly. It is also possible to increase the number of user I/O signals, whereby the number of free PLC/I/O signals is thus reduced correspondingly.
(see rho3 Signal descrption)

The minimum runtime of a PLC program is 2 ms and the maximum runtime should be less than 250 ms.

Important!
If the start address is changed, the end address must also be changed in the same way.
If this is not done, only the RC area representing the difference between the end and start addresses will be copied from/to the PLC.

Example display on the PHG:

```
                MP SET
P21      ADDRESS. PLC-I/O
 I.START 0
#
```

```
                MP SET
P21      ADDRESS. PLC-I/O
 I. END   44
#
```

```
                MP SET
P21      ADDRESS. PLC-I/O
 O.START 0
#
```

```
                MP SET
P21      ADDRESS. PLC-I/O
 O. END 44
#
```

P22
Range of global A-/D-FACTOR

The input range of the acceleration and deceleration factor is defined with parameter P22.
The limit acts globally and applies to all kinematics.
Input range: 0.0001 to 9.9999 (0.01% ... 999.99%) ,the default value of the range is 1 upon delivery (100%).

$A_{act} = A_{BAPS} * P118_{AFAKTOR (Kin.)} * P22_{AFAKTOR global} * A_{PHG/Interf.}$

Example display on the PHG:

MP SET
P22 GLOBAL A/DFACTOR
minimum AFA 0.1000
#

MP SET
P22 GLOBAL A/DFACTOR
maximum AFA 9.9000
#

MP SET
P22 GLOBAL A/DFACTOR
minimum DFA 0.1000
#

MP SET
P22 GLOBAL A/DFACTOR
maximum DFA 9.9000
#

P23
Range of global V-FACTOR

The input range of the speed factor can be limited with parameter P23. This factor can be set by means of “auxiliary functions” or via interface signals.

The limit acts globally and applies to all kinematics.

Input range: 0.0001 to 9.9999 (0.01% ... 999.99%) ,the default value of the range is 1 upon delivery (100%).

$V_{act} = V_{BAPS} * P119_{VFAKTOR (Kin.)} * P23_{VFAKTOR global} * V_{PHG/Interf.}$

Example display on the PHG:

MP SET
P23 GLOB.RANGE VFACT
minimum 0.0100
#

MP SET
P23 GLOB.RANGE VFACT
maximum 9.9000
#

P24
Delete user outputs

Parameter “P24” defines the range of user-outputs to be cleared on “Reset”.
Upon delivery, the clearing of all user-outputs is preset.

☞ **Example:**
The value is set to “120”, that means: all user-outputs (including no.120) are set to ”0” on reset.

If the value is set to “100”, the conditions of the user-outputs no. 101 – 120 are not changes on reset.

Example display on the PHG:

MP SET
P24 DEL. USER-OUTP.
del.user-outp. to no
 # 100

P25
Resetting the A/D/V factors

The reset behavior of the global and kinematic-dependent A/D/V factors is established with P25.
Permissible inputs are “0” and “1”.

The following tables show the how the default settings (all “0”) of the individual factors function:

Operation	global factors	kin. dep. factors
CONTROL RESET	1.0 (100%)	unchanged
AUTO ==> MANUAL	unchanged	unchanged
MANUAL ==> AUTO	unchanged	unchanged
PROCESS SELECTION	unchanged	1.0 (100%)

global factors for	becomes/remains
CONTROL RESET	unchanged
AUTO ==> MANUAL	1.0 (100%) unchanged
MANUAL ==> AUTO	1.0 (100%)
PROCESS SELECTION/START	1.0 (100%) (*)

CAUTION !

The change marked with * acts on all kinematics, including the kinematics already moved in a process.

Kin. dep. factors for:	becomes/remains
CONTROL RESET	1.0
AUTO ==> MANUAL	1.0
MANUAL ==> AUTO	1.0
PROCESS SELECTION/START	unchanged

Example display on the PHG:

MP SET
P25 RESET A/D/V FACT
kin. dep. factors
Control reset: 0#

MP SET
P25 RESET A/D/V FACT
global A/D/V fact.
Control reset: 0#

MP SET
P25 RESET A/D/V FACT
kin. dep. factors
AUTO ==> MANUAL: 0#

MP SET
P25 RESET A/D/V FACT
global A/D/V fact.
AUTO ==> MANUAL: 0#

MP SET
P25 RESET A/D/V FACT
kin. dep. factors
MANUAL ==> AUTO: 0#

MP SET
P25 RESET A/D/V FACT
global A/D/V fact.
MANUAL ==> AUTO: 0#

MP SET
P25 RESET A/D/V FACT
kin. dep. factors
Proc. select/start: 0#

MP SET
P25 RESET A/D/V FACT
global A/D/V fact.
Proc. select/start: 0#

P26
Memory test on/off

The RAM and EPROM tests which are executed during the run-up phase can be deactivated off or activated by means of parameter P26.
Input possibilities:

0 = RAM and EPROM test active (default)
1 = RAM and EPROM test deactivated

CAUTION !

The RAM and EPROM test for the control is a means of meeting the requirements for control units in accordance with VDI 2853. The RAM or EPROM test may not be switched off in the case of all systems subject to VDI or similar regulations.

Example display on the PHG:

```
MP SET
P26 MEMORY TESTS
(On=0, off=1) : 0
#
```

P27
Strobe INTEGER inputs

The strobe for the INTEGER inputs may be switched on or off with parameter P27.
Input possibilities:

0 = with strobe (default)
1 = without strobe

Example display on the PHG:

```
MP SET
P27 STROBE INTEGER IN-
PUTS (with strobe = 0,
without strobe = 1) : 0   #
```

P28
Display available options

If P28 is selectedthe values for all set options are displayed. The value is displayed in hexadecimal form with two digits.
The display begins with the first set option (according to the options list) and ends with the last set option (max. 64). Options which can be amended via the parameters or which are not used are not displayed.
No cursor is shown in P28. Only the keys "SHIFT-ARROW UP (scroll up)", "SHIFT-DOWN ARROW", or "ENTER" (scroll down) are allowed; any other inputs generate an error message. Example of the display under **P28**:

activated options	
Circle:	01
Mirror:	01
Gripper coord.:	01
I/O files:	01
Linear interp.:	01
Program slope:	01
Sinus*2 slope:	01
Cod. text.,MSD:	01
Tool:	01
A/D/V factor EI:	01
Read POS:	01
Several kin.:	01
Coupl. coord.:	01
VF or. ref. pt.:	01
Brake progr:	01
Log book:	01
Passing:	01
3964R protocol:	01
Min. R clock disp.:	03
Global data:	01
Brake pass.:	01
Toler. drive off:	02
Set mach. pos.:	01
Online funct.:	01
Band stop:	01
BSYN without axis:	01

CAUTION !

Option bytes must only be changed by authorized personnel and in consultation with BOSCH. Incorrect option values can lead to control malfunctions.

Example display on the PHG:

```
          MP SET
P28 AVAIL. OPTIONS
Circle :            01
```

P29
Fast servo card software

Parameter P29 allows special servo card software optimised to the runtime to be activated. This enables much shorter position controller scanning cycles than is possible with the normal servo card software.
However, this runtime-optimised servo card software may only be installed with certain configurations (see rho3 options description).
The software must be activated/deactivated for each card individually.
Input possibilities:

0 = normal servo card software (default)
1 = runtime-optimised servo card software

Example display on the PHG:

```
            MP SET
P29 SK SOFTWARE
Servo c. 1: 0
#
```

P30 I/O configuration of CAN bus

The assignment with digital input/output signals from CAN bus 1+2 is defined with parameter P30.

1. Inputs/outputs

The following input possibilities for each CAN bus are available:

– 6 axes	**no additional inputs/outputs**
– 4/5 axes	max. 8 bytes (1 block) dig. input signals + 8 bytes (1 block) dig. output signals
– 3 axes	max. 16 bytes (2 blocks) dig. input signals 16 bytes (2 blocks) dig. output signals
– 2 axes	max. 24 bytes (3 blocks) dig. input signals + 24 bytes (3 blocks) dig. output signals
– 1 axis	max. 32 bytes (4 blocks) dig. input signals + 32 bytes (4 blocks) dig. output signals
– no axis	max. 40 bytes (5 blocks) dig. input signals + 32 bytes (4 blocks) dig. output signals

2. Baud rate

The max. transmission rate (baud rate) is dependent on the cable length between the rho3 and the I/O module.

Cable length	max. baud rate	
up to 20 m	1 Mbaud	(input “0”)
up to 40 m	500 kBaud	(input “1”)
up to 80 m	250 kBaud	(input “2”)
up to 160 m	125 kBaud	(input “3”)

Example display on the PHG:

```
         MP SET
P30 I/O CONF. CAN 1
Dis.dig.inp.bl.:   2
#
```

```
         MP SET
P30 I/O CONF. CAN 2
Dis.dig.inp.bl.:   2
#
```

```
         MP SET
P30 I/O CONF. CAN 1
Dis.dig.outp.bl.:   1
#
```

```
         MP SET
P30 I/O CONF. CAN 2
Dis.dig.outp.bl.:   1
#
```

```
         MP SET
P30 I/O CONF. CAN 1
Baud rate:   0
#
```

```
         MP SET
P30 I/O CONF. CAN 2
Baud rate:   0
#
```

It should be ensured that the maximum total number of digital I/O blocks possible is not exceeded.

Note: The baud rate for a CAN bus may only be set not equal to 1 Mbaud when the bus is not occupied by axes.

P31 address ranges of the CAN inputs

The address ranges, block lengths and identifiers for digital input signals which are to be read via the CAN interface are defined in parameter P31. The PIC byte addresses are must be entered (see signal description rho3). The block length indicates the number of bytes transferred to the corresponding input nodes i.e. with block lengths < 8, the full range of a block is not utilised.

Input possibilities:

Start address digital inputs CAN block 1..5:	0..127
Block length digital inputs CAN block 1..5:	1..8
Identifier digital inputs CAN block 1..5:	541..550

Note: The number of entries is dependent on the number of input blocks as defined in P30.

Example display on the PHG:

```
         MP SET
P31 ADR.CAN I BUS 1
St.addr.block 1:      88
#
```

```
         MP SET
P31 ADR.CAN I BUS 2
St.addr.block 1:      96
#
```

```
MP SET
P31 ADR.CAN I BUS 1
Length block 1:   8
#
```

```
MP SET
P31 ADR.CAN I BUS 2
Length block 1:   8
#
```

```
MP SET
P31 ADR.CAN I BUS 1
Ident. block 1:   541
#
```

```
MP SET
P31 ADR.CAN I BUS 2
Ident. block 1:   542
#
```

P32 address ranges of the CAN outputs

The address ranges, block lengths and identifiers for digital output signals which are to be output via the CAN interface are defined in parameter P32. The PIC byte addresses are must be entered (see signal description rho3). The block length indicates the number of bytes transferred to the corresponding output nodes i.e. with block lengths < 8, the full range of a block is not utilised.

Input possibilities:

Start address digital output CAN block 1..5:	0..127
Block length digital outputs CAN block 1..5:	1..8
Identifier digital outputs CAN block 1..5:	471..480

Note: The number of entries is dependent on the number of output blocks as determined in P30.

Example display on the PHG:

```
MP SET
P32 ADR.CAN O BUS 1
St.addr.block 1:      100
#
```

```
MP SET
P32 ADR.CAN O BUS 2
St.addr.block 1:      108
#
```

```
MP SET
P32 ADR.CAN O BUS 1
Length block 1:   8
#
```

```
MP SET
P32 ADR.CAN O BUS 2
Length block 1:   8
#
```

```
MP SET
P32 ADR.CAN O BUS 1
Ident. block 1:        471
#
```

```
MP SET
P32 ADR.CAN O BUS 2
Ident. block 1:        472
#
```

Note: It should be ensured that the address ranges are not overlapped when additional digital I/O cards (I/O 64/40, PC I/O coupling) are in use. It is therefore sensible to use the high-order I/O addresses first, as the lower addresses ranges are permanently used by the I/O cards.

P33 Selection of the rho 3.0 configuration

The configuration 'PLC modul' or 'Stand alone' is selected via machine parameter 33.
The configuration 'PLC modul' is preselected.

Configuration:

0 : PLC modul
1 : Stand alone – version

If the machine parameter 33 fits to the configuration 'PLC modul' or 'Stand alone', no problems will occur.

If a rho 3.0 is configured via machinen parameter 33 as Stand alone, but it is used in a PLC–Rack, the rho–Firmware can not detect all not allowed variations.

Variation	CPU plugged	Power supply plugged	Power supply switched to ON
1	yes	yes	yes
2	yes	yes	no
3	yes	no	–
4	no	yes	yes
5	no	yes	no

The firmware of the rh0 3.0 recognised the variations 1 – 4 as a wrong configured system and sends a system error. The rho 3.0 doesn't connect the I/O–Bus–power supply (12 V) not to the bus. This errors may be eleminated directly with a corrsct setting of the machine parameters (MP 33 = 0).

The variation 5 (CPU plugged, power supply plugged and switched OFF) can not be detected by the rho 3.0 firmware, that means the rho 3.0 supplies the bus with 12 V. If now the PLC–power supply is also switched ON, both power supplys are supplying the bus. The rho 3.0 is protected via a diode, the PLC–power supply may be damaged.

P34 Number of characters of serial I/O–buffer

If a peripheral unit sets the handshake signal of the serial interface, the characters in the serial output buffer are sent out until the buffer is empty. In machine parameter 34 the Capacityof the output buffer and herewith the number of characters, which are sent after a handshake signal was set, may be reduced.

16 : 16 characters (preselection)
1 – 15 : reduced number of characters in output buffer

3.2 Speeds

P100	**Speeds**
P101	**Required lag in degrees or mm**
P102	**Maximum path speed in mm/s (nominal speed)**
P103	**Max. axis speed PTP in degrees/s or mm/s (nom. speed)**
P104	**Slope accelerat. PTP in degrees/s^2 or mm/s^2**
P105	**Slope point PTP in JC in degrees/s or mm/s**
P106	**Slope point in path mode in mm/s**
P107	**Slope point in jog mode in WC in mm/s**
P108	**Reference point speed in degrees/s or mm/s**
P109	**1st reduced reference point speed in degrees/s or mms**
P110	**2nd reduced reference point speed in degrees/s or mms**
P111	**Jog speed WC slow in mm/s**
P112	**Jog speed WC fast in mm/s**
P113	**Jog speed JC slow in degrees/s or mm/s**
P114	**Jog speed JC fast in degrees/s or mm/s**
P115	**Increment steps WC in mm**
P116	**Increment steps JC in degrees or mm**
P117	**A/D – Slope jog in WC in mm/s^2**
P118	**Range limits for Afactor and Dfactor**
P119	**Range limits for Vfactor**
P120	**Power ON condition slope type (program or block slope)**
P121	**Slope form (ramp or sin^2-type)**
P122	**Acceleration and deceleration change times PTP in JC**
P123	**Acceleration and deceleration change times WC, jog**
P124	**Acceleration and deceleration change times for path mode**
P125	**Switch-off time of interpolator stop monitoring**
P126	**Switch-off time of standstill monitoring function**
P127	**Inpos range of standstill monitoring function**
P128	**A/D – Slope jog in JC in degrees/s^2 or mm/s^2**
P129	**Slope point jog in JC in degrees/s or mm/s**
P130	**Acceleration and deceleration change times jog JC**

P101
Required lag

- The max. lag, which is reached at maximum axis speed (nominal speed), is entered with P101.
- The input is made in degrees or mm.
- The drive amplifiers must be adjusted so that the axes of a particular kinematic behave synchronously.
- The gain parameters K_V of all servo loops of a kinematic must be equal so that the position-controlled axes also behave synchronously (**pre-condition:** the dynamic behavior of the speed-controlled axes must be identical).
- The relationship between K_V parameter and lag is defined by the following formula:

$$L_N = \frac{V_{nom}}{K_V} = \frac{\text{P 103 [mm/sec]}}{\text{KV [1/sec]}} = \frac{\text{P 103 [m/min]}}{\text{KV [1000/min] * 16,67}}$$

$$L_N = w(t_1) - y(t_1)$$

L_N = Required lag in mm or degrees

V_{nom} = Nominal speed in mm/s or degrees/s

K_V = Loop gain in s^{-1}

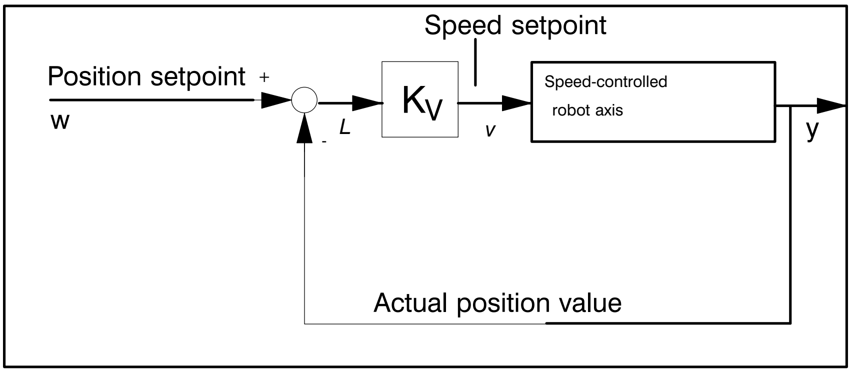
w = Position setpoint

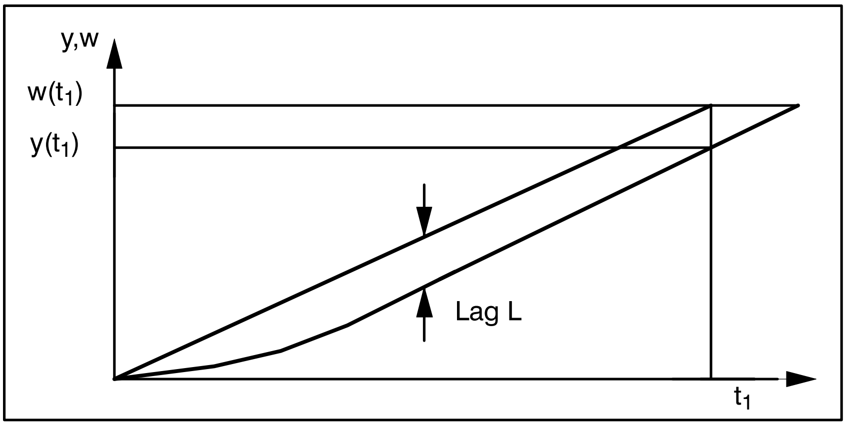
y = Actual position value

- **For CAN axes:**
  The value in P101 only serves the Interpolator Stop and Servo Error Monitoring. It does not affect the behaviour of the controller.
  The values must be set in accordance with the control loop parameters of the Servodyn GC drive modules
  Interpolator Stop und Servo Error Monitoring will not function if they are set incorrectly.
  Value too small: Monitoring does not respond too early
  Value too large: Monitoring responds too late or not at all. This can cause a very large lag in the drive module which can only be reduced slowly at the end of a movement.

  Setting specification:
  L_N [grd] = V_{max} [grd/s] / K_V [1/s] + offset [grd]

L_N:	Lag
V_{max}:	Max. axis speed (P103)
K_V:	Position controller gain (Servodyn GC: Position Loop Gain)
Offset:	V_{max} [grd/s] * (P2−Clock Time [ms] + 6) / 1000

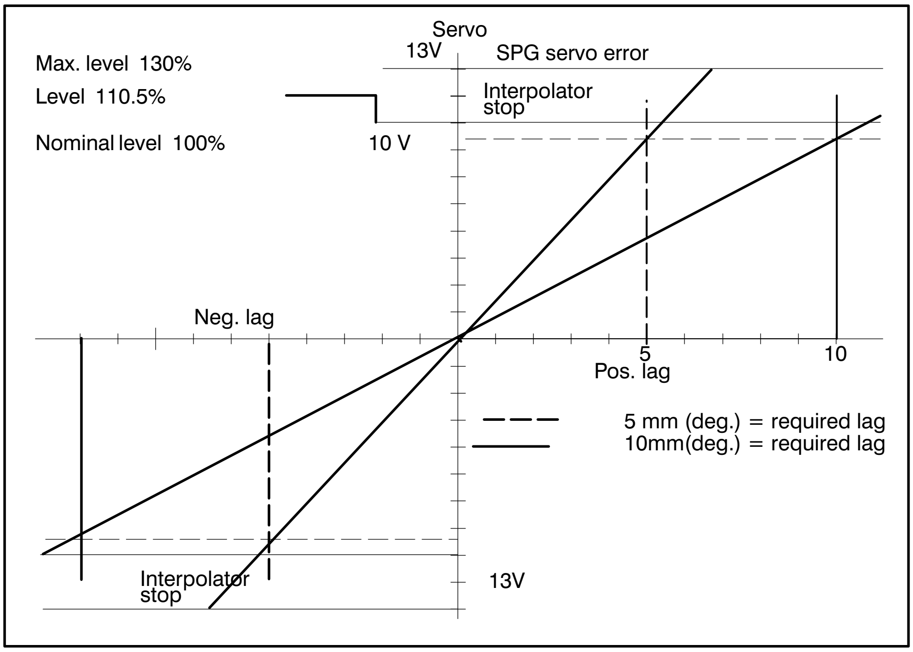




The “interpolator stop ranges” and “servo error ranges” are defined by input of the required lag.

- Input range between 0.01 and 100000.
- The maximum lag is 130% of the required lag.
- A **“servo error”** occurs if the maximum lag = 130% is exceeded.
- An **“interpolator stop”** occurs at 110.5% of the required lag.

Diagram
Functional dependence on required lag



Example display on the PHG:

```
ROBI_1          MP SET
P101  NOMINAL LAG
A_1     66.00
#
```

- **The following 2 examples apply to Controller-typ 1 (P312)**.
- Standardization factor:
  In open loop-controlled mode, this establishes the inter-relationship between setpoint output and the distance travelled.

Example display on the PHG (stand. fact. JOG mode):

```
ROBI_1          MP SET
P101 NEG. JOG FACT.
A_1           0.000
#
```

```
ROBI_1          MP SET
P101 POS. JOG FACT.
A_1           0.000
#
```

Example display on the PHG (stand. fact. autom. mode):

```
ROBI_1             MP SET
P101 NEG. AUTO. FACT.
A_1           0.000
#
```

```
ROBI_1             MP SET
P101 POS. AUTO. FACT.
A_1           0.000
#
```

- Creep speed:
  Percentage of the max. axis speed (extended for open-loop controlled mode).

Example display on the PHG:

```
ROBI_1          MP SET
P101 crawler gear
A_1    0.000
#
```

P102
Maximum path speed in mm/s

- Maximum programmable travel speed in world coordinates (WC) at the tool center point (TCP).
- The definition of a sensible maximum path speed depends on the resolution of the measuring system, the minimum programmed point spacing, the mechanical components of the robot and the sampling time of the position servo loop (clock start time).

Example display on the PHG:

```
ROBI_1          MP SET
P102   MAX. PATH SPEED
       1500.00
#
```

P103
Maximum axis speed PTP in degrees/s or mm/s

- Maximum travel speed of the individual machine axes (machine coordinates JC), restricted by the drive power.
- **For CAN axes:**

$$\text{Input value} <= \frac{\text{max. RPM (Automatic Mode [rev/min] * CPS}}{\text{60 * MS evaluation [incr./degrees or incr./mm]}}$$

max. RPM (Automatic Mode) :	Drive parameters (see Servodyn GC description
CPS :	Can Position Scaling (see Servodyn GC description)
MS evaluation :	see P401

Note:
If a higher speed than the max. speed set at the Servodyn GC is selected by the rho3, the Servodyn GC will trigger an Interpolator Stop.

Example display on the PHG:

```
ROBI_1          MP SET
P103   MAX. AXIS SPEED
A_1      50.000
#
```

P104
MAX. slope acceleration PTP in degrees/s² or mm/s²

- Acceleration of the individual axes for a movement initiated by a PTP movement in automatic mode.
- The input range lies between 0.01 and 9999.99 degrees/s^2 or mm/s^2.
- The values entered under P104 are also used for monitoring axis acceleration in path mode.

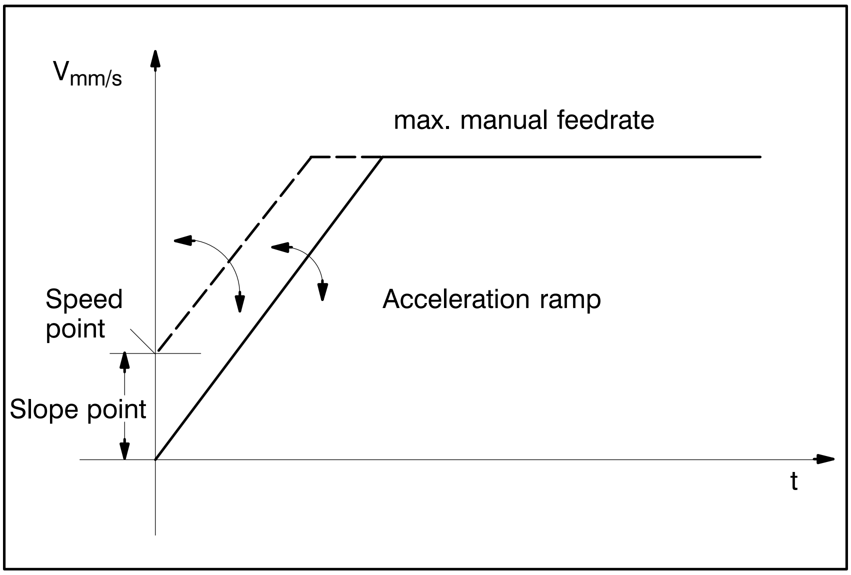


Figure 1

Example display on the PHG:

```
ROBI_1          MP SET
P104   SLOPE-ACCEL. PTP
A_1    9999.00
#
```

P105
Slope point PTP in JC in degrees/s or mm/s

- The slope acceleration in P104 acts from the speed point.
- Inputs are made in degrees/s or mm/s.
- The slope point is set to the maximum speed if operation without slope is desired (see Figure 1).

Example display on the PHG:

```
ROBI_1          MP SET
P105  SLOP-PNT PTP JC
A_1      2000.00
#
```

P106
Slope point PATH MODE in mm/s

- The programmed path slope acceleration acts from the path speed point onwards.
- The slope point is set to the maximum path speed if operation without slope is desired.
- The slope point must be defined separately for program slope (Prog) and block slope (Block).Example display on the PHG:

Example display on the PHG:

```
ROBI_1          MP SET
P106 PATH-SLOP.POINT
Inst        0.000
#
```

```
ROBI_1          MP SET
P106 PATH-SLOP.POINT
Prog        0.000
#
```

P107
Slope point Jog in WC in mm/s

- The WC slope acceleration -> P117 acts as from the jog path speed.
- The slope point is set to the maximum WC jog speed if operation without slope is desired.
- The input is made for world coordinates.

Example display on the PHG:

```
ROBI_1          MP SET
P107 SLOPE-POINT WC
A_X 2000.00
#
```

P108
Reference point speed in degrees/s or mm/s

- The reference point speed is defined with "P108" (acts after the reference points have been approached once).
- The entered values must not be greater than the values in parameter 103, referred to the same axis in each case.
- **For CAN axes:**

$$\text{Input value} <= \frac{\text{max. RPM (Manual Mode [rev/min] * CPS}}{\text{60 * MS evaluation [incr./degrees or. incr./mm]}}$$

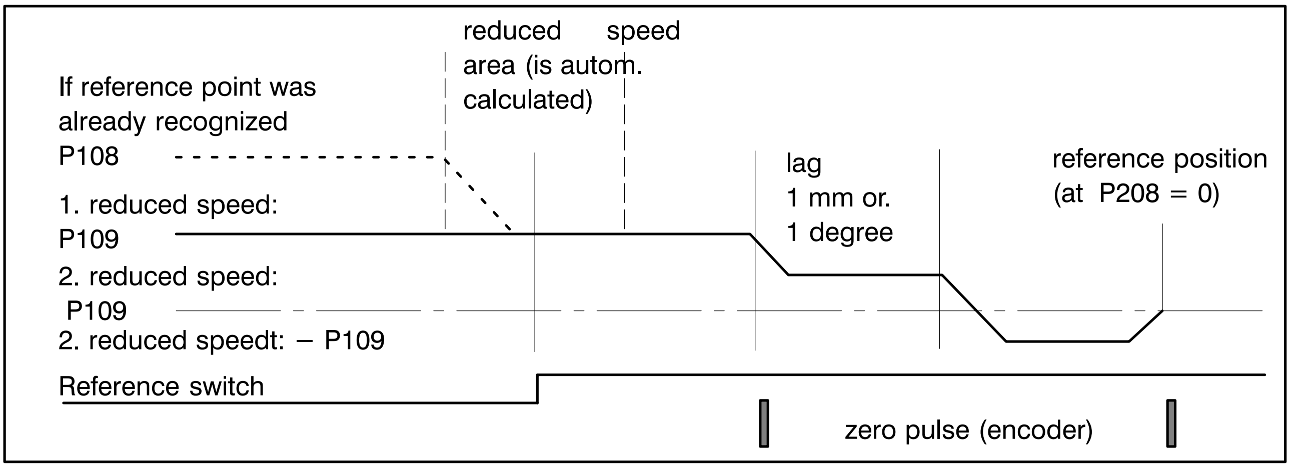
max. RPM (Automatic Mode) :	Drive parameters (see Servodyn GC description
CPS :	Can Position Scaling (see Servodyn GC description
MS evaluation:	see P401

Note:
If a higher speed than the max. speed set at the Servodyn GC is selected by the rho3, the Servodyn GC will trigger an Interpolator Stop.

Example display on the PHG:

```
ROBI_1           MP SET
P108 REFERENC. SPEED
A_1 10.000
#
```

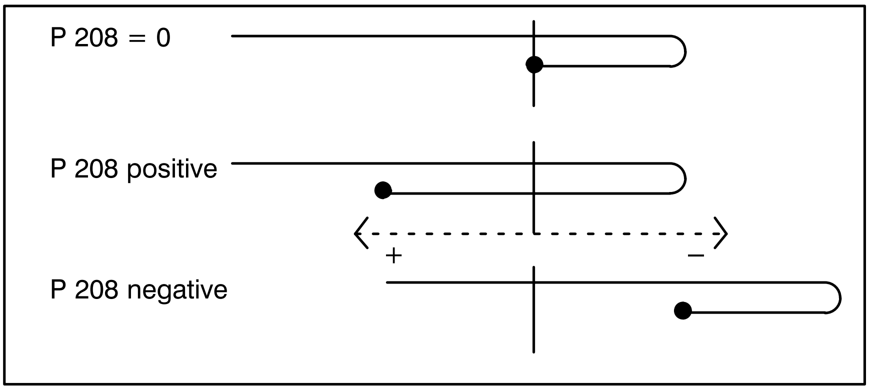
- Reference point speeds



- The selected axis moves in the direction of P402 with the speed defined in P109 in direction reference point. After recognizing the reference switch (selection raising or falling edge in P403) the axis moves on to the first zero pulse of the encoder. At this position the reference point value form P207 is set and the speed is reduced to the 2. reduced speed. The axis moves on a way of 1 mm (or 1 degree) and turns then the moving direction and moves to the position given in P208.
  If referencing is selected during the axis is standing on the reference switch, the axis moves away fom the reference switch in opposite reference direction, before the referencing described upside is executed.

- The switching position of the reference switch should be in the middle of two zero pulses of the encoder to avoid errors due to switching at the raising edge of the reference switch.

- In P 208 the reference point distance is defined. It is always reached in the opposite reference direction (lead screw error compensation).



P109
1st reduced reference point speed in degrees/s or mm/s

- **Caution!**
  The values must not be greater than the values in parameter blocks P103 and P108.
- Initial travel to the ROD marker takes place at this speed.
- “P109” defines the 1st reduced speed which becomes active when the software reduction switch is reached.
- **Note:**
  The first reference point travel operation is started with the 1st reduced speed (P109) after the main switch is switched on. Afterwards, traversing takes place outside the reduction range with the reference point speed (P108). The reduction range is calculated automatically as a function of the slope acceleration (P104), slope point (P105) and reference point speed (P108).
- **See P108 for max. input values for CAN axes.**

Example display on the PHG:

```
ROBI_1          MP SET
P109 1. RED.REF.SPEED
A_1 10.000
#
```

P110
2nd reduced reference point speed in degrees/s or mm/s

- **Caution!**
  The values must not be greater than the values which were defined in parameter block P109.
- P110 defines the 2nd reduced speed at which synchronization with the zero pulse takes place.
- **See P108 for max. input values for CAN axes.**

Example display on the PHG:

```
ROBI_1          MP SET
P110 2.RED.REF.SPEED
A_1    4.000
#
```

P111
Jog speed WC slow in mm/s

- The speed refers to the space path (tool center point) for the movement with the PHG.
- The input value should be less than the value for manual feedrate WC fast (P112).

Example display on the PHG:

```
ROBI_1          MP SET
P111 J.SPEED WC SLOW
A_X   25.00
#
```

P112
Jog speed WC fast in mm/s

- The speed refers to the space path (tool center point) for the movement with the PHG.
- The input value should be greater than the value for jog speed WC slow.

Example display on the PHG:

```
ROBI_1          MP SET
P112 J.SPEED WC FAST
A_X   75.00
#
```

- The automatic switching between incremental movement with a short pressing of the JOG–botton and slow eg. fast continuous movement (after 2 seconds) may be deactivatedwith the interface signal **External speed selection for manual**. If this signal is set to ”1”, the interface inputs (no. 76 .. 79) are valid for the speed selection:
  Manual feed slow **Manual feed fast**
  Incremental dimension small **Incremental dimension large**

P113
Jog speed JC slow in degrees/s or mm/s

- Axis speeds in conjunction with the PHG.
- The input value should be less than the value for jog speed JC fast (P114).
- See P108 for max. input values for CAN axes.

Example display on the PHG:

```
ROBI_1          MP SET
P113 J.SPEED JC SLOW
A_1   4.00
#
```

P114
Jog speed JC fast
in degrees/s and mm/s

- Axis speeds in conjunction with the PHG.
- The input value should be greater than the value for jog speed JC slow (P113).
- **See P108 for max. input values for CAN axes.**

Example display on the PHG:

```
ROBI_1          MP SET
P114 J.SPEED JC FAST
A_1    15.00
#
```

P115
Incremental steps WC in mm

- Input of two different incremental dimensions for a movement with the PHG in world coordinates.
- The input range is between 0.001 and 1000.0
- An input value of “0” is not permitted.

Example display on the PHG (“1” means Low, “2” High Speed):

```
ROBI_1          MP SET
P115 INCREM.STEPS WC
   1   1.000
#
```

```
ROBI_1          MP SET
P115 INCREM.STEPS WC
   2    10.000
#
```

P116
Incremental steps JC in degrees or mm

- Input of two different incremental dimensions for a movement with the PHG in joint coordinates.
- The input range is between 0.001 and 1000.0
- An input value of “0” is not permitted.

Example display on the PHG:

```
ROBI_1          MP SET
P116 INCREM.STEPS JC
   1    0.500
#
```

```
ROBI_1          MP SET
P116 INCREM.STEPS JC
   2   5.000
#
```

P117
A/D− slope acceleration JOG in WC in mm/s²

- "P117" defines the slope acceleration/deceleration for the individual coordinates in jog mode in WC.
- The acceleration/deceleration refers to the space path (tool center point).
- The input range is between 0.01 and 999999.99 mm/s^2.

Example display on the PHG:

```
ROBI_1          MP SET
P117 A- SLOPE JOG WC
X_C   1000.00
#
```

```
ROBI_1          MP SET
P117 D- SLOPE JOG WC
X_C   1000.00
#
```

P118
Range of A-/D-Factor

- The input range for the acceleration factor is entered with "P118".
- The input range is between 0.0001 and 9.9999.
- The A-factor and D-factor are programmable in BAPS and can be set in the mode "Auxiliary functions".
- The deceleration phase of a movement can be influenced with the DFACTOR.
- The DFACTOR acts in the same way as the AFACTOR.

  A act = A * AFACTOR

  D act = A * DFACTOR
- AFACTOR and DFACTOR are preassigned the default value 1.

Example display on the PHG (AFACTOR):

```
ROBI_1          MP SET
P118  AFACTOR/DFACTOR
minimum  AFA 0.0001
#
```

```
ROBI_1          MP SET
P118  AFACTOR/DFACTOR
maximum  AFA 9.9999
#
```

Example display on the PHG (DFACTOR):

```
ROBI_1          MP SET
P118  AFACTOR/DFACTOR
minimum  DFA 0.0001
#
```

```
ROBI_1          MP SET
P118  AFACTOR/DFACTOR
maximum  DFA 9.9999
#
```

P119
Range of V-Factor

- The input range for the speed factor is defined with “P119”.
- The input range is between 0.0001 and 9.9999%.
- The V-factor is programmable in BAPS and can be set in the mode “Auxiliary functions” (see rho 3 PHG operation).

Example display on the PHG:

```
ROBI_1          MP SET
P119   RANGE OF VFACT.
minimum           0.0001
#
```

```
ROBI_1          MP SET
P119   RANGE OF VFACT.
maximum  9.9900
#
```

P120
Power-on condition SLOPE mode

- P120 defines which SLOPE mode (BLOCK SLOPE or PROGR_SLOPE) is active if no SLOPE mode was programmed in the BAPS program.
- The power-on condition is overwritten by programming “Block_stope” or “Progr_stope” in the BAPS program.

Block slope: 0
Program slope: 1

Example display on the PHG:

```
ROBI_1          MP SET
P120 SLOPE-SEL. IS/PR
(0/1)        0
#
```

P121
Acceleration form

- P121 permits selection between the acceleration forms “ramp” or “SIN^2-type”.
- Slope form RA/SI (0 – ramp; 1 – “SIN^2-type”)
- “Ramp” means previous acceleration form, while “sin^2” means soft start with acceleration and deceleration similar to SIN^2 .

Example display on the PHG:

```
ROBI_1          MP SET
P121 SLOPEFORM RA/SI
(0/1)              0
#
```

Note on block slope and soft start (similar to sin^2)

In order to achieve jerk-free acceleration or deceleration of the axes of a robot or handling system, the rate of speed change at the start and end of a movement is influenced so that no jump occurs either at the speed or during acceleration.

The speed increase and decrease are made up of quadratic and linear sections.

Functional description:

The axis movement is started with v = 0 (velocity) and a = 0 (acceleration). Three acceleration phases take place in order to reach the setpoint speed.

Phase 1: Linear acceleration increase up to maximum acceleration.

Phase 2: Constant acceleration.

Phase 3: Linear acceleration reduction to zero.

The acceleration ramp gradients are the same in both phases 1 + 3.

The constant phase (phase 2) of acceleration is calculated so that the programmed setpoint speed is reached at the end of phase 3.

Deceleration takes place analogously to acceleration.

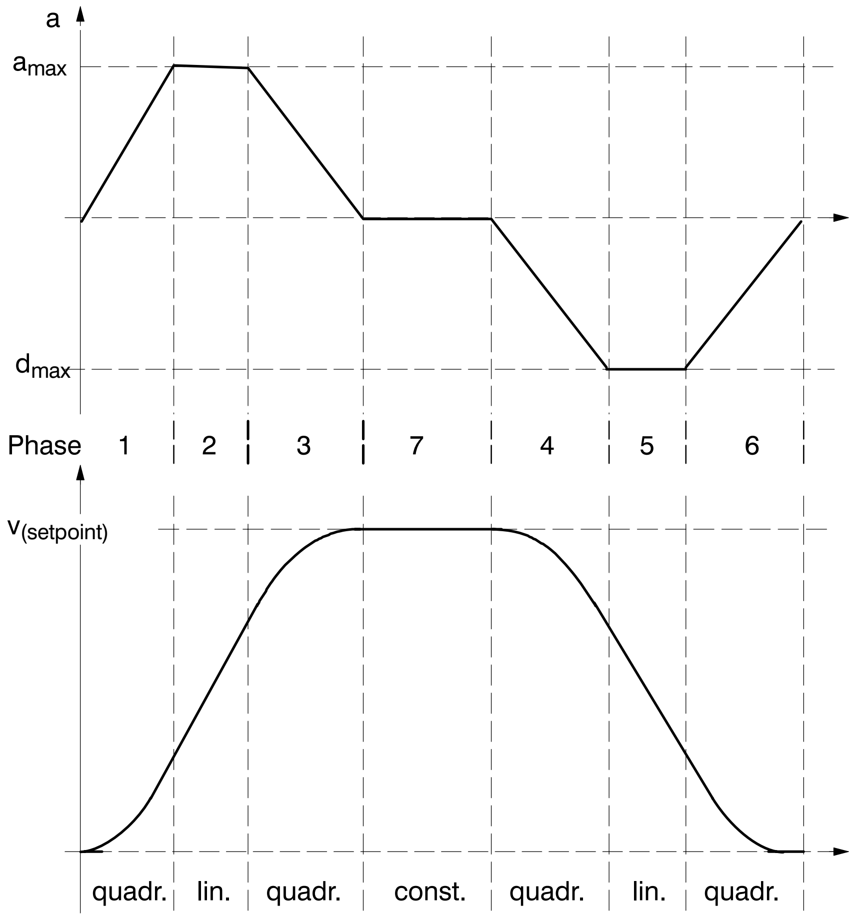
In automatic mode, it is possible to set the maximum deceleration separately from the maximum acceleration. The BAPS language element DFACTOR was introduced as an analogous element to the language element AFACTOR (acceleration factor) for this purpose.

The maximum acceleration values are defined with parameters P104 and P117 for manual mode, with P104 for PTP in automatic mode and with the programmed A-value for LINEAR.

The sin^2-type acceleration response is active in all modes. Manual mode: JC, WC. Automatic: PTP, LINEAR, CIRCULAR

The following diagram shows the basic relationship between acceleration and speed.

Acceleration similar to sin²



Phases 1 and 3 and 4 and 6, i.e. the quadratic phases, are of equal length. Their duration can be defined in milliseconds by the machine parameters P122 (PTP and jog JC), P123 (jog WC) and P124 (path mode).

The duration of phases 2 and 5 depends on the programmed speed and on the programmed distance and is calculated by the RC.

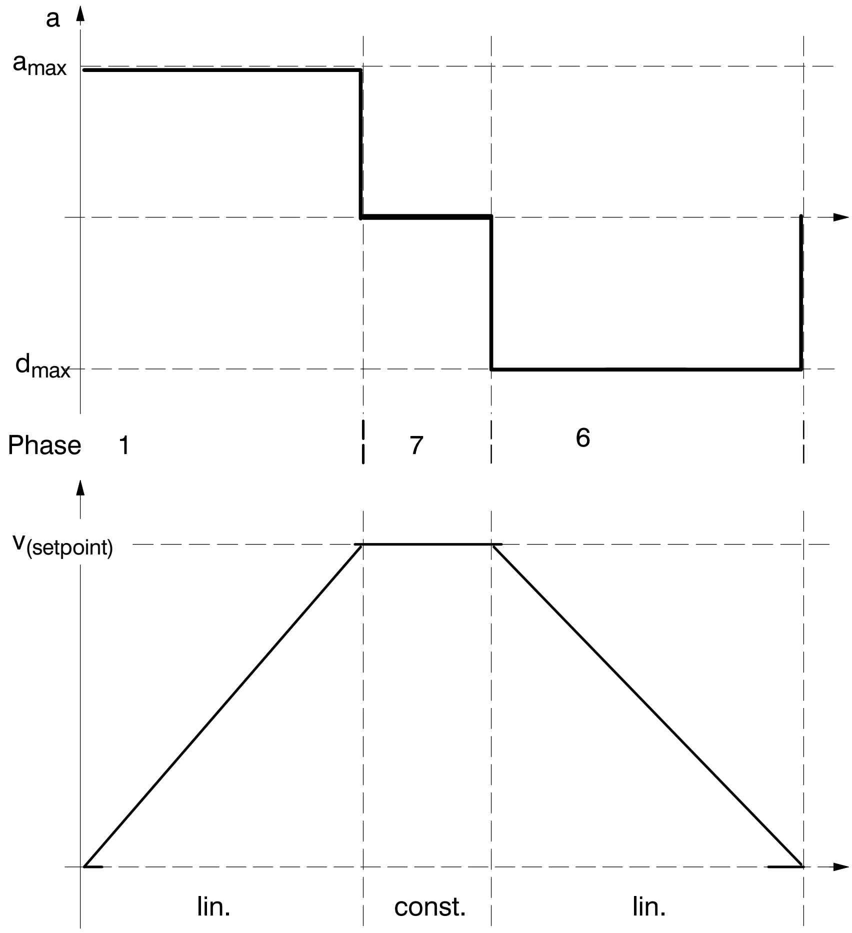
Important:

The time response of the handling system changes compared with the previous “ramp slope” if the sin^2-type slope function is used.

The time requirement for acceleration and deceleration operations increases for unchanged acceleration values.

The same time response can be achieved by increasing the acceleration values. However, it must be checked whether the drives can ”withstand” these higher acceleration values.

Constant acceleration



P122
Acceleration/Deceleration change times PTP in JC in ms

- Acceleration/deceleration change times [ms] for PTP movements in JC. Two values must be entered for each axis.
  - Time until max. acceleration is reached.
  - Time until max. deceleration is reached.

☞ **The parameter P122 is of significance only for a slope form similar to sin², since the acceleration is otherwise constant**

Example display on the PHG:

```
ROBI_1          MP SET
P122 A- VAR-TIME PTP
A_1   100.000
#
```

```
ROBI_1          MP SET
P122 D- VAR-TIME PTP
A_1   100.000
#
```

P123
Acceleration/Deceleration change times (Jog WC in ms)

- Acceleration/deceleration change times [ms] for manual traversing in world coordinates (WC).
- 2 values must be entered for each axis.
  - Time until max. acceleration is reached.
  - Time until max. deceleration is reached.

Example display on the PHG:

```
ROBI_1              MP SET
 P123    A- VAR-TIME WC
 A_X     100.000
 #
```

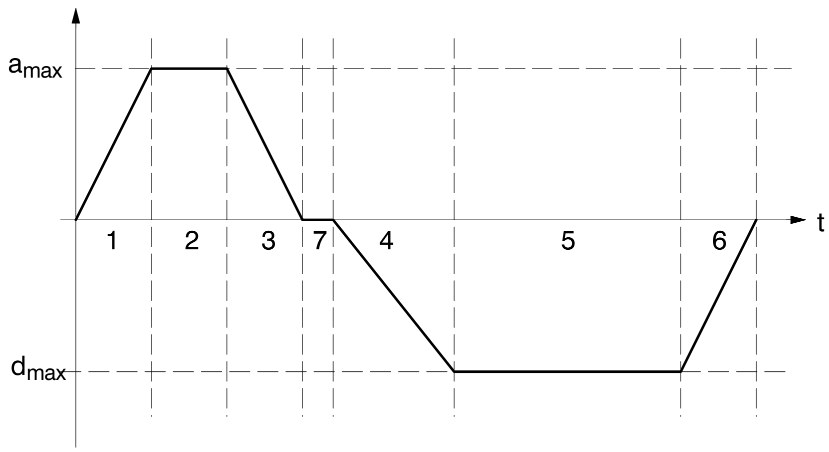
```
ROBI_1 MP SET
 P123    D- VAR-TIME WC
 A_X     100.000
 #
```

☞ **The parameter P123 is of significance only for a slope form similar to sin^2, since the acceleration otherwise always remains constant.**

P124
Acceleration/Dec eleration change times [ms] in path mode

- Acceleration/deceleration change times [ms] in path mode (LINEAR, CIRCULAR). Two values must be entered for each axis.
  - Time until max. acceleration is reached.
  - Time until max. deceleration is reached.

The entered values apply to the rising and falling acceleration and deceleration edges respectively.



Phases 1 and 3 and 4 and 6 are always of the same length.

Important!
The resultant acceleration/deceleration time with respect to speed is made up of twice the time specified in P122 or /P123 or /P124 (accelera-tion/deceleration change times) and the time of constant acceleration.

Resultant acceleration time = phase 1 + phase 2 + phase 3
Resultant deceleration time = phase 4 + phase 5 + phase 6

Example display on the PHG:

```
ROBI_1          MP SET
P124 A/D VAR-TIME PA
  A    100.000
#
```

```
ROBI_1          MP SET
P124 A/D VAR-TIME PA
  D    100.000
#
```

☞ **The parameter P124 is of significance only for a slope form similar to $\sin^2$, since the acceleration otherwise always remains constant.**

P125
Switch-off time for interpolator stop in ms

- Maximum permissible time per axis during which the interpolator stop condition may exist. If this time is exceeded, the signal Ready 2 is can-celled and an EMERGENCY-STOP tripped for safety reasons.
- Number of parameters: 1 value per axis
- Permissible values: 0...2000

CAUTION:

- Input = -1: Switch off monitoring function (for test purposes only).

Example display on the PHG:

```
ROBI_1               MP SET
 P125  SWO.T. IPO-STOP
 A_1      2000 ms
 #
```

P126
Switch-off time for standstill monitoring in ms

- Time between departure from the setpoint position range and triggering of error cut-out at robot standstill or max. permissible time between completion of interpolation and reaching of the setpoint position range.
- Number of parameters: 1 value per axis
- Permissible values: 0...2000

CAUTION:

- Input = −1: Switch off monitoring function (for test purposes only).

Example display on the PHG:

```
ROBI_1          MP SET
P126  SWO.T. STANDST.
A_1     2000 ms
#
```

P127
<In Position> range for standstill monitoring in mm or degrees

- Maximum permissible deviation of the actual position from the setpoint position for standstill monitoring.
- Setpoint position range = setpoint position ± input value.
- Number of parameters: 1 value per axis
- Permissible values: 0...10

Example display on the PHG:

```
ROBI_1          MP SET
P127 IN POS STANDST.
A_1   10.00
#
```

P128
A/D − slope jog in degrees/s^2 or mm/s^2

- Acceleration/deceleration of the individual axes in manual mode.
- Inputs are made in degrees/s^2 or mm/s^2.

Example display on the PHG:

```
ROBI_1          MP SET
P128 A- SLOPE JOG JC
A_1    0.000
#
```

```
ROBI_1          MP SET
P128 D- SLOPE JOG JC
A_1    0.000
#
```

P129
Slope point jog in JC in degrees/s or mm/s

- The slope acceleration -> P128 acts from the speed point – manual feed.
- Inputs are made in degrees/s or mm/s.
- The slope point is set to the maximum speed if operation without slope is desired.

Example display on the PHG:

```
ROBI_1          MP SET
P129 SLOP-PNT JOG JC
A_1   2000.00
#
```

P130
Acceleration/Deceleration change times jog in JC in ms

- Acceleration/deceleration change times [ms] for manual traversing in JC. Two values must be entered for each axis.
  - Time until max. acceleration is reached.
  - Time until max. deceleration is reached.

Example display on the PHG:

```
ROBI_1          MP SET
P130 A- VAR-TIME JOG
A_1   100.000
#
```

```
ROBI_1          MP SET
P130 D- VAR-TIME JOG
A_1   100.000
#
```

☞ **The parameter P130 is of significance only for a slope form similar to sin^2, since the acceleration is otherwise constant.**

3.3. Positions

P200	**Positions**
P201	**IN POSITION range**
P202	**Positive software limit switches in WC**
P203	**Negative software limit switches in WC**
P204	**Positive software limit switches in JC**
P205	**Negative software limit switches in JC**
P206	**Software limit switch tolerance**
P207	**Reference point actual value**
P208	**Reference point offset**
P209	**Maximum value for offset compensation**
P210	**Prealarm limit value for offset compensation**
P211	**Main alarm limit value for offset compensation**
P212	**Presetting for passing -distances and -factors**
P213	**Passing-distances in JC**
P214	**Passing criterion**

P201
In Position range in mm or degrees

- "P201" defines the range in which the axes must be located before the IN-POSITION signal of all axes or the INPOS signal of an individual axis is set to "high" and the next block is executed. The parameter has a considerable influence on positioning accuracy.

Example display on the PHG:

```
ROBI_1          MP SET
P201  <IN POS>  RANGE
A_1     1.000
#
```

P202
Positive software limit switches in WC in mm or degrees

- The values of the positive software limit switches in world coordinates are defined with "P202".

  Acts only in jog mode.

Example display on the PHG:

```
ROBI_1          MP SET
P202  SW LIM.S.POS WC
A_X   9999.99
#
```

P203
Negative software limit switches in WC in mm or degrees

- The values of the negative software limit in world coordinates are defined with “P203”.

  Acts only in jog mode

  An internal travel range limit can be reached during traversing in world coordinates in automatic or manual mode as a result of the kinematics involved. This is indicated in status error mode as “Traversing range limit reached”.

Example display on the PHG:

```
ROBI_1          MP SET
P203 SW LIM.S.NEG WC
X_A   –9999.99
#
```

P204
Positive software limit switches in JC in mm or degrees

- The maximum positive axis movements are defined with “P204”.

  Any hardware limit switches which have been specified must be taken into account for inputs, i.e. the software limit switches must always be located before the hardware limit switches.

  If a software limit switch is approached in automatic mode, “Traversing range limit 1st axis” is displayed in error diagnosis mode, for example.

  Active only if the reference points have been approached.

Example display on the PHG:

```
ROBI_1          MP SET
P204  SW LIM.S.POS JC
A_1   360.000
#
```

P205
Negative software limit switches in JC in mm or degrees

- The maximum negative axis movements are defined with “P205”.

  Any hardware limit switches which are specified must be taken into account for inputs.

  If a software limit switch is approached in automatic mode, “Traversing range limit 1st axis” is displayed in error diagnosis mode, for example.

  Active only if the reference points have been approached.

Example display on the PHG:

```
ROBI_1          MP SET
P205  SW LIM.S.NEG JC
A_1   –360.000
#
```

P206
Software limit switch tolerance in mm or degrees

- The tolerance band of the software machine limit switches (JC) is defined with "P206".

  The "Ready" contact is opened if the entered tolerance is exceeded.

  The message "Machine limit switch 1st axis" is displayed, for example, in error diagnosis mode.

Example display on the PHG:

```
ROBI_1           MP SET
P206  SW LIM.S.TOLER.
A_1      1.500
#
```

P207
Reference point actual value in mm or degrees

- The distance between the axis zero point and reference point is entered with "P207".

  The value for the distance between the axis zero point and reference point should be "0" for absolute measuring systems, otherwise the full encoder range will not be available.

Example display on the PHG:

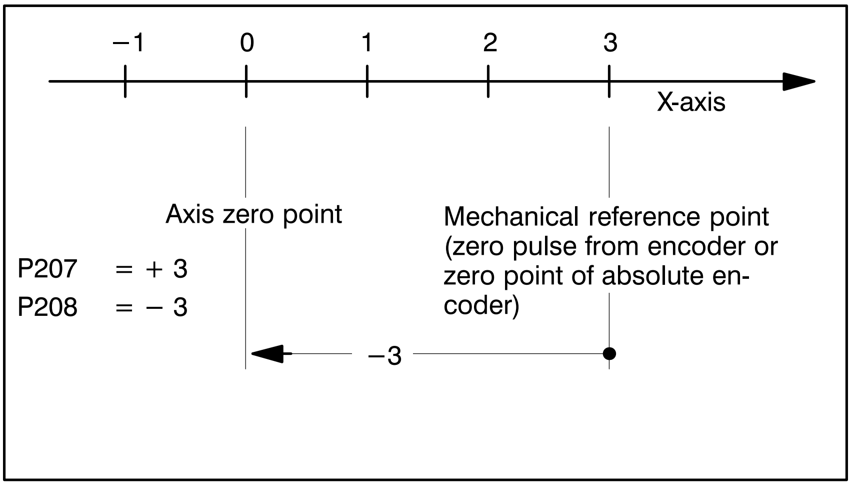
```
ROBI_1           MP SET
P207  REF.P. POSITION
A_1     0.000
#
```

P208
Reference point offset in mm or degrees

- "P208" permits adjustment of the machine reference point without mechanical adjustment of the encoder or scale.

  The reference point offset is approached with the 1st reduced reference point speed.

1st Schematic geometry diagram with reference point corresponding to axis zero point



Example for “P207” and “P208” with reference point corresponding to axis zero point.

☞ The parameters “P207” and “P208” must contain the value “0”.

☞ Reference point travel.

☞ Measure the axis zero point of the corresponding axis in manual mode – using a gauge – and write the offset (position display of the axis) in the reference point offset “P208”.

☞ Write the position value reading from Point 3 as a negative value for the reference point actual value “P207”.

☞ The actual value displayed after reference point approach is 0 and the axis is located at the axis zero point.

Example display on the PHG:

```
ROBI_1          MP SET
P208  REF.P. OFFSET
A_1      0.000
#
```

P209
Maximum value for offset compensation

- Via “P209” the maximum offset compensation is determined, which can be corrected per compensation.

Example display on the PHG:

```
ROBI_1          MP SET
P209  MAX.OFFSETCOMP.
A_1      1.000
#
```

P210
Prealarm limit value for offset compensation

- After control run up, the offset compensation values are reset to “0”. In case the entered prealarm limit is exceeded after an offset compensation, a warning is issued under “errors/warnings”. By resetting, the warning is cancelled.

Example display on the PHG:

```
ROBI_1          MP SET
P210 OFFS.COMP.PREA
A_1      5.000
#
```

P211
Main alarm limit value for offset compensation

- In case the limit value under “P211” is exceeded after an offset compensation, an error message is issued under “errors/warnings”; the “Ready”-contact is opened.
  By resetting, the error message is cancelled.
  The “ready” contact is closed again only when the system starts up.

Example display on the PHG:

```
ROBI_1          MP SET
P211 O.COMP. M.ALARM
A_1    10.000
#
```

P212
Presetting for passing -radius and -factors in mm or degrees

- P212 determines, which passing -radius and -factors are effective by program start.
  The BAPS - command “R” overwrites the default values in P212.
  An input value of “0” disables passing.

Example display on the PHG:

```
ROBI_1          MP SET
P212  PASS. DEFAULT
RAD    1.000
#
```

Example display on the PHG:

```
ROBI_1          MP SET
P212  PASS. DEFAULT
FAK    1.000
#
```

P213
Passing-distances in JC in mm or degrees

- P213 determines the passing-distances, on which the factor “R_PTP” (programmable in the BAPS-program) depends on.
  An input of “0” disables passing.

Example display on the PHG:

```
ROBI_1          MP SET
P213  PASS.-DISTANCE
A_1    2.000
#
```

P214
Type of passing

- P214 is used to determine the passing criterion according to which the values in parameter P213 are used.

  Input possibilities:

  Axis criterion = 0
  World criterion = 1

Example display on the PHG:

```
ROBI_1          MP SET
P214  PASS. CRIT. A/R
(0/1)    0
#
```

Caution!
Only has effect with PTP interpolation (see rho3 releases)

3.4 Kinematic parameters

P300	**Kinematic parameters**
P301	**Kinematic name**
P302	**Number of kinematic axes**
P303	**Axis type**
P304	**Axis name**
P305	**Coordinate name**
P306	**Selection of transformation, robot type**
P307	**Axis lengths, angle deviations**
P308	**Axis coupling factors**
P309	**Flange coordinate system/assembly inaccuracies**
P310	**Displacement and rotation of the world coordin. system**
P311	**Modulo value for endless axes**
P312	**Type of axis regulator**

P301
Kinematic name

- Names may consist of up to 12 ASCII characters, whereby the first character must be a capital letter.
  Permitted characters: A...Z, 0...9 and "_".

Example display on the PHG:

```
ROBI_1          MP SET
P301  NAME OF KINEM.
         ROBI_1
#
```

P302
Number of kinematic axes

- A kinematic may consist of up to 18 axes.

Example display on the PHG:

```
ROBI_1          MP SET
P302  NUMBER OF AXES
         1
#
```

P303
Axis type

- There are normal, manual, auxiliary and endless axes with the numbers 0-3.

  0 --> Normal axis
  1 --> Manual axis
  3 --> Endless axis

Example display on the PHG:

```
ROBI_1          MP SET
P303 TYPE OF AXES
A_1      0
#
```

P304
Axis name

- An axis name may consist of up to 3 ASCII characters, whereby the first character must be a capital letter.
  Permitted characters: A..Z, 0..9 and "_".

Example display on the PHG:

```
ROBI_1            MP SET
 P304 AX.NAMES ASCII
 A 1     A_1
 #
```

P305
Coordinate name

- A coordinate name may consist of up to 3 ASCII characters.
  Permitted characters corresponding to 3.4

Example display on the PHG:

```
ROBI_1          MP SET
P305 AX.COORD. ASCII
C 1     A_X
#
```

P306
Selection of transformation, robot type

- Standard transformations are available for various robot types. These can be activated by means of the corresponding identification number.
  Input possibilities:
  Robot type **(the possible robot types depend on the operating system version and can be determined by asking Bosch directly)**

  Referencing all axes (yes/no), yes =1, no =0

  Read POS on coordinate change (yes/no) yes =1, no =0

  IPOS reading setpoint position/actual position. It is possible to choose whether the actual position (yes) or setpoint position is to be stored under BAPS variable POS (yes/no) yes =1, no =0

  Automatic offset compensation (yes/no) yes =1, no =0

  Endless axis in main range (yes/no) yes =1, no =0
  yes: axis positions are between "0" and the value of P311
  no: axis positions are between "−P311" and "+P311"

  WC-axis monitoring (monitoring the axes speed)
  0 = no monitoring
  1 = monitoring with movement stop
  2 = manual mode only, monitoring with axis speed limitation.
  no monitoring in automatic mode
  3 = monitoring with axis speed limitation in manual and automatic modes.

Example display on the PHG:

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
          10
#
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Reference all axis
#         0
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Read POS on coord-ch
#         0
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Read POS: comm./act.
#         0
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Aut. offset-compens.
#         0
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Endl.ax.in mainr.Y/N
#         0
```

```
ROBI_1          MP SET
P306 TYPE OF ROBOT
Monitoring axis WC
#         0
```

P307
Axis length in mm

- The specific axis lengths for the robot kinematic defined in "P306" are entered with parameter "P307".
- Refer to transformation documentation for axis numbering.

Example display on the PHG:

```
ROBI_1          MP SET
P307 LENGTH OF AXIS
Ax.-Length1   445.000
#
```

P308
Coupling factors

- The robot-kinematics coupling factors defined in “P303” are entered in “P308”. They are used to describe the mechanical coupling between individual axes.

Example display on the PHG:

```
ROBI_1          MP SET
P308 AX.-COUPL.FACT.
C-Factor 1      0.000
#
```

P309
Flange coordinate system (assembly inaccuracy)

- Different gripper systems for the robot-kinematics defined in P306 (also off-center) can be applied with “P309”.
- Refer to transformation documentation for the definition of the flange coordinate system.
- The flange coordinate system is defined by 6 parameters (3 positions, 3 orientations).
- The input range is between −100000.0 and +100000.0

Example display on the PHG:

```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__X       0.000
#
```

```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__Y       0.000
#
```

```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__Z       0.000
#
```

```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__O1      0.000
#
```

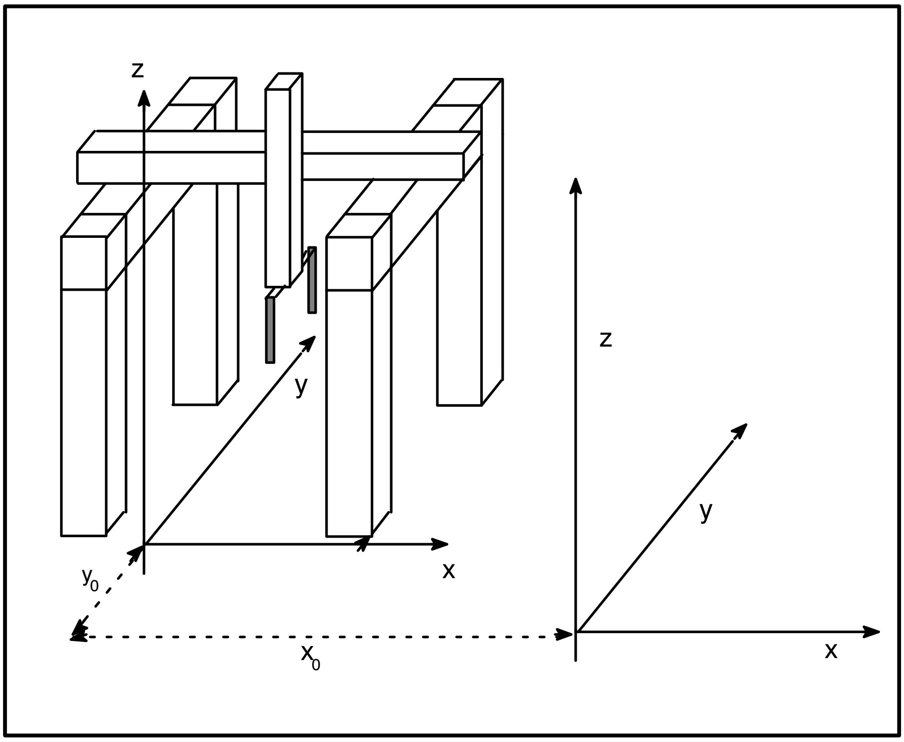
```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__O2      0.000
#
```

```
ROBI_1          MP SET
P309 FLANGE COORDIN.
Flange__O3      0.000
#
```

P310
Displacement of robot assembly position in mm

- The parameter “P310” allows the RC user to shift the world coordinate zero point.

  This facilitates replacement of the robot’s mechanical components.



Example display on the PHG:

```
ROBI_1         MP SET
P310  OFFSET WC-SYST.
X_0            0.000
#
```

```
ROBI_1         MP SET
P310  OFFSET WC-SYST.
01_0           0.000
#
```

```
ROBI_1         MP SET
P310  OFFSET WC-SYST.
Y_0            0.000
#
```

```
ROBI_1         MP SET
P310  OFFSET WC-SYST.
02_0           0.000
#
```

```
ROBI_1         MP SET
P310 OFFSET WC-SYST.
Z_0            0.000
#
```

```
ROBI_1         MP SET
P310  OFFSET WC-SYST.
03_0           0.000
#
```

P311
Modulo value for endless-axes in mm, resp. degrees

- P311 defines the value for the modulo calculation of the control – internal positions. The value is effective only in the case that the corresponding axis is defined as an endless axis via parameter P303.

Example display on the PHG:

```
ROBI_1          MP SET
P311 MOD-VAL ENDL.AX
A_1     1.000
#
```

P312
Type of axis regulator

- P312 defines the regulator type of each axes.

- The following controller types are available:
  0 – P-controller as previously
  1 – open loop-controlled mode
  2 – Lag pre-control

- If open loop-controlled mode is selected as the controller type, parameter 101 is then called. P101 is extended as follows in the case of this "controller type":

  P101 nominal lag
  a) nominal lag (as before)
  b) standardization factor (JOG and AUTOMATIC mode)
  c) creep speed

Example display on the PHG:

```
ROBI_1          MP SET
P312 TYPE OF REGULA.
A_1     0
#
```

3.5 Measuring system parameters

P400	**Measuring system parameters**
P401	**Equipment of measuring system cards**
P402	**Reference point travel direction**
P403	**Activation of reference point switches**
P404	**Number of user-accessible analog outputs**
P405	**Assignment of user-accessible analog outputs**
P406	**Number of user-accessible analog inputs**
P407	**Assignment of user-accessible analog inputs**

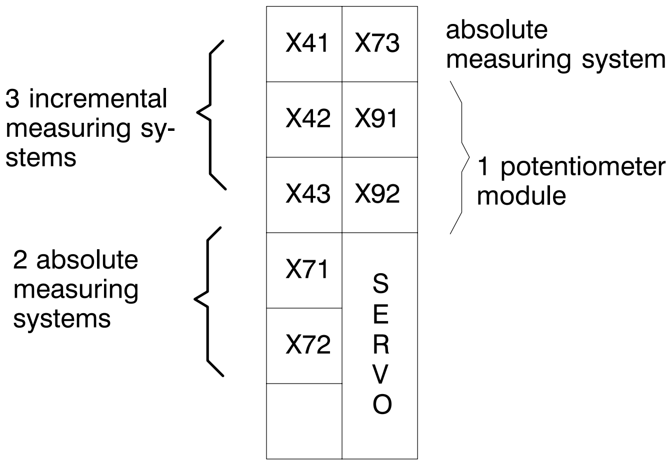
P401
Equipment of measuring system cards

- Every axis, belt and sensor requires a measuring system. The equipped measuring systems are checked during each control “run-up”.
- There are various measuring system cards:
  - ❑ SERVO 6 i with 6 incremental measuring system inputs
  - ❑ SERVO 3 i with 3 incremental measuring system inputs
  - ❑ SERVO 4 i with 4 incremental measuring system inputs
  - ❑ SERVO m9i with 3 absolute measuring system inputs and 6 free module slots
  - ❑ SERVO 8 with 8 incremental measuring system inputs
  - ❑ SERVO 5 with 5 incremental measuring system inputs
  - ❑ modular SERVO
- The permissible servo card combinations are defined in P15
- The modular servo card contains so-called module slots which can be equipped with different measuring systems
- A module number must be specified for each servo card input
- Each incremental and absolute measuring system occupies a module slot
- Potentiometer measuring systems require two module slots located under each other and are designed for connection of up to 12 potentiometers

- Each measuring system possesses a measuring system number or connector number XYZ, e.g. X11
- Identical measuring systems are numbered consecutively. In the case of different measuring systems, numbering starts again with XY1
  Key: X – connector designation
  Y – 1,4,6,7,8,9 dependent upon meas. system
  Z – consecutive number

Example:

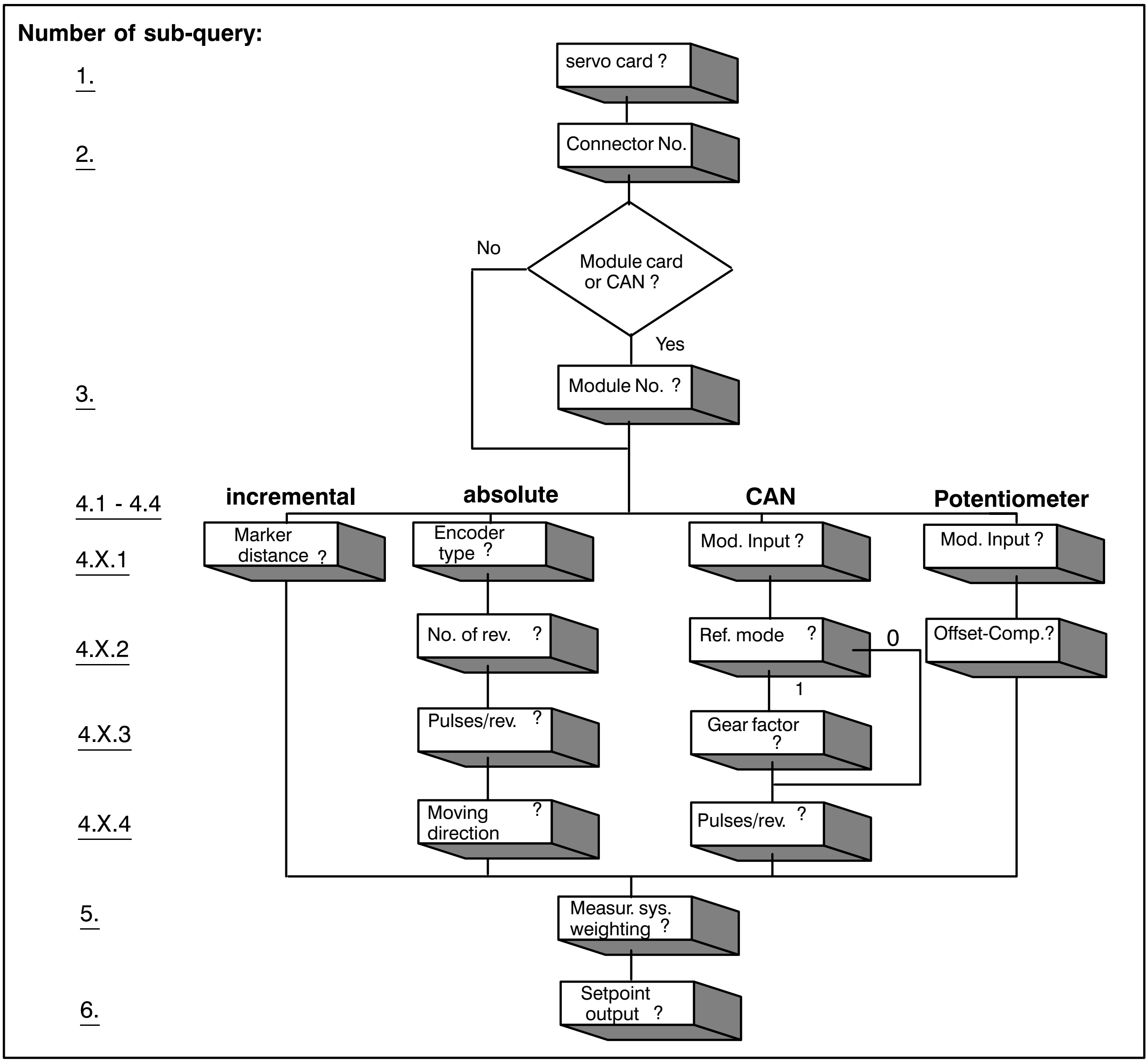
Module card with incremental, cyclically absolute and potentiometer measuring systems.



- The following interrogations are performed for every measuring system, i.e. also for belt measuring systems.

Menu tree for parameter 401

Queries after calling parameter 401 per measuring system



Note: Queries 1 to 3 and 5 and 6 are the same for all encoder types.

Note:

- with **Shift** + ↑↓ it is possible to page axis-by-axis

1 sub-query : servo card

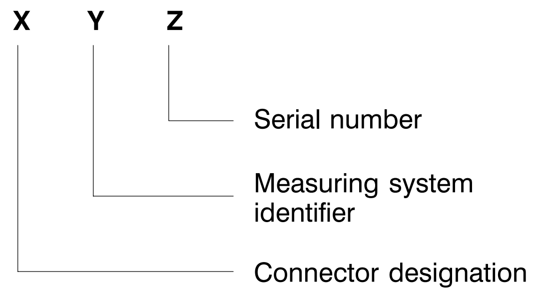
- Input of the number of the installed servo card. The servo card installed furthest left has the number 1. For CAN, the number of the servo card slot assigned under P15 with the CAN interface must be entered.

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 Servo-B.: 1
#
```

2 sub-query : connector number

- The connector number comprises 3 characters, e.g. X11.



The following measuring system identifiers are possible:

1 – **Incremental measuring system – 5-axis card, SERVO 6i –**
Input: e.g. X11...X15

4 – **Incremental measuring system – module card –**
Input: e.g. X41...X48

5 – **CAN measuring system**
Input: e.g. X51...X56

7 – **Absolute measuring system - module card -**
Input: e.g. X71...X78

9 – **Potentiometer measuring system – maximum of 2 modules per 12 measuring system inputs**
Input: X91...X94

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 INC Plug: X11
#
```

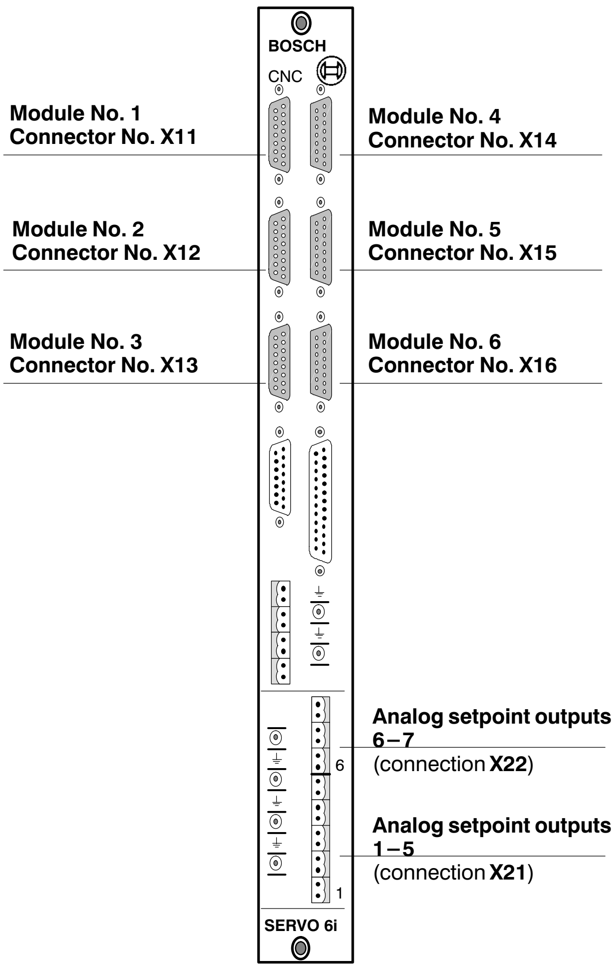
3 sub-query : module number

- For several servo cards: the module number starts again with 1 for each subsequent servo card.
  For potentiometer modules the ascending number of the plug must be entered.
- For CAN the first module number not assigned to other measuring systems must be used.

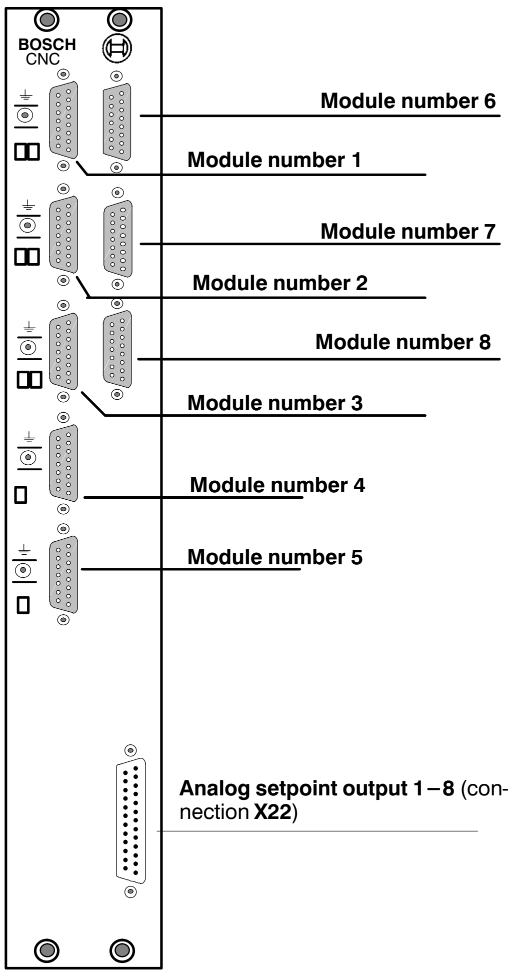
Example display on the PHG:

```
ROBI_1           MP SET
P401 CONST.M.S.BOARD
A_1 INC Module No: 1
#
```

Example :

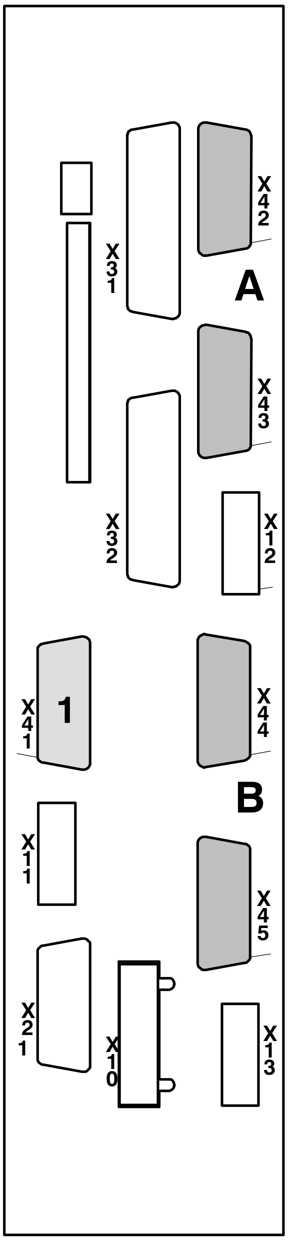


Module numbers and connector numbers for SERVO 6i



Module numbers and connector for SERVO 8 modular

rho 3.0 – assignation of modul numbers to the measuring system connectors



types of rho 3.0								
1	2	3	4	5	6	7	8	9
X42 **2** X43 **3**	X42 **2** X43 **3**	X71 **2** X72 **3**	X71 **2** X72 **3**	X42 **2** X43 **3**	X51 **2**	X42 **2** X43 **3**	X71 **2** X72 **3**	X51 **2**
	X44 **4** X45 **5**		X73 **4** X74 **5**	X71 **4** X72 **5**		X51 **4**	X51 **4**	

Beispiel: X43 – connector number of the measuring system input

3 – modul number for P 401

Different types of rho 3.0:

1	3 Axis INC
2	5 Axis INC
3	1 Axis INC, 2 Axin ABS
4	1 Axis INC, 4 Axis ABS
5	3 Axis INC, 2 Axis ABS
6	6 Axis CAN
7	3 Axis INC, 6 Axis CAN
8	1 Axis INC, 2 Axis ABS, 6 Axis CAN
9	12 Axis CAN

4 sub-query (dependent on measuring system)

4.1 Incremental measuring system

4.1.1 Marker distance

- The measuring system marker distance is the number of pulses between two marker signals.
- **Example:** ROD 420 = 2500 pulses/rev.
- The measuring system marker distance is always “−1” for glass scales.

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 INC Mark-Dist.: 1000
#
```

4.2 Absolute measuring system

4.2.1 Encoder type

- 1 – Stegmann Gray code double transmission.
- 2 – Stegmann binary code double transmission.
- 3 – Stegmann Gray code single transmission.
- 4 – Stegmann binary code single transmission.
- 5 – 8 reserved

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 ABS enc.type:  1
#
```

4.2.2 Number of revolutions

- Refer to the rating plate on the encoder

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 rotations:     64
#
```

4.2.3 Pulses per revolution:

- See rating plate (2^n)

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 puls/rot.:        1024
#
```

4.2.4. Drehrichtung:

- The moving direction for absolute measuring systems is adjusted axis by axis. The function is available with software−version TO07x.

moving direction = 1 : Positive moving direction of the encoder results a positive moving direction in the rho 3.
moving direction = −1: Positive moving direction of the encoder results a negative moving direction in the rho 3.

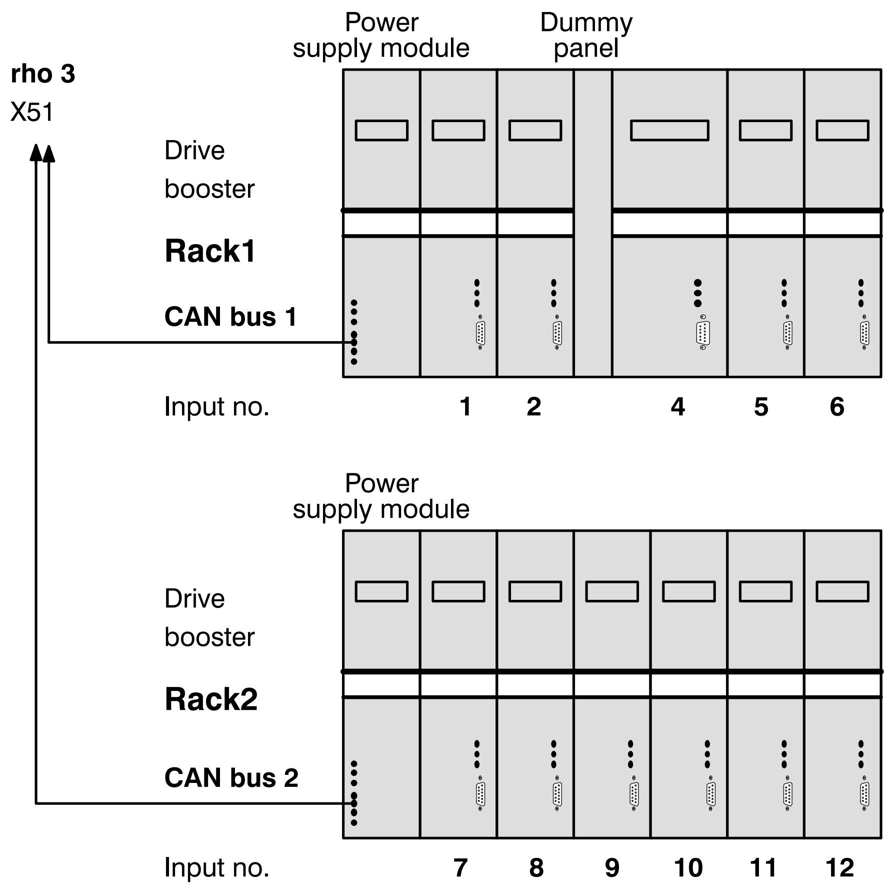
The sign of the measuring system weighting does not influence the moving direction of the absolute measuring systems.

4.3 CAN interface

4.3.1 Module input

- **Allocating axis number −−> input at CAN module when using Servodyn GC:**

This sub−paramter is used to assign the axes to the slots in the Servodyn GC racks. Every CAN bus can be equipped with a drive booster rack; i.e. up to 2 racks can be connected to an rho3 CAN module. The boosters in rack 1 (CAN bus 1) are number consecutively 1..6. The boosters in bus 2 are numbered 7..12. A booster rack can also be connected to bus 2 if bus 1 is not equipped or is only equipped with digital I/O. The booster racks must not be fully equipped. Gaps between the boosters are also permissible. It only has to be ensured that the input numbers correspond to the actual equipping. If a drive booster occupies two slots, the right−hand slot must be entered as an input number for the CAN module input.



Example display on the PH:

```
ROBI_1              MP SET
P401 EQUIP. MEAS. SYS. K
A_1 CAN input: 1
#
```

4.3.2. Reference point travel mode

- MODE = 0
  Reference point travel “normal”.
  Axis travels to next zero crossing of the measuring system after recognising the reference point switch.
- MODE = 1
  Reference point travel “orientation”.
  With some SCARA kinematics, the gripper rotational axis may be able to perform more than one revolution owing to missing mechanical stops. The control must make sure that the gripper axis is first rotated back if reference point travel is started when the gripper has performed such rotation.

The position of the gripper quill is measured by a resolver measuring system on the motor shaft which measures absolutely over 360 degrees when the reference point switch is reached.

It is possible to measure the position of the quill rotated over 360 degrees and the number of rotations from its original position if the motor shaft is rotated via a gear with odd transfer ratio compared with the quill shaft.

- MODE = 2
  Reference point travel “resolver”.
  Axis does not travel to the next zero point after the reference point switch is recognised. When the reference point switch is reached the resolver position is read in and the axis stops immediately.
- MODE = 3
  Combination of MODE 1 and MODE 2

Example display on the PHG:

```
ROBI_1              MP SET
P401 EQUIP. MEAS. SYS. K
A_1 Ref. mode : 0
#
```

- Interrogation follows only if **ref. mode = 1 or ref. mode = 3**
- Input must contain decimal place

Example display on the PHG:

```
ROBI_1              MP SET
P401 EQUIP. MEAS. SYS. K
A_1 Gear fact.:    4.100
#
```

4.3.4. Pulses/revolution

- see drive booster manufacturer instructions.

Example display on the PHG:

```
ROBI_1              MP SET
P401 EQUIP. MEAS. SYS. K
A_1 Pulses/rev.:  16384
#
```

4.4 Potentiometer

4.4.1Module input

- The potentiometer module offers 2x6 analog inputs. The number of the current input (1..6) must be entered here.

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 POT  Input:   7
#
```

- After entry of the input number, you are prompted to enter whether constant offset adjustment of the A/D-converter is to be performed on the potentiometer module.

  0 – no offset adjustment
  1 – constant offset adjustment

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 POT Offs-comp.: 0
#
```

5 Sub-query: measuring system evalution

- The number of encoder increments per degree or mm axis movement must be entered under measuring system weighting.
- **A negative sign for the measuring system weighting factor (MB) means reversal of direction; consequently, rewiring of the encoder is not necessary.**
  Only valid for incremental systems and CAN, not for absolute systems.
- Calculation of the increments per degree or per mm:

  MB = measuring system weighting factor

$$\mathbf{MB} = \frac{\mathbf{Incr}}{\mathbf{distance}}$$

Distance = distance covered per encoder revolution (with gear)

Incr = increments per encoder revolution

- **Pulse quadruplication:**
  The number of encoder pulses must be multiplied by **4** for incremental measuring systems (internal pulse quadruplication).

  Example:
  ROD encoder 2000 pulses/rev.
  Covered distance for 1 ROD revolution = 12.18 mm

  MB = measuring system weighting factor

$$MB = \frac{2000 * 4}{12.18} = 656.81444$$

- The following applies to absolute encoders (potentiometer, SSI after Stegmann):

$$MB = \frac{65536}{distance}$$

- For CAN the following opplies:

$$MB = \frac{\text{Pulse/revolution (see 4.3.4)}}{\text{Distance}}$$

- The encoder accuracy should be 10 times better than demanded at the machine and at least 500 pulses/rev. for motor-flanged encoders.

Example display on the PHG:

```
ROBI_1          MP SET
P401 CONST.M.S.BOARD
A_1 ms.fact:    1000.00
#
```

6 Sub-query : assignment of setpoint outputs

- A setpoint output must be assigned to each servo loop. Numbering must take place consecutively, starting from 1.
- Servo 8: consecutive numbering from 1 to 8

  2 Servo 6i cards:
  Numbering for card 1 : 1-6
  Numbering for card 2 : 1-6

- **For CAN:**
  Numbering only has an internal significance for CAN coupling. Numbering is consecutive and must be performed in ascending order. The actual assignment of the axes is only carried out using axis numbers **(see chapter 4.3.1).**

- **Note:**
  Entering a negative setpoint output turns the setpoint value.

Example display on the PHG:

```
ROBI_1              MP SET
P401 EQUIP. MEAS. SYS. K
A_1 setp. outp: 1
```

Examples for P401

1. Example:

Module servo card with 1 incremental measuring system and 1 analog input. The analog inputs are assigned via P401.

A_1 servo card	: 1	
A_1 INC Plug No.	: X41	(connector number)
A_1 INC Module No.	: 1	
A_1 INC Mark Dist.	: 1000.00	(marker distance)
A_1 INC Ms.Fact.	: 1000.00	(meas. system weighting factor)
A_1 INC Com.output	: 1	(setpoint output)
A_2 servo card	: 1	
A_2 POT Plug. No.	: X91	
A_2 POT Module No.	: 7	
A_2 POT Offs-comp.	: 1	
A_2 POT Input	: 1	
A_2 POT MsFact.	: 1000.00	
A_2 POT Com.output	: 2	

2. Example

Module servo card with 2 absolute encoders and 1 incremental measuring system.

A_1 servo card	: 1
A_1 Plug No.	: X71
A_1 ABS Module No.	: 1
A_1 ABS Encoder Type	: 1
A_1 ABS Rotations	: 64**
A_1 ABS Puls/Rot.	: 1024*
A_1 ABS MsFact.	: 1000.00
A_1 ABS Com.output.	: 1
A_2 servo card	: 1
A_2 Plug No.	: X72
A_2 ABS Module No.	: 2
A_2 ABS Encoder Type	: 1
A_2 ABS Rotations	: 64**
A_2 ABS Puls/Rot.	: 1024**
A_2 ABS MsFact.	: 1000.00
A_2 ABS Com.output	: 2
A_3 servo card	: 1
A_3 INC Plug No.	: X41
A_3 INC Module No.	: 3
A_3 INC Mark Dist.	: 1000
A_3 INC Ms.Fact.	: 1000.00
A_3 INC Com.output	: 3

** Please read off information from Stegmann encoder.

3. Example

rho 3.0 with 3 inkremental measuring systems and 2 absolute encoders.

A_1 servo card.	: 1
A_1 Plug No.	: X41
A_1 INC Module–No.	: 1
A_1 INC Mark Dist.	: 1000
A_1 INC Ms.Fact.	: 1000.00
A_1 INC Com.output	: 1
A_2 servo card.	: 1
A_2 INC Plug No.	: X42
A_2 INC Module No.	: 2
A_2 INC Mark Dist.	: 1000
A_2 INC Ms.Fact.	: 1000.00
A_2 INC Com.output	: 2
A_3 servo card.	: 1
A_3 INC Plug No.	: X43
A_3 INC Module No.	: 3
A_3 INC Mark Dist.	: 1000
A_3 INC Ms.Fact.	: 1000.00
A_3 INC Com.output	: 3

A_4 servo card.	: 1
A_4 Plug No.	: X71
A_4 ABS Module No. .	: 4
A_4 ABS Encoder Type	: 1
A_4 ABS Rotations	: 64*
A_4 ABS Puls/Rot.	: 1024*
A_4 ABS MsFact.	: 1000
A_4 ABS Com.output	: 4

A_5 servo card.	: 1
A_5 Plug No.	: X72
A_5 ABS Module No. .	: 5
A_5 ABS Encoder Type	: 1
A_5 ABS Rotations	: 64*
A_5 ABS Puls/Rot.	: 1024*
A_5 ABS MsFact.	: 1000
A_5 ABS Com.output	: 5

* Please read off information from Stegmann encoder.

4. Beispiel

rho 3.0 mit 6 Achsen CAN und 1 inkrementales Meßsystem.

A_1 servo card.	: 1
A_1 Plug No.	: X41
A_1 INC Module–No.	: 1
A_1 INC Mark Dist.	: 1000
A_1 INC Ms.Fact.	: 1000.00
A_1 INC Com.output	: 1

A_2 Servo card	: 1
A_2 CAN Plug No.	: X51
A_2 CAN Module No.	: 2
A_2 CAN Input No.	: 1
A_2 CAN Ref.–Mode	: 0
A_2 CAN Pulses/Revolution	: 16384
A_2 CAN MsFact.	: 1000.00
A_2 CAN Com.output	: 2

A_3 Servo card	: 1
A_3 CAN Plug No.	: X51
A_3 CAN Module No.	: 2
A_3 CAN Input No.	: 2
A_3 CAN Ref.–Mode	: 0
A_3 CAN Pulses/Revolution	: 16384
A_3 CAN MsFact.	: 1000.00
A_3 CAN Com.output	: 3

A_4 Servo card	: 1
A_4 CAN Plug No.	: X51
A_4 CAN Module No.	: 2
A_4 CAN Input No.	: 3
A_4 CAN Ref.–Mode	: 0
A_4 CAN Pulses/Revolution	: 16384
A_4 CAN MsFact.	: 1000.00
A_4 CAN Com.output	: 4

A_5 Servo card	: 1
A_5 CAN Plug No.	: X51
A_5 CAN Module No.	: 2
A_5 CAN Input No.	: 4
A_5 CAN Ref.−Mode	: 0
A_5 CAN Pulses/Revolution	: 16384
A_5 CAN MsFact.	: 1000.00
A_5 CAN Com.output	: 5
A_6 Servo card	: 1
A_6 CAN Plug No.	: X51
A_6 CAN Module No.	: 2
A_6 CAN Input No.	: 5
A_6 CAN Ref.−Mode	: 0
A_6 CAN Pulses/Revolution	: 16384
A_6 CAN MsFact.	: 1000.00
A_6 CAN Com.output	: 6
A_7 Servo card	: 1
A_7 CAN Plug No.	: X51
A_7 CAN Module No.	: 2
A_7 CAN Input No.	: 6
A_7 CAN Ref.−Mode	: 0
A_7 CAN Pulses/Revolution	: 16384
A_7 CAN MsFact.	: 1000.00
A_7 CAN Com.output	: 7

Wenn CAN−Achsen verwendet werden müssen zuerst die Achsen mit analogem Sollwertausgang (hardwarebezogen) festgelegt werden, bevor die CAN−Achsen auf die verbleibenden Sollwertausgänge verteilt werden.

P402
Reference point of travel direction

- “P402” defines the direction of reference point travel.

−1	=	negative approach direction
+1	=	positive approach direction
0	=	no reference point travel

For potentiometer measuring system:

+1 or −1	−> potentiometer adjustment active
0	−> potentiometer adjustment not active

Example display on the PHG:

```
ROBI_1          MP SET
P402 REFER.DIRECTION
A_1    -1
#
```

P403
Activation of reference point switch

- The evaluation method for the reference point switch is entered with “P403”.

  Input:

  −1 = falling edge of switch
  +1 = rising edge of switch
  0 = no switch (permitted only if P402 = 0)

Example display on the PHG:

```
ROBI_1          MP SET
P403 REF.P. SWITCHES
A_1     1
#
```

P404
Number of user-accessible analog outputs

- Number of analog outputs
  Permissible maximum values:
  number of available outputs − number of axes (P301)

Example display on the PHG:

```
                MP SET
P404  ANALOG-OUTPUTS
A_1     1
#
```

P405
Assignment of user-accessible analog outputs

- Interrogation of parameter P405 occurs automatically if P404 −> 0
- Identifier for assignment of the corresponding output channels.
- There are 5 sub-queries:

1. sub-query : which servo card (1, 2 or 3)?

- Input of the servo card number to which the analog outputs refer.

Example display on the PHG:

```
ANA-Out. 1      MP SET
P405 MEAN. OF A.-OUT
Servo-B.: 1
#
```

2. sub-query : assignment of analog outputs

- The analog outputs which are not required for axis control can be used for analog output of various signals.
  - 1XX : Output of actual position of axis XX (XX = 1..number of axes)
  - 20X : Channel number by which the corresponding output is set in the BAPS program (X = 1..24)
  - 3XX : Output of setpoint position of axis XX (XX = 1..number of axes)
  - 400 + K. No. : Output of setpoint path speed for kinematic No. XX (see description: "Analog signal proportional to setpoint path speed")
  - 450 + K. No. : Output of actual path speed of kinematic XX (only for RTYP = 0, see P306)

    If RTYP = 0, a speed value is also output for PTP interpolation
    – If RTYP # 0, a speed value is output only for LINEAR and CIRCULAR interpolation
  - 5XX : Output of lag for axis XX (XX = axis number)
  - 6XX : Output of setpoint speed of axis XX (XX = axis number)
  - 7XX : Output of actual speed of axis XX or belt XX (XX =1..number of axes + number of belts)

Example display on the PHG:

ANA-Out. 1 MP SET
P405 MEAN. OF A.-OUT
Meaning :ACT-POS A_1
#

3. sub-query : nominal value for analog outputs

- Decimal value which corresponds to an output voltage of 13.3 V (max. output voltage) for offset = 0 V.

  Decimal value =

  – programmed DEC-value for identifier 20X

  – path speed in mm/sec for identifier 4XX

  – speed in mm/sec or mm/degrees for identifier 6XX, 7XX

  – position or lag in mm or degrees for identifiers 1XX, 3XX, 5XX
    Permissible values: 0.01 ... 9999.99

  Example:

  Nominal values for analog outputs

Vpath mm/s	0.00 ? 1330	; 330 mm/sec = > 13.3 V
Dec: 201	0.00 ? 1330	; progr. dec. value 1330 = > 13.3V
Setpt. pos. A_1	0.00 ? 266	; pos. 266 mm or degrees = > 13.3V
Lag A_2	0.00 ? 26.6	; lag 26.6 mm or degrees = > 13.3V

Calculation from dec. (0) and dec. (max.):

Nominal value	=	dec. (max.) – dec. (0)
Dec. (0):	:	Decimal value at which 0 V is to be output
Dec. (max.)	:	Decimal value at which the max. voltage(13.3V)
	:	is to be output.

Example display on the PHG:

```
ANA-Out. 1      MP SET
P405 MEAN. OF A.-OUT
Nom.val.:  1000.00
#
```

4. sub-query : voltage offset

- Output voltage in % of maximum voltage (13.3 V) when decimal value = 0

  Permissible values −9999...9999%

  Example:

  Voltage offset of analog outputs in % of maximum voltage

Vpath mm/s	0.00 ? 5
Dec: 201	0.00 ? 0
ACT_POS A_1	0.00 ? 1
Lag A_2	0.00 ? 5

  Calculation of P119 from DEC (0) and DEC (max.):

Offset	= -Dec. (0)/nominal value * 100
Dec. (0)	= decimal value at which 0 V is to be output
Nominal value	= see 3rd sub-query

Example display on the PHG:

```
ANA-Out.  1      MP SET
P405 MEAN. OF A.-OUT
Volt.off.(%): 10.00
#
```

5. sub-query : output number on the servo card

- The number of the **1st analog-output** on a servo card is the number of the **first setpoint output** which is not occupied by a controlled robot axis.

Example display on the PHG:
(6-axis servo card, 3 axes applied)

```
ROBI_1           MP SET
P405 MEAN. OF A.-OUT
Com.output: 4
#
```

P406
Number of user-accessible analog inputs

- Permissible maximum value: 24

Example display on the PHG:

```
                 MP SET
P406  ANALOG-INPUTS
         0
#
```

P407
Assignment of user-accessible analog inputs

- Channel number via which the corresponding input is addressed in the BAPS program.

  Permissible values: 201 ... 224

  Example:

  Input 1: not used ? DEC: 201
  Input 2: not used ? DEC: 202

Example display on the PHG:

```
ANA-Inp.  1      MP SET
P407 MEAN. OF A.-IN
Meaning :   REAL:201
#
```

3.6 Belt parameters

P500	**Belt parameters**
P501	**Number of belts**
P502	**Belt counter direction**
P503	**Belt coupling factor**
P504	**Maximum traversing distance in belt direction**
P505	**Limit values for belt counter**
P506	**Belt name**
P507	**Belt time offset**
P508	**Belt simulation velocity**

☞ Belt inputs (measuring systems) can be freely seleted. The setting is performed via P401 analogous to the controlled axes. Measuring systems can be assigned several times with belts.
Also, measuring system inputs of controlled axes can be additionally used as belt inputs. This makes it possible to couple several axes via belt synchronisation.
The coupling factor to apply between the axes can be freely selected via P503.

☞ Starting of belt synchronous procedures is carried out via corresponding programming in the BAPS program (see BAPS2 programming instructions).

- **The following parameters can be set for every kinematic!**

P501
Number of belts

- The maximum number of physically existing belts is 8! This total can be distributed to the available kinematics.

Example display on the PHG:

```
ROBI_1          MP SET
P501 NUMBER OF BELTS
           1
#
```

P502
Belt counter direction

- −1: Belt runs in negative direction
- +1: Belt runs in positive direction

Example display on the PHG:

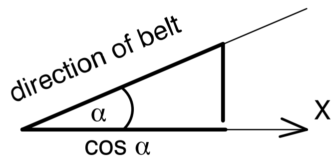
```
ROBI_1          MP SET
P502 DIR. B-COUNTER
BN1     1
#
```

P503
Belt coupling factor

- 1 value per coordinate.
- Specification of the cosine values of the angle included between the belt and the corresponding coordinates.
- or coupling factor between master axis and axis to be coupled (for slave drives)

Example display on the PHG:

```
ROBI_1          MP SET
P503 COUPLING-FACTOR
BN1 A_X    1.000
#
```



P504
Maximum traversing distance

- Max. permissible traversing distance in belt-direction

Example display on the PHG:

```
ROBI_1          MP SET
P504 TRAV.LIM. B-DIR
BN1  5000.00
#
```

P505
Limit values for belt counter

- Min. and max. permissible values for belt counter.

Example display on the PHG:

```
ROBI_1          MP SET
P505 LIM. BELTCOUNT.
BN1 MIN.  −5000.00
#
```

P506
Belt names

- The belt name can be defined offline with up to 12 ASCII characters. Only the first 3 characters can be changed and displayed on the PHG.

Example display on the PHG:

```
ROB_1          MP SET
P506 BELT-NAMES
NAME BELT 1: BN1
#
```

P507
Conveyor time offset

- Positioning errors at a running conveyor, caused by the lags of the affected axis, may be compensated with the conveyor time offset.

  Adjusting the time offset

  - if a axis parallel to the conveyor is present:

  time offset [ms] = nominal lag [mm] / V_{max} [mm/s] * 1000

  nominal lag = nominal lag of the conveyor parallel axis (P101)
  V_{max} = Max. Velocity of the conveyor parallel axis (P103)

  - empiric approvement, if no parallel axis to the conveyor is present:

  1. adjust time offset to 0
  2. position the robot with activated conveyor synchronization and not moving conveyor to a position P1 above the conveyor.
  3. move the conveyor for a short time with a defined speed V_{Conv}
  −−> Point P1 moves to point P1'
  4. measure the distance between P1 and P1'

  time offset [ms] = distance (P1' – P1) [mm] * 1000 / V_{Conv} [mm/s]

Example display on the PHG:

```
ROBI_1         MP SET
P507 BELT TIME OFFS.
BN1     0.000
#
```

P508
Belt simulation velocity

- The rho3 allows – for testing purposes – the execution of belt synchroneous movements without having the belts moving. This is achieved by internal simulation of the belts movements (see also “rho3 signal description” “belt simulation”).

Example display on the PHG:

```
ROBI_1         MP SET
P508 BELT SIM-VELOC.
BN1     0.000
#
```

3.7 Drive parameters (Servodyn GC)

P600	**D r i v e p a r a m e t e r s**
P601	**Perform transfer**
P602	**Drive amplifier type**
P603	**Motor type**
P604	**Proportional value of the speed controller**
P605	**Integral-action time of the speed controller**
P606	**Gain factor of the position controller**
P607	**Torque limit values**
P608	**Emergency stop delay ramp**
P609	**Speed limit values**
P610	**Max. statistic position error**
P611	**Lag error relative to motor speed**
P612	**Filter bandwidth**
P613	**ZETA damping factor**
P614	**Zero shift of the position check-back signal**
P615	**Overtemperature protection on/off**

Transfer of the drive parameters

The drive parameters stored in the rho3 EEPROM are transmitted to the drive amplifiers in the start-up phase.

However, there remains the possibility of direct parameter entry at the drive booster.
Parameters for which a dependency between control and drive exists (e.g.: scanning cycles) or which are already defined in the control (e.g. software limit switches) are defined directly from the existing control parameters).
This specifically refers to:

Communication_Cycle_Period (Prod. no. 4, CLOCK start time)

The value for the rho3 CLOCK start time (P5) is transmitted to the drive boosters as a Communication_Cycle_Period.

Software_Limit_Positions (prod. no. 8 and 9, software limit switch)

The software limit switches for the drive boosters are calculated from the rho3 parameters P204, P205 (software limit switch in MK), P206 (software limit switch tolerance), P207 (reference point actual position) and P208 (reference point offset). Calculation is such, that the limit switch values + tolerances set at the rho3 and converted into [uincs] are transferred to the drive boosters.
Software_Limit_Position = Software limit switch (P205/P206) +– limit switch tolerance (P207)

Automatic_Mode_Velocity_Limit (prod. no. 12, speed limit in automatic mode)

The maximum PTP axis speeds defined in P107 * max. perm. V FACTOR (P119) are converted into [RPM] and transferred as speed limit values in automatic mode to the drive boosters.

Manual_Mode_Velocity_Limit (prod. no. 13, speed limit in manual mode)

The MK jog speeds defined in P114 * max. perm. V FACTOR (P119) are converted into [RPM] and transferred as speed limit values in manual mode to the drive boosters.

Position_Scaling (prod. no. 21, scaling of the actual position check-back signal)

The transfer value for Position_Scaling (1..3) is derived from the value for pulses/rev. entered in P401.

Direction_Flag (prod. no. 23, motor/encoder direction of rotation)

The direction of rotation of the drive is always transferred positively in clockwise direction (Flag=TRUE). A required spindle reverse is carried out within the rho3 (see P401, negative measuring system evaluation).

☞ **Further details on drive parameters may be found in the manual "Bosch Servodyn Operating and Setting up Servodyn GC"**

P601
Perform parameter transfer rho to amplifier

- Determines whether the stored drive parameters should be transferred during the run-up phase of the rho3.

Example display on the PHG:

```
ROBI_1          MP SET
P601 TRANSF.DRIVE PAR
                1
#
```

- Parameter number: 1
- Permissible values: 0/1
- Entry: 0: Transfer cut-out
  1: Perform transfer

P602
Drive amplifier type

- The type of amplifierer for each axis is defined with P602.
- Parameter number: 1 value per axis
- Permissible values: 1..100000
- Entry:

	Booster type BOSCH – designation
1:	SM 3.5/8 GC
2:	SM 4.7/20 GC
3:	SM 6.5/30 GC
4:	SM 18/60 GC

Example display on the PHG:

```
ROBI_1          MP SET
P602 BOOSTER TYPE
A_1             1
#
```

P603
Motor type

- The type of motor for each axis is defined with P603.
- Parameter number: 1 value per axis
- Entry: see example (the motor type may be derived from the Bosch rating plate of the relevant motor).

Example display on the PHG:

```
ROBI_1          MP SET
P603 MOTOR TYPE
A_1      SG-A0.002.091
         SG-#
```

P604
P component V-controller

- The proportional value of the speed controller is entered in P604.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [Nm/(rad/s)]

Example display on the PHG:

```
ROBI_1          MP SET
P604 P COMP.V-CONT.
A_1             0.005
#
```

P605
I component V-controller

- The integral-action time of the speed controller is entered in P605.
- Parameter number: 1 value per axis
- Permissible values: > 0..100000
- Entry: Value in [s]

Example display on the PHG:

```
ROBI_1        MP SET
P605 I COMP.V-CONT.
A_1           0.001
#
```

P606
Gain factor

- The gain factor of the position controller is entered in P606.
- Parameter number: 1 value per axis
- Permissible values: > 0..100000
- Entry: Value in [(rad/s)/rad]

Example display on the PHG:

```
ROBI_1        MP SET
P606 KV POS. CONTROLLER
A_1           200.000
#
```

P607
Current limit values

- The current limit values for the various modes (automatic, manual, emergency stop) are defined in P607.
- Parameter number: 3 values per axis
- Permissible values: >0..100000
- Entry: Value in [A]

Example display on the PHG:

```
ROBI_1        MP SET
P607 MAX.CURRENT
A_1           AUTO: 10.0
#
```

```
ROBI_1        MP SET
P607 MAX.CURRENT
A_1           MANUAL: 5.0
#
```

```
ROBI_1        MP SET
P607 MAX.CURRENT
A_1 EMERGENCY STOP: 5.0
#
```

P608
Emergency stop delay ramp

- P608 is used to determine the delay ramp (how quickly the speed reaches zero in the event of an emergency stop).
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [rad/s^2]

Example display on the PHG:

```
ROBI_1          MP SET
P608 D VALUE EMERGENCY STOP
A_1             200.0
#
```

P609
Braking speed

- The brake is activated only when the speed falls below the limit value entered in P609.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [grd/s or mm/s] related to the machine axis

Example display on the PHG:

```
ROBI_1          MP SET
P609 BRAKE SPEED
A_1             100.0
#
```

P610
Max. statistic position error

- The max. statistic position error for each axis is entered in P610.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [uincs]

☞ **Input “1000” : switch off position error monitoring**

Example display on the PHG:

```
ROBI_1          MP SET
P610 MAX.POS.ERROR
A_1             500
#
```

P611
Max. lag error

- The max. lag error (relative to the motor speed) is entered in P611.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [%]

☞ **Input “400” : switch off lag monitoring**

Example display on the PHG:

```
ROBI_1          MP SET
P611 MAX.LAG ERROR
A_1             200
#
```

P612
Filter bandwidth for torque signal

- The filter bandwidth (in Hz) is defined in P612.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [Hz]

Example display on the PHG:

```
ROBI_1          MP SET
P612 FILTER BANDWIDTH
A_1             500.0
#
```

P613
ZETA damping factor

- The ZETA damping factor of the RMC filter 2nd order for the torque is defined in P613.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value (dimensionless)

Example display on the PHG:

```
ROBI_1          MP SET
P613 ZETA DAMP.FACT.
A_1             0.007
#
```

P614
Zero shift
Position check-back signal

- The zero shift is entered in P614.
- Parameter number: 1 value per axis
- Permissible values: >0..100000
- Entry: Value in [grd]

Example display on the PHG:

```
ROBI_1          MP SET
P614 ZERO SHIFT
A_1             100.0
#
```

P615
Overtemperature protection

- P615 is used to determine whether the overtemperature protection is switched on or off.
- Parameter number: 1 value per axis
- Permissible values: 0/1 (on=1, off=0)
- Entry: Value (dimensionless)

Example display on the PHG:

```
ROBI_1          MP SET
P615 OVERTEMP.PROT.
A_1             1
#
```

- **Note:**
  To an extent, the limit values entered for the drive paramters are greater than the maximum permissible values of the drive boosters. This means that it is also possible to enter values for currently non-existent booster types via the rho3 machine paramter program. Should values be entered in the machine parameter program which are not accepted by the booster concerned, the parameter transmission is aborted with the relevant error message.

4 Parameter overview

GENERAL SYSTEM PARAMETERS					
P1	Number of kinematics				
P2	Machine configuration				
P3	Number of timers/counters (8, 16, 24, 32)				
P4	Parity for INTEGER inputs at interface (0 = none, 1 = odd, 2 = even)				ms
P5	CLOCK start time P2 clock divisor for Servo 6I		servo card 1 =	servo card 2 =	servo card 3 =
P6	Runtime monitoring (ms) [min. 10 * clock]			P1 =	P2 =
P7	Subdivision of user memory (256 k)		System Heap=	EMX Heap=	Prog.Mem.=
P8	Strobe times for INTEGER user output 1 - 8 (ms)	Output 1 =	Output 2 =	Output 3 =	Output 4 =
		Output 5 =	Output 6 =	Output 7 =	Output 8 =
P9	Strobe time for system outputs (ms)				
P10	Selection of language (0 = German, 1 = English)				
P11	Servo board inputs (Servo board 1-3)			No. of Probeln:	No. of HS-Inp.:
P12	Access authorization for machine parameters (1 = modifiable, 0 = not modifiable)				
P13	Times for PIC250 (ms)	Time 1 =	Time 2 =	Time 3 =	Time 4 =
		Time 5 =	Time 6 =	Time 7 =	Time 8 =
		Time 9 =	Time 10 =	Time 11 =	Time 12 =
		Time 13 =	Time 14 =	Time 15 =	Time 16 =
		Time 17 =	Time 18 =	Time 19 =	Time 20 =
		Time 21 =	Time 22 =	Time 23 =	Time 24 =
		Time 25 =	Time 26 =	Time 27 =	Time 28 =
		Time 29 =	Time 30 =	Time 31 =	Time 32 =
P14	Counters for PIC250 (ms)	Counter 1 =	Counter 2 =	Counter 3 =	Counter 4 =
		Counter 5 =	Counter 6 =	Counter 7 =	Counter 8 =
		Counter 9 =	Counter 10 =	Counter 11 =	Counter 12 =
		Counter 13 =	Counter 14 =	Counter 15 =	Counter 16 =
		Counter 17 =	Counter 18 =	Counter 19 =	Counter 20 =
		Counter 21 =	Counter 22 =	Counter 23 =	Counter 24 =
		Counter 25 =	Counter 26 =	Counter 27 =	Counter 28 =
		Counter 29 =	Counter 30 =	Counter 31 =	Counter 32 =
P15	Servo card types (0=none, 1=narrow, 2=wide, 3=Can, 4=6l, 9+rho3.0)		servo card 1 =	servo card 2 =	servo card 3 =
P16	IRDATA stack size				kByte

P17	Direct inputs			1.BAPS BIN .no.:	No. BIN. inputs:	Addr .BIN inputs:
				2.BAPS BIN.no.:	No. BIN. inputs.:	Addr .BIN inputs:
		BAPS INT.-inp.n	no. INT.inputs	val.addr. INT.	str.addrINT	par.addrINT.

GENERAL SYSTEM PARAMETERS

P18	Direct outputs			1.BAPS BIN.no.	no .BIN.outputs	addr.BIN. O...
				2.BAPS BIN.no.	no.B IN.outputs	addr.BIN. O...
		1.BAPS INT.-no	no.INT.outputs	val.addrINT.O .	str.addrINT.O .	par.addrINT.O .
				1.IO-Logic no.	no.IOL outputs	addr IOLogic
P19	Definition of PHG key groups					
P20	I/O module configuration					
P21	Address areas for PLC bit coupling		Input-Start:	Input-End:	Output-Start:	Output-End:
P22	Global limit	Afactor	Minimum value:		Maximum value:	
		Dfactor	Minimum value:		Maximum value:	
P23	Global limit	Vfactor	Minimum value:		Maximum value:	
P24	Delete user outputs				delete to sel. outp.	
P25	Reset behaviour of A/D/V factors				global factors	kin. dep. factors
				BASIC SETTING		
				AUTO ==> MANUAL		
				MANUAL ==> AUTO		
				PROCESS SELECTION		
P26	Memory test at start−up				(on=0, off=1)	
P27	Strobe INTEGER inputs				(with=0, without=1)	
P29	servo card software	(0= normal software, 1= runtime optimised software)		servo card 1:	servo card 2:	servo card 3:
P30	I/O configuration CAN bus				CAN bus 1	CAN bus 2
				Dis. dig. inp. blocks		
				Dis. dig. inp. blocks		
				Baud rate		
P31	Address ranges CAN inputs			Start addr. CAN 1	Block length CAN 1	Identifier CAN 1
			Block 1			
			Block 2			
			Block 3			
			Block 4			
			Block 5			
				Start addr. CAN 2	Block length CAN 2	Identifier CAN 2
			Block 1			
			Block 2			
			Block 3			
			Block 4			
			Block 5			
P32	Address ranges CAN outputs			Start addr. CAN 1	Block length CAN 1	Identifier CAN 1
			Block 1			
			Block 2			
			Block 3			
			Block 4			
				Start addr.. CAN 2	Block length CAN 2	Identifier CAN 2
			Block 1			
			Block 2			
			Block 3			
			Block 4			
P33	rho 3.0 Hardware version				(Stand alone=0, use as PLC board=1)	
P34	rnumber of characters in the serial output buffer				(Standard: 16, possible values: 1 . . 16)	

P 100 SPEEDS				MA_1	MA_2
P101	Required lag (degrees/s or mm/s)				
	stand. factor				
	creep speed				
P102	Maximum path speed in mm/s				
P103	Maximum axis speed PTP in degrees/s or mm/s				
P104	Slope acceleration PTP (degrees/s^2 or mm/s^2)				
P105	Slope point PTP in JC (degrees/s or mm/s)				
P106	Slope point PTP in path mode (mm/s)				
P107	Slope point WC Jog (mm/s)	Block slope			
		Program slope			
P108	Reference point speed (degrees/s or mm/s)				
P109	1st reduced reference point speed (degrees/s or mm/s)				
P110	2nd reduced reference point speed (degrees/s or mm/s)				
P111	Jog speed WC slow (mm/s)				
P112	Jog speed WC fast (mm/s)				
P113	Jog speed JC slow (degrees/s or mm/s)				
P114	Jog speed JC fast (degrees/s or mm/s)				
P115	Incremental steps WC (mm)	Incremental dimension 1			
		Incremental dimension 2			
P116	Incremental steps JC	Incremental dimension 1			
	(degrees or mm)	Incremental dimension 2			
P117	A/D – Slope acceleration for WC Jog (mm/s^2)				
P118	Range limits for	AFACTOR		min: max:	min: max:
		DFACTOR		min: max:	min: max:
P119	Range limits for	VFACTOR		min: max :	min: max:
P120	Selection of slope mode (0=block slope, 1=program slope)				
P121	Selection of slope form (0=ramp, 1=$\sin^2$ t)				
P122	Accel. change times PTP in JC for $\sin^2$ t (m)		**A**		
	Decel. change times PTP in JC for $\sin^2$t (ms)		**D**		
P123	Accel. change times for WC Jog for $\sin^2$ t (ms)		**A**		
	Decel. change times for WC Jog for $\sin^2$ t (ms)		**D**		
P124	Accel. change times for path mode for $\sin^2$ t (ms)		**A**		
	Decel. change times for path mode for $\sin^2$ t (ms)		**D**		
P125	Switch-off time of interpolator stop monitoring in ms				
P126	Switch-off time of standstill monitoring in ms				
P127	<INPOS> range of standstill monitoring				
P128	A/D - Slope Jog in JC		**A**		
			D		
P129	Slope point Jog in JC (degrees/s or mm/s)				
P130	Accel. change times Jog in JC		**A**		
	Decel. change times Jog in JC		**D**		

P 200 POSITIONS		MA_1			MA_2		
P201	<In Position> range in mm or degrees						
P202	Positive software limit switches WC in mm or degrees						
P203	Negative software limit switches WC in mm or degrees						
P204	Positive software limit switches JC in mm or degrees						
P205	Negative software limit switches JC in mm or degrees						
P206	Software limit switch tolerance (degrees or mm)						
P207	Reference point actual value (degrees or mm)						
P208	Reference point offset (degrees or mm)						
P209	Maximum value for offset compensation (degrees or mm)						
P210	Prealarm limit value for offset compensation (degr. or mm)						
P211	Main alarm limit value for offset compensation (degr. or mm)						
P212	Presetting for passing - radius radius						
	and factors (degr. or mm) factor						
P213	Passing distance JC (degr. or mm)						
P214	Passing type (axis criterion = 0, world criterion = 1)						

	P 300 KINEMATIC PARAMETERS	MA_1		MA_2	
P301	Kinematic name (max. 12 ASCII characters)				
P302	Number of kinematic axes				
P303	Axis type (0=normal, 1=manual, 3=endless axis)				
P304	Axis names (max. 3 ASCII characters)				
P305	Coordinate names (max. 3 ASCII characters)				
P306	Selection of robot type (transformation)				
	Reference all axis in case of ambiguity (Y/N)				
	Read POS on coordinate change (Y/N)				
	IPOS reading (0 = setpoint, 1 = actual value) (Y/N)				
	Automatic offset compensation (Y/N)				
	Endless axis in main range (Y/N)				
	Monitoring axis WC (0,1,2,3)				
P307	Axis lengths (mm), angle deviations (mm)				
P308	Axis coupling factors (values between 0.0 and 1.0)	01:	02:	01:	02:
		03:	04:	03:	04:
		05:	06:	05:	06:
		07:	08:	07:	08:
P309	Flange coordinate system or (_X,_Y,_Z)				
	Assembly inaccuracies (_O1,_O2,_O3)				
P310	Displacement and rotation of the (X_0,Y_0,Z_0)				
	world coord. sys. (mm and degr.) (O1_0,O2_0,O3_0)				
P311	Modulo value of endless axis in mm or degrees				
P312	Type of axis regulator				

P 400 MEASURING SYSTEM PARAMETERS		MA_1	MA_2
P401	Equipment of measuring system card with		
	Servo card number		
	connector number		
	module number		
	Encoder type Module input marker distance		
	No. of rev. Ref. mode		
	pulses/rev. gear factor		
	offset-comp. pulses/rev.		
	meas. sys. weighting fac.		
	setpoint output No.		
P402	Direction for reference point travel (−1 = negative, +1 = positive, 0 = none)		
P403	Activation mode of reference point switches (−1 = falling edge, +1 = rising edge, 0 = no switch)		
P404	Number of user-accessible analog outputs		
P405	Assignment of analog outputs		
P406	Number of user-accessible analog inputs		
P407	Assignment of analog inputs		

P 500 BELT PARAMETERS		MA_1	MA_2
P501	Number of belts		
P502	Direction of belt counters		
P503	Belt direction cosine (coupling factor)		
P504	Maximum traversing distance in belt direction (mm)		
P505	Limit values for belt counters (mm) minimum value		
	maximum value		
P506	Belt name (max. 12 ASCII characters)		
P507	Belt time offset		
P508	Belt simulation velocity		

P600 DRIVE PARAMETERS		MA_1			MA_2		
P601	Perform transfer (yes=1, no=0)						
P602	Amplifierer type						
P603	Motor type						
P604	Proportional value speed controller						
P605	Integral−action time speed controller						
P606	Gain factor position controller						
P607	Torque limit values						
	Automatic:						
	Manual:						
	Emergency stop:						
P608	Emergency stop delay ramp						
P609	Speed limit values						
P610	Max. static position error						
P611	Max. lag error						
P612	Filter bandwidth torque signal						
P613	ZETA damping factor						
P614	Zero shift position check-back signal						
P615	Overtemperature protection (on=1, off=0)						

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