

Handbook Position Controller BPC AX/DX

Position Controller BPC

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Position Controller BPC

1.0 General

1.1 General Notes

The BPC Position Controller is an electronically programmable limit switch. Various operating modes can be selected on the membrane key pad. First supply voltage (+24 V DC) must be present on the Controller and the keyboard activated with the "Enable-Input" (+24 V). Turning off the "Enable" signal locks out the keyboard, just as a key switch would. This makes it possible to secure the BPC from unauthorized program changes. If only individual outputs need to be protected, a code can be used to prevent changing the program.

After power is turned on the BPC goes directly into the "RUN" mode, the operating program of the Controllers. In the "RUN" mode the outputs are switched according to the program entered. The program number selected is displayed in the "Function" field [30].

At low rpm's the actual is displayed in the "Value" field (26). At higher slewing speeds, since the value can no longer be read, the message "BPC A" appears in the display. The display threshold lies between - 10 rpm (display change from "BPC A" to actual value) and 25 rpm (display change from actual value to "BPC A"). These figures are valid for a rotary sensor with 1° resolution. For models BPC AX ... E3 there is no threshold. The display in the "Value" field is determined by the "SET 11" condition function.

Caution!

The BPC may only be opened by MP-Elektronik technicians. Unauthorized opening of the unit will void the warranty.

1.2 X-Types

For models with an "X" in front of the maximum resolution, start-up procedures 2.1 to 2.4 must be followed.

Standad-BPC

Example: BPC A X 3600-....

Follow start-up procedures 2.3 to 2.5 !

BPC for 3 Encoders

Example: BPC A X 3600- E3 -....

See procedure in 4.1!

Note!

When substituting the Position Controller **BPC AO...** for **BPC AX...**, please note the different connections X3, 4 in the connection plan.

Position Controller BPC 2.0 Start-Up

2.1 General Note for Start-up

Position Controller with an "X" in the part number are factory set with six programs, 360 step resolution and no program messages.

These versions are fully compatible with the standard types (BPC A 00360).

If a different program number, resolution or program message is required, start-up procedures 2.3 to 2.5 must be carried out. For BPC... E3... procedure 4.1 must also be carried out.

Out of the box, the position controller displays "01 LEER" bzw. "01 null". The output "READY" is not switched on. This condition means that no cam values have been programmed.

—> Enter cam values, then the unit is ready.

The "01 LEER" or "01 null" message also appears when resolution, program number, program number message, or the number of encoders (for BPC ... E3 ...) has been changed.

Position Controller BPC 2.0 Start-Up

2.2 Overview

These parameters must be set before programming the outputs. Each parameters change deletes all cam values.

2.3 Programming Number of Programs	
The number of programs is variable: 4, 6, 8, 16, 32 Programs	SET 6

2.4 Programming Resolution	
The max. number of steps is variable: 150, 180, 200, 256, 300, 320, 360, 500, 512, 720, 750, 1000, 1024, 1250, 1500, 1750, 2000, 2048, 2250, 2500, 2750, 3000, 3200, 3600 steps	SET 5

2.5 Programming Program Message	
Program message yes/no	SET 8

4.1 Programming Number of Encoders (only BPC ... E3 ...)	
The number of encoders used is selectable: 1, 2, 3. Models BPC... E3... are factory set for connecting 3 encoders.	SET 1

fettgedruckt = Werkseinstellung

Attention!

As delivered new, and whenever a change is made with SET 1, SET 5, SET 6 or SET 8, a „for list“ is programmed in the program with the highest possible program number. Before this program is overwritten with its own values, it should be deleted.

Position Controller BPC 2.0 Start-Up

2.3 Programming

"No.of Programs" "SET 6"

Purpose:

The "Tools" function is used for setting the program number on the keypad.

For Standard models, the options are 4, 6, 8, 16 or 32 programs.

"Tools" can be called up only in the "Program" mode. This must always be selected before the sub-function is called up.

Operation:

1. Press [Set] and [06], and then [Enter].
====> "Tools" appears in the "Value" display
If the correct sub-function was not selected, the [Enter] key can be pressed to start a new selection. This is visible from the text "Set" in the "Value" display.
2. By pressing the [Set] key again, the desired sub-function can be entered.
====> the momentarily set number of programs appears in the "Value" display. "Function" display goes dark, and a "t" appears in the "Status" display.
3. Fixed options are given for the "Tools" sub-function (see above). These can be selected with the [+] and [-] keys. The new program number blinks and the previously selected one stays on. Once the correct number blinks, it can be confirmed by pressing the [Enter] key. The new program number now blinks alternating with the question "Sure?".

There are three ways to exit this sub-function:

Pressing the [Set] key returns to the sub-function with no response.

Pressing the [0] key allows one to leave the sub-function with changed number of programs. All cam values are deleted.

====> two periods appear in the "Function" display, a "t" in the Status display, and the new program number in the "Value" display.

Pressing the [Enter] key allows one to leave the sub-function with no change.

Position Controller BPC 2.0 Start-Up

Important:

4. Factory Setting "06 TOOLS"

If this has been changed, the "Store" LED comes on. A blinking decimal point in the "Function" display means that the Output memory is being erased. This takes about 80 sec.

Reason:

By processing the new parameters, the entire Output memory is erased, since new operating conditions are requested!

At the end, either the initialization of the BPC is continued with a new sub-function, or one leaves the sub-function.

5. Final exit from the sub-function is done by pressing the [Enter] key.
==> returns to the "Program" mode.

For Special models, the factory setting corresponds to the requested specifications.

Note:

This setting can only be changed if no Outputs are locked.

Position Controller BPC 2.0 Start-Up

2.4 Programming System Resolution "SET 5"

Purpose:

The "Steps" function is used to set System resolution using the keypad.

The following resolutions (steps) are selectable:

150, 180, 200, 256, 300, 320, 360, 500, 512, 720, 750, 1000, 1024,
1250, 1500, 1750, 2000, 2048, 2250, 2500, 2750, 3000, 3200, 3600.

The "Steps" sub-function can only be called up in the "Program" mode. This must always be selected before the sub-function is called up.

Operation:

1. Press the [Set] and [05] keys and then [Enter].
====> "Steps" appears in the "Value" display.
If the proper sub-function was not selected, a new selection can be entered by pressing the [Enter] key. This is shown with "Set" in the "Value" display.
2. Pressing the [Set] key again then allows entry into the selected sub-function.
====> The "Function" display goes dark. The letter "C" appears in the "Status" display, and the associated value appears in the "Value" display. For models BPC AX ... E3, the [Set] key is used to select the encoder for setting the respective resolutions.
3. Fixed options are given for the "Steps" sub-function (see above). These can be selected with the [+] and [-] keys. The new step number blinks and the previously selected one stays on. Once the correct number blinks, it can be confirmed by pressing the [Enter] key. The new step number now blinks alternating with the question "Sure?".

There are three ways to exit this sub-function:

Pressing the [Set] key returns to the sub-function with no response.

Pressing the [0] key allows one to leave the sub-function with changed number of programs. All cam values are deleted. ====> two periods appear in the "Function" display, a "C" in the "Status" display, and the new System resolution in the "Value" display.

Pressing the [Enter] key allows one to leave the sub-function with no change.

Position Controller BPC 2.0 Start-Up

Important:

4. Factory Setting "C = 360 Steps"

If this is changed, the "Store" LED comes on. A blinking decimal point in the display indicates that the Output memory is being deleted. This takes about 80 sec.

Reason:

By processing the new parameters, the entire Output memory is erased, since new operating conditions are requested!

At the end, either the initialization of the BPC is continued with a new sub-function, or one leaves the sub-function.

5. Final exit from the "Set" function is done by pressing the [Enter] key.
==> returns to the "Program" mode.

Note:

1. If after turning on power the "10 Error" code appears, this indicates that the preset resolution does not agree with the System resolution, or that the code and/or parity function deviate from the model type.

To check the preset resolution, the [Program] key must be pressed while the model type is displayed. The unit now automatically switches to the "Program" mode. Now the "Steps" function can be selected (see par. 1), in order to check or reset the resolution (2 - 5).

If the System shows the wrong code type or false parity function, the measuring System must be replaced or reprogrammed if possible.

2. This setting can only be changed if no Outputs are locked.
3. With BPC A...E3 models, the resolution must be set separately for each encoder. The resolution may be different for different encoders.

Position Controller BPC 2.0 Start-Up

2.5 Programming Message "SET 8"

Purpose:

The "Pro.Nr." function acknowledges the set program number at the last eight connected Outputs.

"Pro.Nr." can be called up only in the "Program" mode. This must always be selected before the sub-function is called up.

Operation:

1. Press the [Set] and [08] keys and then [Enter].
==> "Pro.Nr." appears in the "Value" display.
If the proper sub-function was not selected, a new selection can be entered by pressing the [Enter] key. This is shown with "Set" in the "Value" display.
2. Pressing the [Set] key again then allows entry into the selected sub-function.
==> The "Function" display goes dark. The letter "P" appears in the "Status" display, and the associated operating mode appears in the "Value" display. "P" Stands for program number message.

"Yes" Stands for operating mode "with" program message. "No" Stands for operating mode "without" program message.
3. Two fixed options are given for the "Steps" sub-function. These can be selected with the [+] and [-] keys. The new step number blinks and the previously selected one stays on. Once the correct number blinks, it can be confirmed by pressing the [Enter] key. The new operating mode now blinks alternating with the question "Sure?".

There are three ways to exit this sub-function:

Pressing the [Set] key returns to the sub-function with no response.

Pressing the [0] key allows one to leave the sub-function with changed number of programs. All cam values are deleted.

==> two periods appear in the "Function" display, a "C" in the "Status" display, and the new System resolution in the "Value" display.

Pressing the [Enter] key allows one to leave the sub-function with no change.

Position Controller BPC 2.0 Start-Up

Important:

4. Factory Setting "No" without program message.

If this is changed, the "Store" LED comes on. A blinking decimal point in the "Function" display indicates that the Output memory is being deleted. This takes about 80 sec.

Reason:

By processing the new parameters, the entire Output memory is erased, since new operating conditions are requested!

At the end, either the initialization of the BPC is continued with a new sub-function, or one leaves the sub-function.

5. Final exit from the sub-function is done by pressing the [Enter] key.
==> returns to the "Program" mode.

Note:

This setting can only be changed if no Outputs are locked.

Position Controller BPC

3.0 Programming

3.1 "Program" Mode

Selecting the "Program" [27] mode = Program turns all Outputs off. The "Function" field [30] displays the present program. The "Output" key [23] calls up the Outputs. The number of the selected Output blinks in the "Function" display [30], "Enter" [17] is used to select the Output, and the cam values can now be entered. Pressing the "A" key in "Program" brings the current program number to the display.

The on point can be set with the "Data on" key [21], and the off point with the "Data off" key [18]. The "Status" field [28] displays the corresponding letters "A" for on and "E" for off. By pressing "Enter" [17] the new values are stored in the working memory. This is shown by the "Store" LED [4] Coming on.

The BPC also offers the ability to program multiple set points. Each Output can have up to 15 set points.

To protect certain Outputs from alteration, press the "R1" key [15] to enter a 3-digit code number. There is no limit to the number of Outputs which can be protected against unauthorized access.

The "Display on" [22] and "Display off" [19] keys can allow the entered values to be entered but not changed. If invalid values are entered (e.g. angle values > 359° or unused Outputs), the old value will again appear after "Enter" [17] is pressed. The invalid value is not stored in memory. While in the "Program" mode, pressing the "A" key [20] allows the current program number to be checked in the "Function" field.

Important:

As long as the "Store" LED [4] is on, data are only buffer stored in RAM. If power is interrupted during this time, all data are erased. For non-volatile storage of the data, switch back to the "Run-Mode" [6], the "Store" LED [4] will go out after about 80 sec, and the data is automatically stored. Now power can be interrupted with no loss of data.

Position Controller BPC 3.0 Programming

3.2 Selecting Programs

Programming

* "PROGRAM" [27]

Status Message on BPC

o LED "PROGRAM" [27]
o "01...06/04/08/16/32" [30]
o "Pro." [26]

* "MODULE" [7]

oo 01...06/04/08/16/32" [30]
o "Pro." [26]
o LED "MODULE" [7]
o LED "PROGRAM" [27]

* "01...06/04/08/16/32"[24]
(Program select)

oo "01...06/04/08/16/32" [30]
o "Pro." [26]
o LED "PROGRAM" [27]
o LED "MODULE" [7]

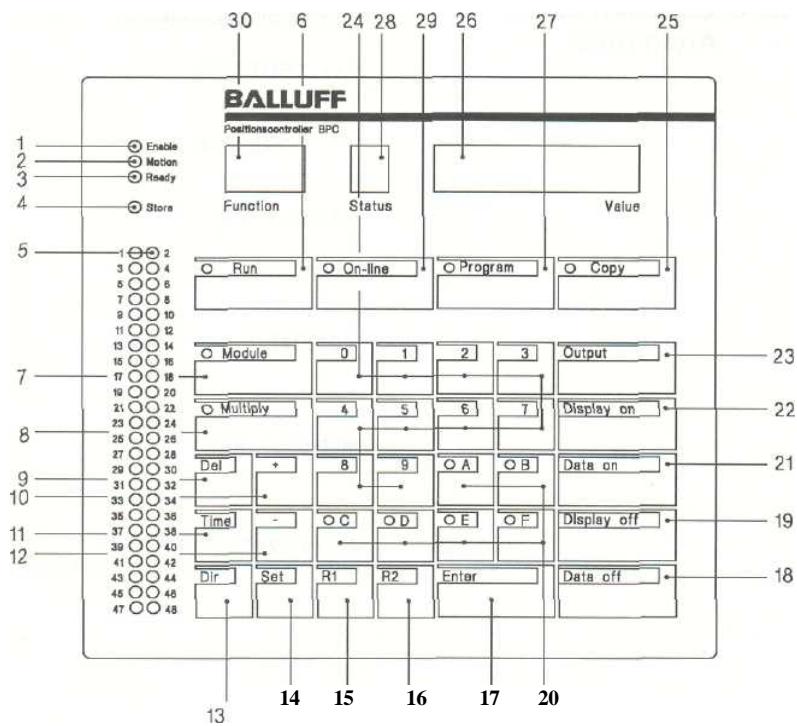
"ENTER"¹¹ [17]

o "01...06/04/08/16/32" [30]
o "Pro." [26]
o LED "PROGRAM" [27]
o LED "STORE" [4]

If an empty program was selected:

o "01...06/04/08/16/32" [30]
o "LEEr" [26] or "null"
o LED "PROGRAM" [27]

Control Panel Legend



* = Press key
oo = Indicator blinks

o = Indicator on
[] = Key number

Position Controller BPC

3.0 Programming

3.3 Selecting Outputs

Programming	Status Messages on BPC
Before selecting an output, carry out programming Stepp 3.2.	
* "OUTPUT" [23]	<ul style="list-style-type: none"> 00 "01..24/48" [30] o "OutP." [26]
* "1...24/48" [24] (Select output)	<ul style="list-style-type: none"> 00 "01..24/48" [30] o "OutP." [26]
* "ENTER" ¹¹ [17]	<ul style="list-style-type: none"> o "01..24/48" [30]
Output not programmed	<ul style="list-style-type: none"> 0 "01. .24/48" [30] 0 "....." [26]
Output programmed	<ul style="list-style-type: none"> o "01..24/48" [30]

3.4 Programming Cams

Before programming a cam, carry out programming steps 3.2 and 3.3.

Programming Cam „ON“

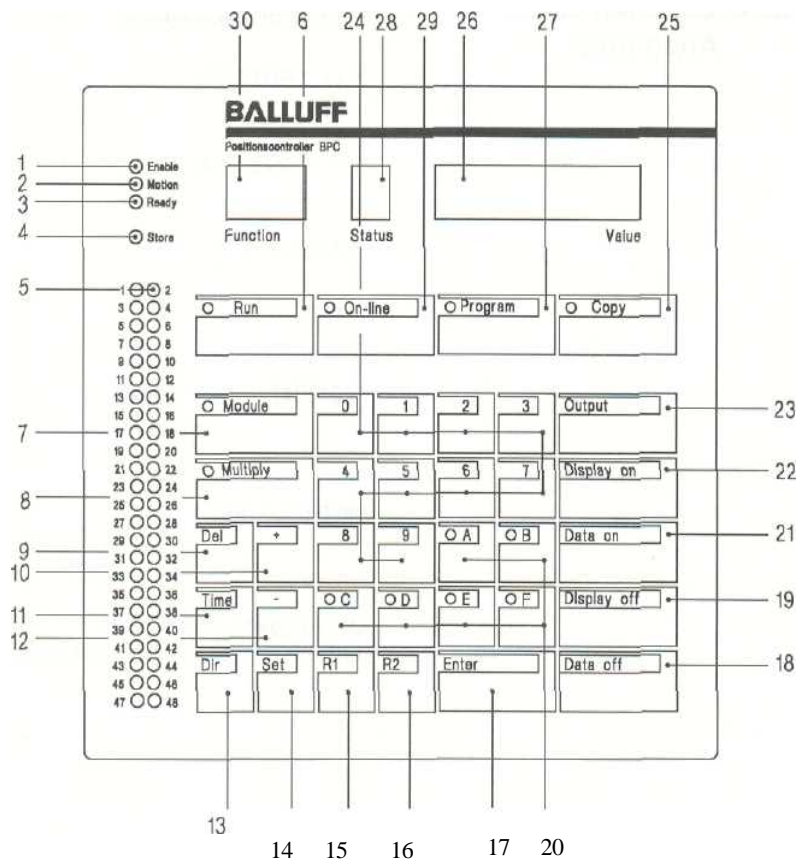
* "DATA ON" [21]	<ul style="list-style-type: none"> o "01. .24/48" [30] o "A" [28]
Output not programmed	<ul style="list-style-type: none"> o " 0.0.0." [26]
Output programmed	<ul style="list-style-type: none"> o "current on value" [26]
* "30" [24] (example)	<ul style="list-style-type: none"> o "030" [26] o "01.24/48" [30] o "A" [28]
* "ENTER" [17] (Value is stored)	<ul style="list-style-type: none"> o "030" [26] o LED "STORE" [4] o "01..24/48" [30] o "A" [28]

Position Controller BPC 3.0 Programming

Programming Cam „OF“

* "DATA OFF" [18]	^o "01..24/48" [30] [∞] "E" [28]
Output not programmed	⁰ " 0.0.0." [26]
Output programmed	⁰ "current off value" [26]
* "60" [24] (example)	[∞] "060" [26] ⁰ "01..24/48" [30] ⁰ "E" [28]
* "ENTER" [17] (value is stored)	⁰ "060" [26] ⁰ LED "STORE" [4] ⁰ "01..24/48" [30] ^o "E" [28]

Control Panel
Legend



Position Controller BPC

3.0 Programming

3.5 Programming Multiple Cams

Programming

Status Message on BPC

Before programming a multiple cam, carry out programming steps 3.2, 3.2,

* "MULTIPLY" [8]	<ul style="list-style-type: none"> ° "01..24/48" [30] o "1" [28] ° LED "MULTIPLY" [8] o LED "STORE" [4]
* "MULTIPLY" [8]	<ul style="list-style-type: none"> o "2" [28] o "..."[26]
* "DATA ON" [21]	<ul style="list-style-type: none"> ° "01. .24/48" [30] o "2" [28] ° "A 0.0.0." [26]
* "70" [24] (example)	<ul style="list-style-type: none"> ° "01. .24/48" [30] o "2" [28] o "A" [26] °° "070" [26] ° LED "MULTIPLY" [8]
* "ENTER" [17]	<ul style="list-style-type: none"> ° "01. .24/48" [30] o "2" [28] o "A 070" [26] o LED "MULTIPLY" [8] ° LED "STORE" [4]
* "DATA OFF" [18]	<ul style="list-style-type: none"> ° "01. .24/48" [30] o "2" [28] o "E 0.0.0." [26] ° LED "MULTIPLY" [8]
* * "90" [24] (example)	<ul style="list-style-type: none"> o "01. .24/48" [30] ° "2" [28] ° "E " [26] °° "090" [26] ° LED "MULTIPLY" [8]
* " ENTER" [17]	<ul style="list-style-type: none"> ° "01. .24/48" [30] o "2" [28] ° "E 090" [26] ° LED "STORE" [4] ° LED "MULTIPLY" [8]

Position Controller BPC 3.0 Programming

To program additional cams, carry out programming steps 3.5 starting with * "MULTIPLY" (second step).

For no additional cams:

* "ENTER" [17]

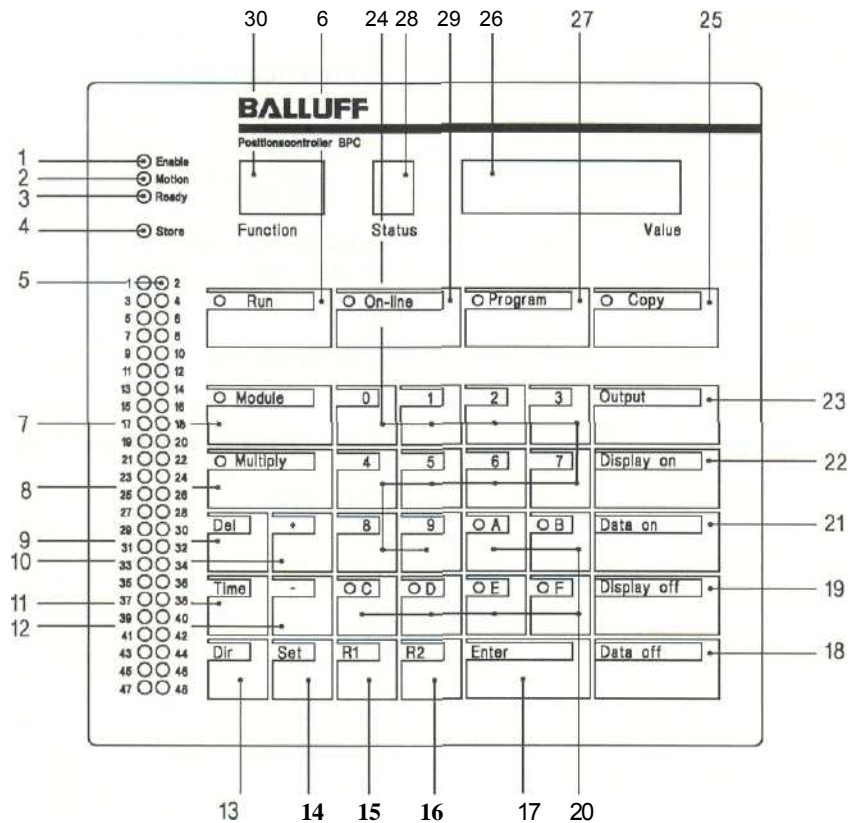
To program an additional output:

* "OUTPUT" [23]

° "01..24/48" [30]

° "OUTP." [26]

Control Panel Legend



* = Press key ° = Indicator on
oo = Indicator blinks [] = Key number

Positions Controller BPC 3.0 Programming

3.6 Locking outputs

It is possible to lock any number of output from access by entering a code number. A 3-digit code-number and the corresponding output must be entered. The LED "STORE" [4] should not be illuminated.

Input Code-Number

Programming	Status Message on BPC
* "PROGRAM" [27] ° "Pro." [26]	o "01...06/04/08/16/32" [30]
**"R1" [15]	°"01"[30] ° "CArE" [26]
* "R1" [15]	o "01" [30] o "COdE" [26]
3-digit code number e.g. * "345" [24]	o "01" [30] °° "345" [26]
* "ENTER" [17]	° "01" [30] ° "345" [26]
* "R1" [15]	o "01" [30] ° o "Pro." [26]

345 is stored as the code number

Locking outputs

* "PROGRAM" [27] o "Pro." [26]	o "01...06/04/08/16/32" [30]
* "R1" [15] o "COdE" [26]	o "01...06/04/08/16/32" [30]
3-digit code number e.g. "345" [24] after 1 sec.	o "YES" [26] o "OUtP" [26]
* "OUTPUT" [23]	oo "01" [30] o "OUtP" [26]

Enter number of output to be locked, e.g. output no.14

* "14" [24]	oo "14" [30] o "OUtP." [26]
* "ENTER" [17]	o "14" [30] o "unloc." [26]
* "R1 ¹¹ [15]	o "14" [30] o "LOC." [26] o LED"STORE" [4]

Position Controller BPC 3.0 Programming

Output 14 is locked for all programs.

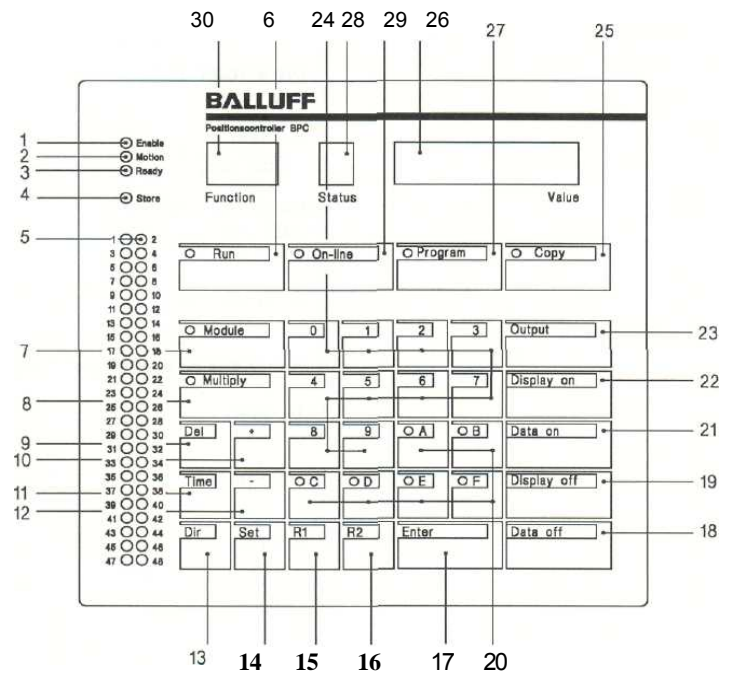
All 24/48 outputs can be locked.

To check which outputs are locked, press the [F] key. The output numbers which are locked will be displayed in sequence.

o "01 ...06/04/08/1

o "01...06/04/08/16/32" [30]
o "Pro." [26]

Control Panel Legend



* = Taste drücken
oo = Anzeige blinkt

o = Anzeige leuchtet
[] = Tastennummer

Position Controller BPC

3.0 Programming

3.7 Unlocking Single Outputs

Programming

* „PROGRAM " [27]

* "R1" [15]

3-digit code number, e.g.

* "345" [24]

after ca. 1 sec

wrong code-Nr.

after ca. 1 sec

* "OUTPUT" [23]

Enter output no. to be unlocked, e.g. no. 14

* "14" [24]

* "ENTER" [17]

* "DEL" [9]

In this way any locked output can be individually unlocked. The same output is unlocked in all programs.

* "ENTER" [17]

Status Message on BPC

o "01...06/04/08/16/32" [30]

o "Pro." [26]

o "01" [30]

o "COdE" [26]

o "01" [30]

o "YES" [26]

o "OUtP." [26]

o "01" [30]

o "no" [26]

o "01" [30]

o "COdE" [26]

oo "01" [30]

o "OUtP." [26]

oo " 14" [30]

o "OUtP." [26]

o "14" [30]

o "LOC." [26]

o "14" [30]

o "unloc." [26]

o LED "STORE" [4]

o "01 ...06/04/08/16/32" [30]

o "Pro." [26]

Position Controller BPC 3.0 Programming

3.8 Unlocking Multiple Outputs

Programming

* "PROGRAM" [27]

**"R 1" [15]

3-digit code number, e.g.
* "345" [24]
after ca. 1 sec

* "DEL" [9]

"0" [24]

"ENTER" [17]

Status Message on BPC

◦ "01...06/04/08/16/32" [30]
◦ "Pro." [26]

◦"01" [30]
◦"COdE" [26]

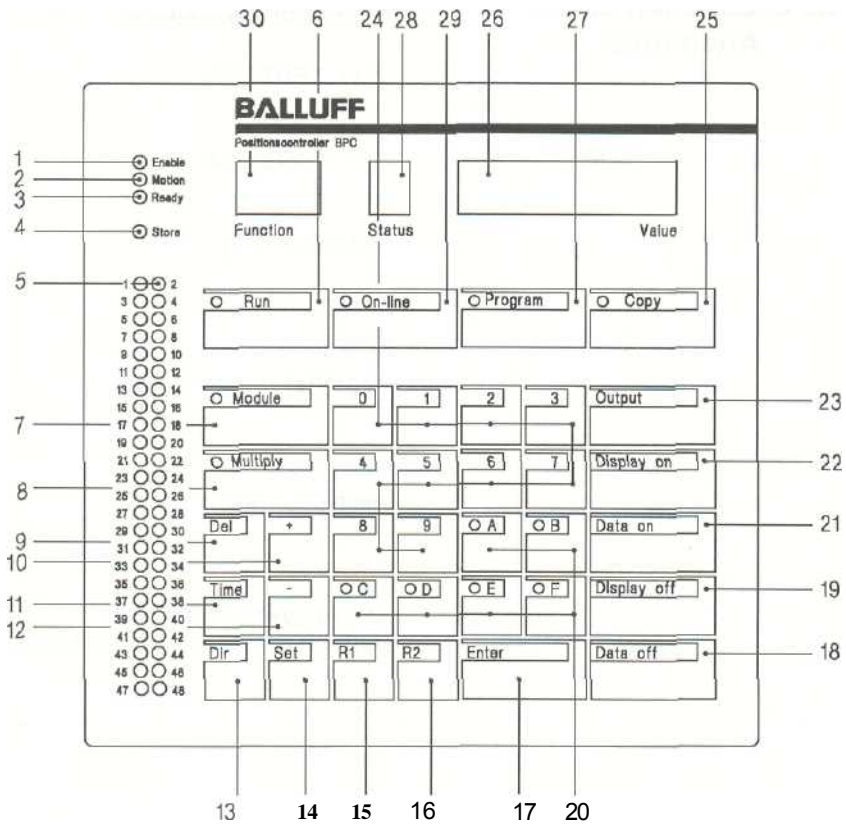
◦ "01" [30]
◦ "YES"[26]
"OUTP." [26]

◦ "ALL" [30] "unloc." [26]

◦ "OUTP." [26]
◦ LED "STORE" [4]

◦ "01...06/04/08/16/32" [30]
◦ "Pro." [26]

Control Panel Legend



Position Controller BPC 3.0 Programming

3.9 Deleting a Program

Programming	Status Message on BPC
* "PROGRAM" [27]	° "01...06/04/08/16/32" [30] ° "Pro." [26]
"MODULE" [7]	°° "01...06/04/08/16/32" [30] ° "Pro." [26]
* "01...06/04/08/16/32" [24] (Select program to be deleted)	°° "01...06/04/08/16/32" [30] ° LED "MODULE" [7]
* "ENTER" [17]	° "01...06/04/08/16/32" [30] ° "Pro." [26]
* "DEL" [9]	°° "dEL" [26] ° "01...06/04/08/16/32" [30]
* "0" [24]	° "dEL" [26] ° "01...06/04/08/16/32" [30] ° LED "STORE" [4]
after ca. 4 sec	° "LEEr" [26] bzw. "null" ° "01...06/04/08/16/32" [30] ° LED "STORE" [4]

The program is deleted.

3.10 Deleting an Output

Before deleting an output, carry out programming steps 3.9 through * "ENTER".

* "OUTPUT" [23]	°° "01..24/48" [30] ° "OutP." [26]
* "1...24/48" [24]	°° "01..24/48" [30] ° "OutP." [26]
* "ENTER" ¹¹ [17]	° "01..24/48" [30]
* "DEL" [9]	° "01..24/48" [30] °° "dEL" [26]
* "0" [24]	°° "01..24/48" [30] ° "dEL" [26] ° LED "STORE" [4]
after ca. 4 sec	°° "01..24/48" [30] ° "OutP." [26] ° LED "STORE" [4]

The output is deleted.
Each output can be individually deleted.

Position Controller BPC 3.0 Programming

3.11 "On-line" Mode (Teach-in, Learn)

In this mode, the Controller automatically selects either "On-line" (Learn) or "On-line" (Teach-In). "Teach-In" is only possible for slow slewing speeds below the threshold of 10 rpm. The "Teach-In" function can not be called up if a program is empty, and can be locked out against unauthorized access, see 5.1.

The "On-line" (Learn) mode is possible at any slewing speed (max. for "Learn" = 100 rpm).

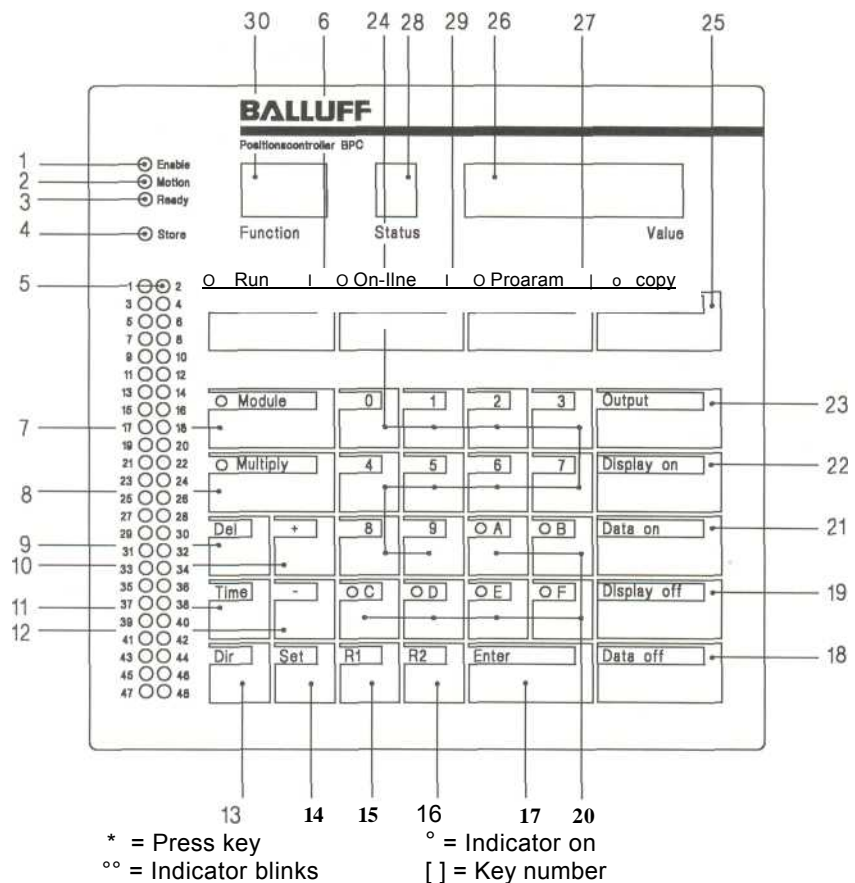
By pressing the "On-line" key [29], the "On-line" mode is called up. After selecting an output, the "Display on" [22] or "Display off" [19] keys can be used to display the stored value of the switch point. To set a new value for the switch point, use the Plus [10]/Minus [12] keys. This value is immediately accepted and valid! Use "Enter" [17] to store the changed value in memory.

At slow slewing speeds (under the threshold) the "On-line" mode is available. Use the "Data on" [21] and "Data off" [18] keys to store the displayed encoder value in the memory of the selected output.

Important:

Overlapping cams can not be changed in on-line mode.

**Control Panel
Legend**



Position Controller BPC

3.0 Programming

3.12 "On-line" Mode (Teach-in)

"Teach-in"-programming can only be done in the selected program. To make changes in another program, the "Program" mode must first be used to select the new program (see 3.2).

3.13 Selecting Outputs

Programming

Status Message on BPC

* "ON-LINE" [29]	<ul style="list-style-type: none"> ◦ LED "READY" [3] ◦ "ON" [30] "-" [28] "LinE" [26]
* "OUTPUT" [23]	<ul style="list-style-type: none"> ◦ LED "READY" [3] ◦ "01..24/48" [30] ◦ " current encoder value" [26]
* "ENTER" [17]	<ul style="list-style-type: none"> ◦ LED "READY" [3] ◦ "01..24/48" [30] ◦ " current encoder value" [26]

3.14 Changing Cams (Teach-in)

Before changing a cam (teach-in), carry out program steps 3.13.

Changing Cam „ON“

If "LOC" appears in the display [26], the funktion is locked against unauthorized access (see 5.1).

* "DATAON" [21] (displayed value [26] is stored)	<ul style="list-style-type: none"> ◦ LED "READY" [3] ◦ "A" [26] ca. 1 sec. ◦ "current encoder value" [26] ◦ LED "STORE" [4]
--	---

Changing Cam „Off“

* "DATA OFF" [18] (displayed value [26] is stored)	<ul style="list-style-type: none"> ◦ LED "READY" [3] ◦ "E" [26] ca. 1 sec. ◦ " current encoder value " [26] ◦ LED "STORE" [4]
"ENTER" [17]	<ul style="list-style-type: none"> ◦ "ON" [30] "-" [28] "LinE" [26] ◦ LED "READY" [3] ◦ LED "STORE" [4]

Positionscontroller BPC 3.0 Programming

3.15 Changing Additional Cam

Programming

Status Messages on BPC

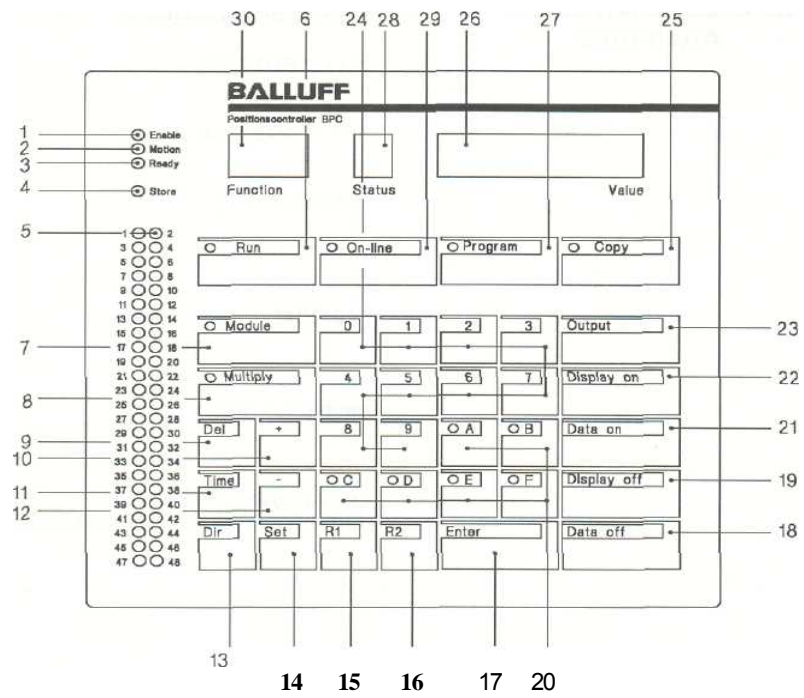
Before changing additional cams, carry out program steps 3.13 starting with * "OUTPUT".

3.16 Leaving "On-line"

* "RUN" [6]

- o LED "READY" [3]
- o LED "STORE" [4] ca. 2 - 10 sec
- o "current encoder value" [26]

Control Panel Legend



* = Press key o = Indicator on
oo = Indicator blinks [] = Key number

Position Controller BPC

3.0 Programming

3.17 "On-line" Mode (Learn)

"Learn"-programming can only be done in the selected program. If changes in a different program need to be made, first the "Program" mode must be used to select the new program (see 3.2).

3.18 Selecting Outputs

Programming

Status Message on BPC

* "ON-LINE" [29]

- LED "READY" [3]
- "ON" [30] "-" [28] "LinE" [26]

* "OUTPUT" [23]

- LED "READY" [3]
- ⁰⁰ "01..24/48" [30]
- "current encoder value" [26]

* "ENTER" [17]

- ⁰ LED "STORE" [4]
- "01..24/48" [30]
- " current encoder value" [26]

3.19 Changing Cams (On-line)

Before changing a cam (on-line), carry out programming steps 3.18.

Änderung Nockenanzug

* "DISPLAY ON" [22]

- "01..24/48" [30]
- "current cam on value" [26]
- "A" [28]

* "+" [10] or "-" [12]

- ⁰⁰ "cam value change" ± [26]

* "ENTER" [17]

- "01..24/48" [30]
- " current encoder value " [26]
- LED "STORE" [4]

Changing Cam „Off“

* "DISPLAY OFF" [19]

- "01..24/48" [30]
- " current cam on value " [26]
- "E" [28]

* " + " [10] oder "-" [12]

- ⁰⁰ "cam value change" ± [26]

* "ENTER" [17]

- "01..24/48" [30]
- " current encoder value " [26]
- LED "STORE" [4]

Position Controller BPC 3.0 Programming

3.20 Changing Additional Cam

Programming

Status Messages on BPC

Bevor changing additional cams, carry out of programming steps 3.18 starting with * "OUTPUT".

3.21 Leaving "On-line"

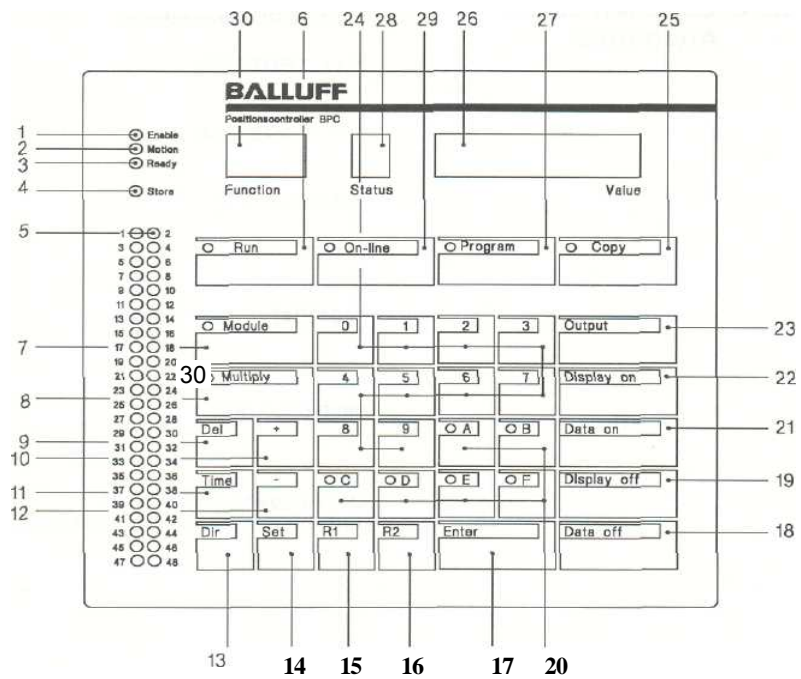
- * "ENTER" [17]
- * "RUN" [6]

- o "ON" [30] "-" [28] "Line" [26]
- o " current encoder value " [26]

Note:

Data is now safely stored.

Control Panel Legend



* = Press key
oo = Indicator blinks

o = Indicator on
[] = Key number

Position Controller BPC 3.0 Programming

3.22 "Copy" Mode

The "Copy" function permits an already existing program to be copied. If the differences between an existing program and the new one are only minor, the existing one can be copied and then changed without having to rewrite an entire program. If there are locked outputs, the "Copy" function will be also locked.

3.23 Copying a Program

Programming	Status Messages on BPC
* "PROGRAM" [27]	<ul style="list-style-type: none"> ° "01...06/04/08/16/32" [30] ° "Pro." [26]
"MODULE" [7]	<ul style="list-style-type: none"> °° "01...06/04/08/16/32" [30] ° "Pro." [26] ° LED "MODULE" [7]
* "01...06/04/08/16/32" [24] Program to be copied	<ul style="list-style-type: none"> °° "01...06/04/08/16/32" [30] o "Pro." [26] o LED "MODULE" [7]
* "ENTER" [17]	<ul style="list-style-type: none"> o "01...06/04/08/16/32" [30] ° "Pro." [26]
* "COPY" [25]	<ul style="list-style-type: none"> ° "01...06/04/08/16/32" [30] o "- -" [26]
* "01...06/04/08/16/32" [24] Program to be copied to	<ul style="list-style-type: none"> ° "01...06/04/08/16/32" [30] ° "- -" °° "01...06/04/08/16/32" [26]
"ENTER" [17]	<ul style="list-style-type: none"> o "01...06/04/08/16/32" [30] ° "Pro." [26] o LED "STORE" [4]

The copied program is set in the controller.

Position Controller BPC 3.0 Programming

3.24 Changing Cams

Programming

Status Messages on BPC

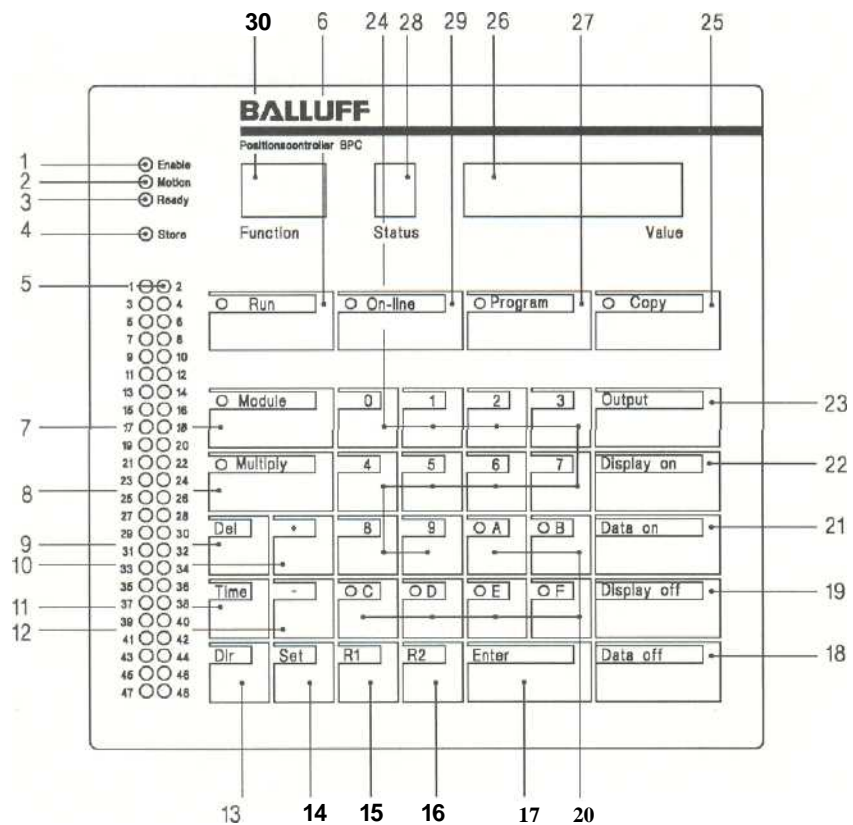
return to 3.3 selecting outputs

3.25 Run Mode

* "RUN" [6]

- o " current encoder value " [26]
- o LED "STORE" [4] ca. 2 - 10 sec.
- o LED "RUN" [6]

Control Panel Legend



Position Controller BPC 3.0 Programming

3.26 Hand-Mode "SET 9" This sub-function is used to switch the outputs as often as desired when the machine is stopped ("Ready" is off).

Programming	Status Messages on BPC
* "PROGRAM" [27]	° "01...06/04/08/16/32" [30] ° "Pro." [26]
**"SET" [14]	⁰ "SEt" [26]
* "9" [24]	⁰ "SEt" [26] ⁰⁰ "09" [30]
* "ENTER" [17]	⁰ "HAnd" [26]
* "SET" [14]	O "H" [28]
* "OUTPUT" [23]	⁰⁰ "01...24/48" [30] o "H" [28]
* "0...9" [24] (Output selection)	⁰⁰ "01...24/48" [30] o "H" [28]
* "ENTER" [17]	⁰⁰ "01...24/48" [30] O "H" [28]

The selected output is switched off

* "DATAON" [21]	° "01...24/48" [5] ⁰ "01...24/48" [30] o "H" [28] O "on" [26] ca. 1 sec
-----------------	---

The selected output is switched off

* "DATA OFF" [18]	o "01...24/4[30] o "H" [28] ⁰ "oFF" [26] ca. 1 sec
-------------------	---

Position Controller BPC 3.0 Programming

3.27 Leaving Hand-Mode

Programming

- * "ENTER" [17]
- * "0" [24]

Status Messages on BPC

- oo "dEL" [26]
- o "SEt" [26]

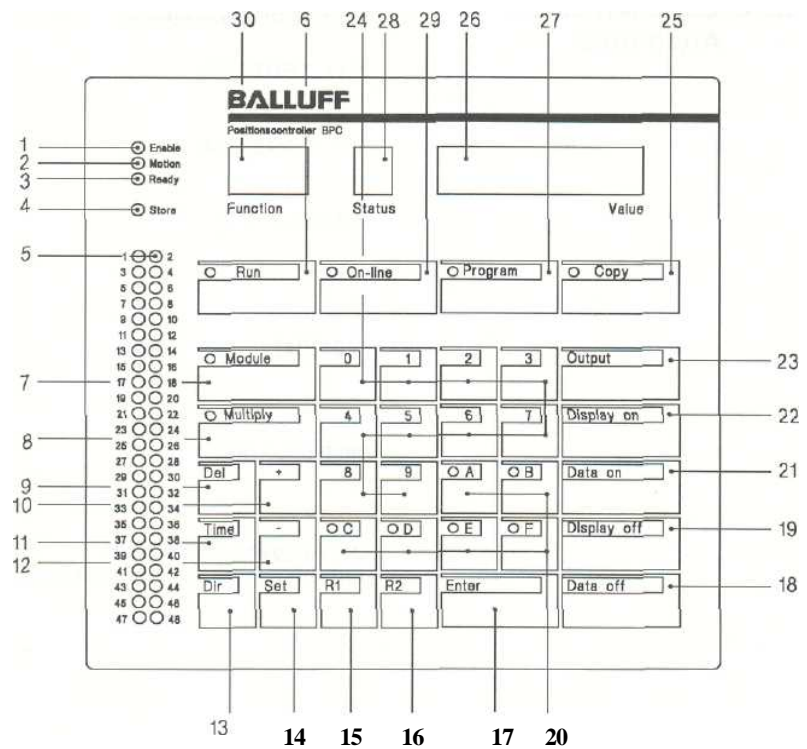
Pressing key [0] turns off all outputs which were turned on in "Hand-Mode"

- "ENTER" [17]
 - o "01 ...06/04/08/16/32" [30]
 - o "Pro" [26]

If [Enter] is pressed while the "dEL" display is blinking, the BPC will stay in "Hand-Mode".

o "H" [28]

Control Panel Legend



* = Press key
oo = Indicator blinks

o = Indicator on
[] = Key number

Position Controller BPC 4.0 Options

4.1 Connecting 3 Encoders to a BPC...E3... "SET1 "/"SET 2"

Version BPC...E3... permits up to 3 encoders to be connected. This allows 3-axis control, for example.

The encoders are connected to the BPC...E3... through a BPC-Exp 01 Expander Module, and require a select input.

The time between the select signal and presence of data cannot exceed 100 μ s. This requirement is met by encoders in the BRG-C 5 series (see pulse diagram).

Distribution of Outputs to the encoders:

	at 1 Encoder	at 2 Encoders	at 3 Encoders
1. third of Outputs	Encoder 1	Encoder 1	Encoder 1
2. third of Outputs	Encoder 1	Encoder 2	Encoder 2
3. third of Outputs	Encoder 1	Encoder 2	Encoder 3

The actual value of the selected encoder is always displayed. If "10 Error" appears on an E3 version with only one encoder, the likely cause is that the unit is set for Operation with two or three encoders.

Help:

Program correct number of encoders.

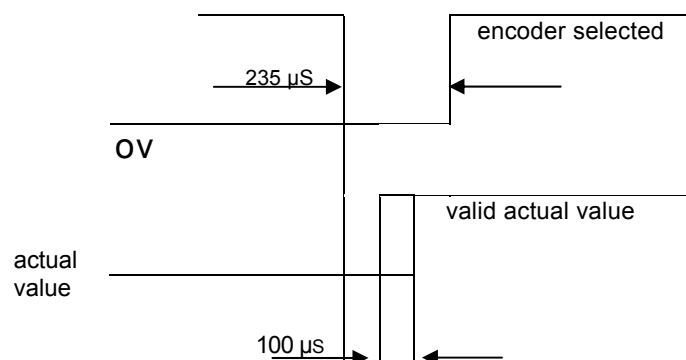
If the function "Pro.Nr." (program reply) is set on BPC..E3.. versions, the Output Lwk is always controlled by Encoder 1.

Factory settings are as follows:

- 3 encoders selected
- First encoder is displayed
- 6 Programs
- no program message
- 360 Steps
- Actual encoder value constantly displayed

Pulse diagram: Select and actual values

Select 1030 V



0 V on Select means: encoder selected.

Position Controller BPC 4.0 Options

Programming Number of Encoders "SET 1"

Purpose: The number of connected encoders is input.

The programming of "No. of Encoders" can only be done in the "Program" mode. This must always be selected before the "Encoder Display" is programmed.

Operation:

1. Press [Set] and [01], then [Enter].
==> "Enc" appears in the "Value" display.
If the proper sub-function was not selected, the [Enter] key can be pressed to initiate a new selection. This is visible as "Set" in the "Value" display.
2. Pressing the [Set] key again permits entry into the selected help function.
==> The "Function" display goes dark. A "1" appears in the "Status" display, and "Enc 3" appears in the "Value" display (the "1" blinks).
The "1" means that in Operation, the present encoder value for encoder 1 is displayed. The "3" means that the device is set for Operation with 3 encoders.
3. There are three possibilities for the help function "No. of Encoders".
These can be selected using the [+] or [-] keys. When the selection has been made, the blinking display is confirmed by pressing the [Enter] key.
The new encoder number now blinks alternating with the question "Sure?".

There are three ways to exit this function:

Pressing the [Set] key returns to the help function with no action.

Pressing [0] exits the help function with changed resolution. All set-point values are deleted.

==> Two decimal points appear in the "Function" display. The "Status" display goes dark, and the new encoder number appears in the "Value" display (1, 2 or 3).

Pressing [Enter] exits the help function with no change.

Note:

If the encoder number is changed, the encoder display "SET 2" will automatically be set to encoder no. 1.

Position Controller BPC 4.0 Options

Connecting 3 Encoders to a BPC...E3...

"SET1 "/"SET 2"

Programming Encoder Display in "Value" Display "SET 2"

Purpose: Selects which encoder to be displayed.

The programming of "Encoder Display" can only be done in the "Program" mode. This must always be selected before the "Encoder Display" is programmed.

Operation:

1. Press [Set] and [02], then [Enter].
==> "Enc" appears in the "Value" display.
If the proper sub-function was not selected, the [Enter] key can be pressed to initiate a new selection. This is visible as "Set" in the "Value" display.
2. Pressing the [Set] key again permits entry into the selected help function.
==> The "Function" display goes dark. A "1" appears in the "Status" display, and "Enc 3" appears in the "Value" display (the "1" blinks). The "1" means that in Operation, the present encoder value for encoder 1 is displayed. The "3" means that the device is set for Operation with 3 encoders.
3. Pressing the [+] and [-] keys permits selection of 1, 2 or 3. The digit will appear in the "Value" display.
==> Press [Enter] to end programming the encoder display.
If the encoder number is greater than the number of connected encoders, encoder no. "1" will automatically be set.
==> "Set" appears in the "Value" display.
If an additional number is pressed on the keyboard, additional sub-functions can be programmed.
To leave the sub-function, press [Enter]. This returns to the "Program" mode.

Note:

1. For each program, a different encoder can be selected for this display.
Standard: Encoder 1
2. If an empty program is selected, "SET 2" is blocked.
3. In the "ONLINE" mode, a blinking output number in the "Function" display will show which encoder is selected.
If the output number is acknowledged by pressing [Enter], the corresponding encoder (corresponds to the Output number) is displayed.

Position Controller BPC

4.0 Options

4.2 Dynamic Cam Function "SET 3"

Purpose: Permits input of up to 6 hold-off times.

This function is called "DELAY", and is a sub-function of the "Program" mode. With this function, up to six velocity-dependent Output groups can be programmed with up to eight Outputs each. This means up to six different 'hold-off times' can be set. These hold-off times are the switching delay times of subsequent blocks. Input is in ms, whereby the maximum hold-off time is 255 ms.

Characteristics:

- The velocity calculation is done continuously.
- The complete output function (turn-on and turn-off) is corrected.
- The correction is done in complete steps, referenced to the set resolution.
- The accuracy of the correction is $\pm 1/2$ step.

This means that the effect of a correction can vary by the time of a Single step, because the BPC rounds off when calculating the correction value (only full steps can be corrected).

Operation:

1. Press [Program].
Press [Set], [03], and [Enter] in that order.
====> "Delay" appears in the "Value" display.
2. If an incorrect sub-function was selected, press [Enter] to initiate a new selection. This is indicated with "Set" in the "Value" display.
Pressing [Set] again actually gains entry into the selected help function.
====> "01" appears in the "Function" display (Group number).
====> "d" appears in the "Status" display (designator for delay time).
====> The corresponding value in ms appears in the "Value" display.

01 Stands for Group 1, i.e. Outputs 01 - 08
02 Stands for Group 2, i.e. Outputs 09 - 16
03 Stands for Group 3, i.e. Outputs 17 - 24
04 Stands for Group 4, i.e. Outputs 25 - 32
05 Stands for Group 5, i.e. Outputs 33 - 40
06 Stands for Group 6, i.e. Outputs 41 - 48

3. The hold-off time is set with the tens key and acknowledged with [Enter].

Position Controller BPC

4.0 Options

Dynamic Cam Function "SET 3"

4. The [Set] key is used to select the next group. The corresponding time is set with the tens key and acknowledged with [Enter]. The [Set] key allows the group selection to scroll, so that checking the programmed hold-off time is possible.

If the [Enter] key is pressed during this sub-function, the input of the hold-off times is ended.

==> "Set" appears in the "Value" display.

Pressing [Enter] leaves the "Set" function and returns to the "Program" mode.

Important:

Factory setting "without hold-off".

Diagrams 1 and 2 refer to a system resolution of 360 Steps. Both diagrams show typical correction values. Any deviations which are caused by correction value changes are not considered.

Diagram 1 shows for various hold-off times at which slewing speed the minimal correction amounts to one step.

Diagram 2 shows for various hold-off times up to which slewing speed the correction is the same as the resolution.

Be sure that before starting up the dynamic cam function, the function of the measuring system (linear or rotary) is correctly set (see 5.2).

Position Controller BPC

4.0 Options

Hold-off time, correction value, slewing speed, traverse velocity

Slewing speed – rotary encoder
Traverse velocity – linear transduce

t_v = Hold-off time [ms]
 s = correction value [steps]
 n = slewing speed [1/min]
 A = system resolution [steps]

Using a known correction value, the hold-off time to be set is calculated.

$$t_v = \frac{60.000 \times s}{n \times A}$$

Using a known slewing speed and hold-off time, the correction value is calculated.

$$s = \frac{t_v \times n \times A}{60.000}$$

n_{min} = minimum slewing speed
begin correction [1/min]

n_{max} = maximum slewing speed
correction steps same as system resolution [1/min]

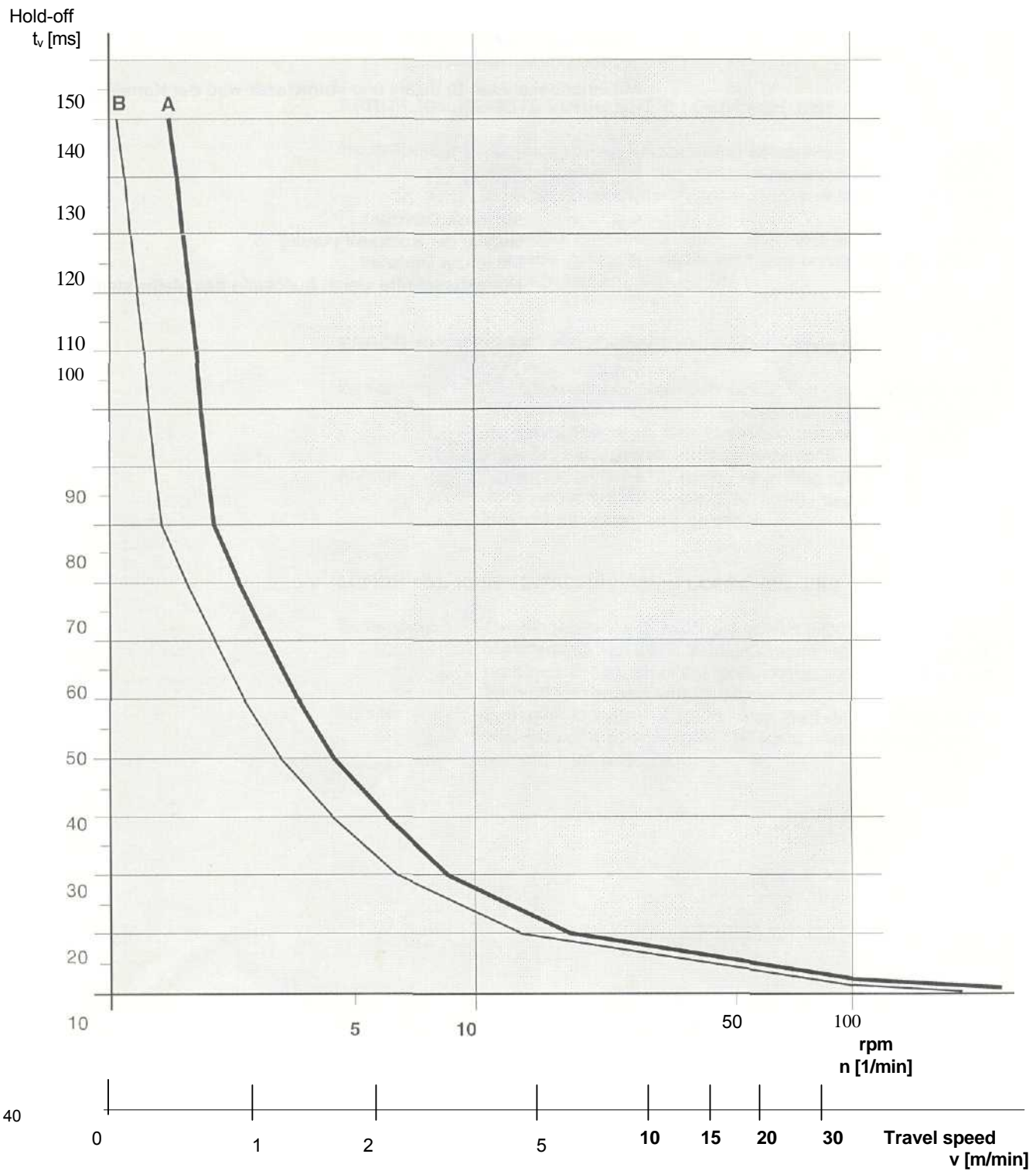
$$n_{min} = \frac{120.000}{A \times t_v \times 2}$$

$n_{max} = n_{min} \times A$

Position Controller BPC 4.0 Options

Dynamic Cam Funktion "SET 3"

Diagram 1 shows the typical relationship between hold-off time t_v and the beginning of correction.
Curve A shows the theoretical response, Curve B shows the actual response.
Correction rounding to whole steps occurs at 60 % of a step.
For rotary motion assume 1° resolution. For linear motion assume 1mm resolution.

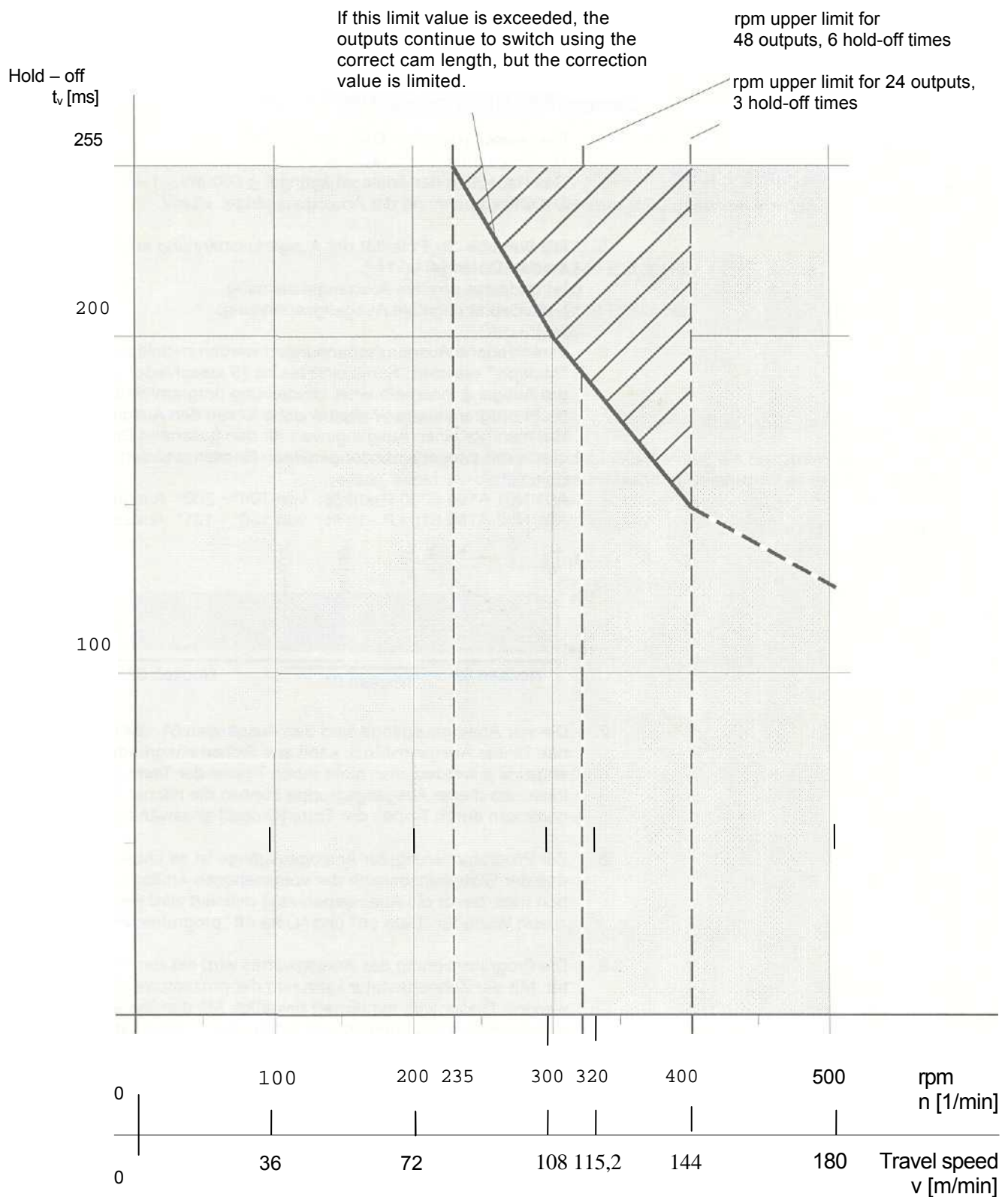


Position Controller BPC

4.0 Options

Diagram 2 shows the relationship between set hold-off time t_v and the maximum possible change velocity of the measuring system.

For rotary motion assume 1° resolution. For linear motion assume 1 mm resolution.



Position Controller BPC

4.0 Options

4.3 Analog Voltage Outputs 0 to ± 10 V

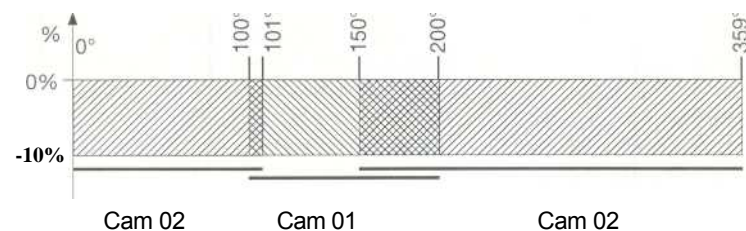
1. For this function, external voltage of ± 15 V (± 5 %) must be applied.
2. The output voltages are between -10 V and +10 V (maximum values). The tolerance of these voltages is ± 100 mV. Permissible load is $I_A > \pm 5$ mA.
3. Entering the desired output voltage is done as a percent, with 10 V equal to 100 %. The arrangement is handled internally corresponding to the resolution of the D-A Converter (resolution 8 bits). The accuracy of the D/A is ± 2 LSB. The non-linearity of the D/A is ± 1 LSB. Output noise: ≤ 500 mV_{pp}, f - 3 MHz Offset voltage of the analog Outputs: ± 5 mV
4. Polarity of the output voltage is entered using the [+] and [-] keys. [+] means positive output voltage, [-] means negative output voltage.

Different output voltages are achieved with the "Multiply" function. Up to 15 various voltage values per output within one revolution are programmable. Not programmed angle ranges carry the output value "0V". If there is only one output value for the entire rotational range, this must be done with two adjacent cams.

Example:

A01 N01 A100 E200 P -10 %: from 100° - 200° Output -1 V

A01 N02 A150 E101 P -10 %: from 150° - 101° Output -1 V



7. The four analog Outputs are assigned to Outputs 51 ... 54 in order. For safety reasons, this output block can only be selected directly, and not from the [Output] key. Within this output group, the next higher output number can be selected by pressing the [Output] key.
8. To program the analog Outputs, it is absolutely necessary to give the valid range of the intended analog voltage before the analog voltage is defined (i.e. there must first be values for "Data on" and "Data off" programmed).
9. Programming the analog value is done with key [R2]. The tens key is used then to input the percentage value. This is confirmed with [Enter]. Press keys [+] and [-] to determine the polarity, and press [Enter] again to finish. To change the polarity again, the percentage input must be repeated.
10. Be sure that the sequence of programming is maintained (Data on, Data off, analog value mit Polarität).
11. If multiple cams are programmed with various analog values, they are not allowed to overlap in the validity range. Otherwise, false analog values (the last programmed word) would be output in the overlap range.

Position Controller BPC 4.0 Options

12. Analog Outputs can only be programmed in the "Program" mode.

Reason:

Overlapping cams with different Output values or erroneous pressing of the [+] or [-] keys can cause machine damage.

13. Analog Outputs are connected on Connector X1.

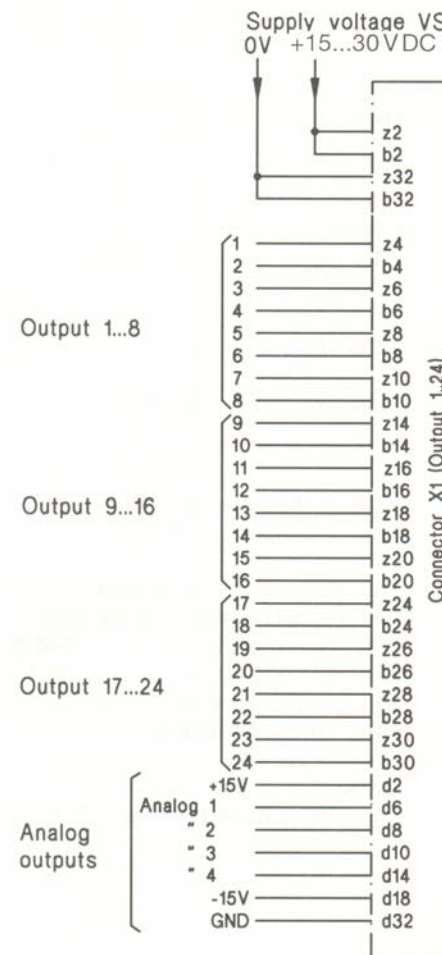
Assignments are as follows:

d2	-	+15 V external voltage $\pm 5\%$
d18	-	-15 V external voltage $\pm 5\%$
d32	-	GND for external voltages
d6	-	Analog Output 1 (effective through Channel 51)
d8	-	Analog Output 2 (effective through Channel 52)
d10	-	Analog Output 3 (effective through Channel 53)
d14	-	Analog Output 4 (effective through Channel 54)

Note:

The analog ground (d32) and the device ground (z32/b32) are not to be connected.

Ensure that pins d2 (+15 V external voltage) and z2/b2 (+24 V supply voltage) are not connected together.



Position Controller BPC

4.0 Options

4.4 Serial Interface "SET4"

Basic data for the serial interface

This description is valid basically for all versions with serial interface except Option 09. For option 09 there is a separate description. For options 13 and 20 a brief description of the differences follows at the end.

Electrical Characteristics

The BPC serial interface conforms to RS-232C Standard in its electrical characteristics.

Pin Configuration

A 25-pole sub-D socket is located on the rear of the BPC. Along with other in/ and Outputs this provides connections for the serial interface (see 8.3, connector X3).

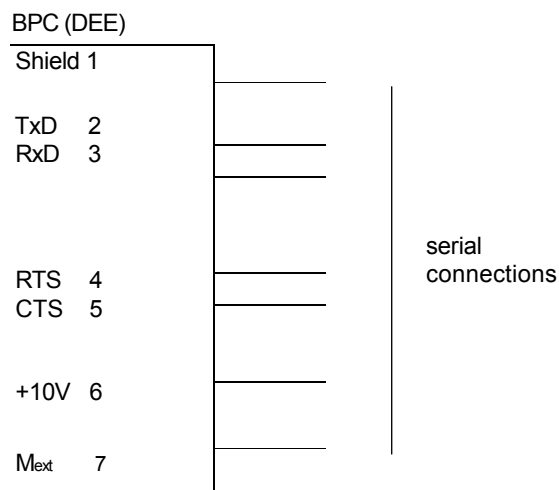


Fig. 1: Female connector X3 with connections for the serial interface, located on back side of BPC.

The interface is a simplified RS-232C interface. For communication with the BPC not all in/ and Outputs which RS-232C provides for are used. Therefore they are not provided. Eliminated are the DTR and DSR terminations. If the BPC is used with a communication partner which has a DSR input, connect BPC pin 6 (+10 V) to this input. A second possibility is to Jumper the DSR input on the partner with its DTR.

Note:

The BPC is configured as a DTE device.

Position Controller BPC 4.0 Options

Connecting a terminal to the BPC

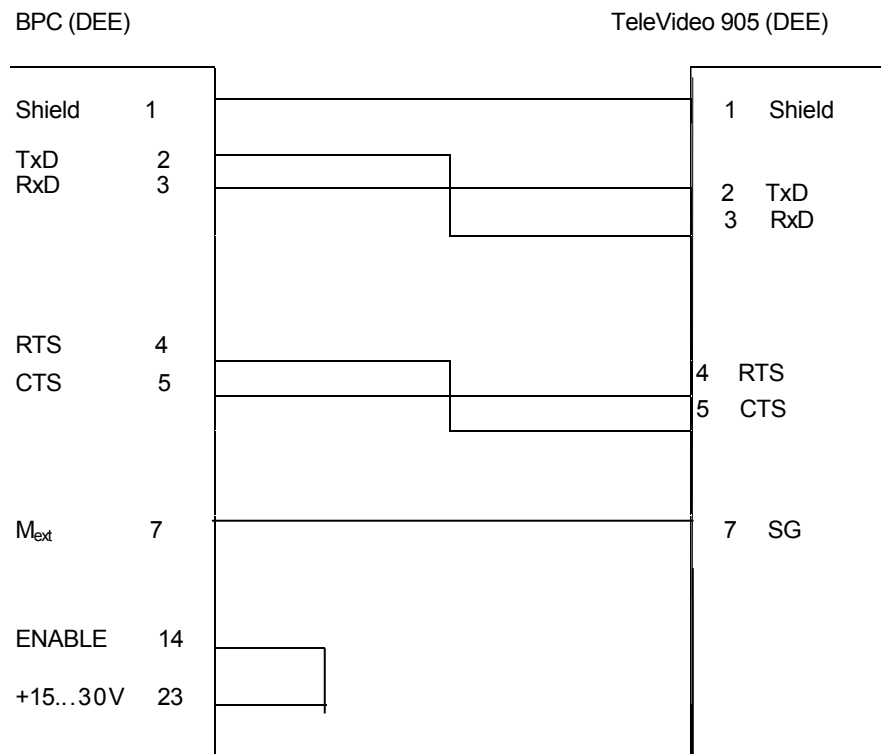


Fig. 2: As an example of how to connect a terminal, this shows the connections to a TeleVideo 905-terminal (TeleVideo is a registered trademark of TeleVideo Systems, Inc.).

A jumper between pins 14 and 23 on the BPC is recommended, so that the BPC keypad is enabled. The interface can only be configured using the keypad.

Position Controller BPC 4.0 Options

Serial Interface "SET4"

Protocol Procedure

In order to control and monitor the data flow, various handshake methods and protocol procedures are used. The serial interface on the BPC is designed for the following protocol procedure.

RTS/CTS-Protocol (Hardware-Handshaking)

Transmission is controlled by the control line RTS and message line CTS. When the control Output RTS on the BPC goes to logic 0, if the RTS control Output on the BPC goes to logic 0, the BPC will still be ready to receive for another ca. 30 ms.

Within this time a maximum of 2 characters can be received. Any additional characters or those sent after these 30 ms will be lost.

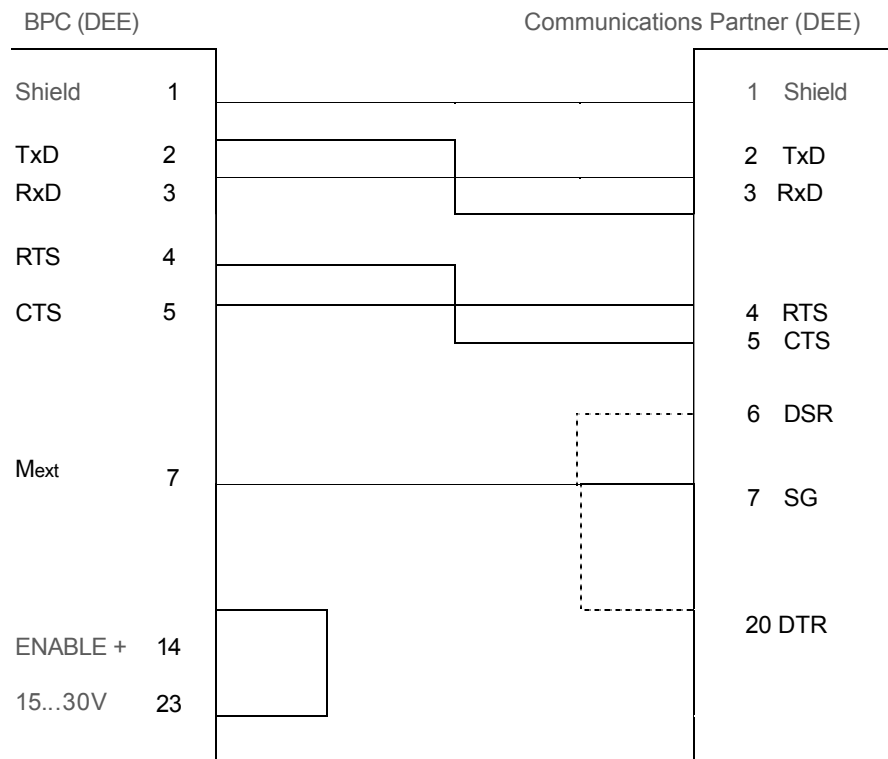


Fig. 3: Terminations for RTS/CTS protocol (Hardware-Handshaking)

The terminations shown in Fig. 3 show the minimum required by the BPC. Depending on the Communications partner, it could be necessary to use the jumper shown in dashed lines.

XON/XOFF-Protocol (Software-Handshaking)

Transmission is controlled by the control characters XON (ASCII 17) and XOFF (ASCII 19). If the BPC sends XON, data may be transmitted to the BPC. If the BPC sends XOFF no characters may be received. The BPC will still be ready to receive for another ca. 30 ms.

Within this time a maximum of 2 characters can be received. Any additional characters or those sent after these 30 ms will be lost.

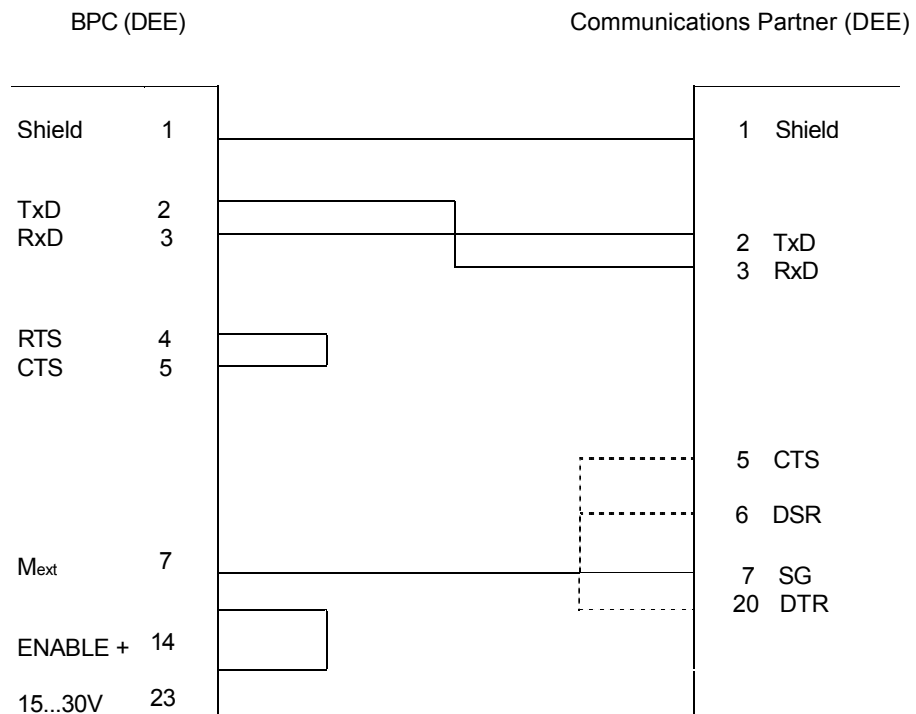


Fig. 4: Terminations for XON/XOFF-protocol (Software-Handshaking)

This termination diagram is again just an example. If for example a PC is connected and operated with a terminal emulator (e.g. Procomm, Telemate etc.), then pins 5, 6 and 20 on the 25-pin connector of the PC must be jumpered together (dotted lines).

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Configuring the serial interface on the keypad

Factory Setting:

9600 Baud
7 Data bits
1 Stop bit
odd Parity
RTS/CTS-Protocol

The keypad (SET04) can be used to set all important parameters for operating the serial interface.

Parameters:

Baud rate	The following rates can be set: 19200, 9600, 4800, 2400, 1200
Data bits	7 or 8
Stop bits	1 or 2
Parity bit	odd, even, or no parity
Protocol	RTS/CTS (hardware) or XON/XOFF (Software)

This function is a subfunction of the "PROGRAM" mode.

Operation:

1. Press [PROGRAM] key.

Press [SET], [4], and [ENTER] in sequence.
====> "LINE" appears in the "VALUE" display.

2. If the correct subfunction was not selected, pressing the [Enter] key permits a new selection to be made. This is shown by the word "Set" in the "Value" display. Pressing the [Set] key again allows entry into the selected subfunction.

====> "b" (baud rate) appears in the "Function" display.
====> The current value appears in the "Value" display.

3. The [+] or [-] keys can be used to set the desired values, which will blink in the "VALUE" display.

====> Pressing the [ENTER] key holds the desired value in the display and finally selects it.

4. Pressing the [SET] key again permits the data bits to be selected.

====> The word "d-bit" appears in the "FUNCTION" display, and the "VALUE" display shows the current value.

The [+] or [-] keys can be used to select 7 or 8 data bits, which will blink in the "VALUE" display

====> Pressing the [ENTER] key holds the desired value in the display and finally selects it.

5. Pressing the [SET] key again allows the stop bits to be selected.

====> The word "s-bit" appears in the "FUNCTION" display, and the current value appears in the "VALUE" display.

Pressing the [+] and [-] keys changes the number of stop bits (1 or 2), which blink in the "VALUE" display.

====> Pressing the [ENTER] key holds the desired value in the display and finally selects it.

Position Controller BPC

4.0 Options

6. Pressing the [SET] key again allows the parity to be selected.
==> The letter "P" appears in the "FUNCTION" display, and the current value is shown in the "VALUE" display.
Pressing the [+] and [-] keys changes the parity selection (odd, even or no parity), which blinks in the "VALUE" display.
==> Pressing the [ENTER] key holds the desired selection in the display and finally selects it.
7. Pressing the [SET] key again allows the protocol type to be selected.
==> The letter "P" appears in the "FUNCTION" display, and the current setting is shown in the "VALUE" display.
Pressing the [+] and [-] keys changes the protocol type selected (hardware or Software), which blinks in the "VALUE" display.
==> Pressing the [ENTER] key holds the desired setting in the display and finally selects it.
8. Pressing the [SET] key again ends the serial interface configuration.
==> The word "SET" appears in the "VALUE" display.
Pressing the "4" key and then [ENTER] causes the word "LINE" to appear in the "VALUE" display. Pressing the [SET] key again allows the Operator to scroll the interface configuration.
==> If an additional number is pressed in conjunction with the "SET" display, additional subfunctions can be programmed. Pressing the [ENTER] key exits the "SET" function and returns to the "PROGRAM" mode.

Note:

Each of the subfunctions in this "LINE" mode can, when the display is static, be exited by pressing the [ENTER] key.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Operating System

Introduction

Before the operating system is described in complete detail, the general design of the BPC and a few concepts should be explained.

Basic Operation of the BPC

The BPC contains a non-volatile memory. Cam values are stored in this memory and are not lost when power is interrupted. The memory is divided into equal sized modules. The working memory holds the cam values of a module. After turning on power, the cam values of the module which were processed before power was interrupted are loaded into the working memory (all cam values of a module are also called a program). The BPC goes into the "RUN" mode, and the Outputs are switched according to the program which is loaded.

A cam value is defined as follows:

e.g. O01 N00 A100 E300 or
 O01 N00 A0100 E1023

O01 O Stands for Output, 01 is the Output number. Valid values for the output number are from 01 to 24 or 01 to 48, depending on which BPC Version is used.

N00 N Stands for cam, 00 is the cam number. The distinction between Single and multiple cams must be made. If a Single cam is associated with an Output, it receives the number 00. Up to 15 cams can be programmed per output. If multiple cams are assigned to an Output, the number begins with 01. All subsequent cams must be numbered in continuous sequence.

A100 A Stands for turn-on value of the cam. The value itself contains 3 or 4 digits, depending on the encoder resolution. If the latter is < 1000, the value is given in 3 places, always with leading zeroes.

E300 E Stands for turn-off value of the cam.
E1023

Examples:

Program with Single cams

O01 N00 A010 E300
O02 N00 A020 E230
O03 N00 A244 E166
O05 N00 A200 E300
O12 N00 A300 E234

Program with multiple cams

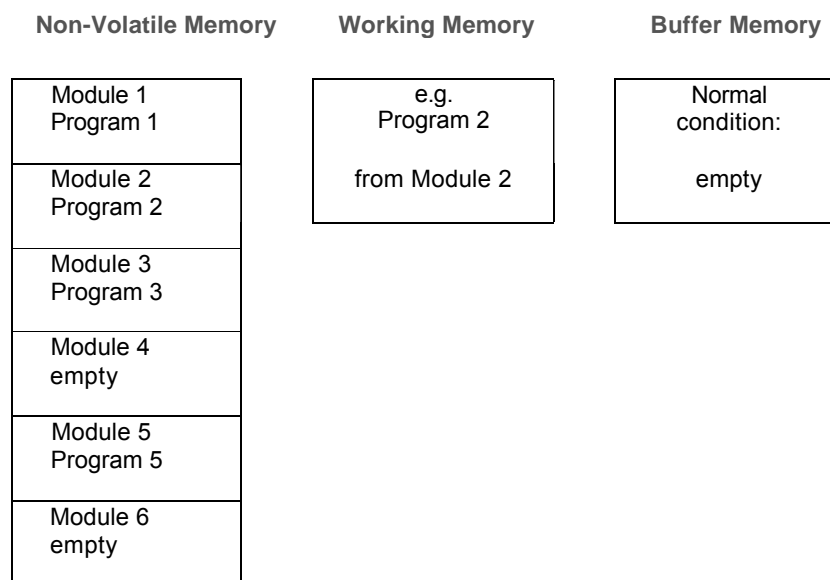
O01 N01 A000 E030
O01 N02 A050 E060
O01 N03 A100 E200
O01 N04 A250 E350
O02 N01 A200 E320
O03 N01 A056 E333
O04 N01 A350 E040

Position Controller BPC

4.0 Options

With one exception, the BPC can be programmed through the serial interface exactly as with the keypad. The device parameters which are set with the SET functions cannot be changed over the serial interface. However the complete contents of the non-volatile memory can be output through the serial interface and reloaded. Using a Computer and an appropriate program, it is possible to transmit all the BPC programs and store them using the memory media (e.g. diskette) of the Computer.

When cam values are input through the serial interface, they are not entered directly into the working or non-volatile memory, but rather into a buffer. The values are preloaded, while the program in the working memory is processed without change. With a command (TM - Take Module, see page 66) the cam values are transmitted from the buffer to the working and non-volatile memory, and only at this point are the Outputs switched with the new cam values. The buffer is then empty.



Overview:

The three various memories of the BPC. The non-volatile memory is divided into six modules (factory setting).

Note:

Function SET 6 can be used to change the number of modules.

Position Controller BPC

4.0 Options

Serial Interface "SET 4"

Description of the Operating System

The BPC provides an operating System for use in a serial interface. Like the commands used to manage programs and files in the operating Systems of PC's, commands for managing programs and cam values are provided.

The operating System and the transmission protocol are so designed that even a simple terminal can be connected to the serial interface.

Transmission Protocol

A transmission protocol must be used to send data to the BPC. This consists of a start block, a data block, and an end block.

Start block: STX (ASCII 02) initiates a serial data exchange.
Command... follows right after STX. See page 53, commands in alphabetical order.
CR/LF .. These control characters (ASCII 13 and ASCII 10) finish the start block.

The BPC sends all received characters back to the sender as an echo. If the sender is a terminal in full-duplex, the characters are input on the keypad and sent directly to the BPC without appearing on the screen. The terminal does display all characters which it receives over the serial interface. The echo shows which key has been pressed. If a wrong key is pressed, the input should be ended with CR/LF. The BPC acknowledges this input with an error message. Then repeat the entry, beginning with STX etc.

Data block: Cam value... e.g. O01 N00 A123 E321
CR/LF .. finishes the data block.

The BPC sends these entries back to the sender as an echo, and adds an "OK" message for correct input. If incorrect, an error message is generated. The entire data block must be resent. If an "OK" is received, the next data block can be sent.

End block: ETX..... The end of a transmission is indicated with ETX (ASCII 03) .

Position Controller BPC

4.0 Options

Notes on Transmission Protocol

This transmission protocol only applies to the "CM" and "WM" commands. CM Stands for "Complete Module", and WM for "Write Module". In both cases data words, namely cam values, are sent to the BPC.

In the case of the "LOAD" command, cam values are also transmitted, but the transmission protocol is slightly different. The following section describes this command in detail.

The remaining commands are those for which data is transmitted by, not to, the BPC. These commands are transmitted in the form of a start block. The BPC follows with data which are finished off with ETX.

Blank Spaces can be used within a start or data block. The number of characters within a block (including cr/lf) may not exceed 55.

Commands in Alphabetical Order

Following is a listing of all commands in alphabetical order.

Overview:

CM	- Input additional cam values (buffer)
LOAD	- Complete reloading of non-volatile memory from an external memory (diskette or other)
RAV	- Output the encoder actual value
RCW	- Output internal specifications
RM	- Output all cam values in the working memory
ROxx	- Output the cam values of an output (working memory)
SAVE	- Output the complete memory contents (non-volatile memory)
SELxx	- Program change
TM	- Transfer input cam values from the buffer to the working and non-volatile memories
WM	- Write new cam values (buffer)

Sub-commands:

DELOxx	- Cancel all cam values of output xx (buffer)
LM	- List all cam values (buffer)
LOxx	- List all cam values of output xx (buffer)

Position Controller BPC

4.0 Options

Serial Interface "SET 4"

An example is given for each command. The example is divided into
a.) characters sent to the BPC, and
b.) characters sent from the BPC.

Note!

The BPC accepts capital letters only and no umlauts.

The control characters are shown in parentheses, whereby the control characters "Carriage Return" and "Line Feed" are shown in a Single parenthesis, since they only occur as a pair.

(stx) = ASCII 02
(etx) = ASCII 03
(eot) = ASCII 04
(cr/lf) = ASCII 13 and 10

On a terminal, these control characters are generated by pressing the control key and a letter key simultaneously.

(stx) Control B
(etx) Control C
(eot) Control D
(lf) LINE FEED key or Control J
(cr) RETURN key or Control M

In b.) of the example, the characters are shown as they appear on a terminal. The control characters which are not visible are indicated in parentheses. The characters which are sent back from the BPC as an echo are shown in *italics*.

Position Controller BPC

4.0 Options

CM (Complete Module) - Entering additional cam values

The cam values in the **working memory** of the active program are copied into the **buffer memory** and can then be expanded with additional cam values. The new values are stored in the **buffer memory**.

Condition: There must be at least one cam value in the working memory. If not, the error message: "ERR 112: MODUL xx IST LEER! (cr/lf)(etx)" will be sent (means "module xx is empty").

Example: Characters sent **to** the BPC.

Start block: (stx)CM(cr/lf)
Data block: 025 N00 A240 E320(cr/lf)
Data block: 026 N00 A100 E255(cr/lf)
End block: (etx)

Characters sent **from** the BPC.

(stx)CM(cr/lf)
25 N00 A240 E320(cr/lf)
OK(cr/lf)(etx)
26 N00 A100 E255(cr/lf)
OK(cr/lf)(etx)
(etx)

Remember!

After sending the data blocks, an end block must be sent, otherwise all subsequent commands will be acknowledged with an error message.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

So that the contents of the **buffer memory** can be checked and cam values can be deleted, the following sub-commands can be sent instead of the data blocks.

a.) DELOxx (DELeTe Output xx) - Deletes all cam values of Output xx in the buffer memory

Example: Characters sent **to** the BPC.

DELO04(cr/lf) Characters sent

from the BPC.

DELO04(cr/lf)

OK(cr/lf)

(etx)

b.) LM (List Module) - Lists all cam values in the buffer memory

Example: Characters sent **to** the BPC.

LM(cr/lf) Characters sent **from** the

BPC.

LM(cr/lf)

(cr/lf)

PROGRAM 01(cr/lf)

----- (cr/lf)

ENCODER NUMBER: 1 (cr/lf)

ENCODER DISPLAYED: 1(cr/lf)

DIRECTIONAL OUTPUTS: NO(cr/lf)

O01 N00A000 E111 (cr/lf)

O03 N01 A100 E200(cr/lf)

O03 N02 A210 E023(cr/lf)

(etx)

c.) LOxx (List Output xx) - Lists all cam values of Output xx in the buffer memory

Example: Characters sent **to** the BPC.

LO03(cr/lf)

Characters sent **from** the BPC.

LO03(cr/lf)

O03 N01 A100 E200(cr/lf)

O03 N02 A210 E023(cr/lf)

(etx)

Position Controller BPC

4.0 Options

LOAD (LOAD) - Complete reloading of the constant memory with data from an external memory (diskette, etc.)

A complete memory contents which has already been read by the BPC using the SAVE command can be uploaded back to the BPC. (Not possible with a terminal. A PC with appropriate Software is required. We offer the "BPCEDIT" program (for Computers running under MS-DOS), which has been specially designed for this purpose. Another, somewhat more complicated method, is to use a terminal program, similar to Telemate.)

It should be noted that the transmission protocol is slightly changed. Along with the user data with the cam values, other data are also sent: The end block consists of an EOT control character (ASCII 04). ETX is used to separate the individual programs. For Software handshaking, a 1 sec. pause must follow every ETX before the next character can be sent.

Attention!

While this command is being carried out, switching of the Outputs is interrupted. The Ready Signal and all the Outputs are set to the 0 Volt level. This means the machine must be turned off beforehand. After the command is ended the first module is activated. If there is a program in the first module, it is processed and the Ready signal is set. If the module is empty, the Ready signal stays at 0 V and the BPC display shows "01 null".

For BPC models BPC AX3600-E1-... a check is made before the command is carried out to verify that the encoder is turning at less than 1.35 rpm. (applies to encoders with 360-step resolution.) For all other resolutions, the formula is:

$$\text{speed} < 1.35 \text{ rpm} \times \frac{360}{\text{Resolution}}$$

If the speed is above this level, the command is broken off with an error message.

For BPC models BPC AX3600-E3... (for connecting up to 3 encoders), this safety condition is not included.

Requirements:

- The machine must be stopped and at rest.
 - The BPC must be in the RUN mode.
 - The "STORE" LED may not be on.
- If one of these conditions is not met, an error message is output.

Position Controller BPC 4.0 Options

SSerial interface "SET 4"

```

Example:      Characters sent to the BPC.

Start block:  (stx)LOAD(cr/lf)
              (cr/lf)
              BPC A X3600 - E1 - 48P - 01 - E (cr/lf)
              _____ (cr/lf)
              (cr/lf)

Encoder:

              BINAERCODE(cr/lf)
              ODD PARITY(cr/lf)
              ROTARY(cr/lf)
- RESOLUTION ENCODER 1: 0360 STEPS(cr/lf)
DISPLAY ENCODER ACTUAL VALUE: NO(cr/lf)
SERIAL INTERFACE:      9600 BAUD(cr/lf)
                       7 DATENBIT(cr/lf)
                       ODD PARITY(cr/lf)
                       1 STOP BIT(cr/lf)
                       X-ON/XOFF-PROTOCOL(cr/lf)

PROGRAMS:              06(cr/lf)
PROGRAM NUMBER REPLAY: NO (cr/lf)
CHANGEABLE CAMS:      223(cr/lf)
LOCKED OUTPUTS:      NONE(cr/lf)
TEACH-IN:             YES(cr/lf)
(etx) *
PROGRAM 01
              _____ (cr/lf)
              (cr/lf)
ENCODER NUMBER:      (cr/lf)
ENCODER DISPLAYED:  1 (cr/lf)
DIRECTIONAL OUTPUTS: NO(cr/lf)
DATA-block: O01 N00 A000 E111 (cr/lf)
DATA-block: O03 N01 A100 E200(cr/lf)
DATA-block: O03 N02 A210 E023(cr/lf)
              (etx)*
PROGRAM 05 (cr/lf)
              _____ (cr/lf)
ENCODER NUMBER:      1 (cr/lf)
ENCODER DISPLAYED:  1 (cr/lf)
DIRECTIONAL OUTPUTS: NO(cr/lf)
DATA-block: O07 N00 A000 E347(cr/lf)
DATA-block: O14 N01 A100 E200(cr/lf)
DATA-block: O14 N02 A210 E023(cr/lf)
END-block: (etx)*
              (eot)

```

* 1 sec pause for software hand-shaking

Position Controller BPC

4.0 Options

Characters sent **from the BPC.**

```
(stx)LOAD(cr/lf)
(cr/lf)
BPC A X3600 - E1 - 48P - 01 - E (cr/lf)
------(cr/lf)
```

```
(cr/lf)
ENCODER:                                BINARY CODE(cr/lf)
                                           ODD PARITY(cr/lf)
                                           ROTARY(cr/lf)
- RESOLUTION ENCODER 1:                 0360 STEPS(cr/lf)
DISPLAY ENCODER ACTUAL VALUE:           NO(cr/lf)
SERIAL INTERFACE:                       9600 BAUD(cr/lf)
                                           7 DATA BITS(cr/lf)
                                           ODD PARITY(cr/lf)
                                           1 STOP BIT(cr/lf)
                                           X-ON/X-OFF-PROTOCOL(cr/lf)
```

```
PROGRAMS:                                06(cr/lf)
PROGRAM NUMBER RESPONSE:                 NO(cr/lf)
CHANGEABLE CAMS:                        223(cr/lf)
LOCKED OUTPUTS:                         NONE(cr/lf)
TEACH-IN:                                YES(cr/lf)
```

```
(etx)
PROGRAM 01                                (cr/lf)
-----                                (cr/lf)
```

```
ENCODER NUMBER:                          1 (cr/lf)
ENCODER DISPLAYED:                       1 (cr/lf)
DIRECTIONAL OUTPUTS:                     NO(cr/lf)
```

```
007 N00 A000 E 111(cr/lf)
OK (cr/lf)(etx)
003 N01 A100 E200(cr/lf)
OK(cr/lf)(etx)
003 N02 A210 E023(cr/lf)
OK(cr/lf)(etx)
```

```
PROGRAM 05
-----                                (cr/lf)
-----                                1 (cr/lf)
ENCODER NUMBER:                          1 (cr/lf)
ENCODER DISPLAYED:                       NO(cr/lf)
```

```
DIRECTIONAL OUTPUTS:
007 N00 A000 E347(cr/lf)
OK(cr/lf)(etx)
014 NO 1 A100E200(cr/lf)
OK(cr/lf)(etx)
014 N02 ^210 E023(cr/lf)
OK(cr/lf)(etx)
(etx)
(eot)
```

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Note:

After reloading, only the programs which were sent are in the non-volatile memory. All other modules are empty, regardless of whether they previously contained a program or not.

Non-volatile memory before	Non-volatile memory after
Module 1 old Program 1	Module 1 new Program 1
Module 2 old Program 2	Module 2 empty
Module 3 old Program 3	Module 3 empty
Module 4 empty	Module 4 empty
Module 5 old Program 5	Module 5 new Program 5
Module 6 empty	Module 6 empty

Condition of the non-volatile memory before the LOAD command is executed and after.

RAV (Read Actual Value) - Outputs the encoder actual value

For units with three encoders, the encoder actual value for the encoder whose actual value is shown in the display is Output.

Condition: At least one cam value must be present in the selected module.

Example: Characters sent **to** the BPC.

Start block : (stx)RAV(cr/lf)

Data block:

End block:

Characters sent **from** the BPC.

(stx)RAV(cr/lf)

ACTUAL VALUE ENCODER 1:

(etx)

258(cr/lf)

Position Controller BPC

4.0 Options

RCW (Read Code Word) - Outputs internal specifications

An overview of the currently valid device parameters is given. The overview contains the following Information:

- BPC model number
- Code type of the encoder(s)
- Parity of the encoder(s)
- Type of encoder(s)
- Resolution of encoder(s)
- Whether encoder(s) resolution is constantly shown in the "VALUE" display
- Configuration of the serial interface
- Maximum number of programs
- Whether program-number response is active
- Number of available cams per program
- List of locked Outputs
- Whether teach-in function is active

Condition: none

Example: Characters sent **to** the BPC

Start block: (stx)RCW(cr/lf)

Data block:

End block:

Characters sent **from** the BPC

```

(stx)RCW(cr/lf)
(cr/lf)
BPC A X3600 - E1 - 48P - 01 - E (cr/lf)
_____ (cr/lf)
(cr/lf) ENCODER:
                                BINARY CODE(cr/lf)
                                ODD PARITY(cr/lf)
                                ROTARY(cr/lf) 0360
- RESOLUTION ENCODER 1:        STEPS(cr/lf)
DISPLAY ENCODER ACTUAL VALUE   NO(cr/lf)
SERIAL INTERFACE:              9600 BAUD(cr/lf) 7
                                DATA BITS(cr/lf) ODD
                                PARITY(cr/lf) 1 STOP BIT(cr/lf)
                                X-ON/X-OFF-PROTOCOL(cr/lf)
PROGRAMS:                      06(cr/lf)
PROGRAM NUMBER REPLY:          NO(cr/lf)
CHANGEABLE CAMS:               223(cr/lf)
LOCKED OUTPUTS:                NONE(cr/lf)
TEACH-IN:                      YES(cr/lf)
(etx)

```

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

RM (Read Module) - Outputs cam values in working memory

All cam values in the active module are Output, i.e. the program which is currently in the **working memory** is output.

Condition: At least one cam value must be in the **working memory**, otherwise the message "WARNING 101: MODULE xx IS EMPTY!" is Output. The warning refers only to the empty **working memory**.

Example: Characters sent **to** the BPC.

Start block: (stx)RM(cr/lf)
Data block:
End block:

Characters sent **from** the BPC.

```
(stx)RM(cr/lf)
(cr/lf)
PROGRAM 01 (cr/lf)
----- (cr/lf)
ENCODER NUMBER: 1 (cr/lf)
ENCODER DISPLAYED: 1 (cr/lf)
DIRECTIONAL OUTPUTS: NO (cr/lf)
O01 N00A000 E111 (cr/lf)
O03 N01 A100 E200 (cr/lf)
O03 N02 A210 E023 (cr/lf)
(etx)
```

ROxx (Read Output xx) - Output the cam values of an Output

All the cam values of output xx from the active program are Output.

Condition: none
If no cams are programmed for this output, then only an (etx) is Output.

Example: Characters sent **to** the BPC.

Start block: (stx)RO12(cr/lf)
Data block:
End block:

Characters sent **from** the BPC

```
(stx)RO12(cr/lf)
012 N01 A100 E200 (cr/lf)
012 N02 A210 E023 (cr/lf)
012 N03 A030 E079 (cr/lf)
(etx)
```

SAVE (SAVE) - Outputs the entire memory contents

The entire contents of the **non-volatile memory** is output on the serial interface, beginning with the internal specifications as they would be Output for the "RXW" command. Then follows the program from the modules in increasing order. An empty module is skipped. The internal specifications and the individual programs are separated by the (etx) control character. Therefore the control character (eot) is used to mark the end of transmission.

Not practical using a terminal, since the data are not stored. A PC with appropriate Software is required. We offer the "BPCEDIT" program (for Computers running under MS-DOS), which has been specially designed for this purpose. Another, somewhat more complicated method, is to use a terminal program, similar to Telemate.)

Attention!

While this command is being carried out, switching of the Outputs is interrupted. The Ready signal and all the Outputs are set to the 0 Volt level. This means the machine must be turned off beforehand. After the command is ended the first module is activated. If there is a program in the first module, it is processed and the Ready signal is set. If the module is empty, the Ready signal stays at 0 V and the BPC display shows "01 null".

For BPC models BPC AX3600-E1 -... a check is made before the command is carried out to verify that the encoder is turning at less than 1.35 rpm. (applies to encoders with 360-step resolution.) For all other resolutions, the formula is:

$$\text{speed} < 1.35 \text{ rpm} \times \frac{360}{\text{Resolution}}$$

If the speed is above this level, the command is broken off with an error message.

For BPC models BPC AX3600-E3... (for connecting up to 3 encoders), this safety condition is not included.

Requirements:

- The machine must be stopped and at rest.
- The BPC must be in the RUN mode.
- The "STORE" LED may not be on.

If one of these conditions is not met, an error message is output.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Example: Characters sent **to the** BPC.

Start block: (stx)SAVE(cr/lf)
Data block:
End block:

Characters sent **from the** BPC.

```
(stx)SAVE(cr/lf)
(cr/lf)
BPC A X3600 - E1 - 48P - 01 - E (cr/lf)
.....(cr/lf)
(cr/lf)
ENCODER:
                                     BINARY CODE(cr/lf)
                                     ODD PARITY(cr/lf)
                                     ROTARY(cr/lf)
-RESOLUTION ENCODER 1:              0360 STEPS(cr/lf)
DISPLAY ENCODER ACTUAL VALUE:       NO(cr/lf)
SERIAL INTERFACE:                   9600 BAUD(cr/lf)
                                     7 DATA BITS(cr/lf)
                                     ODD PARITY (cr/lf)
                                     1 STOP BIT(cr/lf)
                                     X-ON/X-OFF-PROTOCOL(cr/lf)
PROGRAMS:                            06(cr/lf)
PROGRAM NUMBER REPLAY:              NO(cr/lf)
CHANGEABLE CAMS:                    223(cr/lf)
LOCKED OUTPUTS:                     NONE(cr/lf)
TEACH-IN:                           YES(cr/lf)
(etx)
PROGRAM 01      (cr/lf)
.....         (cr/lf)

ENCODER NUMBER :                      1 (cr/lf)
ENCODER DISPLAYED:                   1 (cr/lf)
DIRECTIONAL OUTPUTS:                 NO(cr/lf)
O01 N00 A000 E111 (cr/lf)
O03 N01 A100 E200(cr/lf)
O03 N02 A210 E023(cr/lf)
(etx)
PROGRAM 05      (cr/lf)
-----        (cr/lf)

ENCODER NUMBER :                      1 (cr/lf)
ENCODER DISPLAYED:                   1 (cr/lf)
DIRECTIONAL OUTPUTS:                 NO(cr/lf)
O07 N00 A000 E347(cr/lf)
014 N01 A100 E200(cr/lf)
014 N02 A210 E023(cr/lf)
(etx)(eot)
```

Position Controller BPC

4.0 Options

SELxx (SElect module xx) - **Selects a program**

The program from module xx is loaded into the **working memory** and is then active. If the module is empty, the message "WARNING 101: MODULE xx IS EMPTY" is output. The working memory is empty. The Ready LED is off, and the Ready signal is not set. The message "xx LEEr" or "xx null" appears in the display. This condition remains until a cam value is programmed or another program is activated.

Condition:

- The BPC must be in the RUN mode.
- The machine must be stopped and at rest.
- The "STORE" LED may not be on.

If one of these conditions is not met, an error message is output.

Example: Characters sent **to** the BPC.

Start block: (stx)SEL05(cr/lf)

Data block:

End block:

Characters sent **from** the BPC.

(stx)SEL05(cr/lf)
OK(cr/lf)
(etx)

Position Controller BPC

4.0 Options

Serial Interface "SET 4"

TM (Take Module) - Fetches entered cam values

The cam values in the **buffer memory** are transferred to the **working and non-volatile memory**. The buffer memory is then empty. The transmission time in the working memory is very short, the program from the buffer memory is immediately active after input, whereas the transmission into the permanent memory takes somewhat longer.

Attention!

While this command is being carried out, switching of the Outputs is interrupted. The Ready signal and all the Outputs are set to the 0 Volt level. This means the machine must be turned off beforehand.

Requirements:

- The machine must be stopped and at rest.
- The BPC must be in the RUN mode.
- The "STORE" LED may not be on.
- At least one cam value must reside in the buffer memory.

If one of these conditions is not met, an error message is Output.

Example: Characters sent **to** the BPC.

Start block: (stx)TM(cr/lf)

Data block:

End block:

Characters sent **from** the BPC.

(stx)TM(cr/lf)

OK(cr/lf)

(etx)

Position Controller BPC

4.0 Options

WM (Write Module) - Inputs new cam values

The **buffer memory** is deleted and new cam values can be entered. The sub-commands of the CM command apply (see page 55).

Condition: none

Example: Characters sent **to** the BPC.

Start block: (stx)WM(cr/lf)

Data block: O25 N00 A240 E320(cr/lf)

Data block: O26 N00 A100 E255(cr/lf)

End block: (etx)

Characters sent **from** the BPC.

(stx)WM(cr/lf)

O25 N00 A240 E320(cr/lf)

OK(cr/lf)(etx)

O26 N00 A100 E255(cr/lf)

OK(cr/lf)(etx)

(etx)

Remember!

After entering data blocks an end block must be sent, otherwise all subsequent commands will be acknowledged with an error message.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Handling locked outputs

WM and CM Command

With the WM command, first all cam values for the locked Outputs are sent to the buffer memory. This cam values can only be deleted by knowing the code number.

Example: Characters sent **to** the BPC.

```
(stx)WM(cr/lf)
345 O01 N01 A100 E322(cr/lf)
(etx)
```

Characters sent **from** the BPC.

```
(stx)WM(cr/lf)
345 O01 N01 A100 E322(cr/lf)
OK(cr/lf)
(etx)
```

The same applies to the DELOxx sub-command. To delete a cam value for a locked Output, the code number must first be sent.

LOAD Command

When saving (SAVE), a designator for the locked outputs are also transmitted, but not the code number for programming the locked outputs. If the saved programs are sent back to the same unit, there is no problem. To send the data to another BPC and no code number is yet present, a code number is entered. Any number may be used, and it does not have to coincide with the number of the other unit. After loading, the designated Outputs can be programmed using this code number. If no code number is available, the transmission **is** broken off with an error message.

Position Controller BPC 4.0 Options

Using Directional Outputs

LOAD Command

The directionality of the Outputs cannot be set through the interface. But when the SAVE command is used, the system checks with every program whether directional Outputs are present or not.

PROGRAM 02

```
NO. OF ENCODERS:           2
ENCODER SHOWN:            1
DIRECTIONAL OUTPUTS:      NO
001 N00 A023 E029
```

If a file is loaded into the BPC using "LOAD", then four different situations must be distinguished:

Directional Outputs		Effect
in unit	in the file	
NO	NO	-----
YES	NO	Directionality of the Outputs is cancelled. All Outputs are bi-directional.
NO	YES	All Outputs are bi-directional. WARNING 103 is Output. You must enter the desired direction on the keypad.
YES	YES	The directionality of the Outputs is the same as before the LOAD command was executed. WARNING 103 is Output. You must verify that the Outputs are set for the desired direction and adjust as necessary

WARNING 103: Directional Outputs Present.

Meaning: Please verify that the Outputs are set for the desired direction, and adjust as necessary.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

Error messages from the BPC on the serial interface

ERROR 101: SYNTAX ERROR

Meaning: Incorrect or incomplete command.
Action: Resend the command in the correct form.

ERROR 102: SYNTAX DATE

Meaning: Data or other requests were incorrectly or incompletely entered.
Action: Resend data or other requests in the correct form.

ERROR 103: ALREADY PRESENT! DELETE J/N?

Meaning: The entered cam value is already present (same output number and same cam number). Asks whether old cam value should be replaced by the new one.
Action: Enter either "J" (cr/lf) - old value is deleted, or "N" (cr/lf) - new value is rejected, old value is kept.

ERROR 104: NO MULTIPLE CAMS! DELETE J/N?

Meaning: The entered multiple cam value (NO ... N15) already exists (same Output number) as a Single cam (N00). Asks whether old Single cam value should be replaced with the new multiple cam value.
Action: Enter either "J" (cr/lf) - old value (single cam) is deleted, or "N" (cr/lf) - new value (multiple cam) is deleted.

ERROR 105: NO SINGLE CAMS! DELETE J/N?

Meaning: The entered Single cam value (N00) already exists (same Output number) as a multiple cam (N01 ... N15). Asks whether old multiple cam value should be replaced by the new Single cam value.
Action: Enter either "J" (cr/lf) - old value (multiple cam value) is deleted, or "N" (cr/lf) - new value (single cam) is deleted.

Position Controller BPC

4.0 Options

ERROR 106: NO CONTINUOUS CAM NUMBER!

Meaning: No continuous cam number was entered. Example:
After sending ... N03 ..., only ... N04 ... is permitted to follow, not ... N06 ...!

Action: Resend data with correct cam number.

ERROR 107: TRANSMISSION ERROR!

Meaning: During data transmission a transmission error occurred. Possible causes are cable break, a nearby electrical field, improper setting of the serial interface (baud rate, number of data or stop bits, parity selection), etc. At least one character was not correctly received, which also causes an ERROR 101 or ERROR 102 to follow the transmission even though the input was correct.

Action: Remedy cause(s) listed above.

ERROR 108: SLEWING SPEED TOO HIGH!

Meaning: Command sent cannot be executed at the moment because the slewing speed is too high.

Action: Reduce slewing speed and resend the command.

ERROR 109: NOT ENOUGH MEMORY!

Meaning: The memory capacity of the buffer is insufficient for the last input. Units with 6 programs can only contain 223 cams per program.

Action: Cancel non-essential Outputs.

ERROR 110: NOT POSSIBLE NOW!

Meaning: Command just sent cannot be executed at this time. Possible causes are:

- Unit is not in RUN mode
- "Store" LED on BPC is still on
- Slewing speed too high
- Internal fault is present

Action: Remove problem if possible and resend command.

ERROR 111: OUTPUT LOCKED!

Meaning: The cam value for a locked output was sent.

Action: See page 68 - handling locked Outputs.

Position Controller BPC 4.0 Options

Serial Interface "SET 4"

ERROR 112: MODUL xx IS EMPTY!

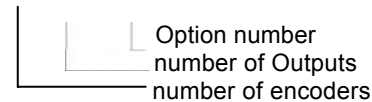
Meaning: The working memory and its associated module in the non-volatile memory are empty.
Action: Sent cam values with the "WM" command.

ERROR 113: BUFFER MEMORY IS EMPTY!

Meaning: The buffer memory is empty.
Action: Write cam values to the buffer memory with "WM" or "CM".

ERROR 114: PROGRAM IS NOT COMPATIBLE!

Meaning: 1. When loading programs from external memories, three Parameters must agree:
- Number of encoders
- Number of BPC Outputs
- BPC Option number
All three parameters are in the line
BPC A X3600 - E1 - 48P - 01 - E :



Exeption: Programs from a unit with 24 Outputs can be loaded into a unit with 48 Outputs. 2. Programs with locked Outputs should be loaded into a unit into which no code number has yet been sent.

Action: 1. None.
2. Enter any code number and carry out the LOAD command again.

ERROR 115: TOO MANY CHARACTERS IN A LINE!

Meaning: The number of characters in a start or data block is limited to 55 (including final (cr/lf)).
Action: Use fewer blanks.

Warnings sent on the BPC serial interface

WARNING 101: MODULE xx IS EMPTY!

Meaning: Says that the selected module and thereby the working memory contains no cam values.

WARNING 103: WARNING 103: Directional Outputs Present.

Meaning: Please verify that the Outputs are set for the desired direction, and adjust as necessary.

Position Controller BPC

4.0 Options

4.5 Serial Interface and Dynamic Cams

Option 13 differs in the commands RCW, SAVE and LOAD.

Along with the RCW command, the hold-off time of the individual groups is Output.

RCW (Read Code Word) - Outputs internal specifications

An overview of the currently valid device parameters is given.

Condition: none

Example: Characters sent **to** the BPC.

Start block: (stx)RCW(cr/lf)

Data block:

End block:

Characters sent **from** the BPC.

(stx)RCW(cr/lf)

(cr/lf)

BPC A X3600 - E1 - 48P - 13 - E(cr/lf)

(cr/lf)

ENCODER:	BINARYCODE(cr/lf)
	ODD PARITY(cr/lf)
	ROTARY(cr/lf)
- RESOLUTION ENCODER 1:	0360 STEPS(cr/lf)
DISPLAY ENCODER ACTUAL VALUE:	NO(cr/lf)
SERIAL INTERFACE:	9600 BAUD(cr/lf)
	7 DATA BITS(cr/lf)
	ODD PARITY(cr/lf)
	1 STOP BIT(cr/lf)
	X-ON/X-OFF-PROTOCOL(cr/lf)
PROGRAMS:	06(cr/lf)
PROGRAM NUMBER REPLY:	NO(cr/lf)
CHANGEABLE CAMS:	223(cr/lf)
LOCKED OUPUTS:	NONE(cr/lf)
TEACH-IN:	YES(cr/lf)
HOLD-OFF TIME 1:	100MS(cr/lf)
HOLD-OFF TIME 2:	023 MS(cr/lf)
HOLD-OFF TIME 3:	000 MS(cr/lf)
HOLD-OFF TIME 4:	000 MS(cr/lf)
HOLD-OFF TIME 5:	255 MS(cr/lf)
HOLD-OFF TIME 6:	000 MS(cr/lf)
(etx)	

This Information is Output in the same manner with the **SAVE** command. With the **LOAD** command, the hold-off times are set corresponding to the values which were read in.

Position Controller BPC

4.0 Options

4.6 Serial Interface and Analog Outputs Option 20

Here the CM and WM commands are expanded. To program the analog cams with the numbers 51 ... 54, a percent value for the output voltage must also be entered. The range for the percent value is between -100 and +100.

CM (Complete **Module**) - Inputs additional cam values

The cam values in the **working memory** of the active program are copied to the **buffer memory** and can now be expanded with additional cam values.

Condition: There must be at least one cam value in the working memory. If not, the error message "ERR 112: MODULE xx IS EMPTY" is sent.

Example: Characters sent **to** the BPC.

```
Start block : (stx)CM(cr/lf)
Data block:  O10 N00 A122 E160(cr/lf)
Data block:  O51 N00 A240 E320 P+056(cr/lf)
Data block:  O52 N00 A100 E255 P-100(cr/lf)
Data block:  O53 N01 A010 E055 P+050(cr/lf)
Data block:  O53 N02 A100 E255 P-089(cr/lf)
End block:   (etx)
```

Characters sent **from** the BPC.

```
(stx)CM(cr/lf)
O10 N00 A122 E160(cr/lf)
OK(cr/lf)(etx)
O51 N00 A240 E320 P+056(cr/lf)
OK(cr/lf)(etx)
O52 N00 A100 E255 P-100(cr/lf)
OK(cr/lf)(etx)
O53 N01 A010 E055 P+050(cr/lf)
OK(cr/lf)(etx)
O53 N02 A100 E255 P-089(cr/lf)
OK(cr/lf)(etx)
(etx)
```

The same is true for the WM command. For commands RM, ROxx and SAVE, the cam values of analog cams are output accordingly. For the LOAD command, the cam values of the analog cams are read in in the form that they were output for the LOAD command.

Position Controller BPC

4.0 Options

4.7 Timer Outputs

Purpose:

Enter timer Outputs.

The first 8 Outputs can each be assigned a timer function, i.e. the turn-off point can be delayed by a maximum of 99990 ms. The timer Outputs can not be programmed as multiple cams. The timer Outputs are programmed in the "Program" mode.

Operation:

1. First the switchpoint must be programmed, as with normal Outputs
An additional period appears in the "Function" display to indicate a timer output.
2. Press the [Time] button
==> a "t" = time appears in the "Status" display
==> "0.0.0.1." (no value stored) or the stored value appears in the "value" display.
3. The numeric keypad is used to program the multiplier of 10 ms. Values between 1 (= 10 ms) and 9999 (= 99990 ms) are permitted.
==> the entered value flashes in the "value" display.
4. Press [Enter] to confirm the value.
==> the new value appears in the "Value" display.
5. Delete a timer output the same as for a normal output, by using the "Del" function.

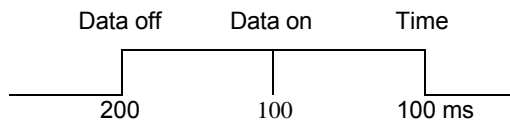
Important:

When using encoders, the programmed time is not allowed to be longer than the time for one revolution of the encoder.

Pulse diagram for up-counting encoder



Pulse diagram for down-counting encoder



Position Controller BPC

5.0 Additional Functions

5.1 Locking the Teach-in Function "SET 12"

Purpose:

The "Teach" function can be used to lock the "Teach-in" function.

The "Teach" sub-function can only be called up in the "Program" mode. This must always be selected before the sub-function is selected.

Operation:

1. Press [Set] and [12], then [Enter].
====> "Teach" appears in the "Value" display.
If the correct sub-function was not selected, press [Enter] to initiate a new selection. This is visible as "Set" in the "Value" display.
2. Pressing [Set] again allows entry into the selected sub-function.
====> The "Function" display goes dark. A "T" appears in the "Status" display, and the momentarily selected mode appears in the "Value" display.

"Yes" means "Teach-in"-Function active.
"No" means "Teach-in"-Function inactive.
3. [+] and [-] keys are used now to choose between the two options "Yes" or "No". These flash in the "Value" display.
====> Press [Enter] to finish the selection of the "Teach-in" function.
====> "Set" appears in the "Value" display.
If now an additional number is pressed on the keypad, additional sub-functions can be programmed.
Pressing [Enter] exits the sub-function and returns to the "Program" mode.

Important:

Factory Setting "Yes" with "Teach-in".

If this setting has been changed, the "Store" LED comes on. At this point it is recommended that "Run" mode be selected, so that the new mode is safely stored in memory.

Position Controller BPC

5.0 Additional Functions

5.2 Selcting Encoder Type "SET10"

Purpose:

The "Enc" function is used to select the encoder type (type of measuring System).

The "Enc" help function can only be called up in the "Program" operating mode. This must always be selected before the sub-function can be selected.

Operation:

1. Press [Set] and [10], then [Enter].
==> "Enc" appears in the "Value" display.
If the correct sub-function was not selected, press [Enter] to initiate a new selection. This is visible as "Set" in the "Value" display.
2. Pressing [Set] again allows entry into the selected sub-function.
==> The "Function" display goes dark. An "E" appears in the "Status" display, and the momentarily selected encoder type appears in the "Value" display.

"Rot" means rotary measuring system.

"Lin" means linear measuring system.

3. [+] and [-] keys are used now to choose between the two options "Rot" or "Lin". These flash in the "Value" display.
==> Press [Enter] to finish the selection of the encoder type.
==> "Set" appears in the "Value" display.
If now an additional number is pressed on the keypad, additional sub-functions can be programmed.
Pressing [Enter] exits the sub-function and returns to the "Program" mode.

Important:

Factory Setting "Rot" - rotary type.

If this setting has been changed, the "Store" LED comes on. At this point it is recommended that "Run" mode be selected, so that the new encoder type is safely stored in memory.

Position Controller BPC

5.0 Additional Functions

5.3 Constant Display of Encoder Value "SET 11"

Purpose:

The "Enc" function is used to constantly display the actual encoder value.

The "Enc" sub-function can only be called up in the "Program" operating mode. This must always be selected before the sub-function can be selected.

Operation:

1. Press [Set] and [11], then [Enter].
====> "Enc" appears in the "Value" display.
If the correct sub-function was not selected, press [Enter] to initiate a new selection. This is visible as "Set" in the "Value" display.
2. Pressing [Set] again allows entry into the selected sub-function.
====> The "Function" display goes dark. An "I" appears in the "Status" display, and the momentarily selected encoder type appears in the "Value" display.

"Yes" means continuous display of the actual value is selected.

"No" means display of value depending on slewing speed. With BPC AX...E3, the display shows constant "BPC A".

3. [+] and [-] keys are used now to choose between the two options "Yes" or "No". These flash in the "Value" display.
====> Press [Enter] to finish the selection of the encoder type.
====> "Set" appears in the "Value" display.
If now an additional number is pressed on the keypad, additional sub-functions can be programmed.
Pressing [Enter] exits the sub-function and returns to the "Program" mode.

Important:

Factory Setting

"No" - with rpm-dependent encoder value display for BPC AX...E1,

"Yes" - with constant encoder value display for BPC AX...E3.

If this setting has been changed, the "Store" LED comes on. At this point it is recommended that "Run" mode be selected, so that the new encoder type is safely stored in memory.

Note:

If the "Yes" option is selected for continuous encoder actual value display, then the max. possible slewing speed in "Run" mode will be the same as for "On-line" Operation.

Position Controller BPC

5.0 Additional Functions

5.4 Directional Outputs "DIR"

Purpose:

Output groups switch dependant on the rotational direction of the position transducer.

The function is called "DIR" and is a sub-function of the "Program" mode. With this function up to six (up to eight for BPC's with analog output) directional output groups (with 8 or with 2 Outputs) can be programmed. Four conditions can be selected:

bi Output group switches in both directions
up Output group switches only for increasing encoder values
do Output group switches only for decreasing encoder values
no Output group does not switch

Operation:

1. Press [Program] key.
Press [Dir] key.
====> "Value" field displays the word "dir".
2. To leave the sub-function, press the [Enter] key.
"Value" field displays the word "Pro".
Pressing the [Dir] key again brings up the sub-function mode.
====> "Function" field displays the characters "d1" (group number).
====> "Value" field displays the set direction, e.g. "bi".

d1 Stands for Group 1 ====> Output 01 - 08
d2 Stands for Group 2 ====> Output 09 - 16
d3 Stands for Group 3 ====> Output 17 - 24
d4 Stands for Group 4 ====> Output 25 - 32
d5 Stands for Group 5 ====> Output 33 - 40
d6 Stands for Group 6 ====> Output 41 - 48

Only for BPC with analog output:
d7 Stands for Group 7 ====> Output 51 - 52
d8 Stands for Group 8 ====> Output 53 - 54
3. The [+] or [-] keys can now be used to determine the direction for the selected group. When the value is changed it will first blink in the "Value" field. Pressing the [Enter] key then confirms the selection.
4. Now the [Dir] key can be used to select the next output group; otherwise press [Enter] to leave the "Dir" sub-function. This returns to the "Program" mode.
5. Directional LWK-Signal.
In Software versions 3.9 and higher, the LWK output (output 24 or 48) can be given a directional function. First the LWK output is programmed with the SET 8 function, then the DIR function is used to assign group d6 with the desired directionality. Only the LWK output is now directional. The Outputs for the program number reply (output 17 ... 23 or output 41 ... 47) are always ready.

Position Controller BPC

5.0 Additional Functions

Directional Outputs "DIR"

Important:

Factory Setting

No directional Outputs are factory set, i.e. all groups are loaded with "bi".

If the direction was changed, the "Store" LED is illuminated. To safely store the new value, switch to "Run" mode before interrupting power.

If directional Outputs are programmed, the maximum permissible slewing speed is reduced.

A High signal on the up/down input means up-counting, a Low Signal means down-counting.

Position Controller BPC

5.0 Additional Functions

5.5 Nullpoint Correction "SET 13"

Purpose:

The encoder actual value can be set to any desired value per Software.

Called up only in the "Program" mode. This must always be selected before the sub-function can be selected.

Attention:

The encoder is not permitted to rotate (absolute stop)!
This SET function is not implemented for versions BPCX AX ... E3 and is only active for rotary encoders (SET 10 → rot.).

Operation:

1. Press the keys [Program], [Set], [13] and [Enter] in that order.
====> "O-SET" appears in the "Value" display.
If the correct sub-function was not selected, pressing the [Enter] key will provide a new selection. This is indicated by "Set" in the "Value" display.
2. Pressing the [Set] key again finally enters the selected sub-function.
====> "E1" appears in the "Function" display, "o" in the "Status" display, and the currently set correction value, e.g. "000", in the "Value" display.

"E1" Stands for Encoder 1.

"o" Stands for nullpoint correction.

To see the correction value, you may press [Enter] to immediately exit the sub-function.

3. Pressing [D] starts the actual correction process.
====> The currently set correction value, with decimal points, e.g. "0.0.0." appears in the "Value" display.
Enter the desired encoder value using the numerical keypad [0...9].
====> This value flashes in the "Value" display.
Press [Enter] to confirm the entry.
====> The newly calculated correction value now appears in the "Value" display.
Example:
Encoder actual value 100, desired encoder value 150 means a correction value of 050.
Encoder actual value 100, desired encoder value 050 means a correction value of 310.
Press [Enter] to exit the sub-function.
====> "Set" appears in the "Value" display, and the "Function" and "Status" displays are blank.

Important:

Factory setting is with no nullpoint correction.

If this setting has been changed, the "Store" LED is on. It is recommended that the "Run" mode be selected before the BPC is powered down, so that the new correction value will be stored.

Position Controller BPC 6.0 Error Messages

6.1 General

Operating and device errors are recognized automatically by the BPC and indicated as an error code in the display.

When an error occurs, all outputs are switched off. The "READY" outputs is likewise turned off.

To delete an error, either momentarily interrupt supply voltage or press the [Del] and [0] keys.

Position Controller BPC
6.0 Error Messages

6.2 Other Operating Messages

Message	Meaning	Possible Cause
"Empty" or "null"	The selected program has no set-points selected.	Program Outputs or select another program.
"Check"	The "Error in Expander Module" input (X3/pin 8) is not connected.	Jumper X3 pin 8 to X3 pin 25 if "Check" appears in display and no expander is connected (only for BPC A-00360...).
".test"	BPC is initializing	1. Error in E ² -PROM. 2. Unit was turned off with activated "STORE" LED. ==> Try start-up or repair if necessary.

Position Controller BPC
6.0 Error Messages

6.3 Error Messages
Meaning/Causes

Error No.	Meaning	Possible Cause
01 Error	Error in data protection.	<p>1. "STORE" LED came on before supply voltage was turned off ==> re-program.</p> <p>2. Component defect (E²-Prom) ==> repair.</p>
02 Error	Error in working memory.	<p>Working memory (RAM) is defective ==> repair.</p> <p>Also occurs with transmission error between 310 and 8085.</p>
03 Error	Error in internal memory communication.	<p>Working memory (RAM) is defective ==> repair.</p>
05 Error	<p>Error in external program change.</p> <p>Note: If no external program change is used, X3 pin 10 must be connected to X3 pin 25.</p>	<p>The stored program no. is smaller than the min. possible program number. ==> Check wiring for external program switching.</p>
06 Error	<p>Error in external program change.</p> <p>Note: If no external program change is used, X3 pin 10 must be connected to X3 pin 25.</p>	<p>The stored program no. is larger than the max. possible program number. ==> Check wiring for external program switching.</p>
09 Error	Encoder rpm or traverse velocity too high.	<p>The rpm or input frequency of the absolute value exceeds the max. allowable input frequency of the device.</p> <p>Causes:</p> <p>a) BPC's with an Option have different max. allowable input frequencies.</p> <p>b) Measuring system resolution was selected for too high.</p>

Position Controller BPC

6.0 Error Messages

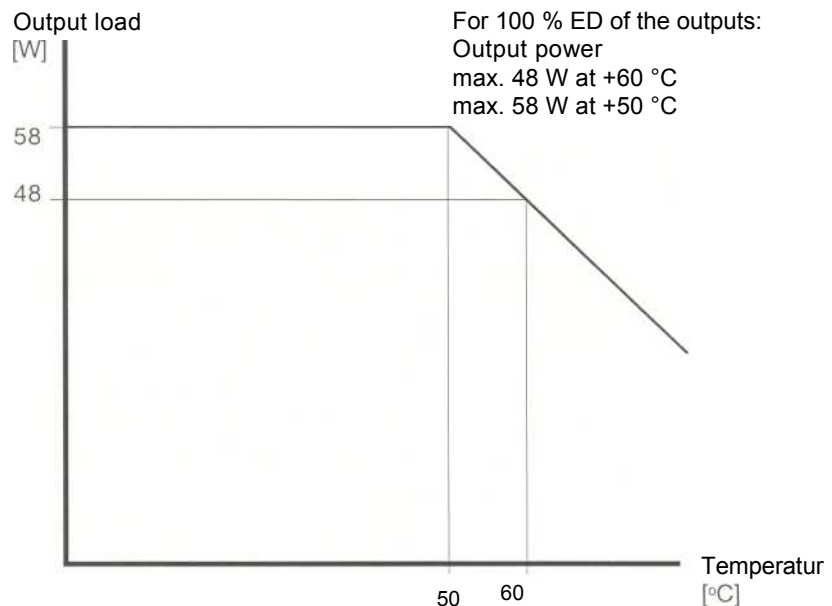
Error No.	Meaning	Possible Cause
10 Error	Encoder error (parity, cable break)	a) The cable between BPC and BRG is defective (break, poor solder joint, loose connector). b) The encoder is defective. c) Set resolution does not agree with that of the feedback system which is connected.
11 Error	Encoder actual value > resolution set in BPC	Program proper resolution using "SET 05" Service routine.
15 Error	Wrong values from the keypad	a) Keypad defective. b) bad/no ground ==> Restart, or return for repair.
20 Error	Fatal Error	Check supply voltage for noise spikes and grounding conditions.
60 Error	Error in slave processor (process error)	Restart ====> possible repair necessary
Sync	Slave processor does not run	====> repair

Position Controller BPC

7.0 Technical Data

7.1 Electrical Data

Supply Voltage V_s	15 ... 30V DC
Ripple Current draw	$\leq 10\%$ ≤ 500 mA at 24 V DC no load on Outputs
max. slewing speed (BPC A... E1... 00) when set for 360 Steps	≤ 1000 rpm with 24 Outputs in Run mode ≤ 800 rpm with 48 Outputs
No. of programs	≤ 180 rpm for BPC...E3 selectable: 4, 6, 8, 16, 32 max.
Cable length between absolute encoder and BPC	50 m
Input voltage	$30\text{ V} \geq U_{in} \geq 10\text{ V}$ (High-Level) $0\text{ V} \leq U_{in} \leq 7\text{ V}$ (Low-Level)
Input impedance	12 k... 14kOhm
Number of Outputs	24/48 PNP or NPN, short circuit protected
Multiple switch points	each output can be programmed up to 15 times
Output voltage	For PNP Outputs: $V(\text{output}) = V_s - 3,3 V_{max}$ (High-Level) For NPN Outputs: $V(\text{output}) = 0\text{V} + 3,0 V_{max}$ (Low-Level)
Output current	50 mA _{max.}



Temperature range:	
Operating temperature	0 °C... +60 °C
Storage temperature	- 20 °C... +70 °C

Position Controller BPC

7.0 Technical Data

7.2 Mechanical Data

Dimensions	192 x 192 mm Installation depth 70 mm or 135 mm with connector
Panel cutout	183 x 183 mm (+2 mm)
Max. thickness of front panel	5 mm
Mounting	Mounting screw back against mounting plate

7.3 Accesories

Rotary Encoders (Absolute)

BPC A...E1...	BRG C5-WAP..*.VOP-G-0-S/K
BPC A...E3...	BRG C5-WAP..*.VOP-G-0-S/K
BPC D...E1...	BRG C5-WBP..*.VOP-G-0-S/K

* Step numbers 360, 512, 720

BPC A...E1...	BRG-CE 100S
---------------	-------------

* Step number 3600

For detailed Information, ask for the encoder catalog!

Linear Displacement Transducers

BPC AX...E1...	BTL-P11-....*-S32
BPC AX...E3...	BTL-P11-....*-S32
Processor card	BTL-P11-200

* Stroke lengths 100 - 3200 mm

For detailed information, ask for the BTL catalog!

Connectors used with Position Controller

X4 encoder/transducer	BKS-S52-00
X3 control	BKS-S37-00
X1/X2 Outputs	BKS-S39-00

Expander Modul for 3 encoders/transducers

BRG Encoders	BPC EXP 01
Others	BPC EXP 00

PC-Software for models with serial interface	BPCEDIT
--	---------

Mounting Kit BPC

Every BPC is supplied with all required connectors and the mounting kit included.

Position Controller BPC

7.0 Technical Data

7.4 Slewing Speed and Resolution

The **input limit frequency** for the BPC is typ. 7.5 kHz. This is the highest frequency of the LSB at which the encoder value can be reliably detected. Higher frequencies are recognized and displayed as an "09 Error" message.

The **max. input frequency** for a BPC depends on the model and configuration. It is the frequency of the LSB of the encoder at which a minimum cam duration (1 measuring step) can be reliably represented on the output (see 7.5, 7.6 and 7.7).

The input frequency depends on the cycle time of the microprocessor. The cycle time is at least 167 μ s for 24 Outputs and a binary-coded encoder in the basic BPC model. More Outputs, encoder codes other than binary, or other models (not Option 00) decrease this input frequency.

The following tables show guidelines for Position Controllers in series BPC A... in the "Run" mode, based on 360 step resolution in the encoder. If other encoder resolutions are set, the values for the slewing speed will change accordingly.

These slewing speed (rpm) values assume that the "Store" LED is not on and no encoder actual value is being displayed.

Position Controller BPC 7.0 Technical Data

7.5 Slewing Speeds for BPC A... E1...

Option	max. input frequency of the system [steps/sec]		Slewing speed in "RUN" mode (at 360 steps)		Slewing speed in „ON-LINE“ mode
	24 Outputs	48 Outputs	24 Outputs	48 Outputs	
00	6,0 kHz	4,8 kHz	1000 1/min	800 1/min	100 1/min (600 Hz)
01	4,2 kHz	3,6 kHz	650 1/min	550 1/min	100 1/min (600 Hz)
04	2,4 kHz	1,9 kHz	360 1/min	225 1/min	100 1/min (600 Hz)
09*	not available	4,2 kHz	not available	700 1/min	100 1/min (600 Hz)
10	4,8 kHz	4,0 kHz	700 1/min	650 1/min	100 1/min (600 Hz)
13	1,8 kHz	1,4 kHz	360 1/min	225 1/min	100 1/min (600 Hz)
20	3,6 kHz	3,0 kHz	520 1/min	480 1/min	100 1/min (600 Hz)
21*	2,4 kHz	—	360 1/min	—	100 1/min (600 Hz)

*Special typ

Option:

- 00 = BPC standard model
- 01 = BPC serial interface
- 04 = BPC with dynamic cams
- 08 = BPC with 8 timer outputs
- 10 = BPC with 4 analog outputs
- 13 = BPC with dynamic cams and serial interface
- 20 = BPC with 4 analog outputs and serial interface

Position Controller BPC
7.0 Technical Data

7.6 Slewing Speeds for BPC D... E1...

Option	max. input frequency of the system [steps/sec]		Slewing speed in "RUN" mode (at 360 steps)		Slewing speed in „ON-LINE“ mode
	24 Outputs	48 Outputs	24 Outputs	48 Outputs	
00	3 kHz	2,7 kHz	500 1/min	450 1/min	80 1/min (270 Hz)
08*	480 Hz	not available	80 1/min	not available	80 1/min (270 Hz)

*Sondertyp

Attention!

Series BPC A... E1 should be specified where possible, as it offers the highest possible slewing speeds.

Position Controller BPC 7.0 Technical Data

7.7 Slewing Speeds for BPC A... E3.

3 Encoder selectable (encoder value always displayed)

Option	max. input frequency of the system [steps/sec]		Slewing speed in "RUN" mode (at 360 steps)		Slewing speed in „ON-LINE“ mode
	24 Outputs	48 Outputs	24 Outputs	48 Outputs	
00	720 Hz	600 Hz	120 1/min	100 1/min	20 1/min
01	540 Hz	420 Hz	90 1/min	70 1/min	20 1/min

2 Encoder selectable (encoder value always displayed)

Option	max. input frequency of the system [steps/sec]		Slewing speed in "RUN" mode (at 360 steps)		Slewing speed in „ON-LINE“ mode
	24 Outputs	48 Outputs	24 Outputs	48 Outputs	
00	840 Hz	720 Hz	140 1/min	120 1/min	25 1/min
01	600 Hz	540 Hz	100 1/min	90 1/min	25 1/min

1 Encoder selectable (encoder value always displayed)

Option	max. input frequency of the system [steps/sec]		Slewing speed in "RUN" mode (at 360 steps)		Slewing speed in „ON-LINE“ mode
	24 Outputs	48 Outputs	24 Outputs	48 Outputs	
00	1,08 kHz	960 Hz	180 1/min	160 1/min	30 1/min
01	720 Hz	600 Hz	120 1/min	100 1/min	30 1/min

**Position Controller BPC
7.0 Technical Data**

7.8 Cam Organization

Each output can be programmed up to max.15 times.

Option	Available cams per program at XX-programs						Additional cams per program	
	04	06	08	16	32	48	Analog-cams	Timer-cams***
00	328	223	167	82	40	—	—	—
01	328	223	167	82	40	—	—	—
04	328	223	167	82	40	—	—	—
08	313	208	152	67	25	—	—	8
10**	258	153	97	12	—	—	60	—
13	328	223	167	82	40	—	—	—
20**	258	153	97	12	—	—	60	—
21*	328	223	167	82	40	25	—	—

*Special versions on request.

**These versions can not be set with 32 programs.

***Outputs with timer cams can be programmed only once.

Position Controller BPC

8.0 Pin Configurations

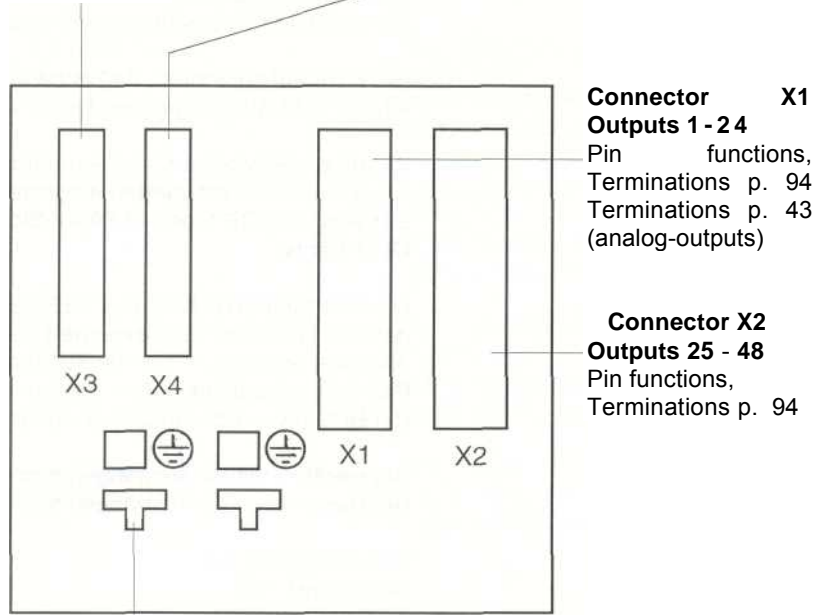
8.1 Overview Terminations

Connector X3 Control

Pin functions see p. 95 - 97
Terminations see p. 98

Connector X4 Encoder/transducer

Pin functions see p. 99
Terminations see p. 100-103



Connector X1 Outputs 1 - 24

Pin functions,
Terminations p. 94
Terminations p. 43
(analog-outputs)

Connector X2 Outputs 25 - 48

Pin functions,
Terminations p. 94

Grounding Connector

Carry ground through to star point
protection ground (δ^2)

Position Controller BPC 8.0 Pin Configurations

8.2 Connectors X1 and X2

Connections z 2 and b 2 = + Ub Supply voltage
z 32 and b 32 = 0 V Supply voltage
z 4 to b 30 = Outputs

The Outputs are sourcing for PNP versions, and sinking for NPN versions.

Remember that the last eight Outputs must have different meanings depending on the selected operating mode.

If the "Program Reply Message" mode is selected, these Outputs will show in binary the presently set program. The OP-output carries a parity signal to this program number as ODD parity.

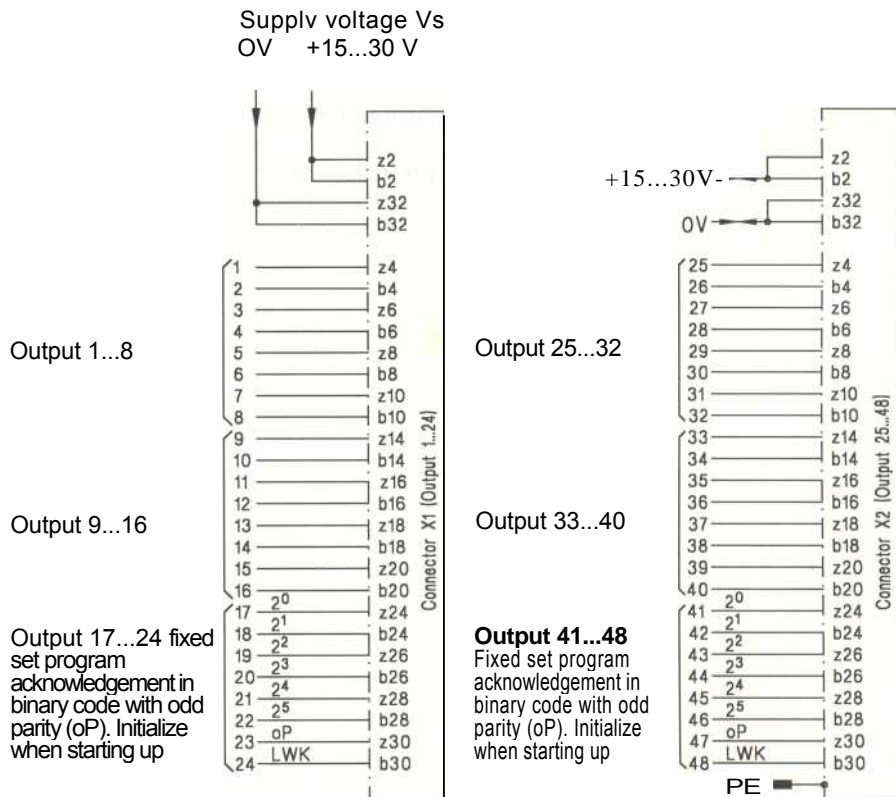
Output LWKext carries the LSB of the encoder/transducer, but through Software. Here an **external** motion Controller such as BES-516-604... can be connected.

For BPC AX...E3, this output is **always** associated with Encoder 1.

For units with 24 Outputs, these are Outputs 17 to 24. For units with 48 Outputs, these are Outputs 41 to 48.

Connector X1
Outputs 1 - 24
Analog Outputs:
Pin assignments X1 (p. 43)

Connector X2
Outputs 25 - 48



Position Controller BPC 8.0 Pin Configuration

8.3 Connector X3

Pin 1 - 7 = Serial Interface (Option)
Pin 8, 9, 11 - 13 = Program-Number of the external program select

Depending on the program, the corresponding program number must be present in binary code. The program number depends on the number of programs set for.

UB $\hat{=}$ 15...30 V

Strobe	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	Prog.-Nr.	Programm-Anzahl
UB	0V	0V	0V	0V	UB	1	
UB	0V	0V	0V	UB	0V	2	
UB	0V	0V	0V	UB	UB	3	
UB	0V	0V	UB	0V	0V	4	4
UB	0V	0V	UB	0V	UB	5	
UB	0V	0V	UB	UB	0V	6	6
UB	0V	0V	UB	UB	UB	7	
UB	0V	UB	0V	0V	0V	8	8
UB	0V	UB	0V	0V	UB	9	
UB	0V	UB	0V	UB	0V	10	
UB	0V	UB	0V	UB	UB	11	
UB	0V	UB	UB	0V	0V	12	
UB	0V	UB	UB	0V	UB	13	
UB	0V	UB	UB	UB	0V	14	
UB	0V	UB	UB	UB	UB	15	
UB	UB	0V	0V	0V	0V	16	16
UB	UB	0V	0V	0V	UB	17	
UB	UB	0V	0V	UB	0V	18	
UB	UB	0V	0V	UB	UB	19	
UB	UB	0V	UB	0V	0V	20	
UB	UB	0V	UB	0V	UB	21	
UB	UB	0V	UB	UB	0V	22	
UB	UB	0V	UB	UB	UB	23	
UB	UB	UB	0V	0V	0V	24	
UB	UB	UB	0V	0V	UB	25	
UB	UB	UB	0V	UB	0V	26	
UB	UB	UB	0V	UB	UB	27	
UB	UB	UB	UB	0V	0V	28	
UB	UB	UB	UB	0V	UB	29	
UB	UB	UB	UB	UB	0V	30	
UB	UB	UB	UB	UB	UB	31	
UB	0V	0V	0V	0V	0V	32	32

2⁰ = Pin 13
2¹ = Pin 12
2² = Pin 11
2³ = Pin 9
2⁴ = Pin 8

Position Controller BPC 8.0 Pin Configurations

Connector X3

Pin 10 = Strobe

External Program Select R

Retrieving a binary coded program number (Diagram 1) is done in the "Run" mode by changing a logic level from "0" to "1". Logic "1" must be present for min. 150 ms (Diagram 2). During the program change (ca. 1 sec) the position Controller is not running, and the "Ready" Output (pin 15) is off for ca. 1 sec (Diagram 3).

Program select is enabled done when the machine is stopped or at slewing speeds of < 20 rpm and the "Store" LED is off. Output "Release external program select" on pin 18 is switched (Logic "0"). If no program selecting is done, connect Jumper pin 10 and 25.

Diagram 1



Diagram 2

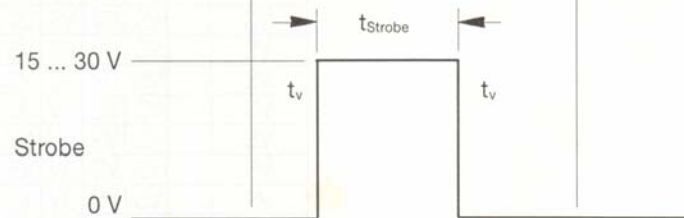
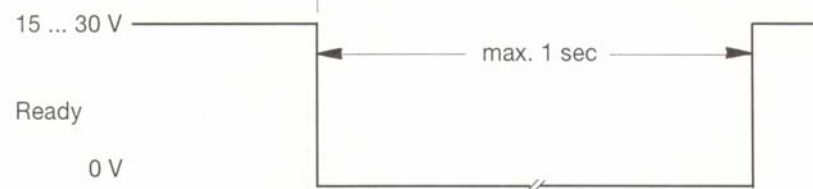


Diagram 3



$t_v = 10 \text{ ms}$
 $t_{Strobe} = 150 \text{ ms}$

Position Controller BPC

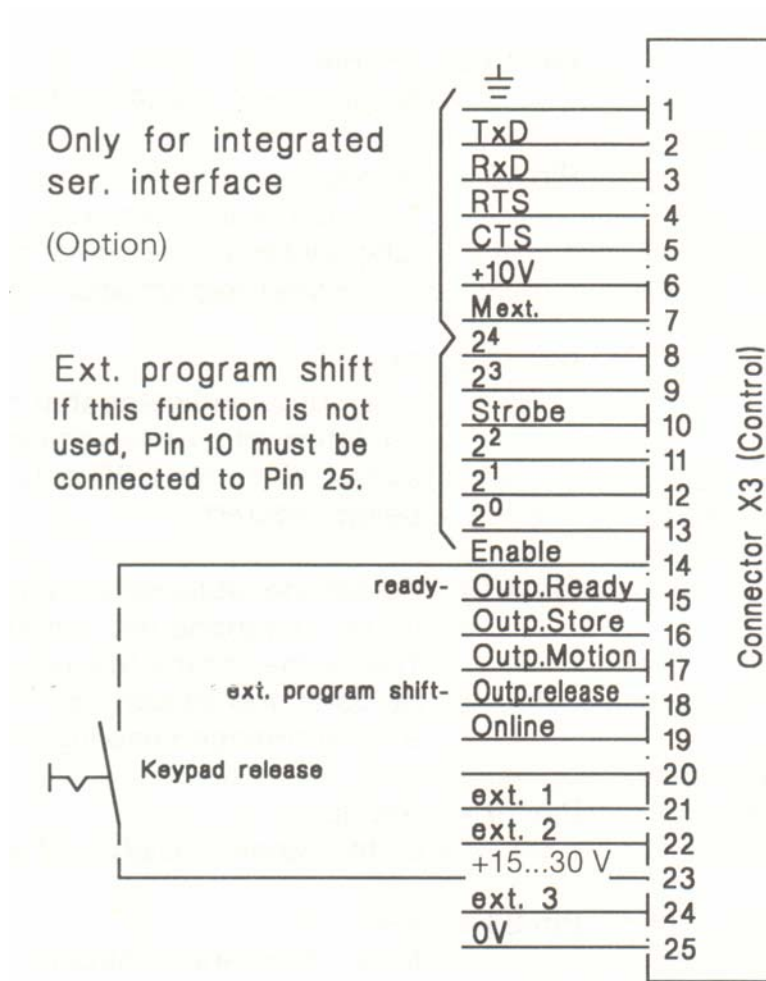
8.0 Pin Configurations

- Pin 14 = Enable
By applying V_s Pin 23 to this input, the keypad is enabled.
- Pin 15 = Ready
This output also serves as an error signal. If an error occurs (display Error), the signal changes from "high" to "low". It is also at "0" in the Program and Copy modes.
- Pin 16 = Store
This output indicates that the data has not yet been secured. Do not interrupt supply voltage. In the Run mode, operate only at reep speed, since the BPC only operates at low rpm's while data is being secured.
- Pin 18 = Release (enable) external program switching.
In the Run mode this output is set to High (+24 V) at low rpm's. That is the control release allowing an external program change to be done. Pin 18 can be connected to pins 11 -13 as well as 8 and 9 for automatic enabling of the external program select function.
- Pin 19 = Set up
Output goes to High (+24 V) in the On-line mode.
- Pin 23 = $+V_s$
for enabling the control panel over the "Enable" input pin 14.
- Pin 25 = OV

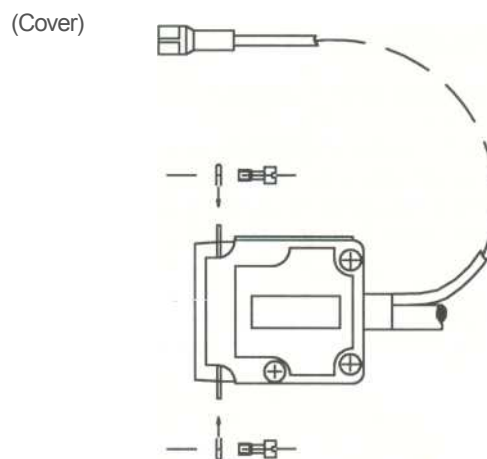
All other pins for this connector which are not described here are marked, but do not have any function and may not be used.

Position Controller BPC 8.0 Pin Configurations

Terminations Control Connector X3



Connector with pin contacts



Position Controller BPC 8.0 Pin Configurations

8.4 Connector X4

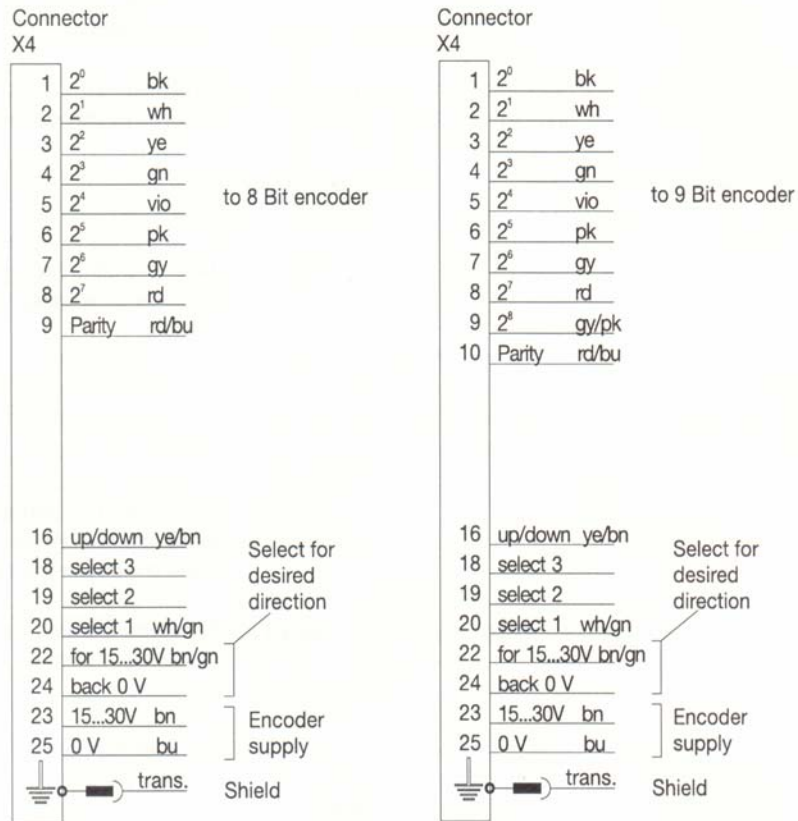
- Pin 1-15 = Bit inputs of the encoder.
If the encoder has less than 15 bits, the remaining inputs have no function. The parity bit is always referenced to the highest bit of the encoder. Other code types (e.g. BCD) are connected accordingly.
- Pin 16 Up/Down(10...30V/0V)
Input indicates whether the encoder is counting up(10... 30 V) or down (0 V).
- Pin 18-20 = Select 1 -3
If the BPC is operated with just a Single encoder, the encoder Select input is brought to pin 20/Select 1. When two or three encoders are used without an expander module, connect as follows:
- Pin 20 / Select 1 for Encoder 1 (0 V = Encoder 1 selected)
Pin 19 / Select 2 for Encoder 2 (0 V = Encoder 2 selected)
Pin 18 / Select 3 for Encoder 3 (0 V = Encoder 3 selected)
- When using the expander module, the Select Outputs from all encoders are brought to pin 20/Select 1. The differentiation is done directly in the expander module.
- Pin 22/24 = Forwards/ $\overline{\text{Backwards}}$ (15 ... 30 V/0 V)
Output for selecting direction of position transducer
- Pin 23 = + V_s
Encoder supply
- Pin 25 = 0 V
Encoder supply

Position Controller BPC 8.0 Pin Configurations

Terminations Encoder with Binary Code Connector X4

BPC AX1024...
BPC AX3600...

BPC AX1024...
BPC AX3600...



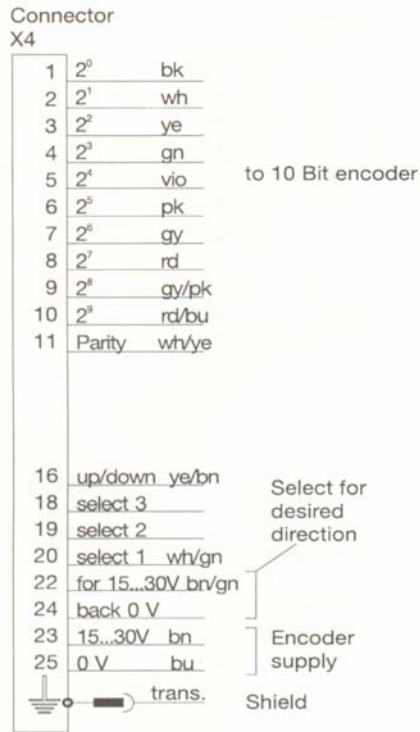
Step no. set on BPC:
128 < Steps ≤ 256

Step no. set on BPC:
256 < Steps ≤ 512

The wire colors indicated are for Series BRG encoders. Connections for Series BTL Linear Displacement Transducers are shown in page 104.

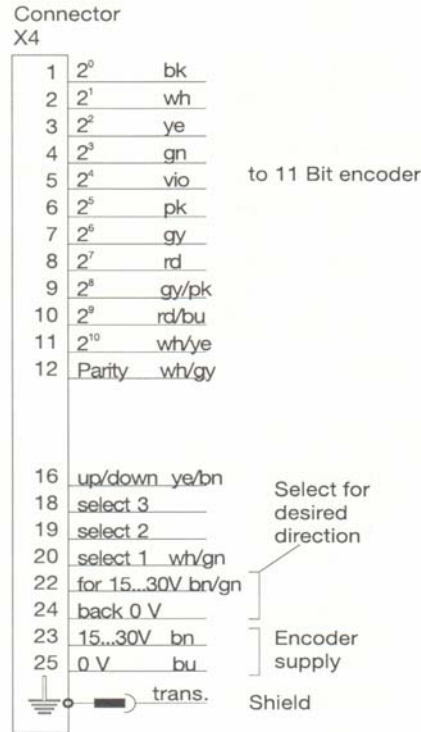
Position Controller BPC 8.0 Pin Configurations

BPC AX1024...
BPC AX3600...



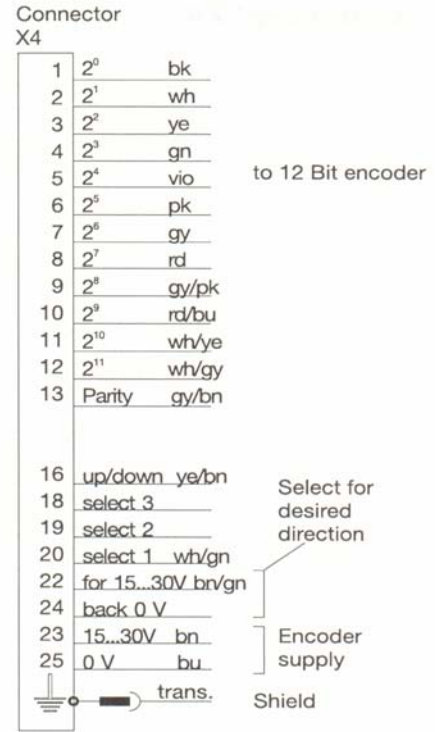
Steps no. set on BPC:
512 < Steps ≤ 1024

BPC AX3600...



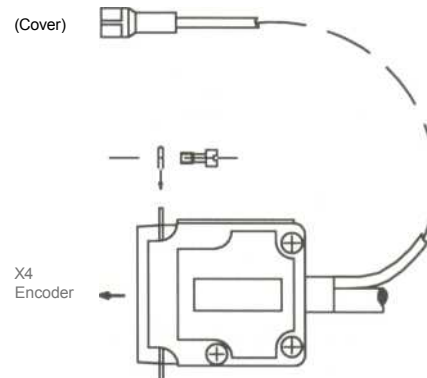
Steps no. set on BPC:
1024 < Steps ≤ 2048

BPC AX3600



Steps no. set on BPC:
2048 < Steps ≤ 3600

Socket Connector

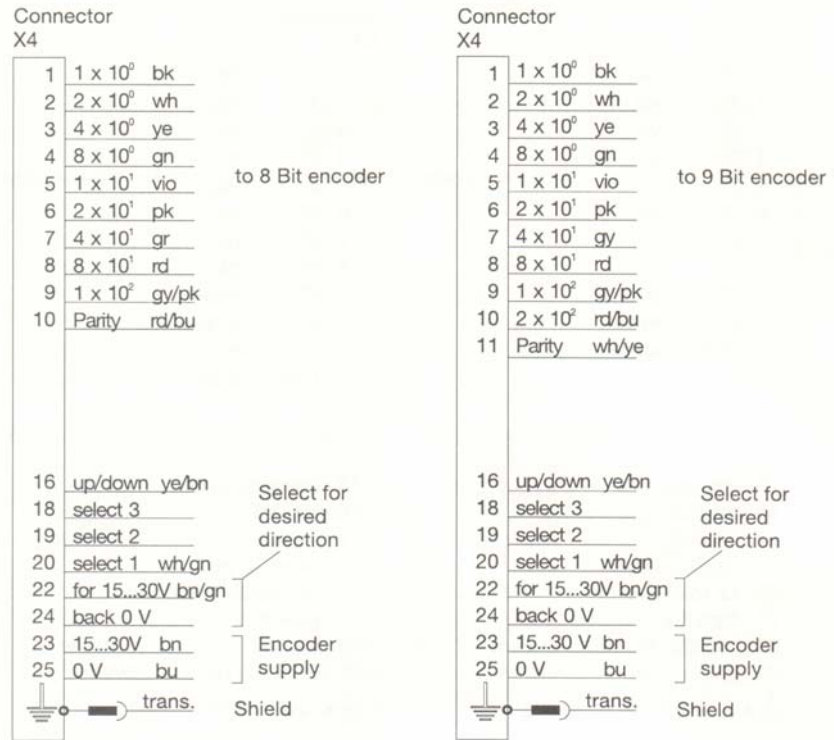


Position Controller BPC 8.0 Pin Configurations

Terminations Encoder with BCD-Code Connector X4

BPC DX3600

BPC DX3600



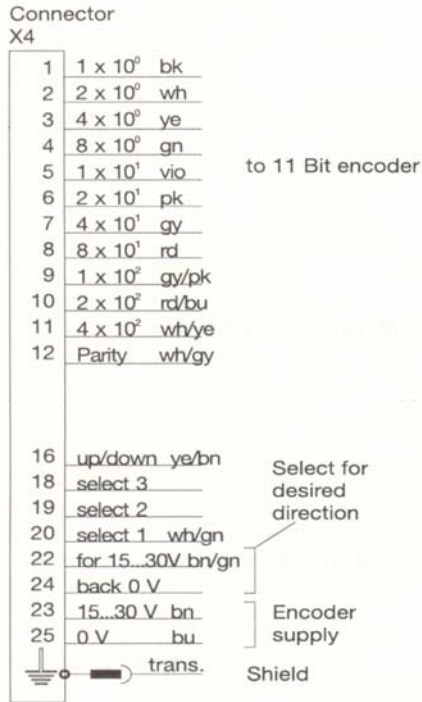
Step no. set on BPC:
150 ≤ Steps ≤ 180

Step no. set on BPC:
200 ≤ Steps ≤ 360

The wire colors indicated are for Series BRG encoders. Connections for Series BTL Linear Displacement Transducers are shown in *page 104.

Position Controller BPC 8.0 Pin Configurations

BPC DX3600...



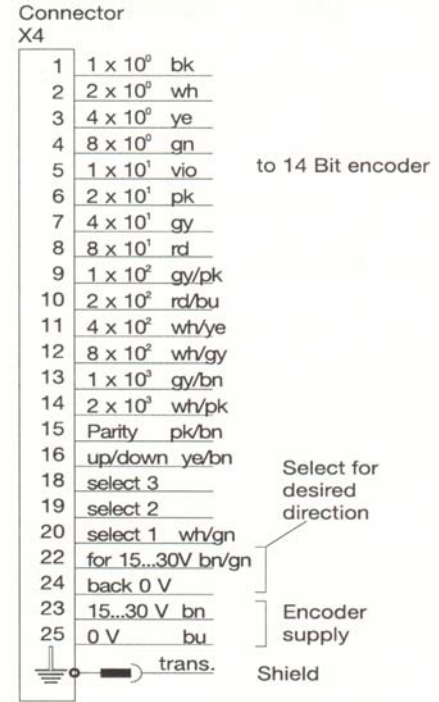
Step no. set on BPC:
500 ≤ Steps ≤ 750

BPC DX3600...



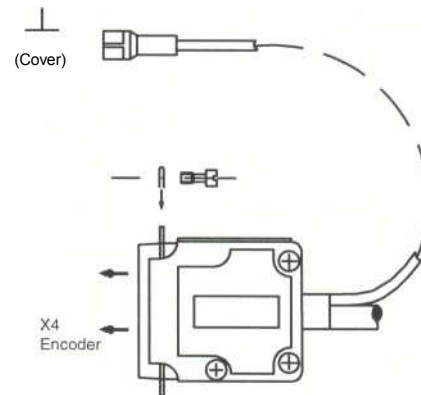
Step no. set on BPC:
1000 ≤ Steps ≤ 1750

BPC DX3600



Step no. set on BPC:
2000 ≤ Steps ≤ 3600

Socket Connector



Position Controller BPC

8.0 Pin Configurations

8.5 Usind with BTL Linear Transducer

The BTL can be connected to the BPC only through the BTA card.

1. Setting Resolution on the BPC

(see 2.4 for programming system resolution)

Up to 360 mm displacement 0.1 mm resolution. From
360 to 3200 mm displacement 1 mm resolution.

Example:

Travel 340 mm with 0.1 resolution
 $340 \text{ mm} / 0.1 \text{ mm} = 3400 \text{ Steps} = 12 \text{ bits}$

2. Setting DIP switches S 1 - 8 on the BTA Processor Card

(see BTA Technical Manual pg. 6)

Settings for BPC:

S1	-	3	-	Binary-Code
S4	+	5	-	displacement
S6			-	odd-Parity
S7			-	resolution 0.1 mm to 359 mm displacement
			-	resolution 1 mm up to 360 mm displacement

3. Hookup BPC-BTA

Data bits BPC → Data bits BTA depending on resolution

Supply voltage BPC → Supply voltage BTA

* Parity BPC → Parity BTA

Note!

* Odd parity must always be connected to the pin according to the data bits of the BPC.

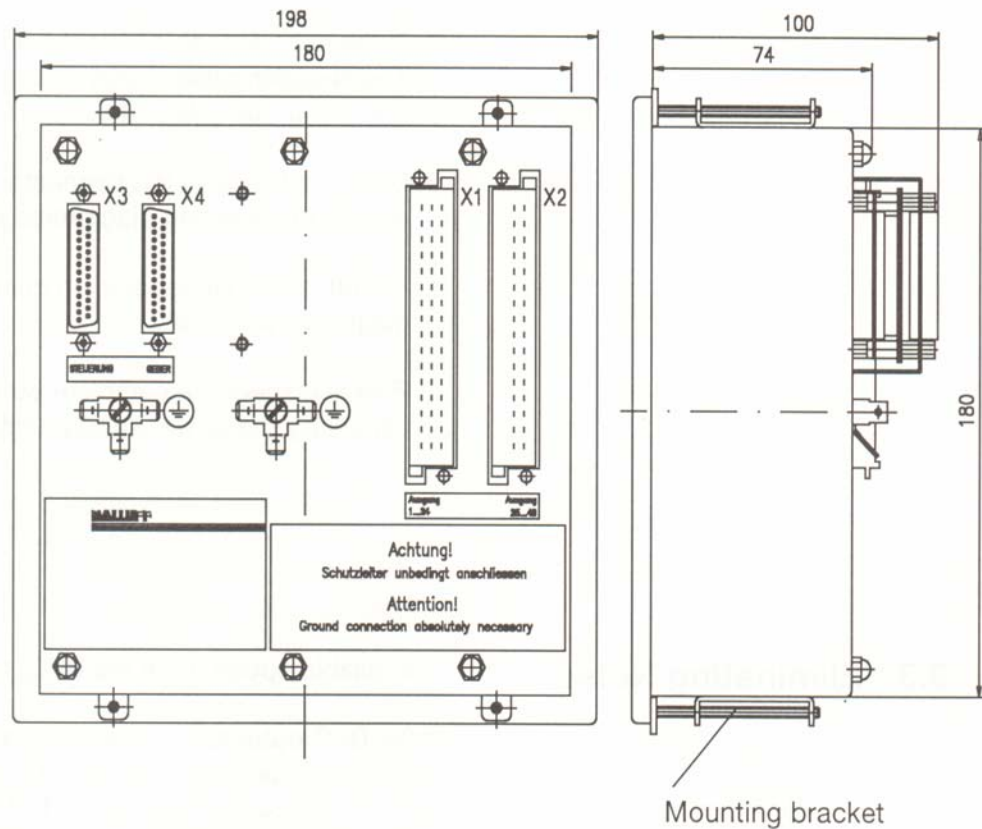
Position Controller BPC

9.0 Installation

9.1 Dimensions

The BPC is designed for installation in a front panel. Cutout dimensions are 183 x 183 mm (+2 mm). The front panel should not be thicker than 5 mm.

The BPC is set in this cutout and tightened against the front panel from behind using mounting attachments (see drawing).



Front panel	192 x 192 mm
Front panel including surrounding rubber seal	ca. 198 x 198 mm
Housing	180 x 180 mm
Front panel cutout	183 x 183 mm (+ 2 mm)
Installation depth	70 mm
Installation depth incl. connector or Expander	ca. 135 mm
Expander	91 x 60 x 30 mm
max. thickness of front panel	5mm

Position Controller BPC

9.0 Installation

9.2 Notes

1. When routing cable in the cabinet, avoid running power cables and control cables in parallel.
2. Do all control elements have protection against inductive turn-off spikes ($V_{\text{inductive}} \leq 40 \text{ V}$)?
3. Is the BPC grounded?
Is this ground carried continuously all the way to the star point of the protective ground, using copper conductor (min. gage 6 mm^2)?
4. Is the encoder cable installed **without** intermediate terminations?
The encoder cable shield must be grounded to the BPC. Interruptions of the shield nullify this effect.
5. Does the wiring of the connector correspond to the resolution of the encoder (see wiring diagrams page 101 -104)?
6. Are **all** unused input pins on connector X3 jumpered to 0 V (see wiring diagram page 99)?
7. Please inspect the complete wiring System **before** turning on the BPC, especially the power supply. Voltages $> 30 \text{ V}$ will destroy the BPC.

9.3 Eliminating Noise

For reliable Operation of the BPC, the following steps may have to be taken:

If the BPC Outputs are switching inductive loads (relays, valve coils), a recovery diode should be used for DC and an RC component for AC (e.g. $22 \text{ uf}/220 \text{ Ohm}$ per VDE 0113 Part 200/IEC 550). The lines to the encoder value inputs, to the external program switching terminal, and the strobe input may require shielded cable, and should not be run directly next to weld current lines or lines to rpm-regulated motors. Also, connectors with metal bodies should be used.

For strong noise in the commons supply, a commons filter (e.g. Schaffner FN 342-3/05) together with a separate supply (e.g. Murr TNG 170-220/24 Article Number 85262) should be used.

MP-ELEKTRONIK

Position Controller BPC AX / DX

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