POSITAL
FRABA

AP20 COUNTER

- 8 Digit display in DIN-enclosure 96x48 mm
- Supply voltage 10 – 35 V 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)
- All connectors removable

User Manual

POSITAL
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AP20 COUNTER

Table of contents

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.

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.

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	Decimal
238H	Hexadecimal
244G	Gray
10010011B	Binary

for example 220D = DCH = 11011100B

1.4.4 Edges

L→H : rising edge (low to high)

H →L : falling edge (high to low)

2 Operation

2.1 Key functions

[P] key

- Cycle through monitoring displays
- Activate programming mode (in combination with other keys)

[+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

2.2 Key functions in programming mode

[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] 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)

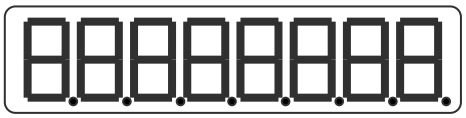
[Enter] key

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

2.3 Display functions

2.3.1 Status functions

Power on



Appr. 1sec.

Operating (normal) mode

2.3.2 Error messages

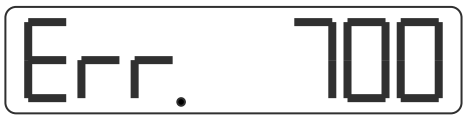
There are two groups of errors:
- Parameter errors (error numbers 0…499, preceded by a “P”)
- General error (error numbers from 500 and up)

Example:

Parameter error number

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

General error number



General error 700

2.3.3 Survey of error messages

Error no:

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 for cams (last 2 digits = cam number)

10xx

Counting range active
Length cam = 0 (if counting range is active)

No counting range active or source for cam is velocity
Length cam <= 0

11xx Length cam <= Hysteresis

12xx Hysteresis too large or length cam too large (2 * Hysteresis) + Length >= Counting range

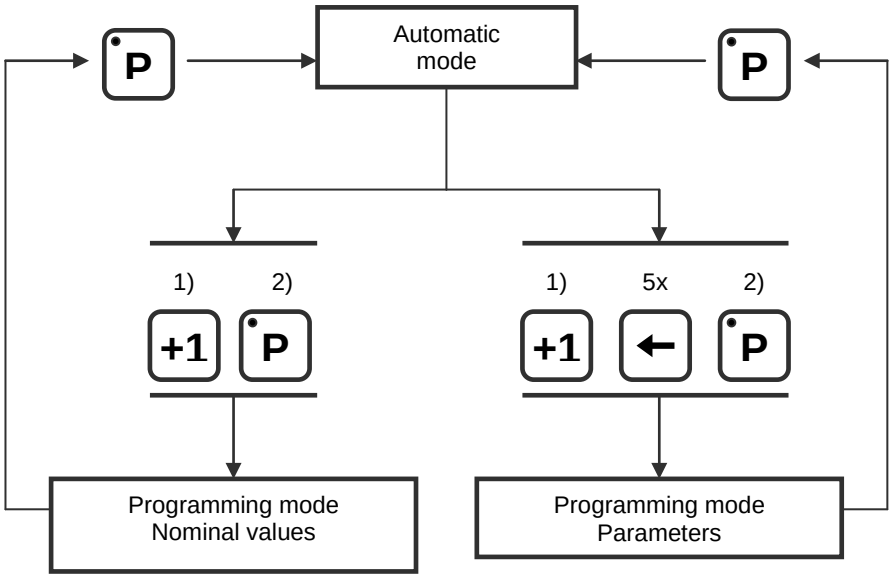
13xx cam begin and/or cam end outside counting range (incl. hysteresis)

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

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

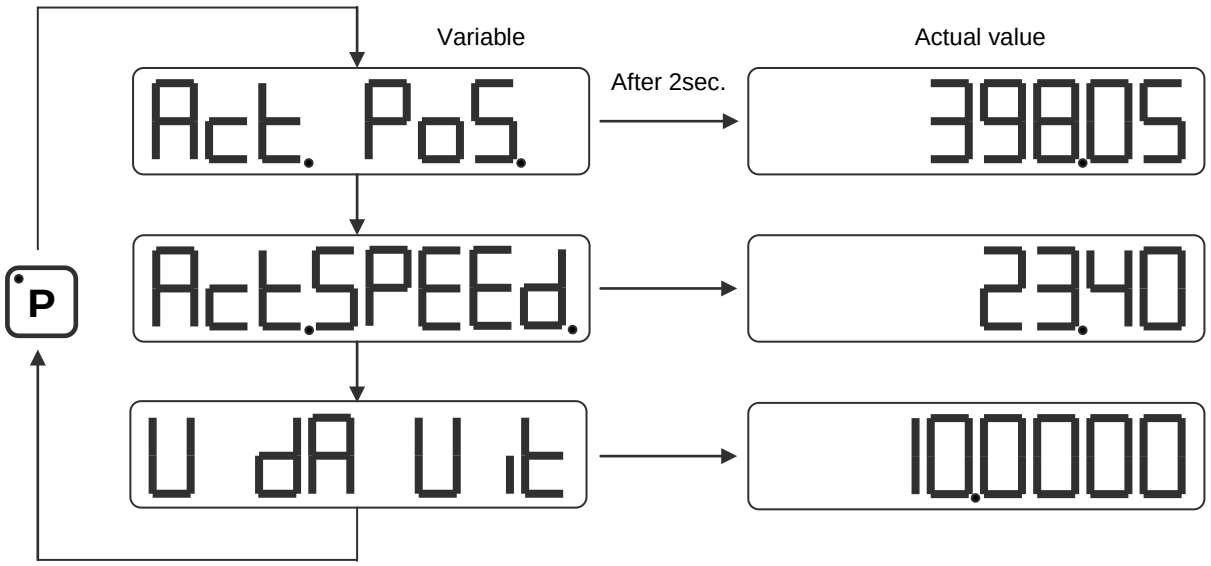
3.1 Automatic mode

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.

3.1.1 Monitor function

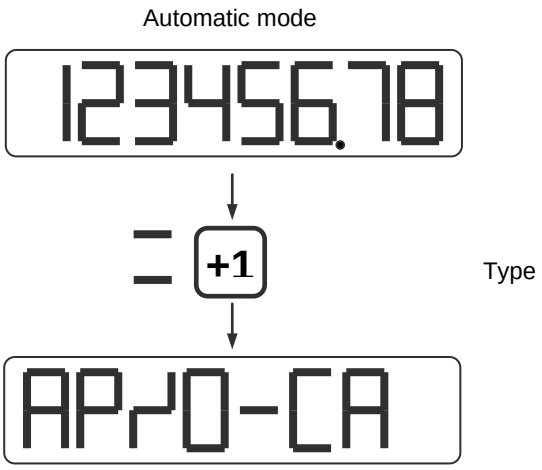
In automatic mode different variables can be displayed. By using the [P] key one can cycle through the different pages:

- Actual position
- Actual velocity
- Voltage or current of the DA (analog out)

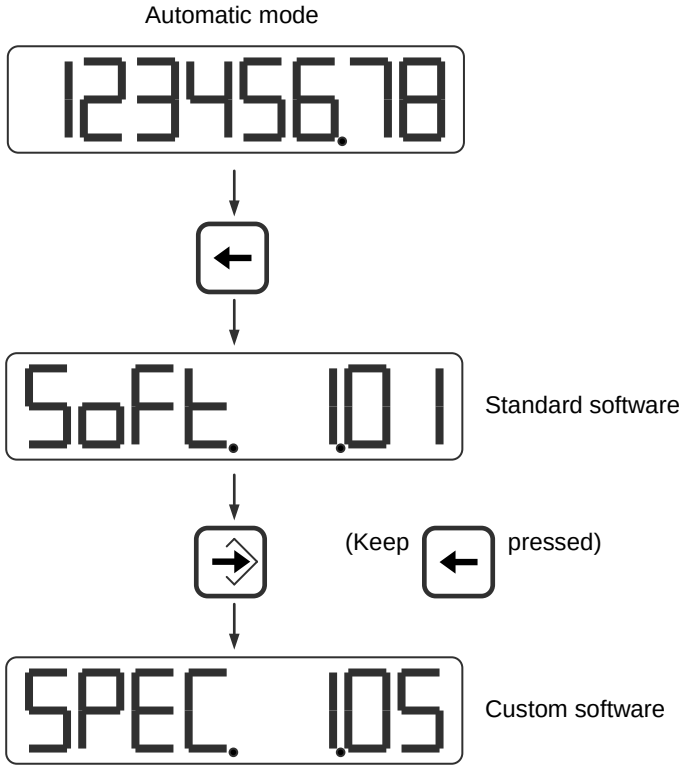


Parameter P[208] determines which option is visible after start-up.

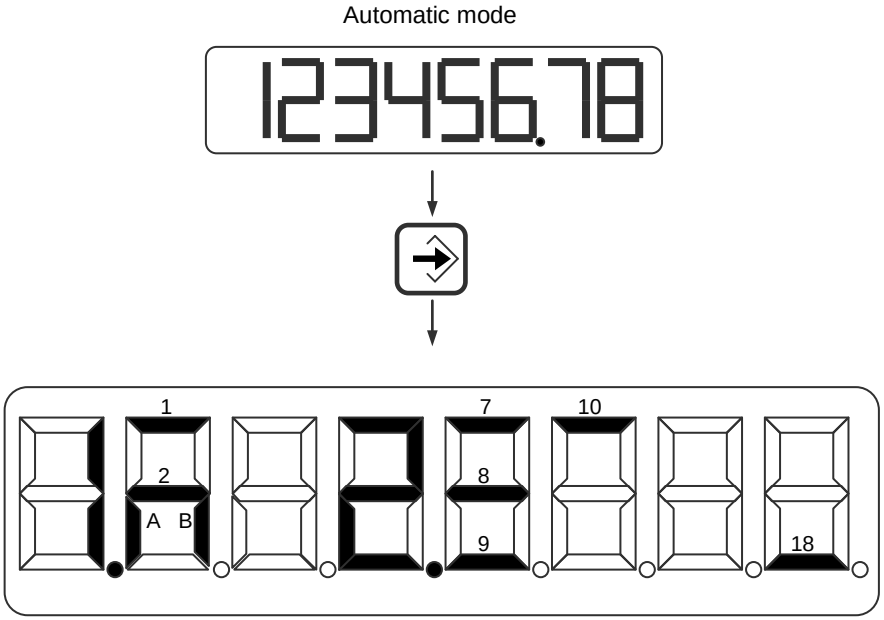
3.1.2 Displaying the type number



3.1.3 Displaying the software-version

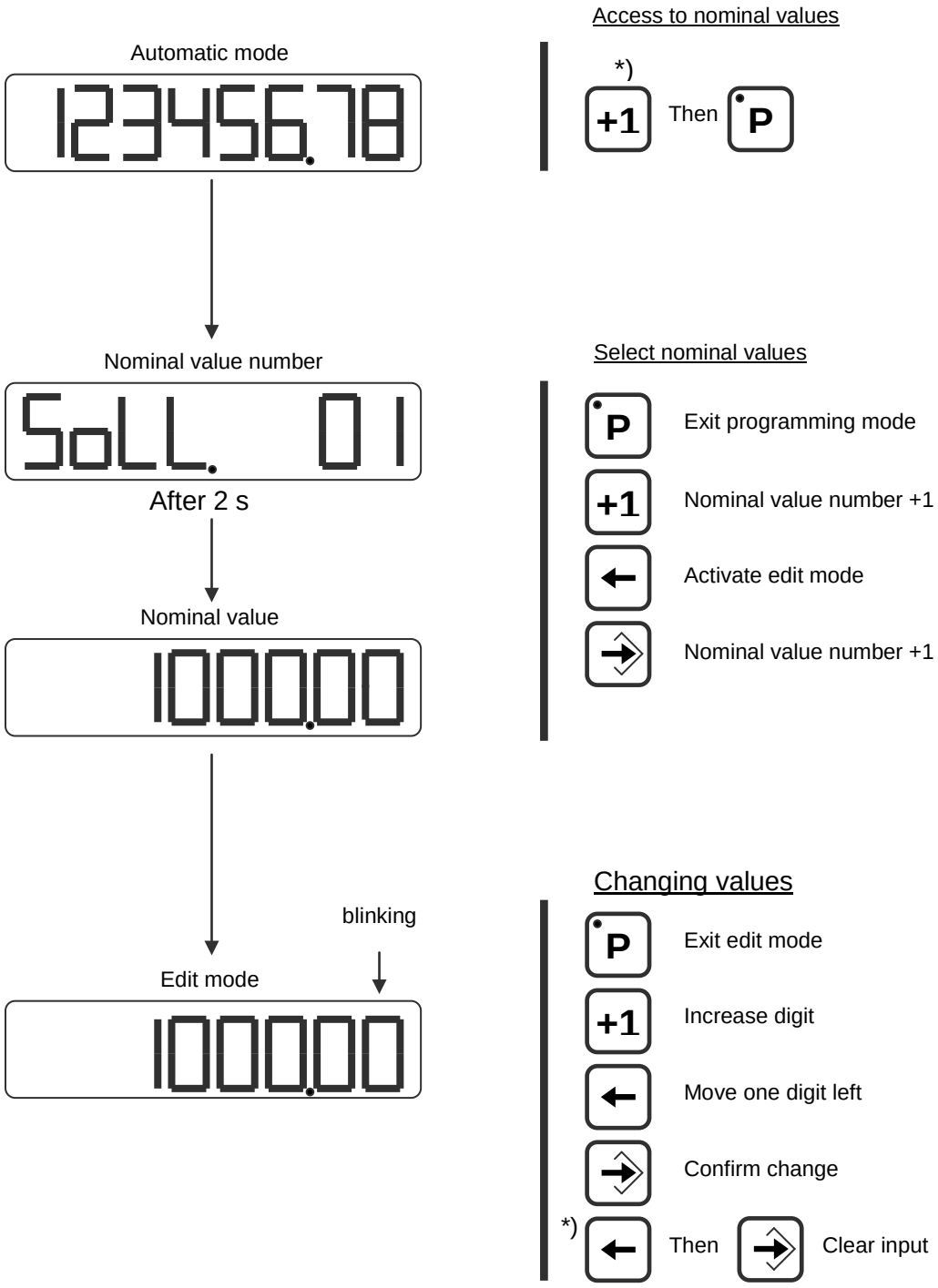


3.1.4 Status in- and outputs



Inputs	Outputs	Outputs
1 = input-1	7 = output-1	18 = Cams active
2 = input-2	8 = output -2	
A = input K1	9 = output -3	
B = input K2	10 = output -4	

3.2 Changing nominal values



*) keep pressed

3.3 Changing parameters

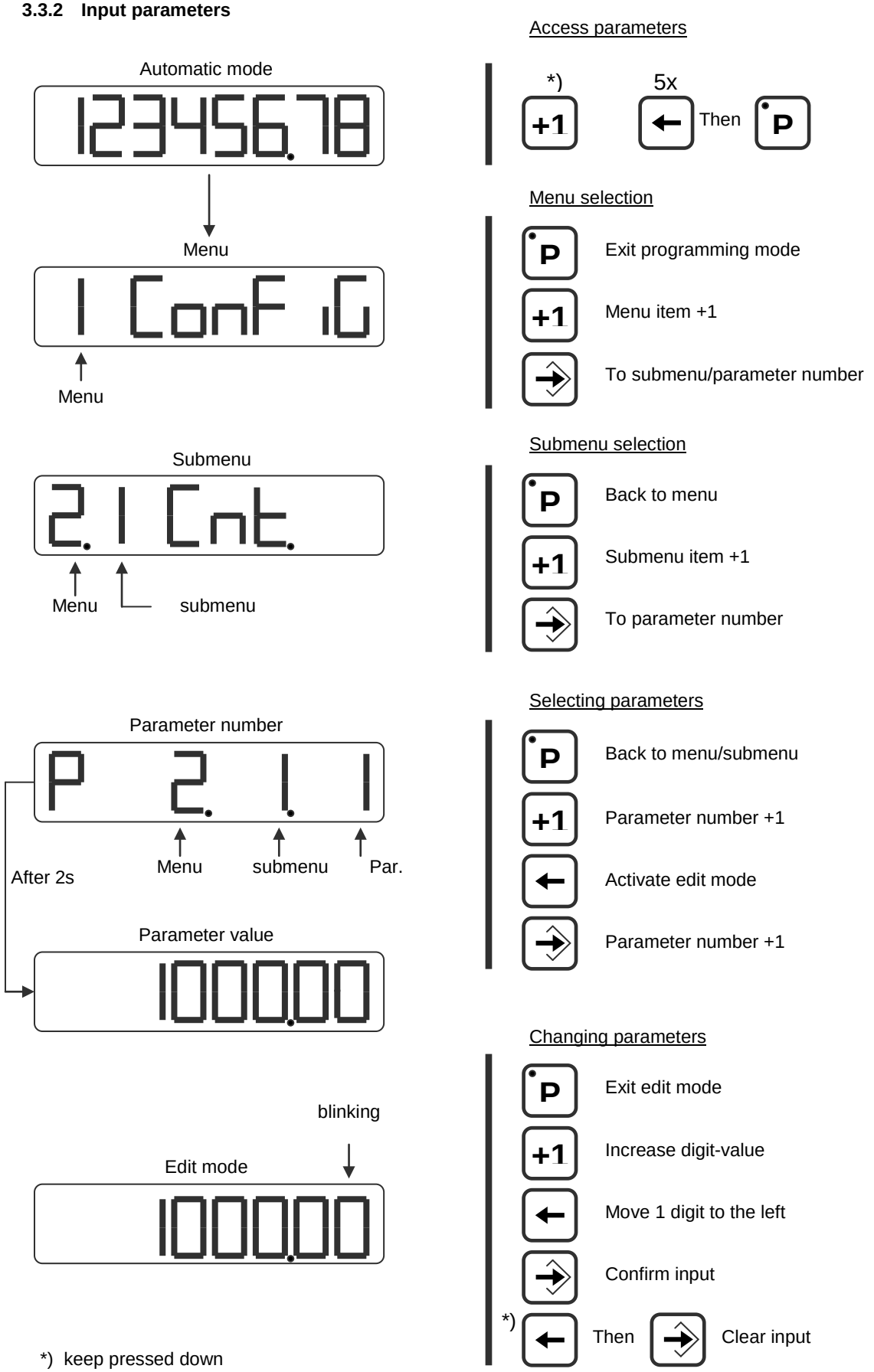
3.3.1 Menus

The parameters are displayed in different menus and submenus:

1 ConFiG
2 ActuAL
3 SEriAL
4 InPut
5 OutPut
6 Cam
6.1 CA1
... ...
... ...
6.12 CA12
7 An out
7.1 ConFG.
7.2 dA-U
7.3 dA-I

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

3.3.2 Input parameters



*) keep pressed down

4 Functions

4.1 Actual position

The actual position shown on the display.

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

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.

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.

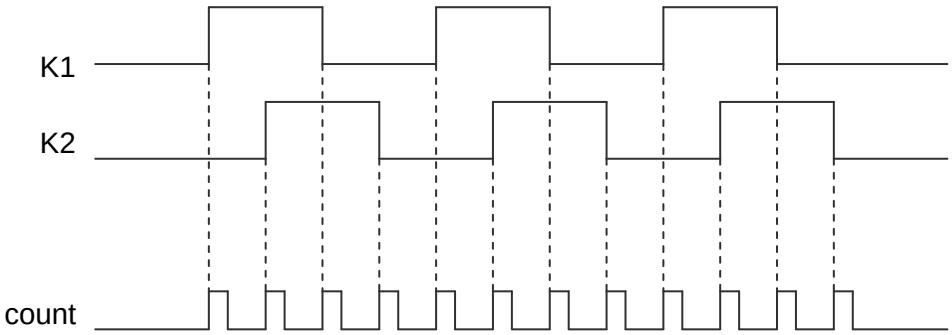
4.4 Power failure protection

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.

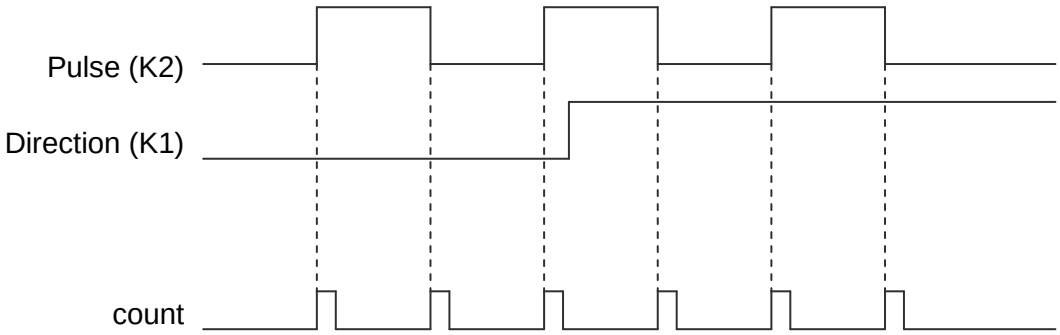
4.5 Edge multiplication (counter input)

There are two 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.



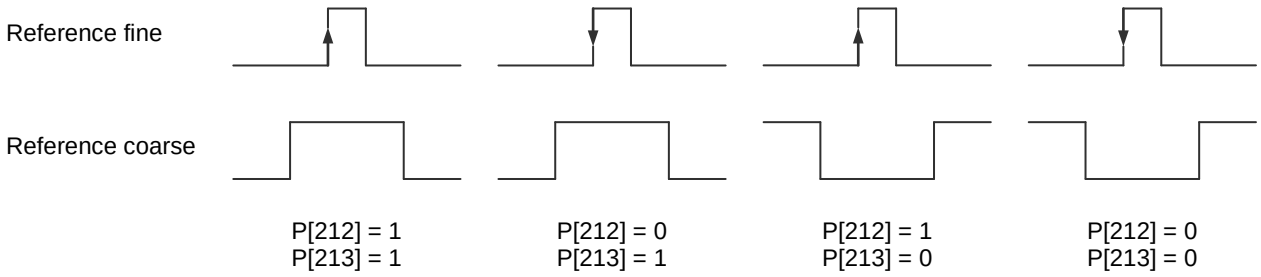
4.6 Preset

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".**



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.

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

The counting range used by the counter can be limited. The number of increments is programmed, ignoring the decimal point.

Counting range P[004]

0 = function not active

1 … counting range

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

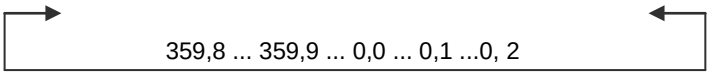
Multiplicator (numerator) P[000] = 3600

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:



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)**
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**

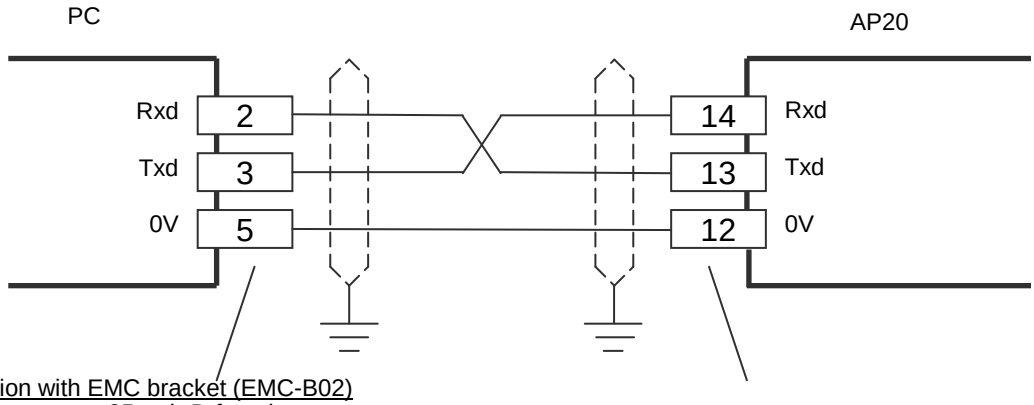
4.8.2 General

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

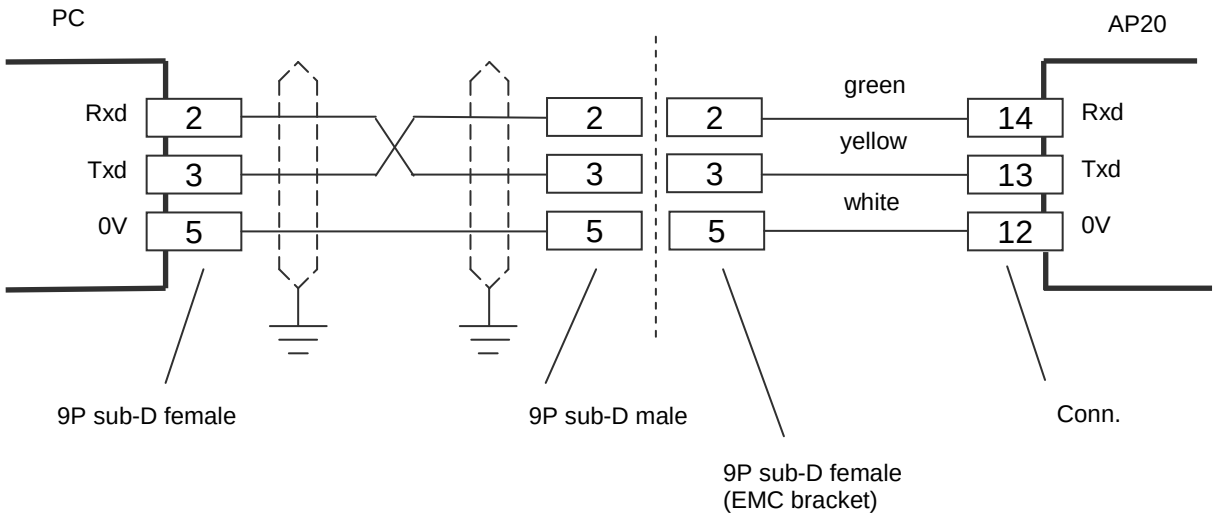
Send: Data from PC, PLC → AP20

Receive: Data from AP20 → PC, PLC

Connection without EMC bracket



Connection with EMC bracket (EMC-B02)



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)*

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

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"

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*

rp **Read parameter**

send:	**rp xxx**
receive:	**rp xxxxxxxx**
transmitting parameter :	parameter number

Example reading parameter P[004]

send:	***rp 4***
answer:	***rp 4 10000***

wp **write parameter** (only EEPROM)

send:	**wp xxx xxxxxxxx**
receive:	**wp xxx xxxxxxxx**
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.

AP20 COUNTER

rs **Read nominal value**

send:	**rs xx**
receive:	**rs xx xxxxxxxx**
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 xxxxxxxx**
receive:	**ws xx xxxxxxxx**
transmitting parameter:	nominal value number and nominal value

Example writing nominal value 22 with value 195200

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

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

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

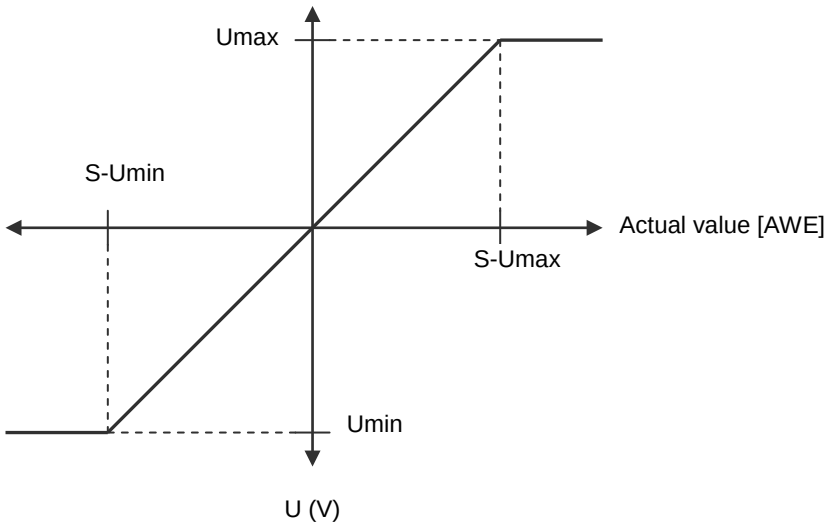
4.9 Analog output

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 or velocity (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].

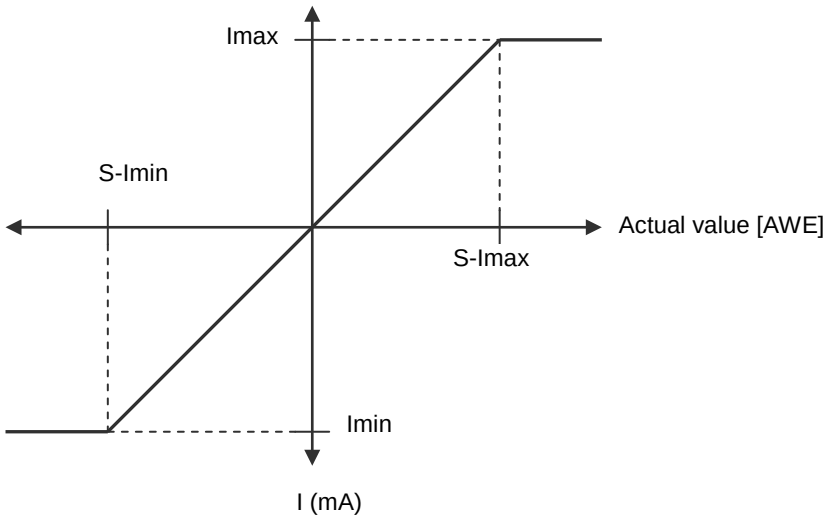
P[080] = Umin [V] (input in 0,0001V units)
P[081] = Umax [V] (input in 0,0001V units)
P[082] = S-Umin [AWE] (actual value at Umin)
P[083] = S-Umax [AWE] (actual value at Umax)



4.9.2 Current output

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

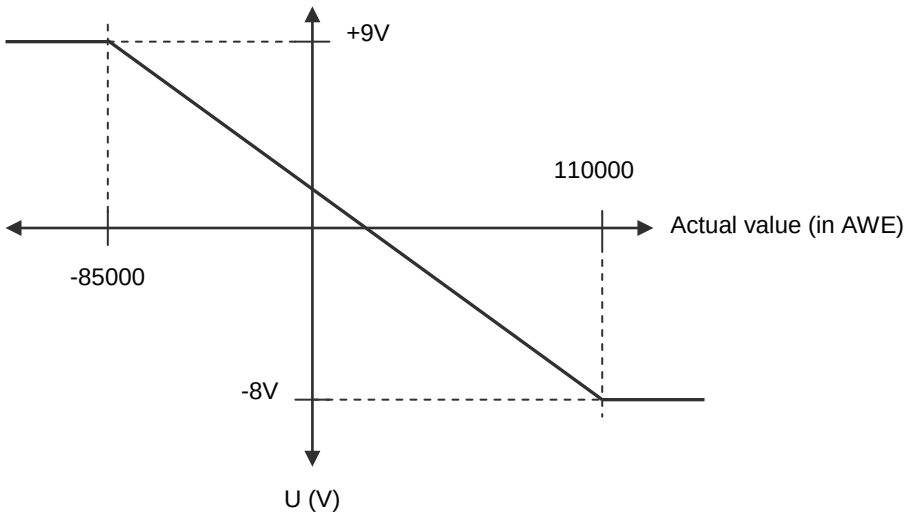
P[084] = Imin [A] (input in 0,0001mA units)
P[085] = Imax [A] (input in 0,0001mA units)
P[086] = S-Imin [AWE] (actual value at Imin)
P[087] = S-Imax [AWE] (actual value at Imax)



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.

4.11 Cams

4.11.1 General

The AP20 has a maximum of 12 programmable cams divided over a maximum of 4 outputs.

Programmable functions:

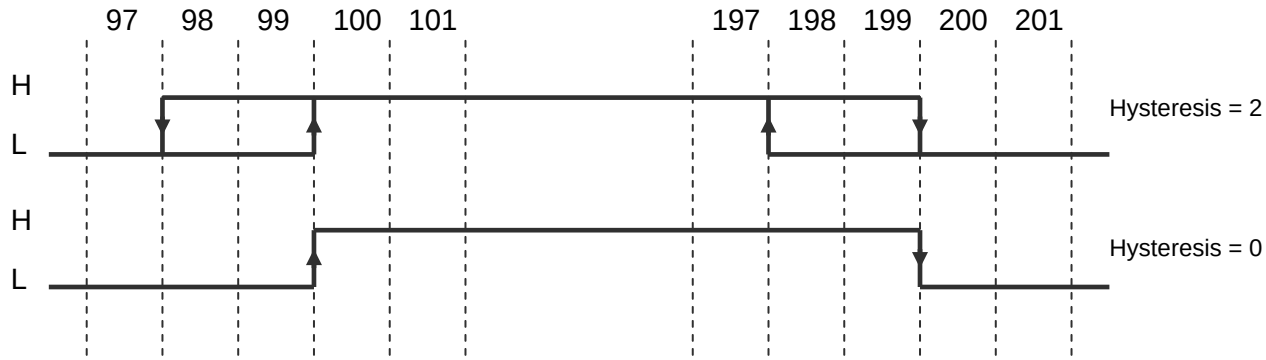
- Type
- Cam with start- and end-value
- Greater than or equal to limit value
- Smaller than or equal to limit value
- Source (actual position or actual velocity
- Nominal value location number for start-, end-, or limit value
- Hysteresis
- Output for cam

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.

4.11.2 Cam with start- and end-value

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

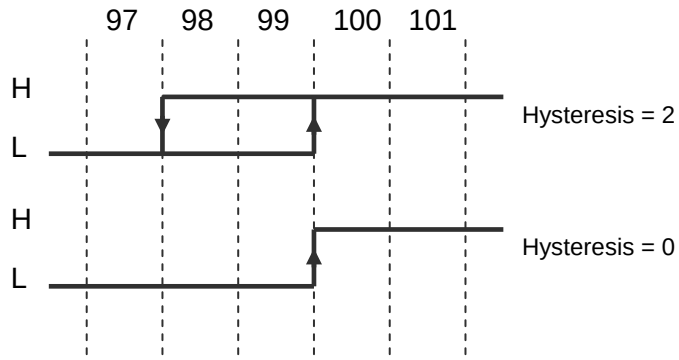
Start = 100, end = 200



4.11.3 Greater than or equal to limit value

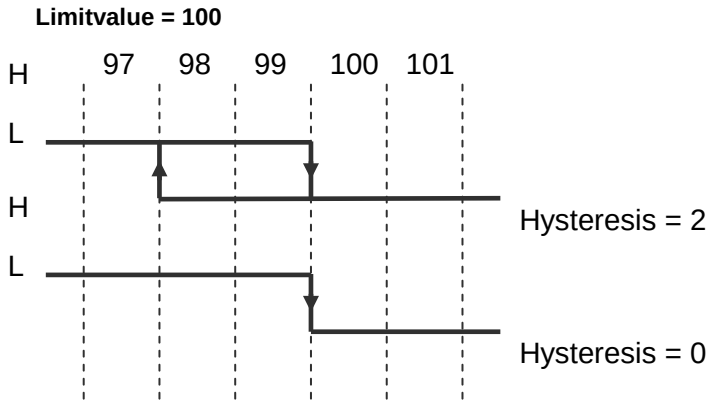
Only one limit value needs to be programmed.

Limitvalue = 100



4.11.4 Smaller than or equal to limit value

Only one limit value needs to be programmed.



4.11.5 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)

4.11.6 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).

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		

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** … 1
Default monitor function Determines the default which is visible after start-up.		
0 = Actual position 1 = Actual velocity		

5.2 Menu 2 Actual

PAR: 2.1.1	P[210]	**0** … 1
Signal type and edge multiplication "S-signal X2": K2 is counter and K1 is direction		
0 = V-signal X4 1 = S-signal X2		

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 1		
-XXXXXXXX (AWE)		

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

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		

5.4 Menu 4 Input

INPUT-1

PAR: 4.0.1	P[249]	**0** … 12

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

INPUT-2

PAR: 4.0.2	P[250]	**0** … 12

Function input-2

XX (see input-1)

5.5 Menu 5 Output

OUTPUT 1

PAR: 5.0.1	P[252]	**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)

OUTPUT-2

PAR: 5.0.2	P[253]	**0** … 7

Function output-2

XX (see output-1)

OUTPUT-3

PAR: 5.0.3	P[254]	**0** … 7

Function output-3

XX (see output-1)

OUTPUT-4

PAR: 5.0.4	P[255]	**0** … 7

Function output-4

XX (see output-1)

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** … 3
Cam function		
0 = no function 1 = range 2 = actual position >= limit value 3 = actual position <= limit value		

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

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		

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		

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** … 1
Selection DA source		
0 = actual position 1 = actual velocity		

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)		

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		
-XXXXXXXX (AWE)		

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

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

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

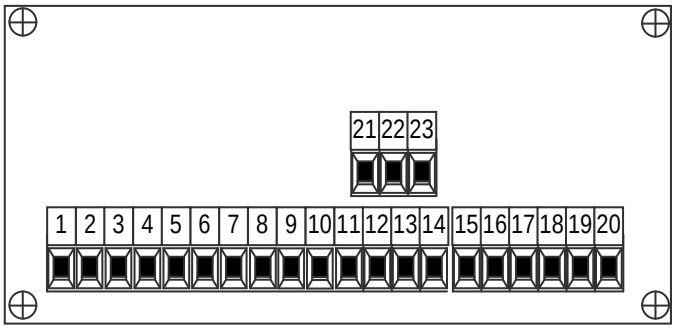
PAR: 7.3.6	P[235]	**0** … 1
Source for Smax		
0 = parameter Smax 1 = teach by input		

5.8 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]…[201]	= no function	
[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 monitor 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
[212]	= Reference fine (input 1 or 2)	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], [233]	= no function	
[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]…[248]	= no function	
[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]	= Camfunction	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	

6 Connections

Connections on the rear

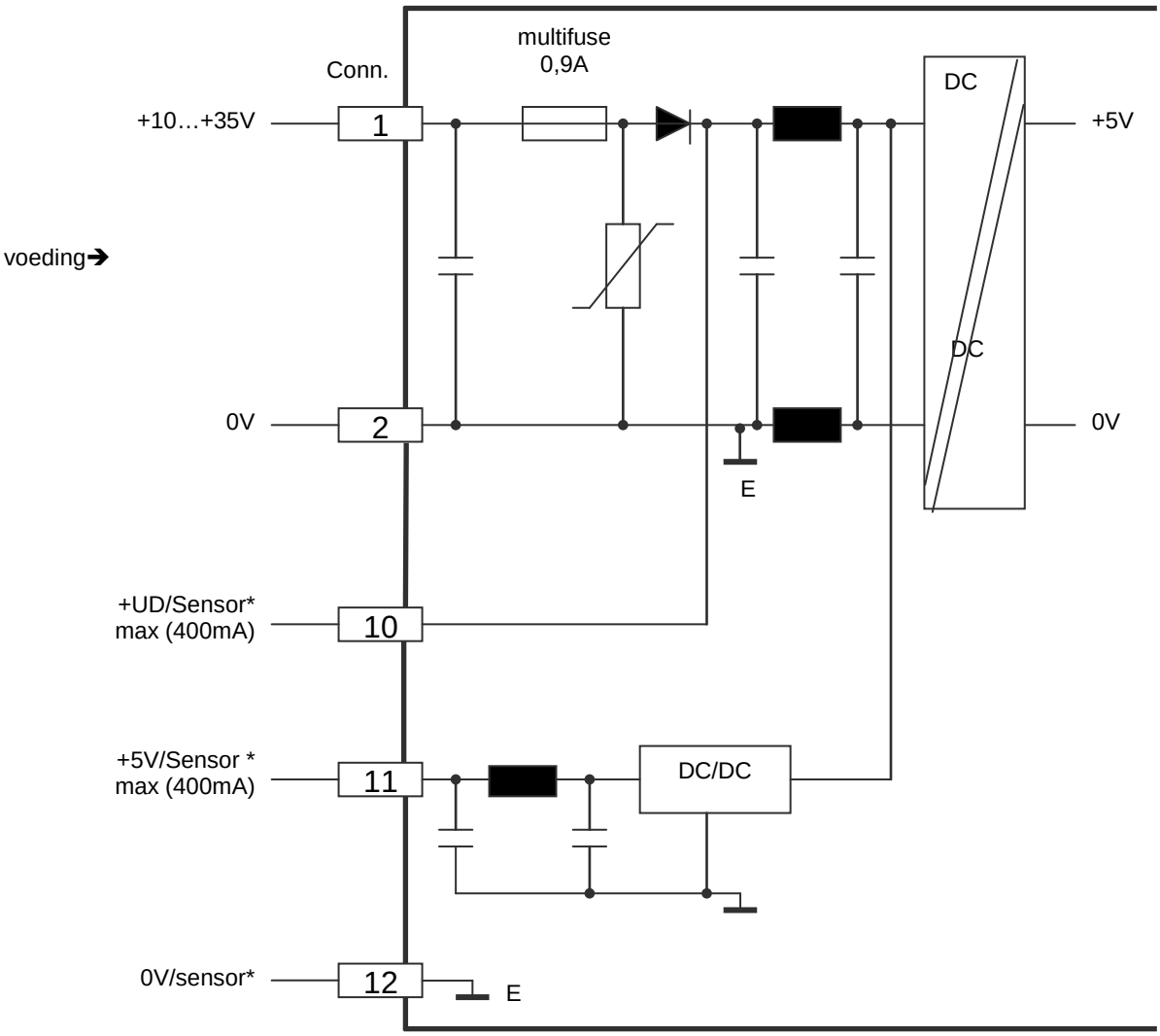


6.1 Overview clamp connections

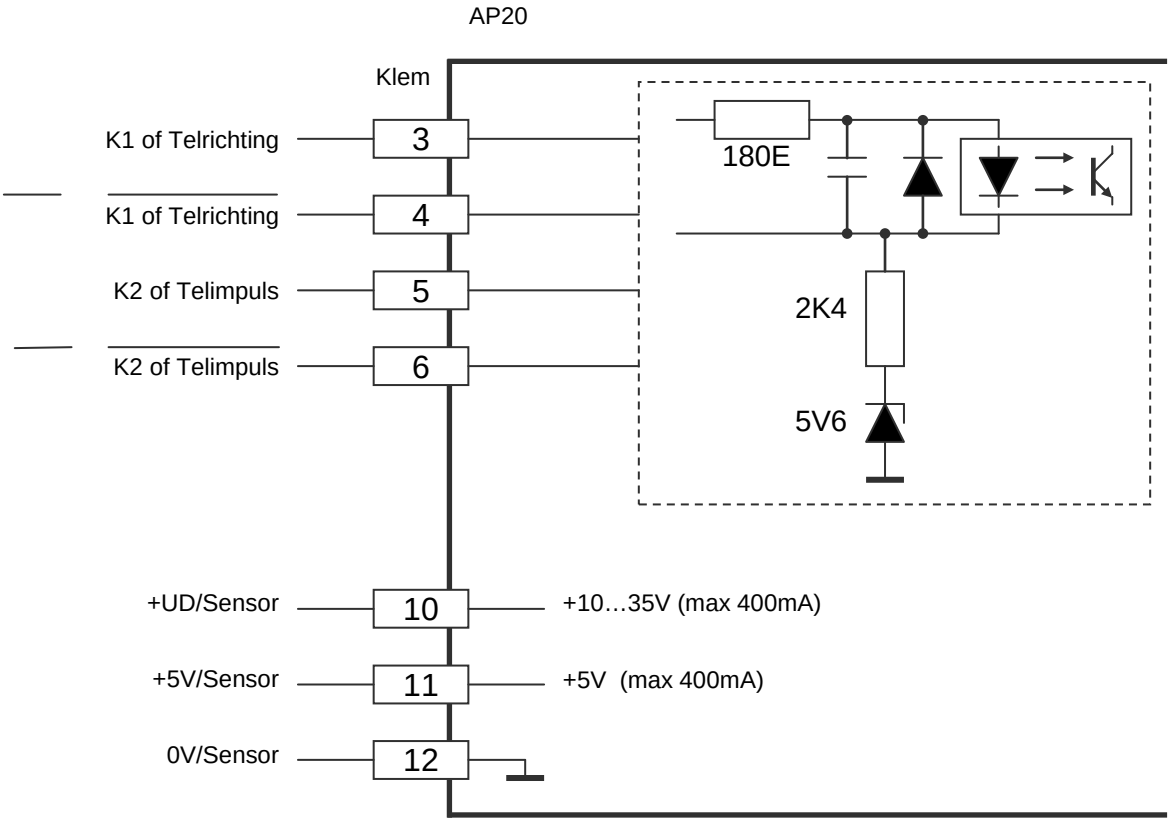
1. +10…+35V supply
2. 0V supply
3. K1 or counting dir.
4. /K1 or counting dir.
5. K2 or counting pulse
6. /K2 or counting pulse
7. Input-1
8. Input-2
9. common for inputs (0V)
10. +10…35V DC supply output for sensor
11. +5V DC supply output for sensor
12. 0V for sensor
13. TxD
14. RxD
15. Output -1
16. 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

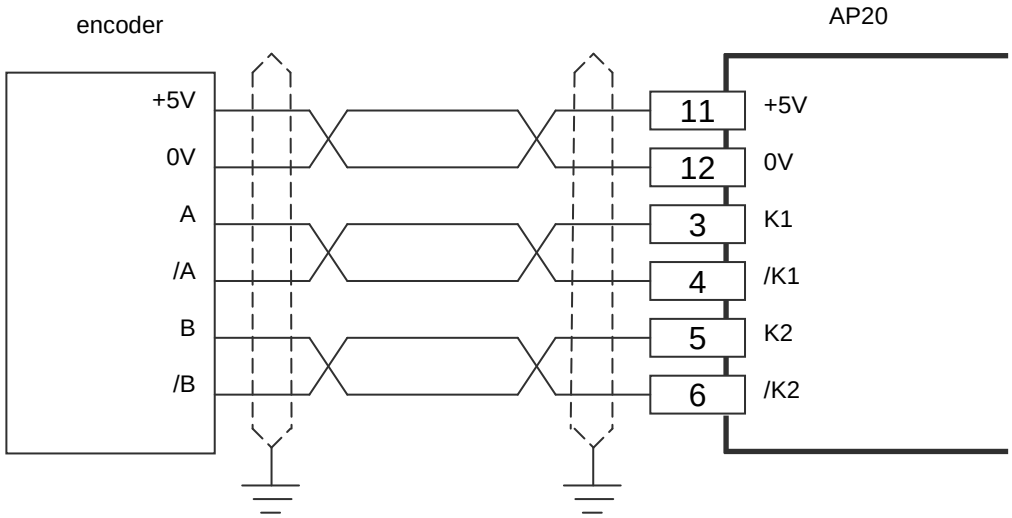
6.2 Supply


Conn.
multifuse
0,9A
DC
+10…+35V
1
+5V
voeding➔
DC
0V
2
0V
E
+UD/Sensor*
max (400mA)
10
+5V/Sensor *
max (400mA)
11
DC/DC
0V/sensor*
12
E

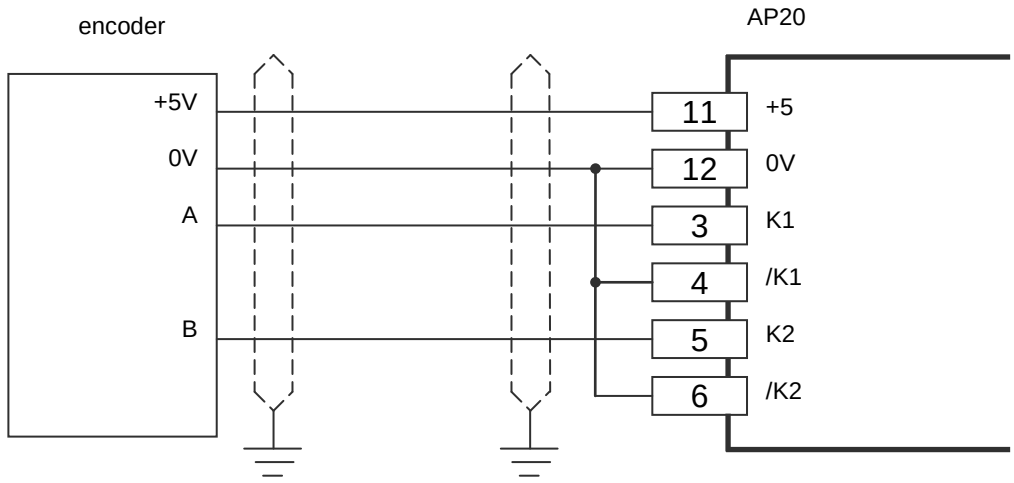
6.3 Counting input



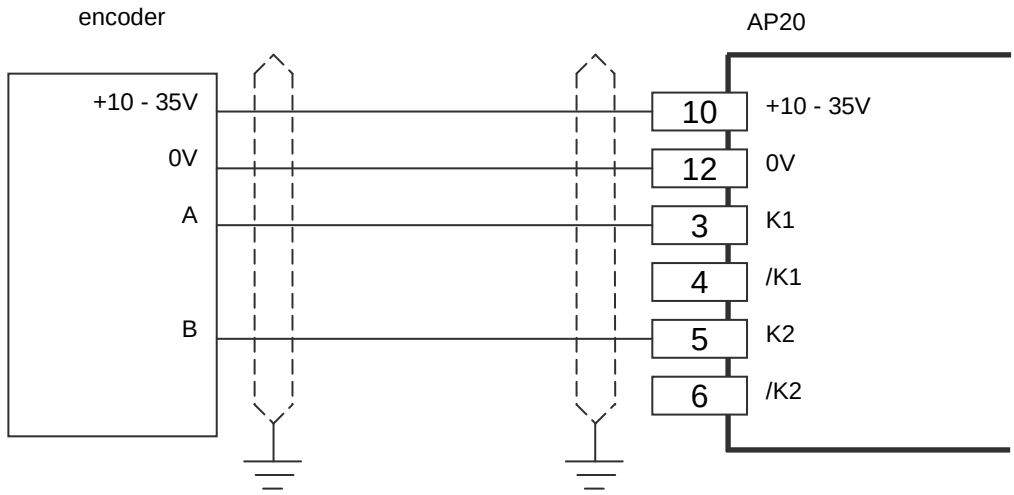
6.4 Encoder 5V with inverted signals



6.5 Encoder 5V without inverted signals

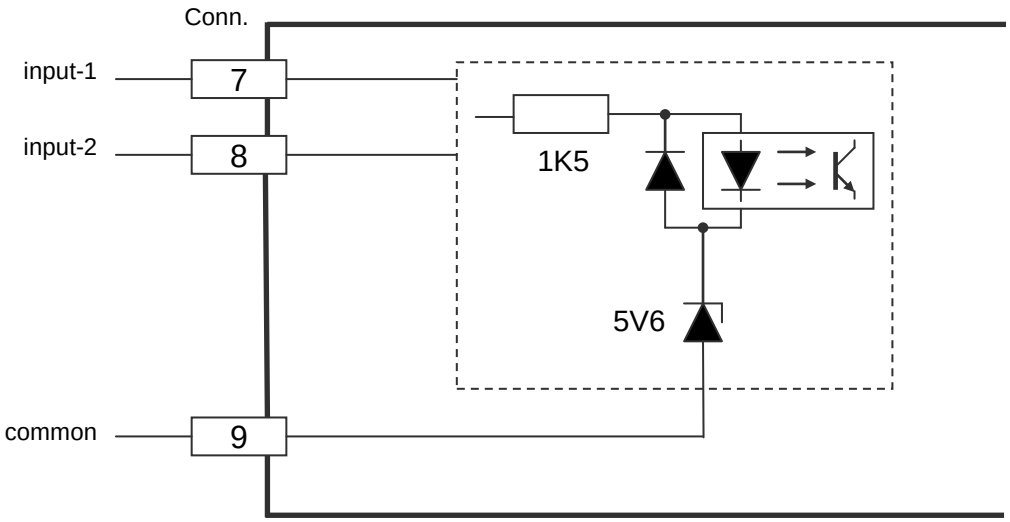


6.6 Encoder 10 – 30V

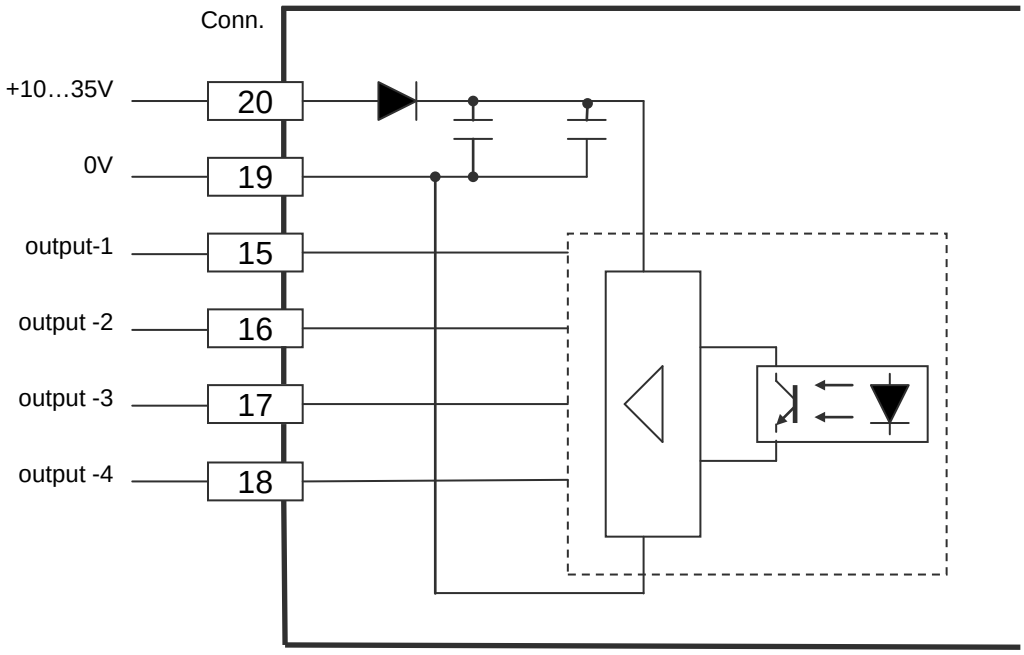


CAUTION!
When using 24 V encoders don't connect terminal 4 and 6.

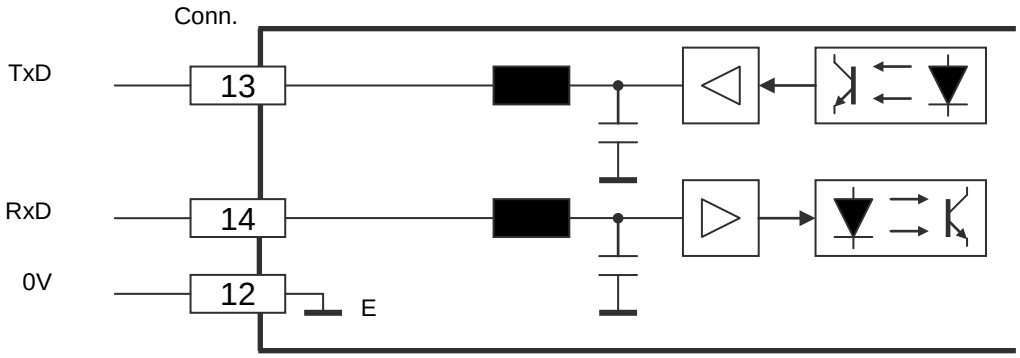
6.7 Digital inputs



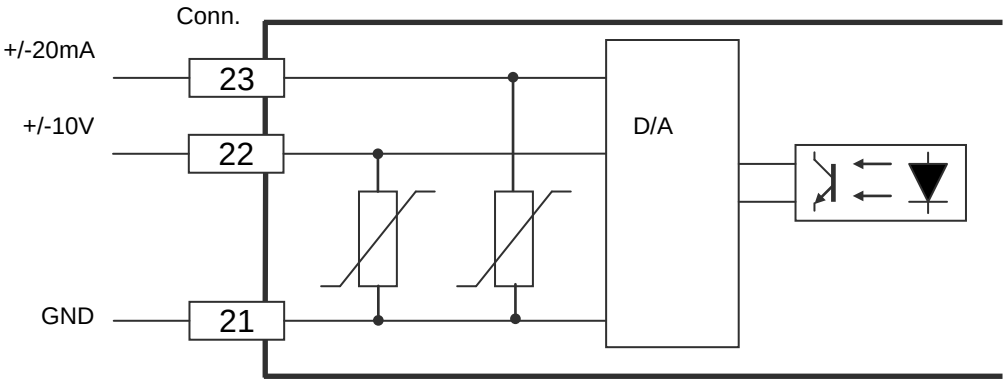
6.8 Digital outputs



6.9 RS232



6.10 Analog output



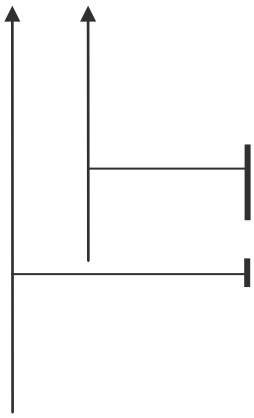
7 Technical specifications

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 resistor	appr. 3kOhm at 24V appr. 0.35kOhm at 5V
input frequency	max. 150 kHz
- Digital inputs 1…2	optically isolated low: 0…+5V high: +10V…+35V
input resistor	appr. 1.8kOhm 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
- 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

7.2 Typekey

AP20- X X

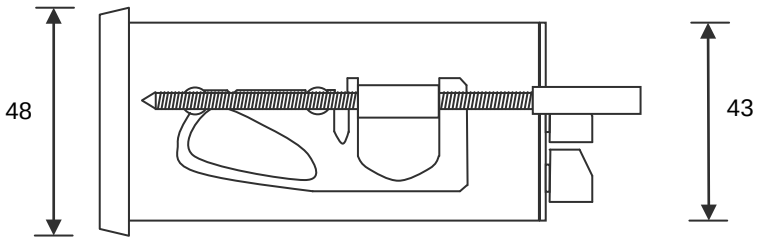


Analog output
0 = no analog in- and output
A = analog in- and output

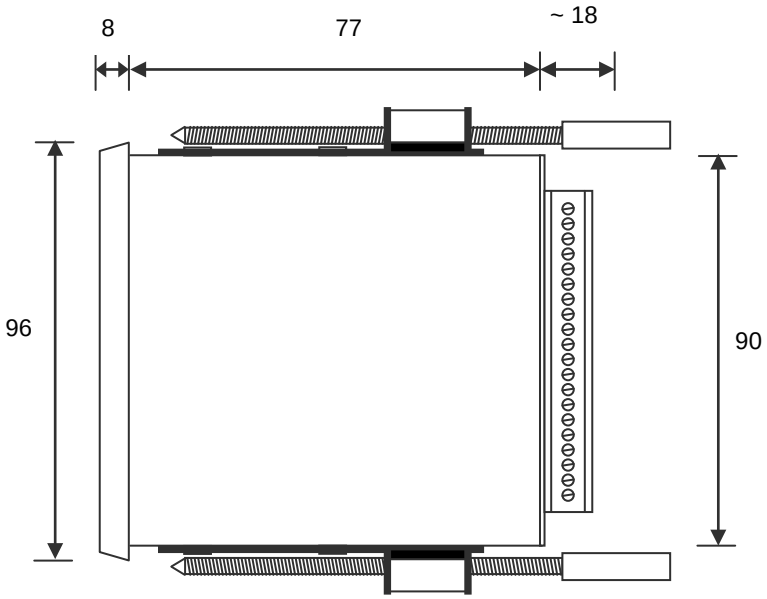
Digital outputs
C = no digital outputs
D = 4 digital outputs

7.3 Dimensions AP20

Side view

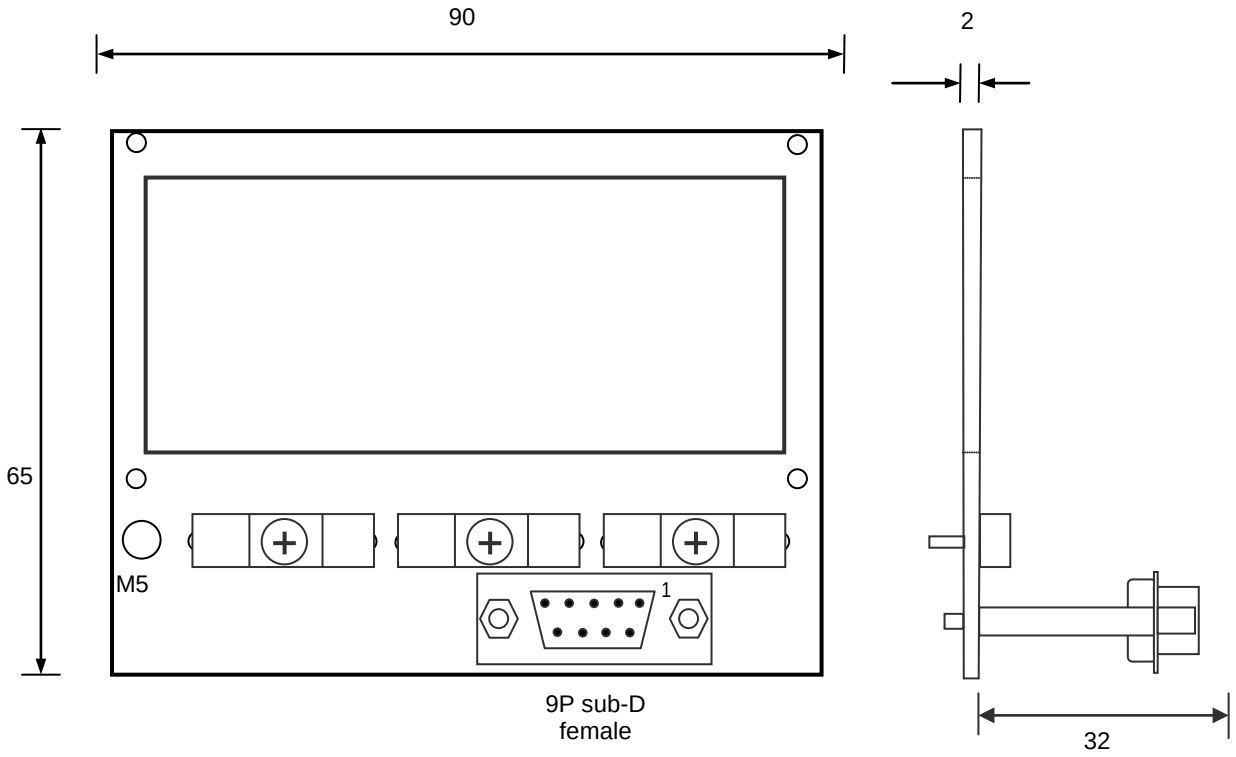


Top view

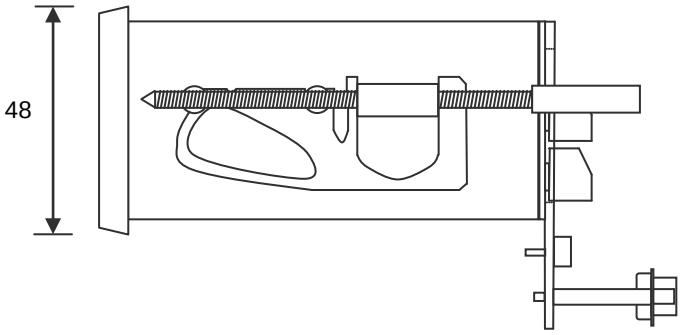


Dimensions EMC bracket type EMC-B02

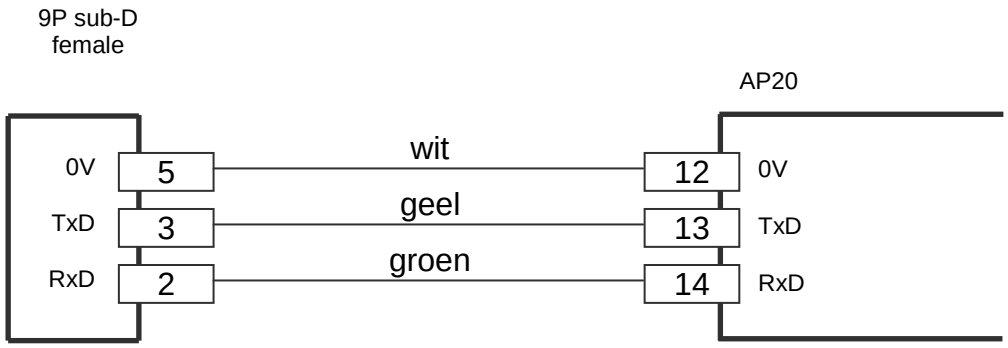
With RS232 (9P sub-D) on EMC bracket



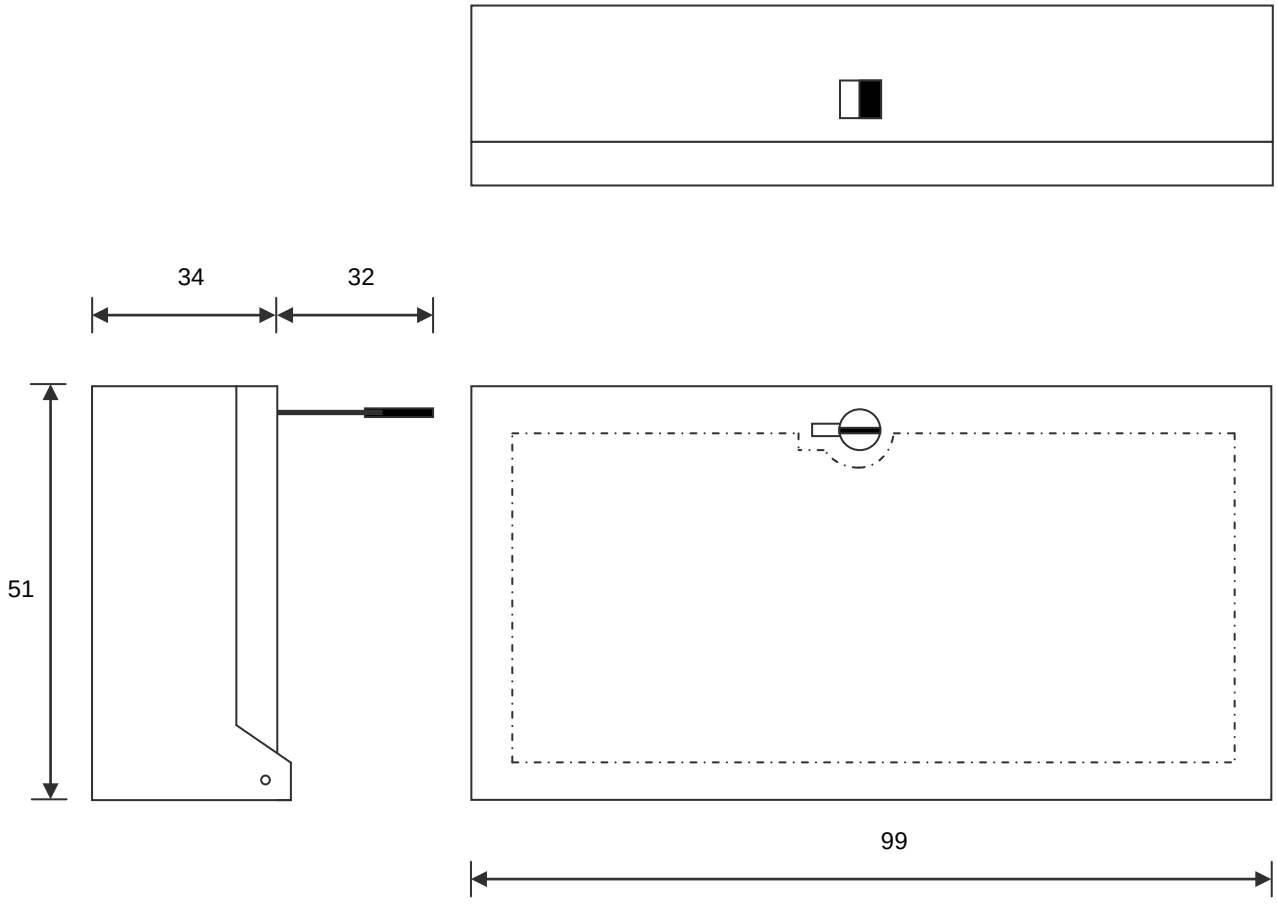
Side view with EMC bracket



7.3.1 Connections RS232 on 9P sub-D connector



7.4 Dimensions protective hood type CDS-B02



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The picture and drawing are for general presentation purposes only. Please refer to the "Download" section for detailed technical drawings. All dimension in [inch] mm.