Manual AP20 Counter

- **8 Digit display in DIN-enclosure 96 X 48 mm**

- **Supply voltage 10 – 35V DC**

- **All in- and outputs optically isolated**

- **Input for incremental encoders**

- **RS232**

- **2 Digital inputs and 4 digital outputs**

- **12 Programmable cams / 4 outputs**

- **24 Programmable nominal values**

- **12 Programmable Cams over 4 outputs
  (cycle time 250μS)**

- **Programmable analog output (16 bit)
  (with teach function)**

- **Programmable Linearization function**

- **Programmable PeakHold function**

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DIEGON

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1   Introduction

1.1 General

With the microcontroller based AP20 it is possible to connect the following encoder types:
- Incremental with quadrature (two 90°) signals
- Incremental with pulssignal and directionsignal

It is standard equipped with 2 digital inputs and 4 digital outputs, all free programmable. The AP20 features a RS232 communication port and a analog output.

With the 12 programmable cams several functions can be realized like limit detection.

Another feature of the AP20 is the memory for the nominal values. The 24 programmable values can be used to determine the positions of the cams.

The microcontroller reads the actual sensor value and calculates the display-value and the actual velocity. A programmable power failure protection makes sure that the actual value is stored in an EEPROM. The AP20 is configurable for numerous applications by adjusting its parameters.

The AP20 can be programmed with the DST2 PC-based software.

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1.2 Important information

✓ The AP20 is a high-tech electronic product. To ensure safety and a correct functioning of the product it is important that only qualified specialists will install and operate the AP20.
✓ If through a failure or fault of the AP20 an endangering of persons or damage to plant is possible, this must be prevented using additional safety measures. These must remain operational in all possible modes of the AP20.
✓ Necessary repairs to the AP20 are only to be carried out by the manufacturer.

1.3 EMC

To ensure the best possible electromagnetic compatibility, it is recommended to pay attention to shielding and grounding the AP20:
✓ Shielding on both sides and with the largest possible contact area.
✓ Keep wiring as short as possible.
✓ Earth-connections should be short and with the highest possible wiring-diameter.
✓ Signal-cables and supply-cables must be separated.
✓ The EMC-bracket type EMC-B02 should be used.

1.4 Definitions

1.4.1 Display units AWE

The display units, referred to as AWE, is the value shown on the display without regarding the decimal point. The decimal point is only used for the comfort of the operator, but has no functional meaning.
(display = 347.4 >> AWE = 3474)

1.4.2 Parameter number

A parameter number is always shown in the format P[xxx]. It is possible that a parameter number appears in more than one menu.

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1.4.3 Notation

Values can be displayed in different notations like binary or hexadecimal. The character behind the value shows in which notation the value is represented:

100D	<u>D</u>ecimal
238H	<u>H</u>exadecimal
244G	<u>G</u>ray
10010011B	<u>B</u>inary

for example 220D = DCH = 11011100B

1.4.4 Edges

L→H	: rising edge (low to high)
H →L	: falling edge (high to low)

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2   Operation

2.1 Key functions

[P]

[P] key
- Cycle through monitoring displays
- Activate programming mode (in combination with other keys)

[+1]

[+1] key
- View type number

[←]

[Cursor] key
- View software version
- View custom software version (in combination with the [Enter] key)

[→]

[Enter] key
- View status of inputs and outputs

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2.2 Key functions in programming mode

P

[P] key
- one step back in menu
- discontinue programming mode
- discontinue changing nominal values/parameters (edit mode)
- LED is on when programming mode is active

+1

[+1] key
- cycle through menu
- increase nominal value- / parameter number
- increase digit (in edit mode)

←

[Cursor] key
- activate edit mode
- move one digit to the left (in edit mode)

→

[Enter] key
- enter a submenu or parameter
- increase nominal value-/parameter number
- store a changed value
- clear value, hold down [Cursor] button (edit mode)

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2.3 Display functions

2.3.1   Status functions

Power on

  Appr. 1sec.

  Operating (normal) mode
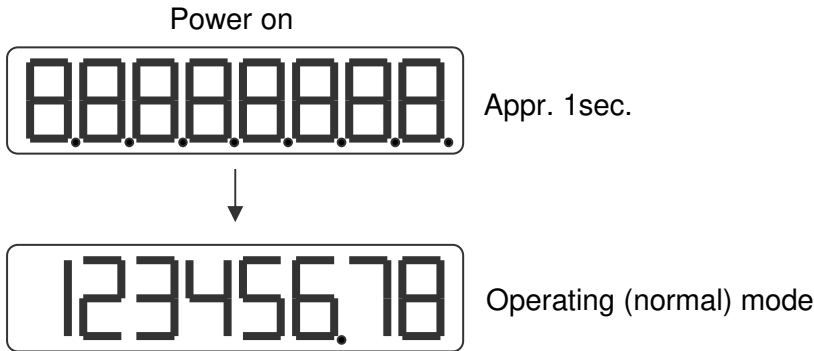
2.3.2   Error messages

There are two groups of errors:
- Parameter errors (error numbers 0…499, preceded by a "P")
- General error (error numbers from 500 and up)

Example:

Parameter error number

  Error parameter 203
(Parameter out of min/max value)

General error number

  General error 700

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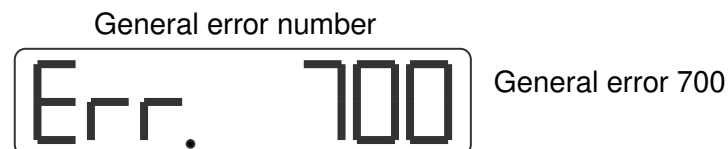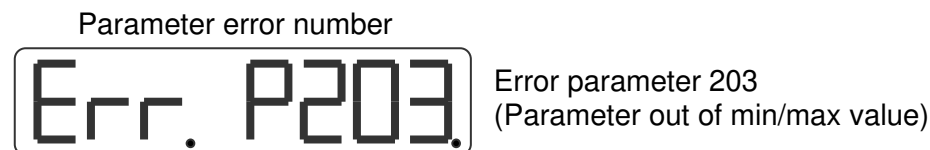
2.3.3   Survey of error messages

Error messages:
000...499   Parameter error is displayed as PXXX on the display.

700 = Reference value P[003] >= Counting range P[004]

716 = Umin >= Umax (analog output)
717 = Imin >= Imax (analog output)

720 = Changelock nominal values active
721 = Changelock parameters active

732 = Function input-2 not valid (equal to input-1)

Error messages linearization (xx = P1 …P30)
9xx = Linearization Xn <= Xn-1
940 = Linearization (mode 1 or 2) X1 <> 0
941 = Linearization mode 1) Y1 <> 0

Error messages for cams (latst 2 digits = cam number)

1001…1012	length cam = 0 (cam begin = cam end) or cam begin <= cam end (with no counting range active)
1101…1112	length cam <= Hysteresis
1201…1212	(2 * hysteresis) + cam length >= counting range
1301…1312	cam begin and/or cam end outside counting range (incl. hysteresis)
1401...1412	hysterese to large (> half counting range) only with timer cams

Error messages ASCII
er 1 = parity error
er 2 = frame error
er 3 = overflow error
er 4 = buffer overrun
er 5 = number invalid
er 6 = data invalid (outside min/max value)
er 7 = programming mode parameters/nominal values active

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3   Programming

There are three different modes of operation:

- Automatic mode
- Programming mode for nominal values
- Programming mode for parameters
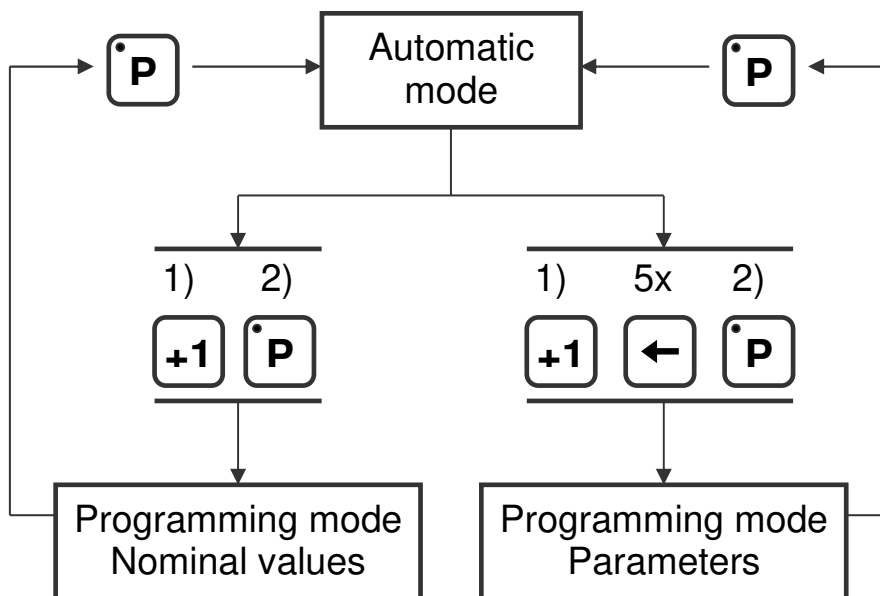
1) hold
2) press once

3.1 Automatic mode

In the automatic mode, depending on the type of sensor, the increments are counted or the absolute position is read and the result is shown on the display as the actual value. The velocity is calculated and can be visualized as well.

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3.1.1   Monitor function

In automatic mode different variables can be displayed. By using the [P] key one can cycle through the different pages:

- Actual position
- Actual velocity
- Actual linearization
- Actual PeakHold 1
- Actual PeakHold 2
- Voltage or current of the DA (analog out)

	Variant		Actuele waarde
[P]	Act. PoS.	Na 2sec. →	398.05
	Act.SPEEd.	→	23.40
	Act. l in	→	10.0000
	P-HoLd 1	→	23.40
	P-HoLd 2	→	23.40
	U dA out	→	10.0000
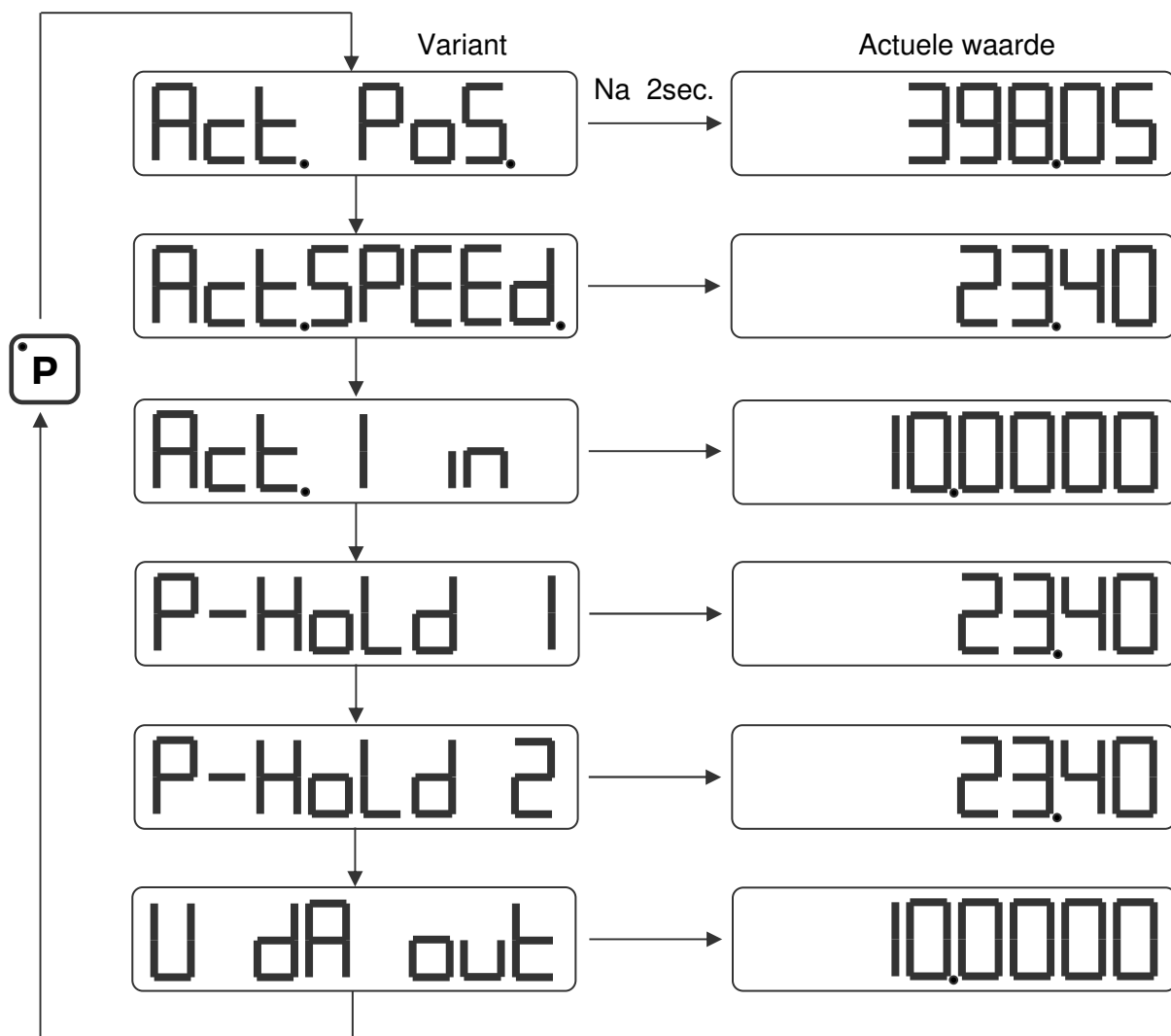
Parameter P[208] determines which option is visible after start-up.

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3.1.2   Displaying the type number

Automatic mode

| 12345678 |

↓

| +1 |

↓

| AP20-CA | Type
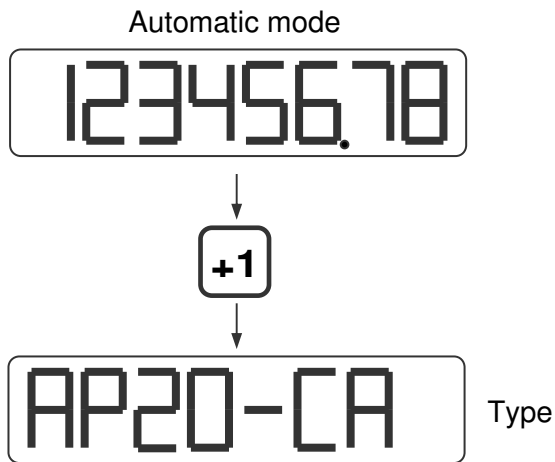
3.1.3   Displaying the software-version

Automatic mode

| 12345678 |

↓

| ← |

↓

| SoFt. 1.01 | Standard software

↓

| → | (Keep ← pressed)

↓

| SPEC. 1.05 | Custom software

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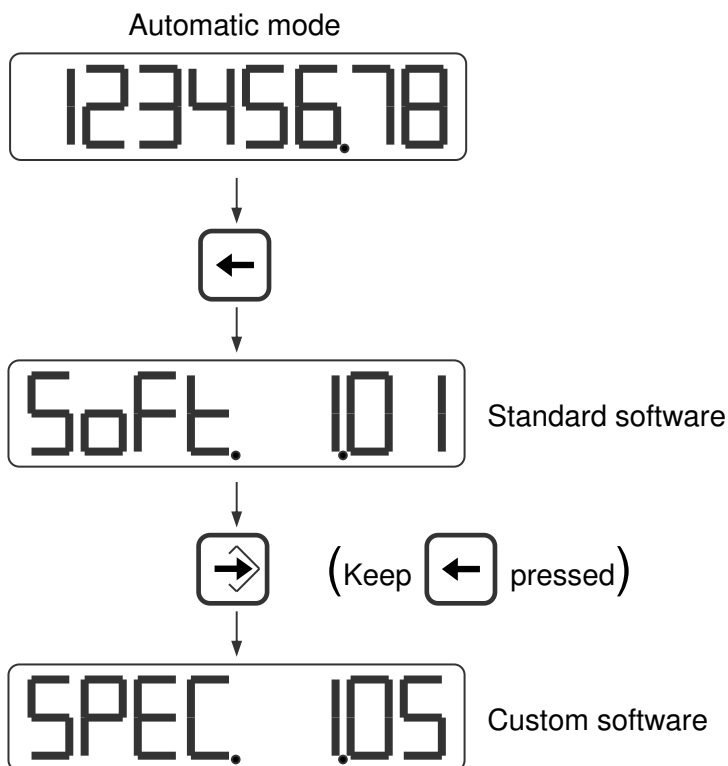
3.1.4   Status in- and outputs

Automatic mode
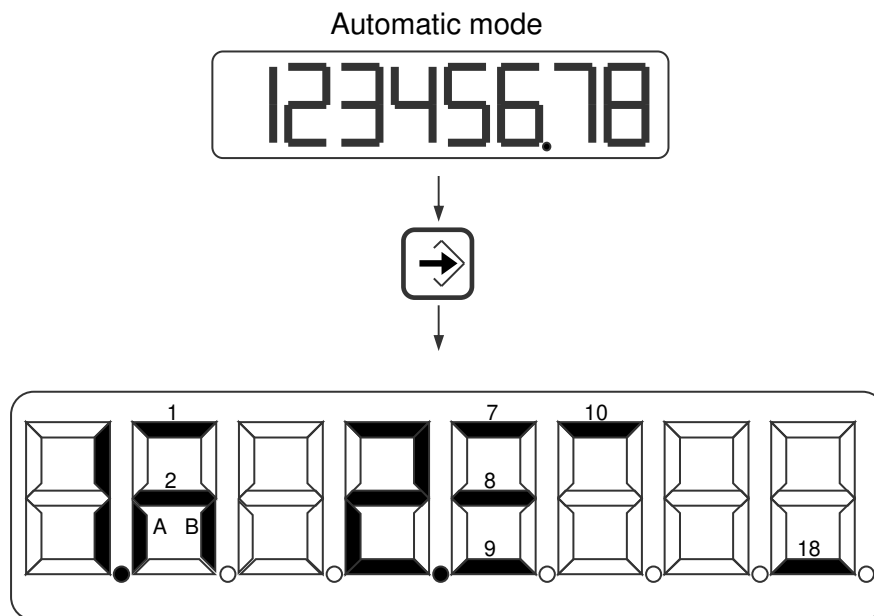
Inputs
1 = input-1
2 = input-2
A = input K1
B = input K2

Outputs
7 = output-1
8 = output -2
9 = output -3
10 = output -4

Outputs
18 = Cams active

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3.2 Changing nominal values

Automatic mode

| 1 2 3 4 5 6 . 7 8 |
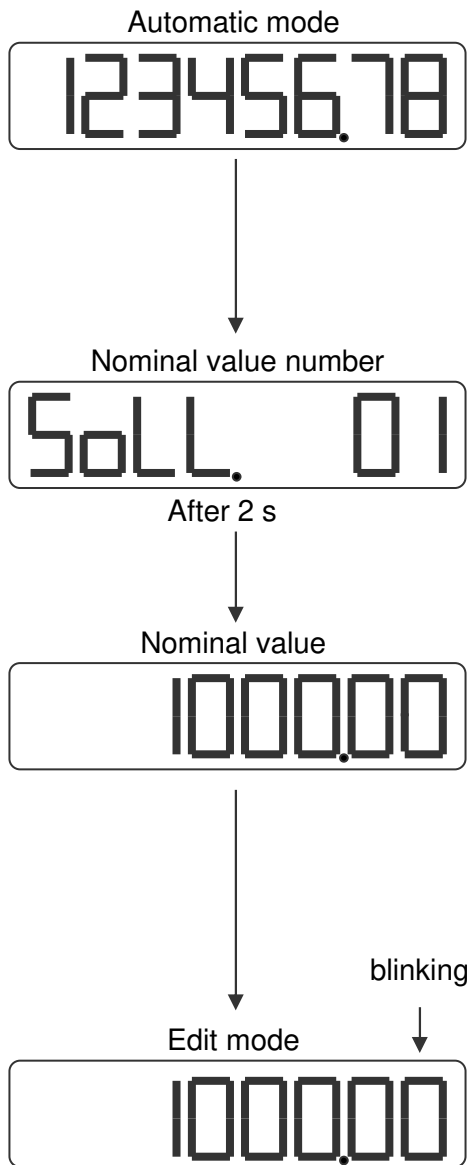
Access to nominal values

*)

| +1 | Then | P |

↓

Nominal value number

| SoLL.   0 1 |

After 2 s
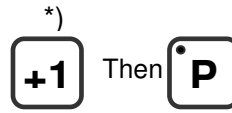
Select nominal values

| P | Exit programming mode

| +1 | Nominal value number +1

| ← | Activate edit mode

| → | Nominal value number +1

↓

Nominal value

| 1 0 0 0 0 . 0 0 |

↓

blinking
↓

Edit mode

| 1 0 0 0 0 . 0 0 |

Changing values

| P | Exit edit mode

| +1 | Increase digit

| ← | Move one digit left

| → | Confirm change

*) | ← | Then | → | Clear input

*) keep pressed

16

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3.3 Changing parameters

3.3.1   Menus

The parameters are displayed in different menus and submenus:

```
1 ConFiG
2 ActuAL
3 SEriAL
4 InPut
5 OutPut
    5.1 OP1
    ... ...
    ... ...
    5.4 OP4
6 Cam
    6.1  CA1
    ...  ...
    ...  ...
    6.12 CA12
7 An out
    7.1 ConFG.
    7.2 dA-U
    7.3 dA-I
8 Lin
    8.1 ConFG.
    8.2 P 1
    ... ...
    ... ...
    8.31 P30
9 P-HoLd
    9.1 Hold1
    9.2 Hold2
```

Example:
PAr. 6.1.1 is
menu 6, submenu 1, parameter 1

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3.3.2 Input parameters

Automatic mode

$$12345678$$

↓

Menu

$$1\ ConFiG$$

↑
Menu

Submenu

$$2.1\ Cnt.$$

↑ ↑
Menu └─ submenu

Parameter number

$$P\ 2.1\ 1$$

After 2s

↑ ↑ ↑
Menu submenu Par.

Parameter value

$$100.00$$

Edit mode

blinking
↓
$$100.00$$
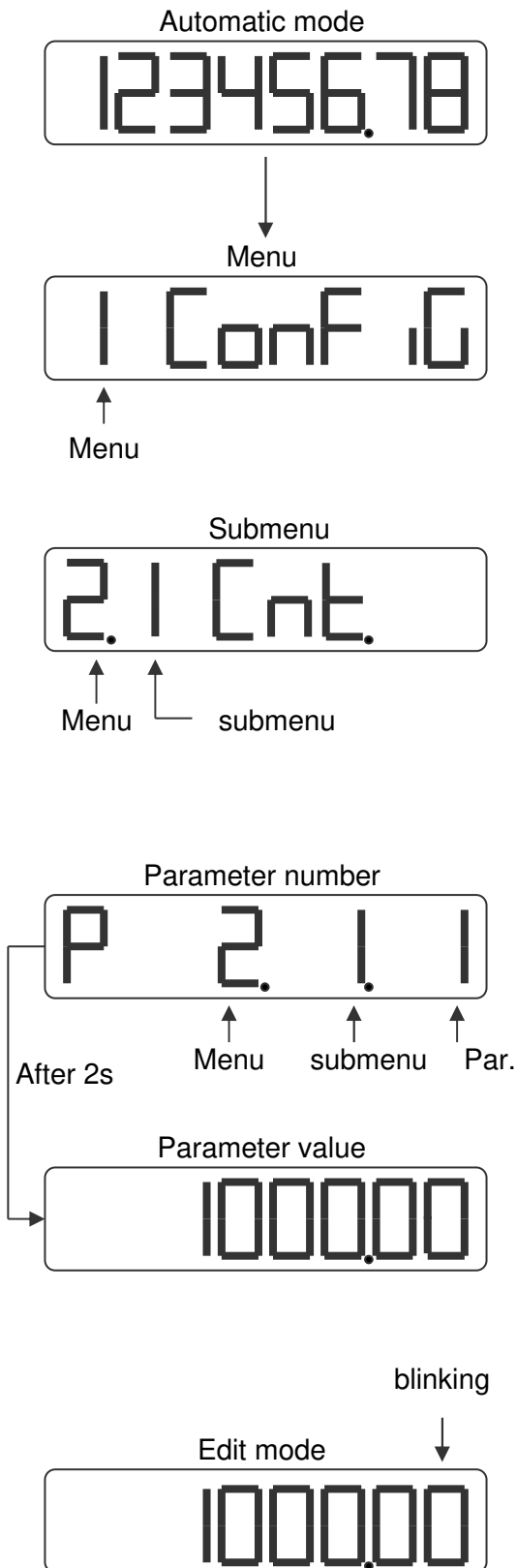
*) keep pressed down

Access parameters
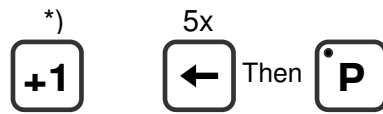
*) | 5x
[+1] [←] Then [P]

Menu selection

[P] Exit programming mode

[+1] Menu item +1

[→] To submenu/parameter number

Submenu selection

[P] Back to menu

[+1] Submenu item +1

[→] To parameter number

Selecting parameters

[P] Back to menu/submenu

[+1] Parameter number +1

[←] Activate edit mode

[→] Parameter number +1

Changing parameters

[P] Exit edit mode

[+1] Increase digit-value

[←] Move 1 digit to the left

[→] Confirm input

*)
[←] Then [→] Clear input

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DIEGON
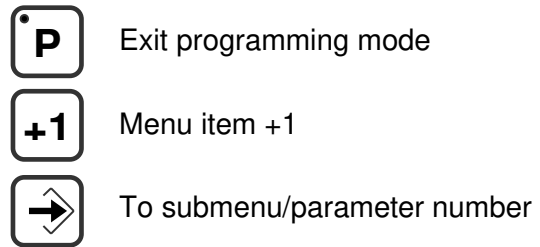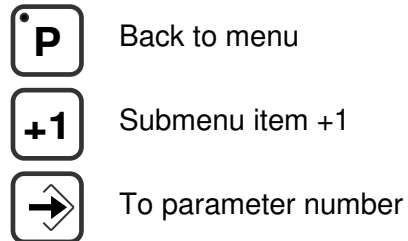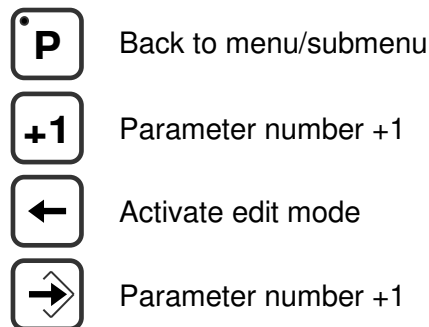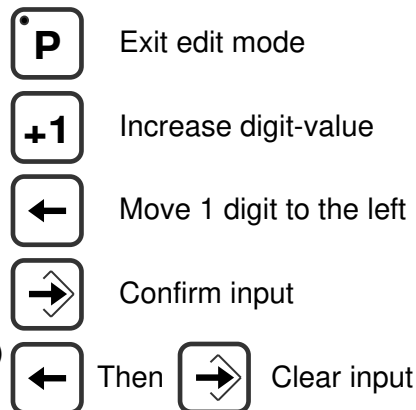
4   Functions

4.1 Actual position

The actual position shown on the display.

$$\text{Actual position} = \text{Counter} \times \text{FL} \times \text{dir} \times \frac{Mt}{Mn}$$

FL	=	edgemultiplier	P[210]
Mt	=	multiplicator numerator	P[000]
Mn	=	multiplicator denominator	P[001]
dir	=	direction (x1 or x −1)	P[211]

4.2 Velocity measurement

The velocity measurement is always active and delivers the actual speed in AWE/s.
Two parameters are necessary to configure the measurement:

P[088] = measuring time [AWE/s]
The smaller the measurement time the more dynamic the velocity measurement will be. This time is also the refreshment-interval on the display.

P[202] = integrator
The number of cycles are programmed. The average velocity (unit =AWE/s) of the programmed cycles is calculated.

Example:
Measurement time = 50ms, integrator = 10.
The actual velocity will be refreshed every 50 ms and is the average velocity during the last 10 measurements.

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4.3 Multiplicator

By using the multiplicator it is possible to convert the counter-value to display-units (AWE).

> *Example:*
> *Encoder with 90º shifted signal and 1024 increments/revolution will have 4096 edges/revolution. If the desired value in the display is 360,0 (= 3600 AWE), the multiplicator will be 3600/4096 = 0,87890625.*
> *It is possible to program the exact values (3600 and 4096) instead of the fraction.*
>
> *Multiplicator (numerator)   P[000]   = 3600*
> *Multiplicator (denominator) P[001]   = 4096*
>
> *Through P[203] it is possible to adjust the decimal point.*

4.4 Power failure protection

If P[206] = 1 then the actual position of the AP20 will be stored in EEPROM when power is shut down. After power up this value will be restored. When the writing is finished the display shows the following.

```
 ┌──────────────────────┐
 │   — — — — — — — —     │
 └──────────────────────┘
```

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DIEGON
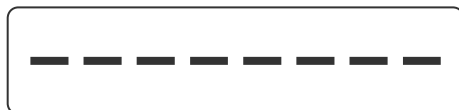
4.5 Edge multiplication (counter input)

There are tree possibilities for the counter input:

V-signal x4:   edge multiplication x4, 90º *shifted encoder signals.*
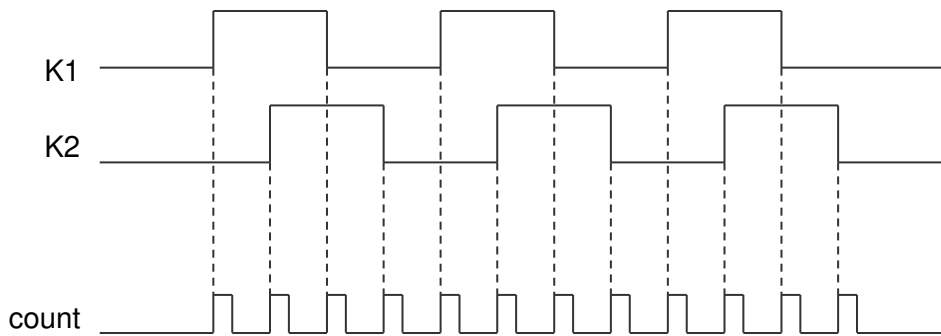
S-signal x2:   edge multiplication x2, encoder signal with directional signal.
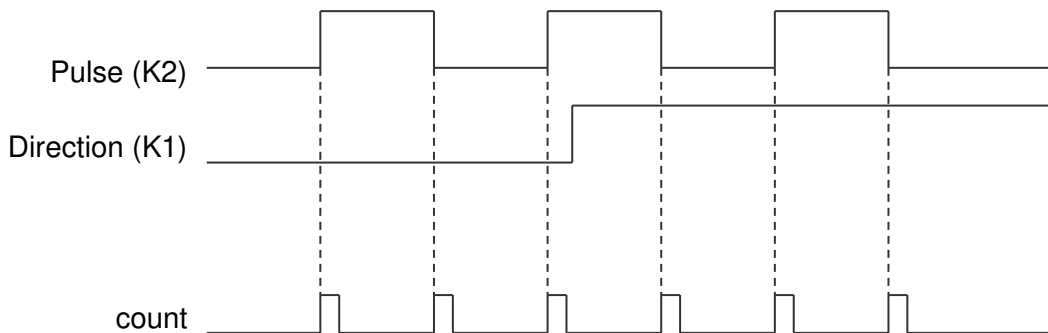
S-signal x1:   edge multiplication x1, encoder signal with directional signal.

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DIEGON
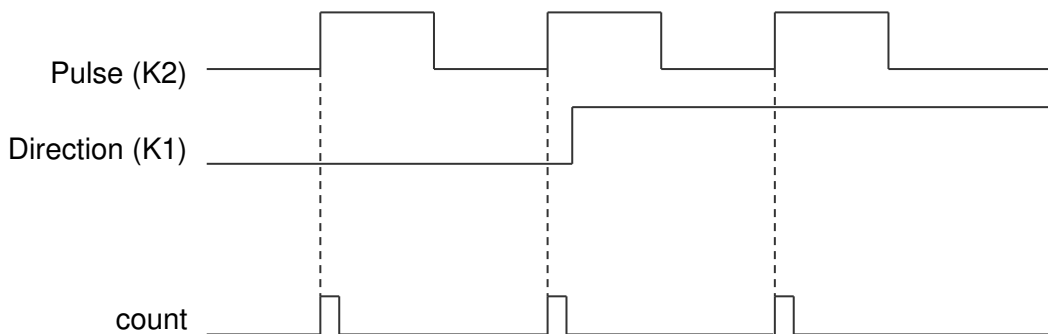
4.6   Preset

The preset function can be used in 3 ways:
- Using inputs 1 or 2 (in combination with reference coarse)
- Using parameter service functions P[207]
- Using front keys

4.6.1 Preset using input 1 or 2

The function preset is used to set the actual value to a programmed value, stored in P[003].
The value will be set in case of an active edge from the reference fine signal (Input 1 or 2).
If reference coarse has been activated (P[213] <> 0) one of the inputs has to be programmed to "`1 – Reference Coarse"`.

Reference fine

Reference coarse

| P[212] = 1 | P[212] = 0 | P[212] = 1 | P[212] = 0 |
| P[213] = 1 | P[213] = 1 | P[213] = 0 | P[213] = 0 |
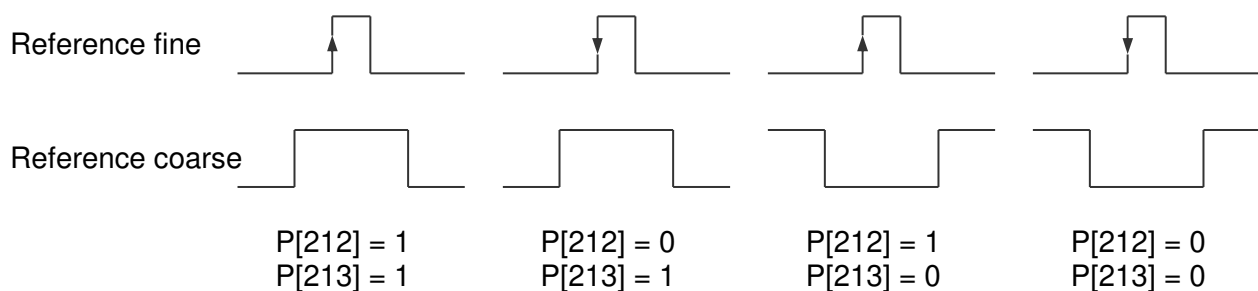
4.6.2 Preset using service parameter P[207]

When P[207] has the value 111 then the actual position is preset with the value of P[003] when exiting the programming mode. The parameter reference coarse P[213] and direction reference fine P[209] have no function.
After executing this function parameter P[207] will have the value 0 again.

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4.6.3 Preset using front keys

The function preset can be executed with the key combination [Enter] + [P]. Holding down the [Enter] key and push the [P] key one time. Then the actual position is preset with the value of P[003]. The parameter referene coarse P[213] and direction reference fine P[209] have no function.

This function is active when: P[212] = variant **"3 front keys"**

4.7 Counting range (counter input and internal frequency)

The counting range used by the counter can be limited when using the counter input or the internal frequency (P[201] = 0 or 2). The counting range can be set either by parameter or nominal value.

4.7.1 Set counting range by parameter "Counting range" P[004]

If P[233] = variant **"0 parameter counting range"** the increments for the counting range can be programmed in parameter P[004], ignoring the decimal point. If P[004] = 0 the counting range is deactivated.

$$\text{Counting range P[004]} \;=\; \frac{\text{Display range (AWE) * Mul (nominator) P[001]}}{\text{Mul (denominator) P[000]}}$$

The number of increments is programmed, ignoring the decimal point.

Counting range P[004]
0 = function not active
1 … counting range

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Example:
Incremental encoder, 90º shifted signals, 1000 pulses/rev. and 1,5 rev.
= 360,0 degrees.

1000 pulses/rev. is equal to 4000 increments/rev. (edge multiplication x4).
3600 AWE ⇔ 1,5 x 4000 = 6000 increments
Multiplicator (numerator)   P[000]   = 3600
Multiplicator (denominator) P[001]   = 6000
Counting range   P[004]   = 6000 increments
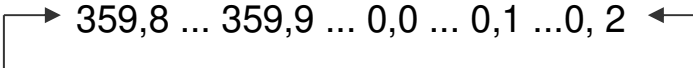
At P[203] it is possible to program the use of a decimal point.

Display will show: → 359,8 ... 359,9 ... 0,0 ... 0,1 ...0, 2 ←

4.7.2 Set counting range by nominal value

If P[233] = variant **"x Nominal value x"** the increments in AWE for the counting range can be programmed by the selected nominal value. In this case P[004] is internally calculated. If the selected nominal value = 0 the counting range is deactivated

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4.8   ASCII protocol

The serial port of the AP20 is able to work with an ASCII protocol.

Using the ASCII protocol, actual values can be read, parameters and nominal values can be stored and read, the status of the digital inputs and outputs can be monitored etc.

4.8.1   Overview functions

sc   **select AP20**
r0   **Read actual position (AWE)**
r1   **Read actual velocity (AWE/s)**
r2   **Read actual voltage analog output (0,1mV units)**
r3   **Read actual current analog output (0,1 mA units)**
r8   **Read actual linearization (AWE)**
ra   **Read actual PeakHold 1**
rb   **Read actual PeakHold 2**
ri   **Read status inputs**
ru   **Read status outputs**
rk   **Read status input K1 en K2**
wu   **Write outputs**
rp   **Read parameter**
wp   **Write parameter** (Only EEPROM)
rs   **Read nominal value**
ws   **Write nominal value** (RAM + EEPROM)
rx   **Read software version**
rt   **Read type number**
rh   **Read hardware version**
rf   **Read error number**
rn   **Read status bits**
bp   **Load and activate**

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4.8.2 General

Through the ASCII protocol it is possible to communicate with the AP20.

Send: Data from PC, PLC → AP20

Receive: Data from AP20 → PC, PLC

Connection without EMC bracket

PC   AP20

Rxd	2	
Txd	3	
0V	5	

14	Rxd
13	Txd
12	0V

9P sub-D female   Conn.
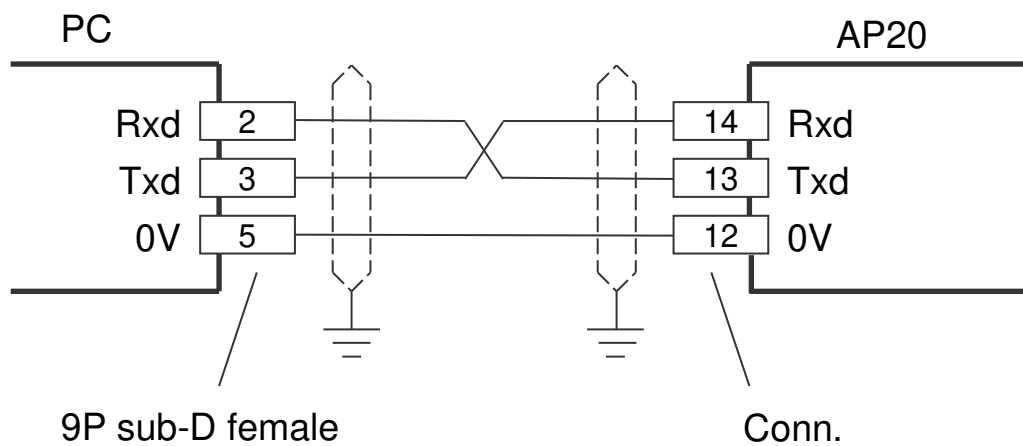
Connection with EMC bracket (EMC-B02)

PC   AP20

Rxd	2
Txd	3
0V	5

2	2
3	3
5	5

green
yellow
white

14	Rxd
13	Txd
12	0V

9P sub-D female   9P sub-D male   Conn.

9P sub-D female
(EMC bracket)

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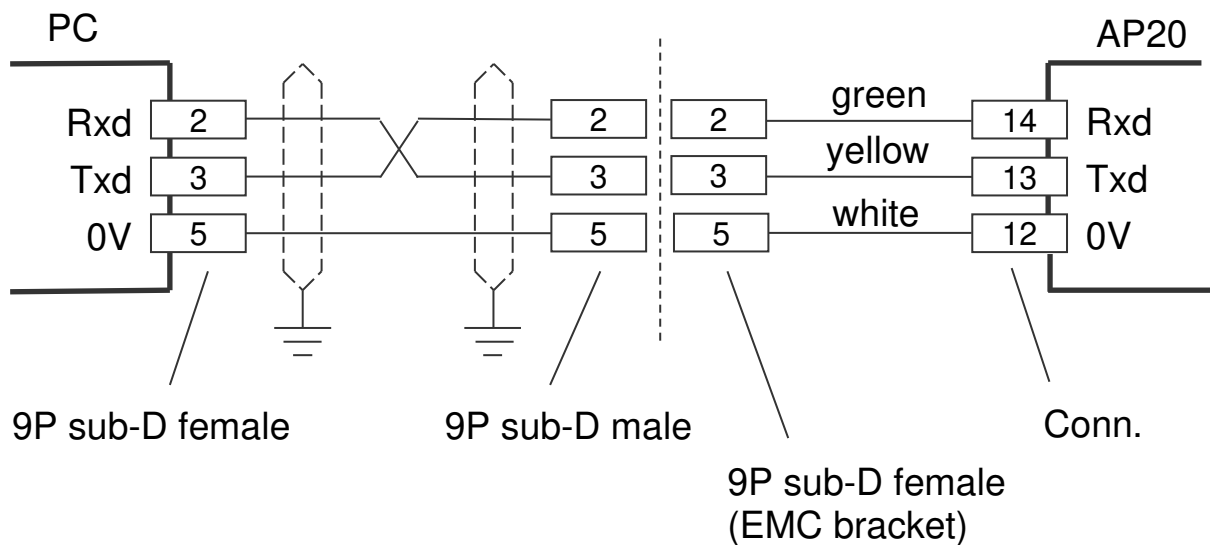
Send structure:
Functioncode (space) [argument 1](space)[argument 2] <CR>

Receive structure:
Functioncode (space) [argument1](space)[argument 2] <CR> <LF>

Functioncode (space) [argument1] [argument 2].
Argument 1 and 2 are depending on the function and are separated by a space.

Example:
wp 20 250 *(write value 250 to parameter 20)*

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4.8.3 Functions

sc   Select AP20

send:	**sc xx**
receive:	**sc xx**
transmitting parameter:	Unit Id number

The AP20 with the unit Id number is selected, all consecutive commands are relevant for this unit.
An AP20 with unit Id number 0 will always respond.

r0   Read actual position (AWE)

send:	**r0**
receive:	**r0 xxxxxxxx**
transmitting parameter:	none

r1   Read actual velocity (AWE/s)

send:	**r1**
receive:	**r1 xxxxxxxx**
transmitting parameter:	none

r2   Read actual voltage analog output (0,1mV units)

send:	**r2**
receive:	**r2 xxxxxxxx**
transmitting parameter:	none

r3   Read actual current analog output (0,1 mA units)

send:	**r3**
receive:	**r3 xxxxxxxx**
transmitting parameter:	none

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r8   Read actual linearization (AWE)

send:	**r8**
receive:	**r8 xxxxxxxx**
transmitting parameter:	none

ra   Read actual PeakHold 1 in (AWE)

send:	**ra**
receive:	**ra xxxxxxxx**
transmitting parameter:	none

rb   Read actual PeakHold 2 in (AWE)

send:	**rb**
receive:	**rb xxxxxxxx**
transmitting parameter:	none

ri   Read status inputs

send:	**ri**
receive:	**ri xxx**
transmitting parameter:	none

B0 = input-1
B1 = input-2
B2 = 0
B3 = 0
B4 = 0
B5 = 0
B6 = 0
B7 = 0

Example: **ri 03 gives the following answer:**
03 → 03H, 0000 0011 B
input-1 = "1"
input-2 = "1"

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DIEGON

`ru`   Read status outputs

send: **ru**
receive: **ru xxx**
transmitting parameter: none

B0 = output-1
B1 = output-2
B2 = output-3
B3 = output-4

`rk`   Read status input K1 and K2

send: **rk**
receive: **rk x**
transmitting parameter: none

B0 = K1 or counting direction
B1 = K2 or counting pulse

`wu`   Write outputs
(only valid for outputs with "ASCII protocol" selected)

send: **wu xxx**
receive: **wu xxx**
transmitting parameter: data for output

B0 = output-1
B1 = output-2

Example:
Output-2 should be set to "1":
00000010B = 02H = 02D
send: wu 10
receive: wu 10

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DIEGON

rp   **Read parameter**

send: `rp xxx`
receive: `rp xxxxxxx`
transmitting parameter :   parameter number

Example reading parameter P[004]
send: `rp 4`
answer: `rp 4 10000`

wp   **write parameter** (only EEPROM)

send: `wp xxx xxxxxxx`
receive: `wp xxx xxxxxxx`
transmitting parameter: parameter number and parameter value
Example writing parameter P[004] with value 185000
send: `wp 4 185000`
answer: `wp 4 185000`
Parameter will be stored to EEPROM but is not yet active.

rs   **Read nominal value**

send: `rs xx`
receive: `rs xx xxxxxxx`
transmitting parameter: nominal value

Example reading nominal value 22
send: `rs 22`
answer: `rs 22 72500`

ws   **Write nominal value** (RAM + EEPROM)

send: `ws xx xxxxxxx`
receive: `ws xx xxxxxxx`
transmitting parameter: nominal value number and nominal value

Example writing nominal value 22 with value 195200

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DIEGON

```
send:       wp 22 195200
answer:     wp 22 195200
```

rx   Read software version

```
send:                   rx
receive:                rx SW Vxx.xx SSW xx.xx
transmitting parameter: none
```

SW   = standard software version
SSW = special software version

Example:
send: **rx**
answer: **rx SW 4.02 SSW 1.00**

rt   Read type number

```
send:                   rt
receive:                rt AP20-DA
transmitting parameter: none
```

Example:
send: **rt**
answer: **rt AP20-DA**

rh   Read hardware version

```
send:                   rh
receive:                rh HW x RV x
transmitting parameter: none
```

rf   Read error number

```
send:                   rf
receive:                rf xxxx
transmitting parameter: none
```

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DIEGON

When -1 returns no error is present.

Example:
send: **rf**
answer: **rf 004** *(parameter error)*
or
answer: **rf −1** *(no error)*

rn Read status bits

send:	**rn**
receive:	**rn xxx**
transmitting parameter:	none

B0 = cams active (started)
B1 = reference set

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DIEGON

bp   **Load and activate**

send:	**bp**
receive:	**bp xxx**
transmitting parameter:	none

In case of an error the error number will be returned (-1 is no errors).

Example: answer: **bp -1**   *(no errors)*
answer: **bp 20**   *(error parameter 20)*

4.8.4 Error messages

In case of an error the AP20 will sent an error message followed by an error number.

overview error messages
er 1 = parity error
er 2 = frame error
er 3 = overflow error
er 4 = buffer overrun
er 5 = number invalid
er 6 = data invalid (for example outside min/max range)
er 7 = programming mode parameters/nominal values still active
er 8 = function impossible

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DIEGON

4.9 Analog output

The AP20 has an optional, galvanically isolated analog output. Using parameter P[231] it is possible to choose between a current output or a voltage output. The analog output can be used to give out the actual position, velocity or linearization (see parameter P[230]).

4.9.1 Voltage output

The voltage output has a resolution of 305 µV and is programmable through P[080] … P[083].

P[080] = Umin [V] (input in 0,0001V units)
P[081] = Umax [V] (input in 0,0001V units)
P[082] = S-Umin [AWE] (actual value at Umin)
P[083] = S-Umax [AWE] (actual value at Umax)

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DIEGON
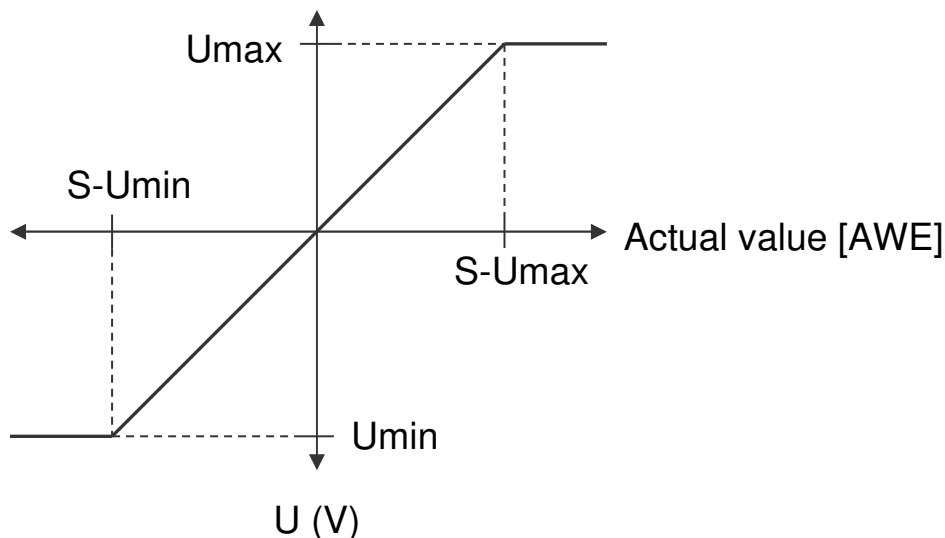
4.9.2   Current output

The current output has a resolution of 610 µA and is programmable through P[084] … P[087].

P[084] = Imin [A] (input in 0,0001mA units)
P[085] = Imax [A] (input in 0,0001mA units)
P[086] = S-Imin [AWE] (actual value at Imin)
P[087] = S-Imax [AWE] (actual value at Imax)

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DIEGON
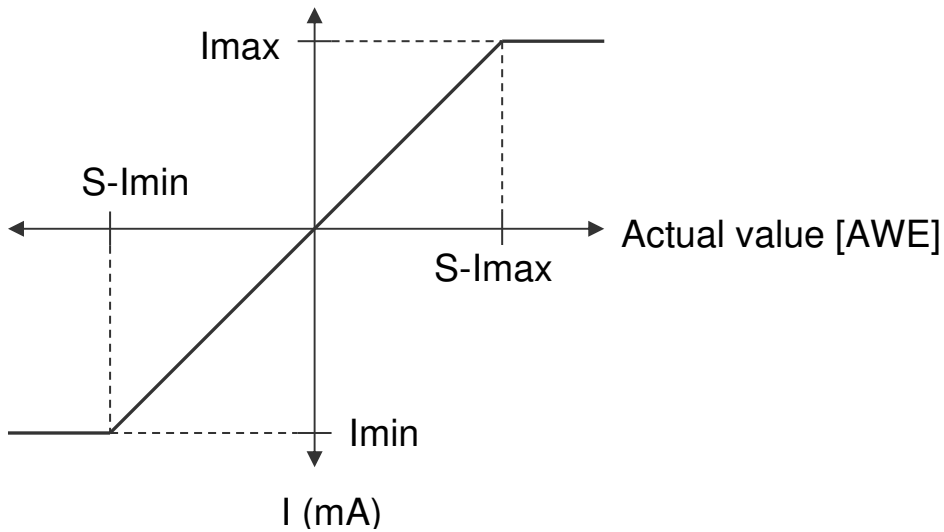
4.9.3   Example programming voltage output

> 0,01 mm units
> actual position at +9V should be -850,00 mm
> actual position at -8V should be 1100,00 mm

P[080] = Umin   = -8,0000 [V]
P[081] = Umax   = +9,0000 [V]
P[082] = S-Umin   = 110000 [AWE]
P[083] = S-Umax   = -85000 [AWE]
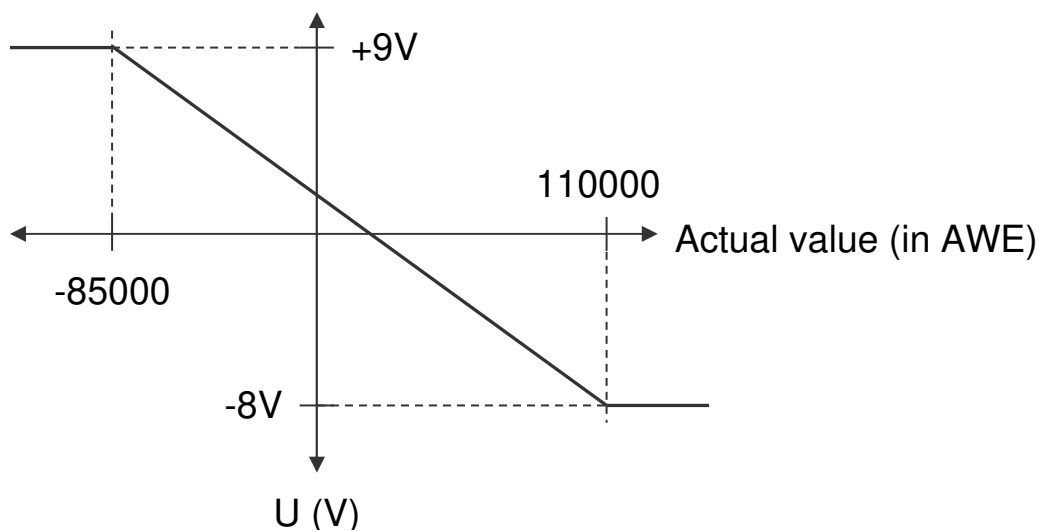
4.10 Teach function analog output

The value for Smin and Smax can be set by an external input signal. For this function parameter P[234] and or P[235] can be set to variant **"1 Teach via input"**. The function for the input 1…4 can be set to variant **"11 DAC Set Smin"** or variant **"12 DAC Set Smax"**.

On the positive edge of the input signal the teach function will be executed. The value of Smin or Smax will be stored with de actual position or the actual speed depending on parameter P[230]. The display will show "teach Lo" or "teach hi " for a short time.

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DIEGON

4.11 Cams

4.11.1 General

The AP20 has a maximum of 12 programmable cams divided over a maximum of 4 outputs. Each with 5 switching types.

> Programmable functions:
> - Switching type
>   1. Cam with start- and end-value
>   2. Greater than or equal to limit value
>   3. Smaller than or equal to limit value
>   4. Greater than or equal to limit value (Timer)
>   5. Smaller than or equal to limit value (Timer)
> - Source (actual position or actual velocity
> - Nominal value location number for start-, end-, or limit value
> - Hysteresis
> - Output for cam
> - Switching time (only for timer cam Type 4 en 5)

For switching type 1 the there is a start- and end value. For Switching type 2...5 there is only a limit value needed.

When selecting switching type 4 and 5 the cam length is depending on the programmed time value in parameter P[120]…P[131].

Per cam one can choose whether to program the values directly into the parameters or to use a nominal value location number where the values are programmed.

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DIEGON

4.11.2   Switching type (1) Cam with start- and end-value

Two values are programmed, a start value and an end-value.

Start = 100, end = 200

| 97 | 98 | 99 | 100 | 101 | | 197 | 198 | 199 | 200 | 201 |

Hysteresis = 2

Hysteresis = 0
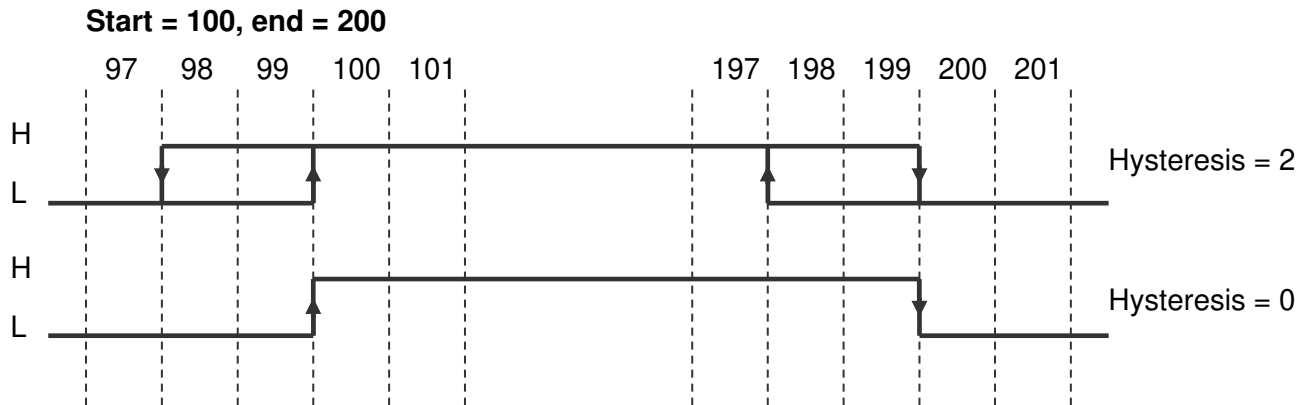
4.11.3   Switching type (2) Greater than or equal to limit value

Only one limit value needs to be programmed.

Limit value = 100

| 97 | 98 | 99 | 100 | 101 |

Hysteresis = 2

Hysteresis = 0
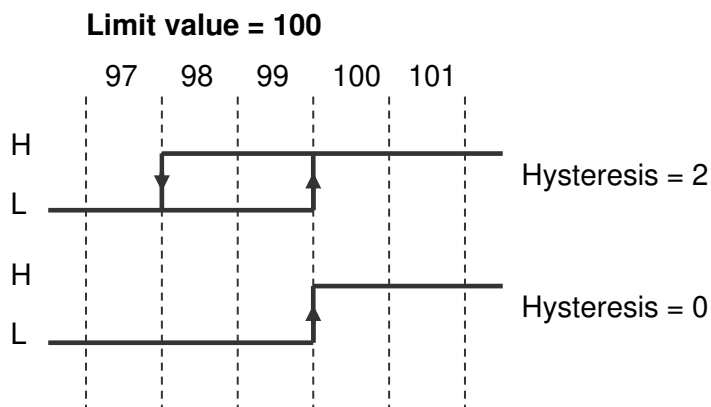
4.11.4   Switching type (3) Smaller than or equal to limit value

Only one limit value needs to be programmed.

Limit value = 100

| 97 | 98 | 99 | 100 | 101 |

Hysteresis = 2

Hysteresis = 0

Manual AP20 counter

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DIEGON
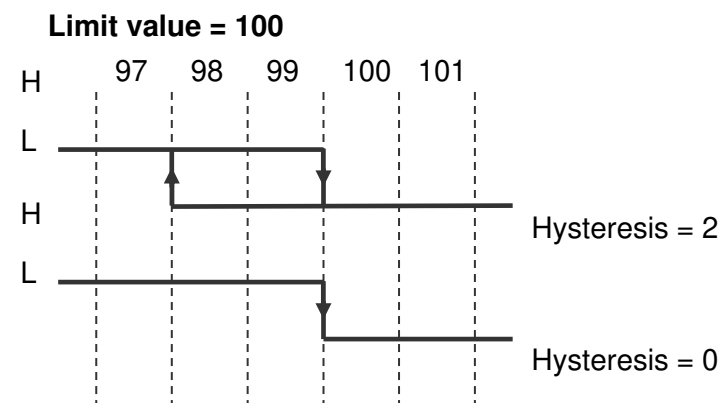
4.11.5 Switching type (4) Greater than or equal to limit value (Timer)

Limit value and switching time need to be programmed. This cam is activated when the actual value is greater than or equal to the limit value (counting upwards) and is a retriggerable timer.
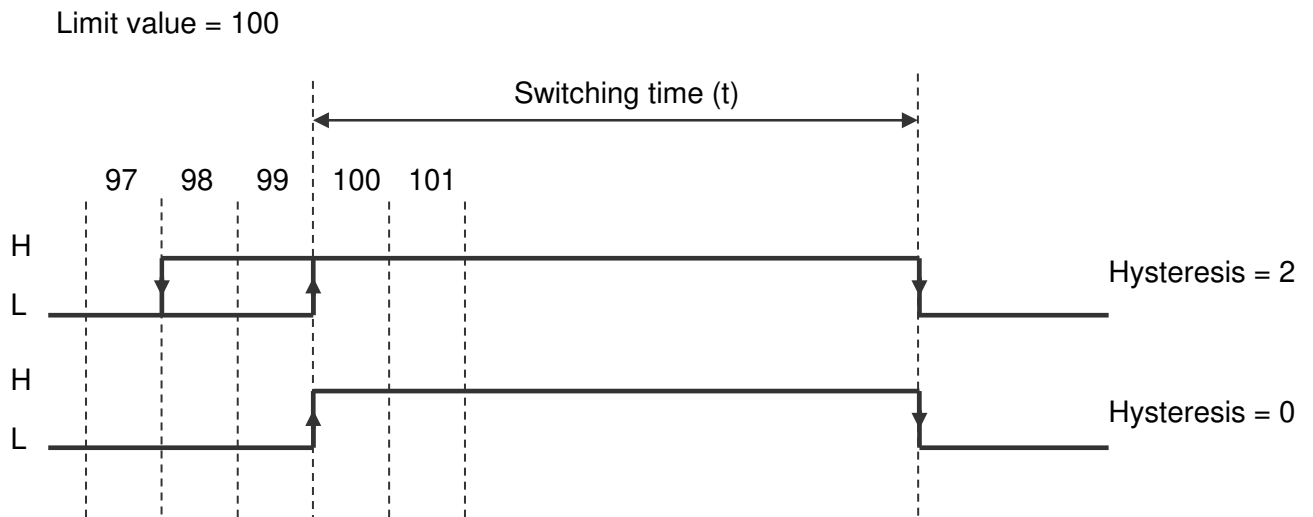
Limit value = 100

4.11.6 Switching type (5) Smaller than or equal to limit value (Timer)

Limit value and switching time need to be programmed. This cam is activated when the actual value is smaller than or equal to the limit value (counting downwards) and is a retriggerable timer.

Limit value = 100

Manual AP20 counter

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DIEGON
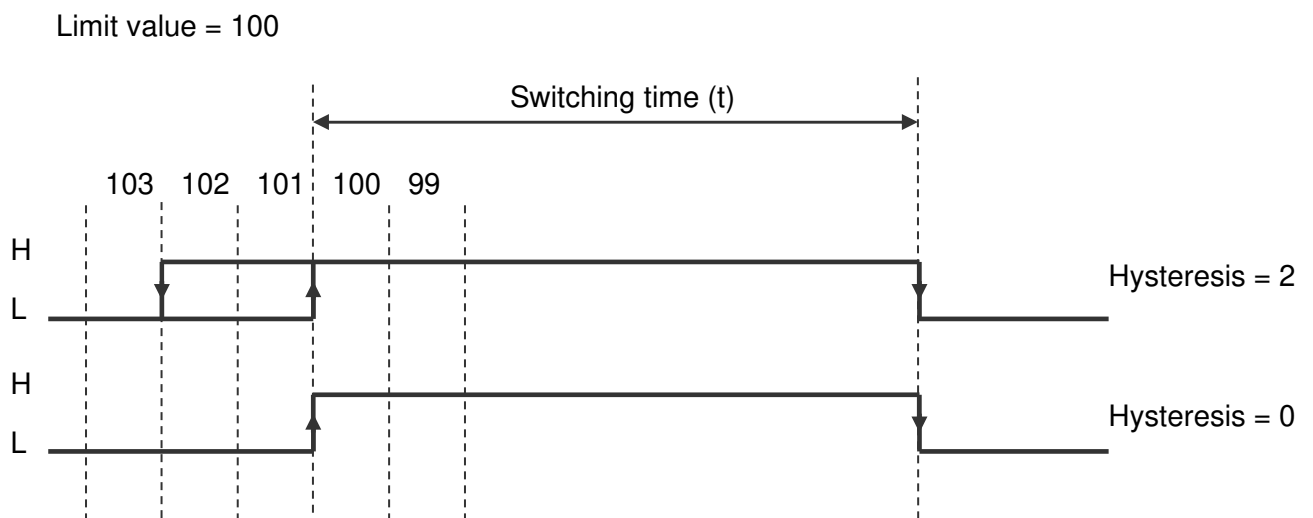
4.11.7 Dynamic cams

To compensate for actions with a static time, for example the switch time of a valve, it is possible to program a time for each output individually. The cams will be shifted according to this programmed time.

This function is only available for cams with (P[256] … P[267] = 1, 4 or 5) and when the source of this cam is the actual position(P[280] … P[291] = 1). When working with a counting range the possibility of cams shifting over the zero-point is taken into account.

> *Example:*
> *startvalue:*   *1*
> *endvalue:*   *200*
> *hysteresis:*   *0*
> *counting range display:* *360*

Advancement cam

Manual AP20 counter

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DIEGON
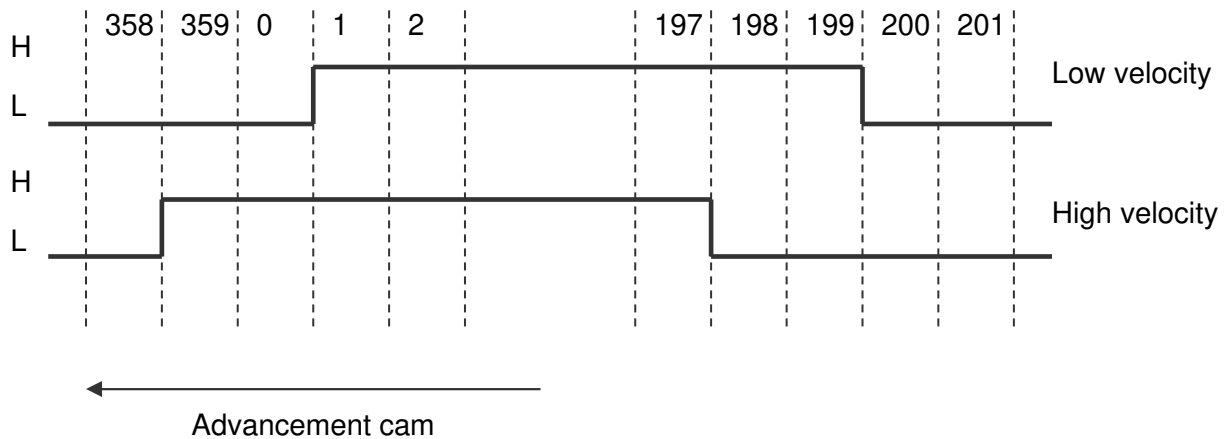
4.11.8 Start/stop cam

The outputs for the cams can be enabled or disabled. If for one of the inputs 1..6 the function start/stop cams has been chosen.

Start/stop cams with one signal
Input-x = option **"5 start/stop cams"**   (high = cams enabled)

Start/stop cams with double signal
Input-x = option **"6 start cams"**   (rising edge = enable cams)
Input-x = option **"7 stop cams"**   (rising edge = disable cams)

4.11.9 Output "Cams active"

On one of the outputs 1…4 the signal "cams active" can be generated by choosing option**"4 cams active"** (high = cams enabled).

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DIEGON

4.12 Linearization

The linearization function allows to display and process nonlinear motions. The actual display position (sensor) position or actual velocity is converted into an additional value "Actual linearization". This additional value can serve as a source for the cams function and analog output.

Parameter "Source" P[246]
optie **"0 Inactive"**
optie **"1 Actual position"**
optie **"2 Actual speed"**

The linearization function works with a tabel of max. 30 points (P1…P30). Every point has a X (Pn-X) and Y (Pn-Y) value. The X value represents the actual (sensor) position or velocity and the Y value represents the desired actual (sensor) position or velocity called "Actual linearization". Interpolation takes place between these points

Parameter P[247] determines the number of active points and can be programmed with a value of 2 …30 points. The value of the actual linearization can be displayed in the monitor function. P[248] determines the number of decimals shown.

For linearization 3 modes are available.

Parameter "mode" P[241]
optie **"0 4-Quadrant"**
optie **"1 Mirror Y-axis"**
optie **"2 Mirror XY-axis"**

Manual AP20 counter

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DIEGON

4.12.1   mode 0 "4-Quadrant"

This is the standard mode wich can build every possible curve. Both the X-axis and the Y-axis may contain negative values.

Condition:
P1-X < P2-X < P3X < … < P30-X)
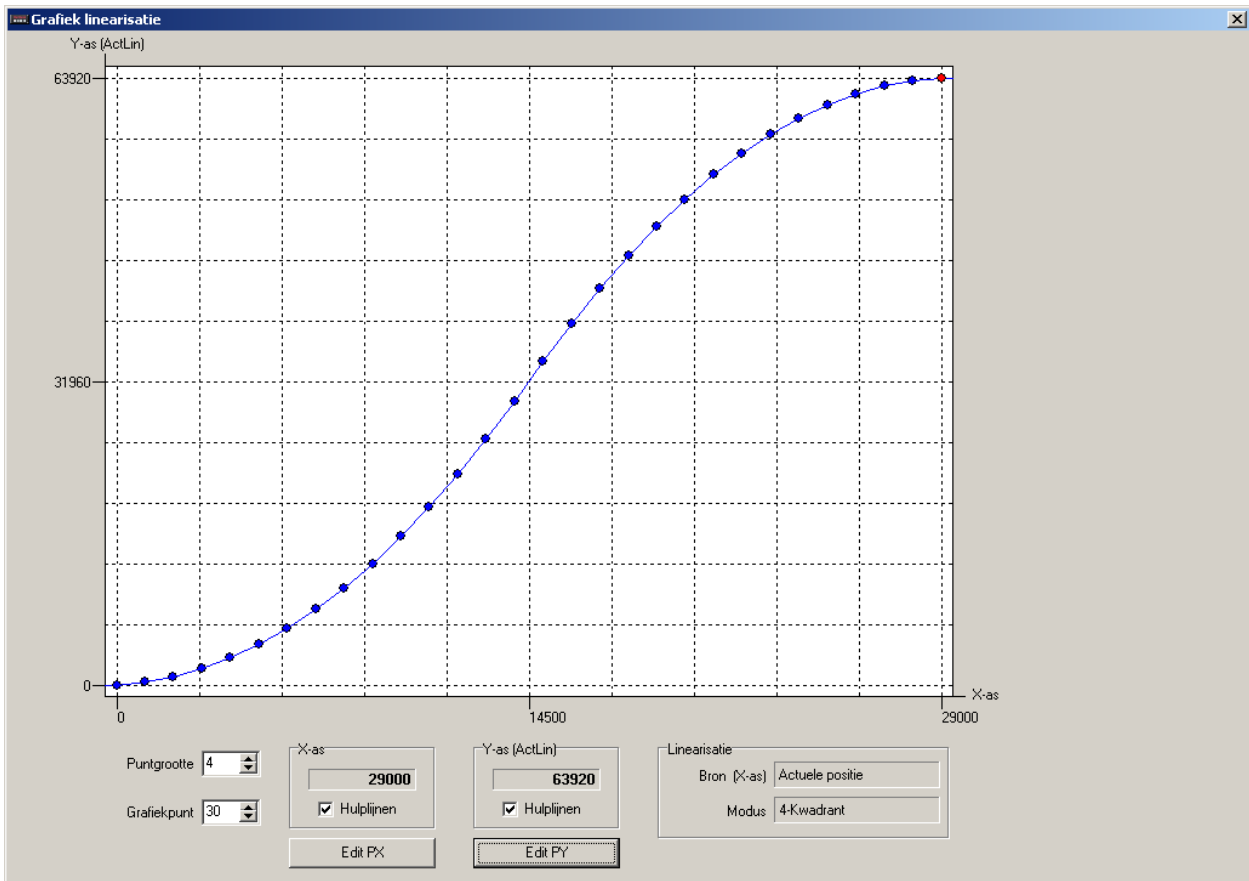
Screenshot from PC programm DST2

Manual AP20 counter

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DIEGON

4.12.2 mode 1 "Mirror Y-axis"

In this mode, the entered curve is mirrored and copied over the Y-axis, so that this curve is the same for the negative X-axis values. Q1 is the entered curve.
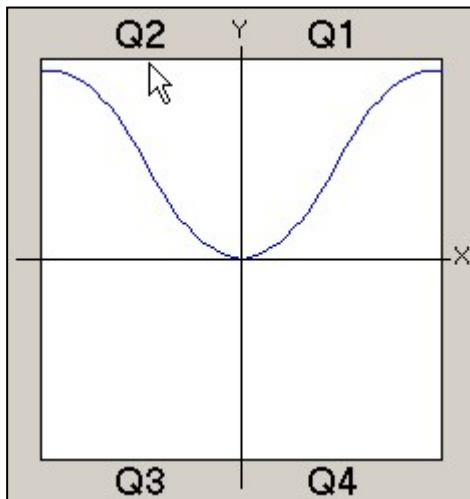
Conditions:
P1-X < P2-X < P3X < … < P30-X)
P1-X = 0

4.12.3 mode 2 "Mirror XY-axis"

In this mode, the entered curve is mirrored and copied over the X-axis and Y-axis, so that this curve is the same for the negative X-axis and Y-axis values. Q1 is the entered curve.

Conditions:
P1-X < P2-X < P3X < … < P30-X)
P1-X = 0
P1-Y = 0

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DIEGON
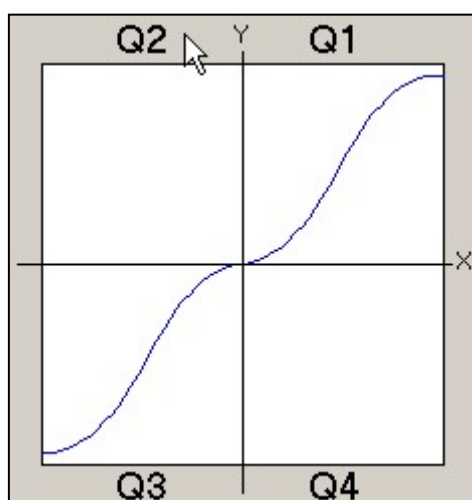
4.13 PeakHold function

4.13.1 general

The PeakHold function can hold the minimum or maximum value of the selected source like actual- position, velocity or linearization.

On power-up or external reset the PeakHold value will be set to the actual value of the selected source.

The PeakHold value can also serve as a source for the cams function.

4.13.2 PeakHold 1

Parameter "Function PeakHold 1" P[242]
option **"0 no function"**
option **"1 detect Peak high"**
option **"2 detect Peak low"**

Parameter "Source PeakHold 1" P[243]
option **"0 actual position"**
option **"1 actual velocity"**
option **"2 actual lineariaation"**

4.13.3 PeakHold 2

Parameter "Function PeakHold 2" P[244]
option **"0 no function"**
option **"1 detect Peak high"**
option **"2 detect Peak low"**

Parameter "Source PeakHold 2" P[245]
option **"0 actual position"**
option **"1 actual velocity"**
option **"2 actual linearizsation"**

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DIEGON

5   Parameters

General lay-out:

PAR.	**PAR Nr:**	Possible values (bold is the standard value)
Basic description		
Description of possible values		

5.1 Menu 1 Config

PAR: 1.0.1	P[088]	0 … **40** … 2500
Measuring time velocity [AWE/s] (equal to refreshment time display)		
X.XXX (sec) input 0 .. 1.000s		

PAR: 1.0.2	P[202]	0 … **10** … 20
Integrator velocity		
Actual velocity is the average from the number of measurements		
0 = not active		
1…20 number of measurements		

PAR: 1.0.3	P[203]	**0** … 6
Number of decimals		
0 = none		
1 = X.X		
2 = X.XX		
3 = X.XXX		
4 = X.XXXX		
5 = X.XXXXX		
6 = X.XXXXXX		

PAR: 1.0.4	P[204]	**0** … 1
Store function		
0 = no function		
1 = display		

PAR: 1.0.5	P[205]	**0** ... 2
Store signal		
0 = high active		
1 = low active		

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DIEGON

PAR: 1.0.6	P[206]	**0** … 1
Power failure protection		
0 = not active		
1 = active		

PAR: 1.0.7	P[207]	**0** … 123
Service functions		
Only possible to activate through keyboard AP20		
Value is automatically set to 0 after executing the service function		
0 = not active		
123 = set default parameters		
111 = adjusting absolute sensors or preset function counter and freq.		

PAR: 1.0.8	P[208]	**0** … 4
Default monitor function		
Determines the default which is visible after start-up.		
0 = actual position		
1 = actual velocity		
2 = actual linearization		
3 = actual PeakHold 1		
4 = actual PeakHold 2		

PAR: 1.0.9	P[201]	**0** … 3
Display multiplicator		
For display value actual position + actual velocity		
0 = no function		
1 = actual position + actual velocity x 0,1		
2 = actual position + actual velocity x 0,01		
3 = actual position + actual velocity x 0,001		

5.2 Menu 2 Actual

PAR: 2.1.1	P[210]	**0** … 3
Signal type and edge multiplication		
"S-signal" X1 or X2: K2 is counter and K1 is direction		
0 = V-signal X4		
1 = S-signal X2		
2 = S-signal X1		
3 = S-signal X1 (max. input frequency 200 Hz)		

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DIEGON

PAR: 2.1.2	P[211]	**0** … 1
Counting direction	
0 = no reverse	
1 = reverse	

PAR: 2.1.3	P[000]	0 … **10000** … 16777215
Multiplicator numerator	
XXXXXXXX	

PAR: 2.1.4	P[001]	0 … **10000** … 16777215
Multiplicator denominator	
XXXXXXXX	

PAR: 2.1.5	P[212]	**0** … 3
Reference fine	
0 = no function	
1 = rising edge (input 1 or 2)	
2 = falling edge (input 1 or 2)	
3 = front keys	

PAR: 2.1.6	P[213]	**0** … 2
Reference coarse	
0 = no function	
1 = high signal	
2 = low signal	

PAR: 2.1.7	P[209]	**0** … 2
Counting direction for setting reference value	
0 = independant from direction	
1 = when counting in positive direction	
2 = when counting in negative direction	

PAR: 2.1.8	P[003]	-9999999 … **0** … 99999999
Reference value	
-XXXXXXX (AWE)	

PAR: 2.1.9	P[004]	**0** … 99999999
Counting range (no function when Hold/Reset is active (P[200])	
XXXXXXXX (AWE)	

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DIEGON

PAR: 2.1.11	P[233]	**0** … 48
Source for counting range		
0 = parameters counting range P[004]		
1…48 = nominal value 1…48		

5.3 Menu 3 Serial

PAR: 3.0.1	P[236]	**0** … 31
Unit adress		
XX		

PAR: 3.0.2	P[237]	0 … **1** … 4
Baudrate		
0 = 9600		
1 = 19200		
2 = 28800		
3 = 38400		
4 = 57600		

PAR: 3.0.3	P[238]	**0** … 1
Number of stopbits		
0 = 1 stopbit		
1 = 2 stopbits		

PAR: 3.0.4	P[239]	0 … **2**
Parity		
0 = none		
1 = odd		
2 = even		

PAR: 3.0.5	P[240]	0 … **1**
Protocol		
0 = no function		
1 = ASCII		

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DIEGON

5.4 Menu 4 Input

INPUT-1

PAR: 4.0.1	P[249]	**0** … 13
Function input-1		
0 = no function		
1 = coarse		
2 = reference fine		
3 = store		
4 = error reset SSI (only AP21)		
5 = start/stop cams		
6 = start cams		
7 = stop cams		
8 = lock input nominal values		
9 = lock input parameters		
10 = lock input nominal values + parameters		
11 = DAC Set Smin		
12 = DAC Set Smax		
13 = reset PeakHold 1/2		

INPUT-2

PAR: 4.0.2	P[250]	**0** … 13
Function input-2		
XX (see input-1)		

Manual AP20 counter

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DIEGON

5.5 Menu 5 Output

5.5.1   Submenu 5.1 – 5.4 Op1…4

OUTPUT 1…4

PAR: 5.x.1	P[252]…P[255]	**0** … 7
Function output-1		
0 = cam		
1 = cam inverted		
2 = SSI error (high = no error) only AP21		
3 = Start/Stop error (no magnet or time-out) only AP23		
4 = reference/adjustment set		
5 = cams active		
6 = ASCII protocol		
7 = Counting direction (high = downwards counting)		

PAR: 5.x.2	P[094]…P[097]	**0** … 5000
Dynamic cams (only when with cam function 1, 4 and 5 and source = actual position)		
X.XXX (sec) input 0 = no function		

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DIEGON

5.6 Menu 6 Cam

5.6.1 Submenu 6.1 … 6.12 CA1…12

CAM-1…12

PAR: 6.x.1	P[256]...P[267]	**0** … 5
Cam function		
0 = no function		
1 = range		
2 = actual position >= limit value		
3 = actual position <= limit value		
4 = actual position >= limit value (Timer)		
5 = actual position <= limit value (Timer)		

PAR: 6.x.2	P[280]…P[291]	**0** … 4
Source		
0 = actual position		
1 = actual velocity		
2 = actual linearization		
3 = actual PeakHold 1		
4 = actual PeakHold 2		

PAR: 6.x.3	P[304]…P[315]	**0** … 12
Source cam begin / limit value		
(limit value if cam function = 2 or 3)		
0 = parameters cam begin		
1…12 = Nominal value 1…12		

PAR: 6.x.4	P[292]…P[303]	**0** … 12
Source cam end		
0 = parameters cam end		
1…12 = Nominal value 1…12		

PAR: 6.x.5	P[007]…P[018]	-9999999 … **1000** … 99999999
Cam begin / limit value		
(limit value if cam function = 2 or 3)		
-XXXXXXX		

PAR: 6.x.6	P[031]…P[042]	-9999999 … **2000** …99999999
Cam end		
-XXXXXXX		

Manual AP20 counter

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DIEGON

PAR: 6.x.7	P[055]…P[066]	**0** … 999999
Hysteresis cam		
XXXXXX		

PAR: 6.x.8	P[268]…P[279]	**0** … 4
Assign cam to output		
0 = no output		
1…4 = output 1-4		

PAR: 6.x.9	P[120]…P[131]	**0** … 5000
Cam switching time (only with cam function 4 en 5)		
X.XXX (sec) ingave 0 = 0,1 sec		

5.7 Menu 7 Analog output

5.7.1   Submenu 7.1 Config

PAR: 7.1.1	P[231]	**0** … 2
Selection DA output		
0 = inactive		
1 = voltage		
2 = current		

PAR: 7.1.2	P[230]	**0** … 3
Selection DA source		
0 = actual position		
1 = actual velocity		
2 = actual |velocity| abs		
3 = actual linearization		

5.7.2   Submenu 7.2 DA-U (voltage)

DA PAR 7.2.1…7.2.4 = 0: DA not active

PAR: 7.2.1	P[080]	**-100000** … 99999
Umin DA		
-XX.XXXX (V)		

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PAR: 7.2.2	P[081]	-99999 … **100000**
Umax DA		
-XX.XXXX (V)		

PAR: 7.2.3	P[082]	-9999999… **-100000** … 99999999
S-Umin DA		
-XXXXXXX (AWE)		

PAR: 7.2.4	P[083]	-9999999 … **100000** … 99999999
S-Umax DA		
-XXXXXXX (AWE)		

PAR: 7.2.5	P[234]	**0** … 1
Source for Smin		
0 = parameter Smin		
1 = teach by input		

PAR: 7.2.6	P[235]	**0** … 1
Source for Smax		
0 = parameter Smax		
1 = teach by input		

5.7.3   Submenu 7.3 DA-I (current)

DA PAR 7.3.1…7.3.4 = 0: DA not active

PAR: 7.3.1	P[084]	**-200000** … 199999
Imin DA		
-XX.XXXX (mA)		

PAR: 7.3.2	P[085]	-199999 … **200000**
Imax DA		
-XX.XXXX (mA)		

PAR: 7.3.3	P[086]	-9999999 … **-200000** …99999999
S-Imin DA		
-XXXXXXX (AWE)		

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PAR: 7.3.4	P[087]	-9999999 … **200000** … 99999999
S-Imax DA		
-XXXXXXX (AWE)		

PAR: 7.3.5	P[234]	**0** … 1
Source for Smin		
0 = parameter Smin		
1 = teach by input		

PAR: 7.3.6	P[235]	**0** … 1
Source for Smax		
0 = parameter Smax		
1 = teach by input		

5.8 Menu 8 Linearization

5.8.1 Submenu 8.1 Config

PAR: 8.1.1	P[246]	**0** … 2
Source		
0 = inactive		
1 = actual position		
2 = actual velocity		

PAR: 8.1.2	P[247]	2 … **10**… 30
Number of points		
XX		

PAR: 8.1.3	P[248]	**0** … 6
Number of decimals for actual position linearization		
0 = geen		
1 = X.X		
2 = X.XX		
3 = X.XXX		
4 = X.XXXX		
5 = X.XXXXX		
6 = X.XXXXXX		

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PAR: 8.1.4	P[241]	**0** … 2
Mode		
0 = 4-Quadrant		
1 = Mirror X-as		
2 = Mirror XY-as		

5.8.2 Submenu 11.2 … 11.31 P1…P30

P1…30 ➔ x = 2…31

PAR: 8.x.1	P[140]…P[169]	-9999999 … **0** … 99999999
P1-X		
-XXXXXXX		

PAR: 8.x.2	P[170]…P[199]	-9999999 … **0** … 99999999
P1-Y		
-XXXXXXX		

Manual AP20 counter

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DIEGON

5.9 Menu 9 PeakHold

5.9.1 Submenu 9.1 PeakHold 1

PAR: 9.1.1	P[242]	**0** … 2
Function PeakHold 1		
0 = non function		
1 = detect peak high		
2 = detect peak low		

PAR: 9.1.2	P[243]	**0** … 2
Source PeakHold 1		
0 = actual position		
1 = actual velocity		
2 = actual linearization		

5.9.2 Submenu 9.2 PeakHold 2

PAR: 9.2.1	P[244]	**0** … 2
Function PeakHold 2		
0 = geen functie		
1 = detectie peak high		
2 = detectie peak low		

PAR: 9.2.2	P[245]	**0** … 2
Source PeakHold 2		
0 = actual positie		
1 = actual velocity		
2 = actual linearization		

Manual AP20 counter

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DIEGON

5.10 Overview parameters

No	Description	Menu
[000] =	Multiplicator numerator	2.1.3
[001] =	Multiplicator denominator	2.1.4
[002] =	no function	
[003] =	Reference value	2.1.8
[004] =	Counting range	2.1.9
[005], [006] =	no function	
[007]…[018] =	Cam begin / limit value	6.1.5…6.12.5
[019]…[030] =	no function	
[031]…[042] =	Cam end	6.1.6…6.12.6
[043]…[054] =	no function	
[055]…[066] =	Hysteresis cam	6.1.7…6.12.7
[067]…[079] =	no function	
[080] =	Umin DA	7.2.1
[081] =	Umax DA	7.2.2
[082] =	S-Umin DA	7.2.3
[083] =	S-Umax DA	7.2.4
[084] =	Imin DA	7.3.1
[085] =	Imax DA	7.3.2
[086] =	S-Imin DA	7.3.3
[087] =	S-Imax DA	7.3.4
[088] =	Measuring time velocity	1.0.1
[089]…[093] =	no function	
[094]…[097] =	Dynamic cam output 1…4	5.1.2…5.4.2
[098]…[119] =	no function	
[120]…[131] =	Cam switching time	6.1.9…6.12.9
[132]…[139] =	no function	
[140]…[169] =	Pn-X (linearization)	8.2.1…8.31.1
[170]…[199] =	Pn-Y (linearization)	8.2.2…8.31.2
[200] =	no function	
[201] =	Display multiplicator	1.0.9
[202] =	Integrator velocity	1.0.2
[203] =	Number of decimals	1.0.3
[204] =	Store function	1.0.4
[205] =	Store signal	1.0.5
[206] =	Power failure protection	1.0.6
[207] =	Service functions	1.0.7
[208] =	Default moniter function	1.0.8
[209] =	Counting direction reference fine	2.1.7
[210] =	Input type and edge multiplication	2.1.1
[211] =	Counting direction	2.1.2

Manual AP20 counter

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DIEGON

No	Description	Menu
[212]	= Reference fine	2.1.5
[213]	= Reference coarse	2.1.6
[214]…[229]	= no function	
[230]	= Selection DA source	1.1.2
[231]	= Selection DA output	7.1.1
[232]	= no function	
[233]	= Source for counting range	2.1.10
[234]	= Source for Smin DA	7.2.5/7.3.5
[235]	= Source for Smax DA	7.2.6/7.3.6
[236]	= Unit adress	3.0.1
[237]	= Baudrate (RS232)	3.0.2
[238]	= Stopbits (RS232)	3.0.3
[239]	= Parity (RS232)	3.0.4
[240]	= Protocol (RS232)	3.0.5
[241]	= Mode linearization	8.1.4
[242]	= Function PeakHold 1	9.1.1
[243]	= Source PeakHold 1	9.1.2
[244]	= Function PeakHold 2	9.2.1
[245]	= Source PeakHold 2	9.2.2
[246]	= Source (linearization)	8.1.1
[247]	= Number of points (linearization)	8.1.2
[248]	= Number of decimals (linearization)	8.1.3
[249], [250]	= Function input 1…2	4.0.1/4.0.2
[251]	= no function	
[252]…[255]	= Function output1…4	5.0.1…5.0.4
[256]…[267]	= Cam function	6.1.1…6.12.1
[268]…[279]	= assign cam to output	6.1.8…6.12.8
[280]…[291]	= Source cam	6.1.2…6.12.2
[292]…[393]	= Source for cam end	6.1.4…6.12.4
[304]…[315]	= Source for cam begin/limit value	6.1.3…6.12.3
[316]…[399]	= no function	

Manual AP20 counter

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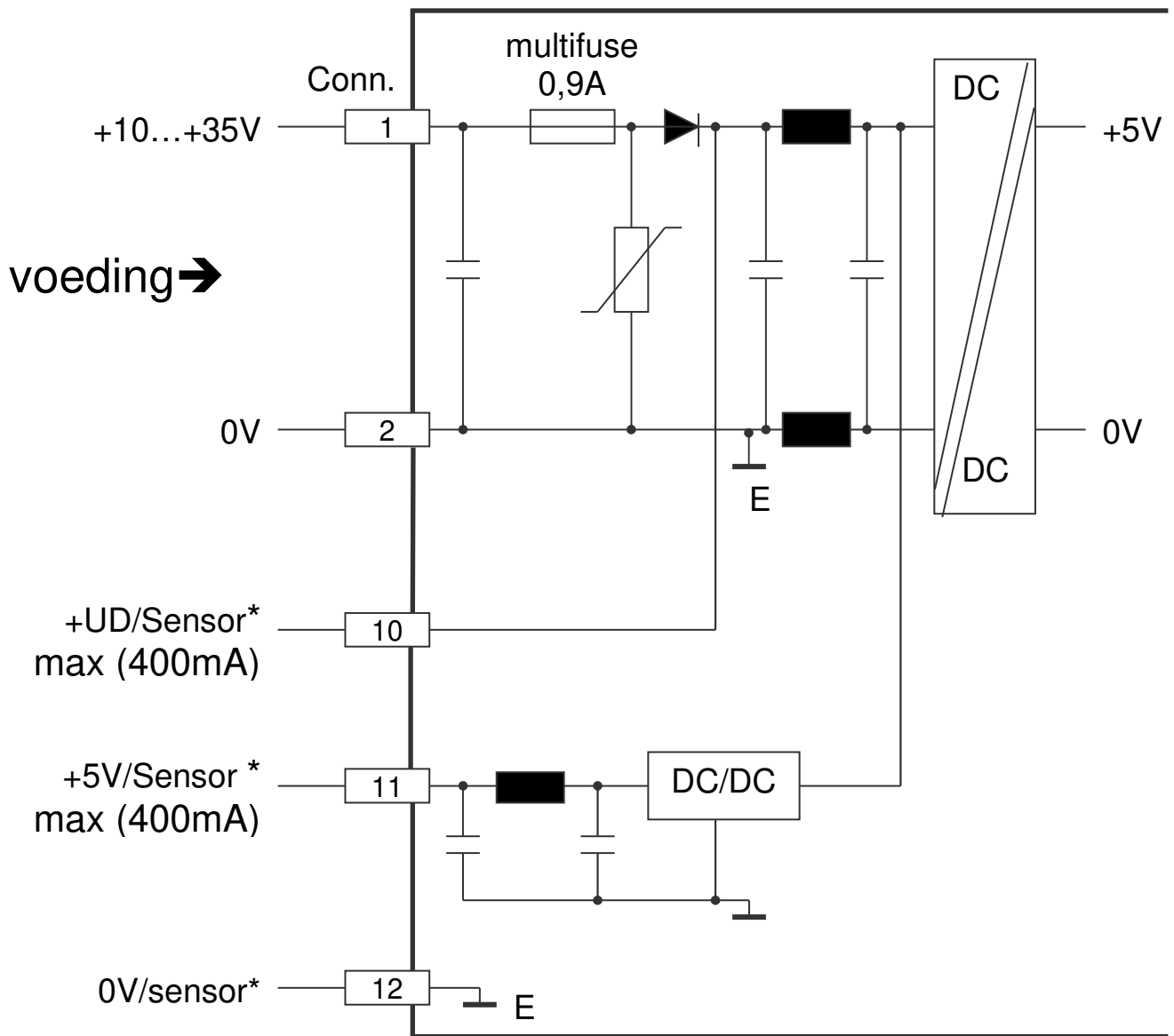
DIEGON

6   Connections

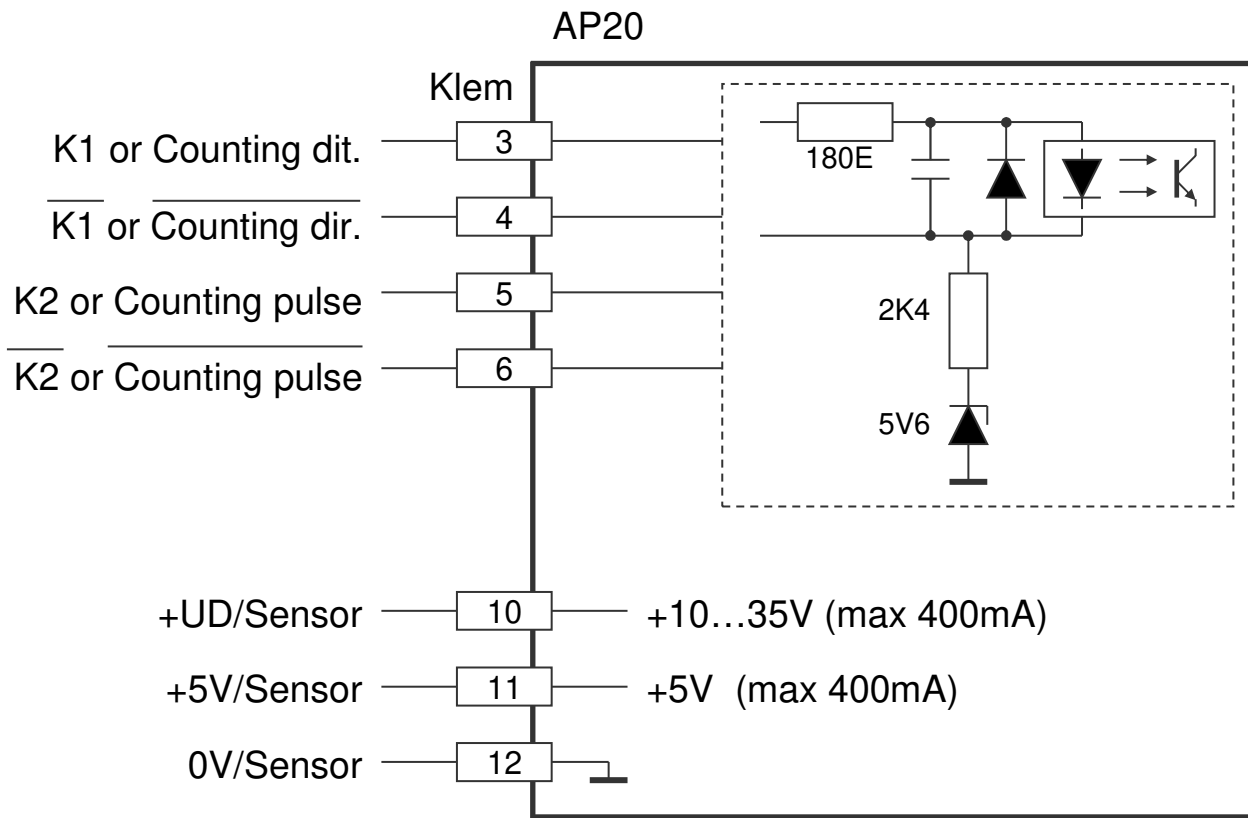Connections on the rear
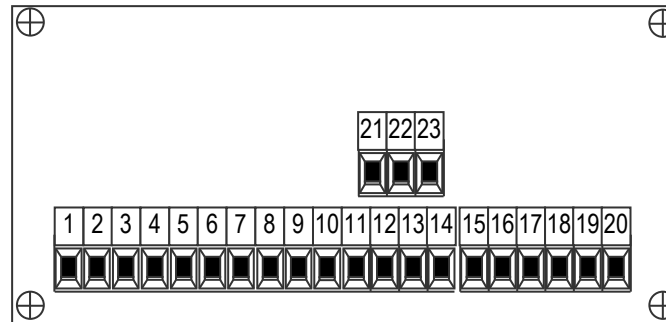
6.1 Overview clamp connections

1. +10…+35V supply
2. 0V supply
3. K1 or counting dir.
4. /K1 or counting dir.
5. K2 or counting pulse
6. /K2 or counting pulse
7. Input-1
8. Input-2
9. common for inputs (0V)
10. +10…35V DC supply output for sensor
11. +5V DC supply output for sensor
12. 0V for sensor
13. TxD
14. RxD
15. Output -1
16. Output -2
17. Output -3
18. Output -4
19. 0V for outputs
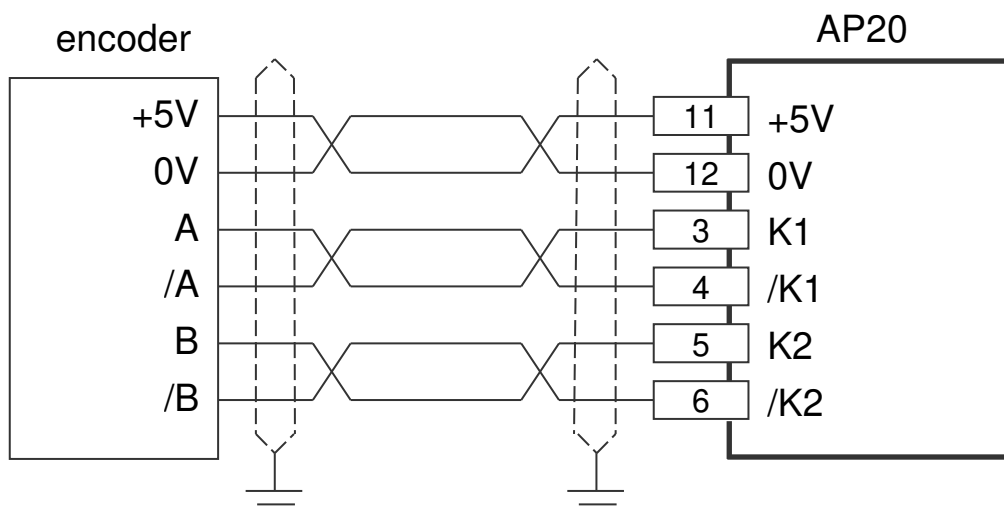20. +U for outputs
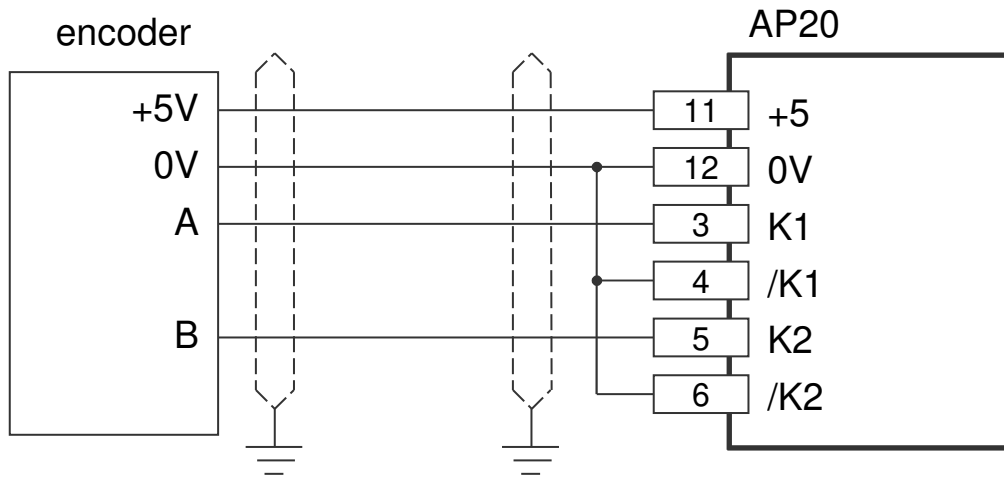
21. 0V analog
22. U-out
23. I-out

Manual AP20 counter

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DIEGON

6.2 Supply

voeding➜

Manual AP20 counter

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DIEGON

6.3 Counting input

AP20

Klem

K1 or Counting dit.	3
$\overline{\text{K1}}$ or $\overline{\text{Counting dir.}}$	4
K2 or Counting pulse	5
$\overline{\text{K2}}$ or $\overline{\text{Counting pulse}}$	6

180E
2K4
5V6

+UD/Sensor	10	+10…35V (max 400mA)
+5V/Sensor	11	+5V (max 400mA)
0V/Sensor	12	

CAUTION!
When using 24V encoders don't connect terminal 4 and 6.

6.4 Encoder 5V with inverted signals

encoder

AP20

encoder		AP20
+5V	11	+5V
0V	12	0V
A	3	K1
/A	4	/K1
B	5	K2
/B	6	/K2

Manual AP20 counter

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DIEGON

6.5 Encoder 5V without inverted signals

encoder

		AP20
+5V	11	+5
0V	12	0V
A	3	K1
	4	/K1
B	5	K2
	6	/K2

6.6 Encoder 10 – 30V

encoder

		AP20
+10 - 35V	10	+10 - 35V
0V	12	0V
A	3	K1
	4	/K1
B	5	K2
	6	/K2

CAUTION!
When using 24V encoders don't connect terminal 4 and 6.

Manual AP20 counter

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DIEGON
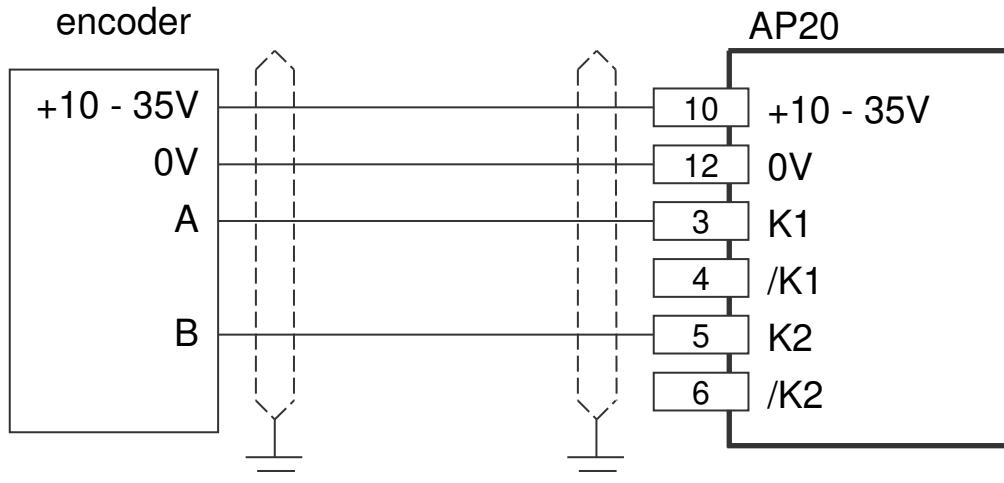
6.7 Digital inputs

6.8 Digital outputs

65

Manual AP20 counter

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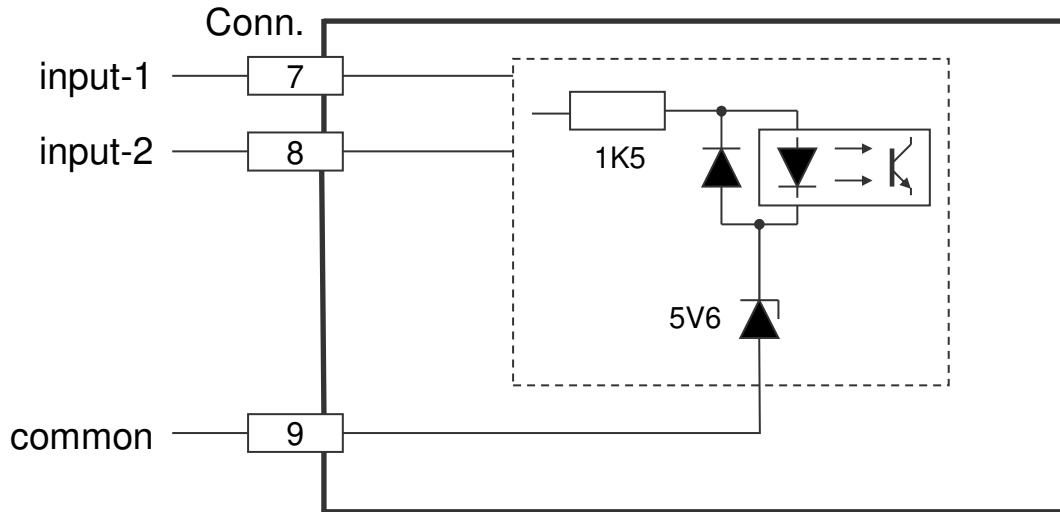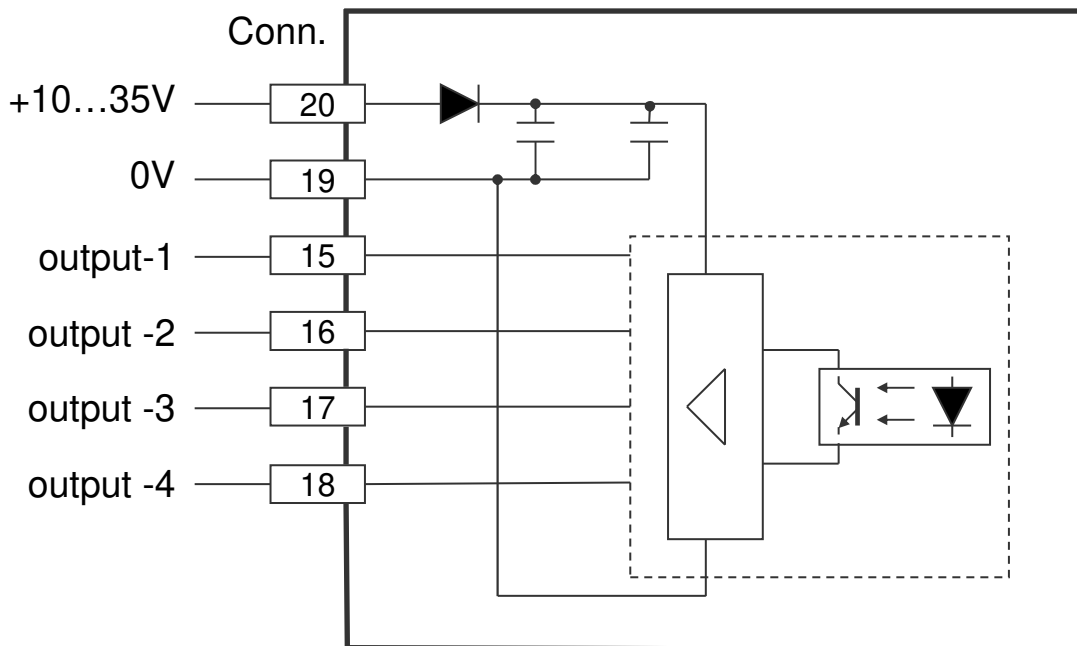
6.9   RS232

6.10 Analog output

Manual AP20 counter

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DIEGON
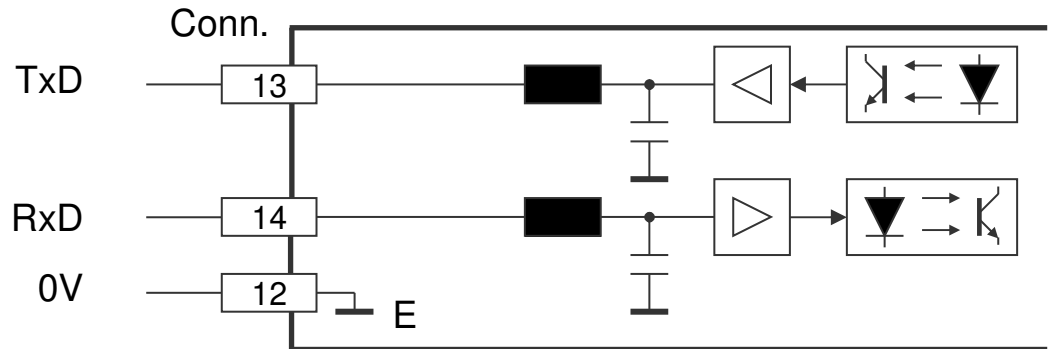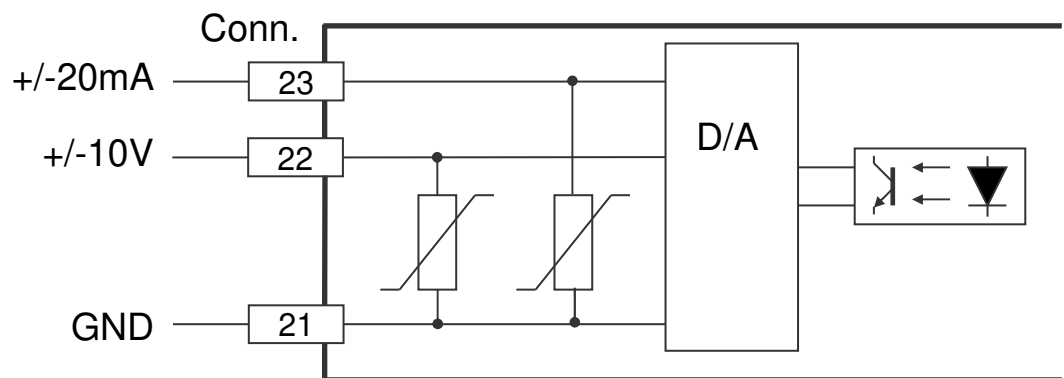
7   Technical specifications
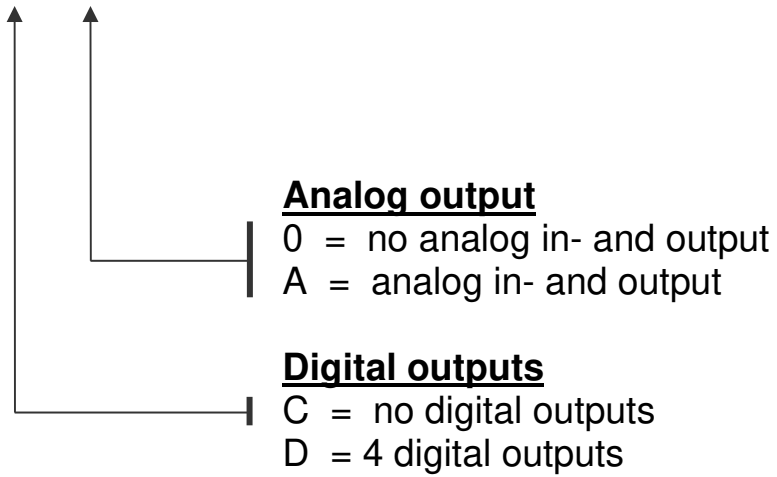
7.1 Specifications

- Supply voltage   10…35V DC (power failure not active)
                              16…35V DC (power failure active)
current consumption   < 150mA

- Output voltage   for external encoder
   +UD   max 400mA depending on supply voltage
   +5V   max 400mA

- Processor
   µController   XC167
   Data memory   EEPROM
   Cycle time   250µS (fixed)
   Counting range   -9999999…+99999999

- Counting input   optically isolated
   signal level   low (5V): 0…+0.8V
                              high (5V): +2.8V…+5V
                              low (24V): 0…+5V
                              high (24V): +15V…+35V
   voltage output   5,3V max. 350mA
   input resistance   appr. 3k Ohm at 24V
                              appr. 0.35k Ohm at 5V
   input frequency   max. 150 kHz

- Digital inputs 1…2   optically isolated
                              low: 0…+5V
                              high: +10V…+35V
   input resistor   appr. 1.8k Ohm at 24V

- Digital outputs 1…4   optically isolated, N FET, short-circuit proof
   Imax   500 mA (min load 200 µA)
   Supply voltage   35V max.

- Voltage output   galvanically isolated
   range   max. −10V … +10V
   resolution   305 µV
   offset-temp. coeff.   < 20 ppm/ °C
   Imax   +/-12mA

Manual AP20 counter

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DIEGON

- Current output   galvanically isolated
       range   max. –20mA … +20mA
       resolution   610 µA
       offset-temp. coeff. < 20 ppm/ °C
       Rmax   550 Ohm

- Serial communication   RS232 C

- Display   8 decades 7-segments LED
       digit height   14 mm

- Temperature range   0…50°C

- Connection diameter   1,6 mm² (raster 3,81mm)

- Electromagnetic   in accordance with guideline
       compatibility   2004/108/EC
       emission   NEN-EN-IEC61000-6-3:2007
       immunity   NEN-EN-IEC61000-6-3:2005

- Weight   < 0.25 kg

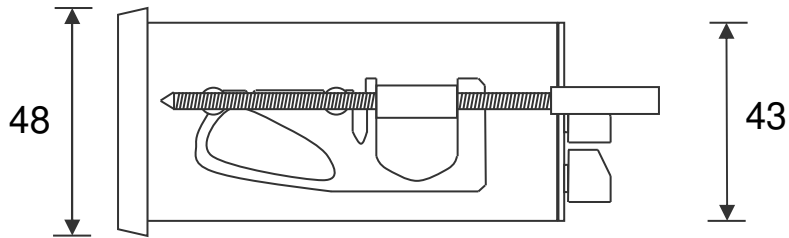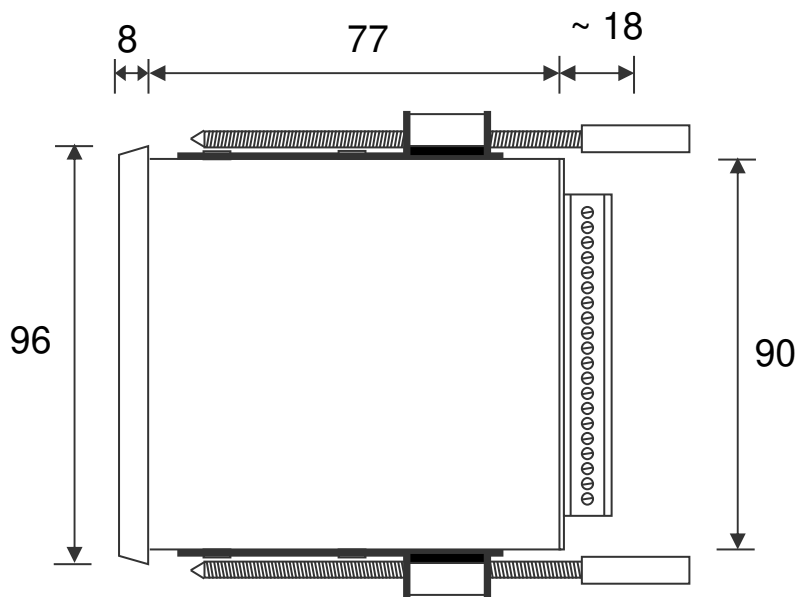- Sealing   front IP50, with protective hood IP54
                          rear IP20

Manual AP20 counter

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DIEGON

7.2 Typekey

AP20- X X

Analog output
0 = no analog in- and output
A = analog in- and output

Digital outputs
C = no digital outputs
D = 4 digital outputs

Manual AP20 counter

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DIEGON

7.3   Dimensions AP20

Side view

Top view

Manual AP20 counter

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DIEGON

7.4 Dimensions EMC bracket type EMC-B02

With RS232 (9P sub-D) on EMC bracket
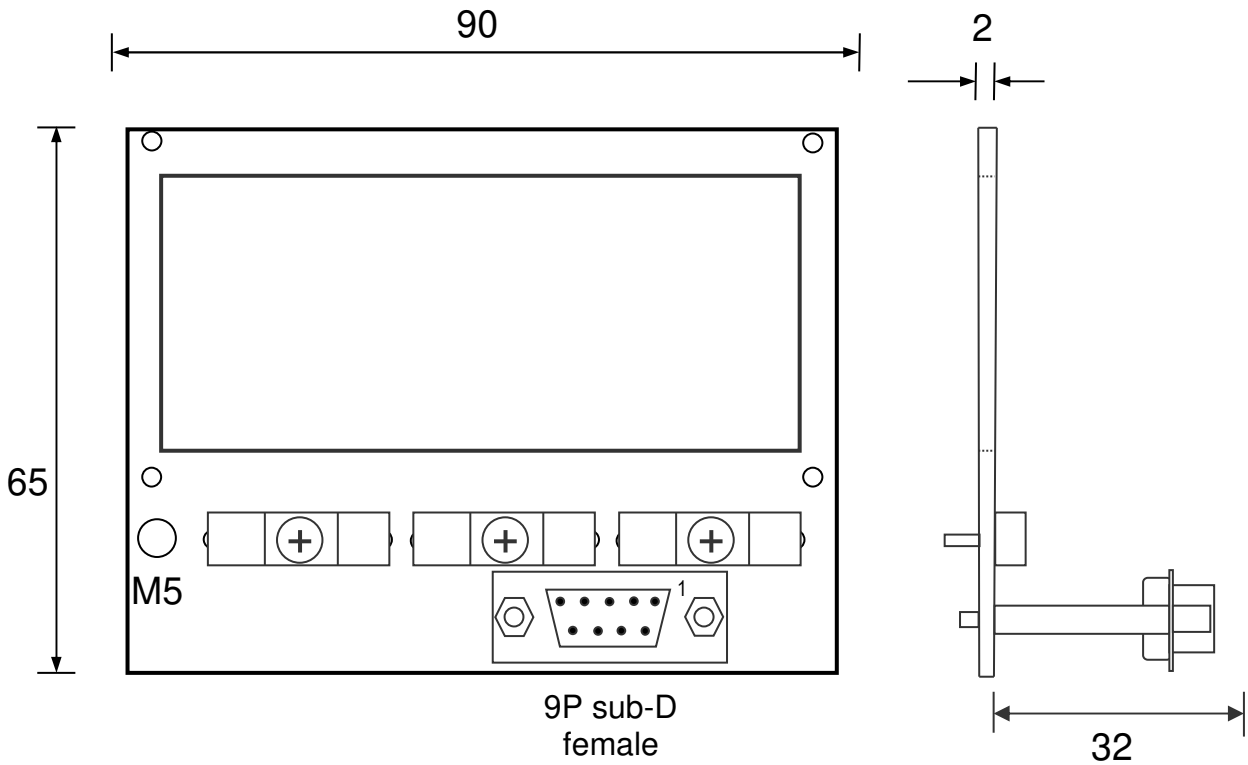
9P sub-D
female

Side view with EMC bracket

Manual AP20 counter

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DIEGON
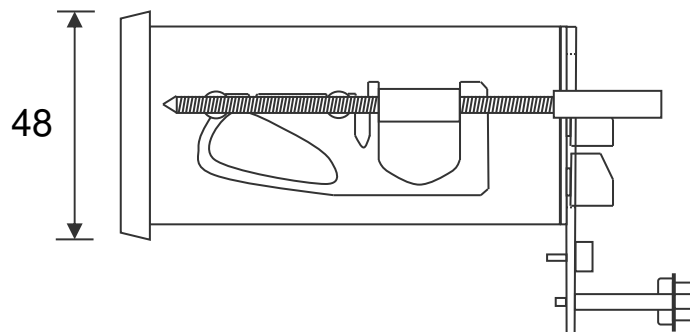
7.4.1 Connections RS232 on 9P sub-D connector

9P sub-D
female

AP20

0V	5	—— wit ——	12	0V
TxD	3	—— geel ——	13	TxD
RxD	2	—— groen ——	14	RxD

Manual AP20 counter

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DIEGON
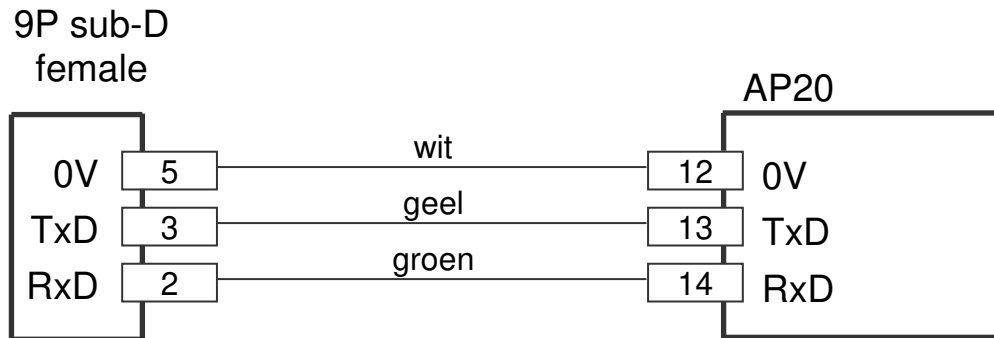
7.5 Dimensions protective hood type CDS-B02

34   32

51

99