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AP21 SSI DISPLAY

- 8 Digit display in DIN-enclosure 96 X 48 mm
- Supply voltage 10 – 35V DC
- All in- and outputs optically isolated
- Input for absolute SSI 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

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AP21 SSI DISPLAY

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AP21 SSI DISPLAY

1 Introduction

1.1 General

With the microcontroller based AP21 it is possible to connect absolute sensors with SSI interface (Synchron Serial Interface)

It is standard equipped with 2 digital inputs and 4 digital outputs, all free programmable. The AP21 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 AP21 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 AP21 is configurable for numerous applications by adjusting its parameters.

The AP21 can be programmed with the DST2 PC-based software.

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1.2   Important information

▪   The AP21 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 AP21.
▪   If through a failure or fault of the AP21 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 AP21.
▪   Necessary repairs to the AP21 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 AP21:
▪   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)

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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

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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)

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2.3   Display functions

2.3.1   Status functions

Power on

Appr. 1sec.

Operating (normal) mode
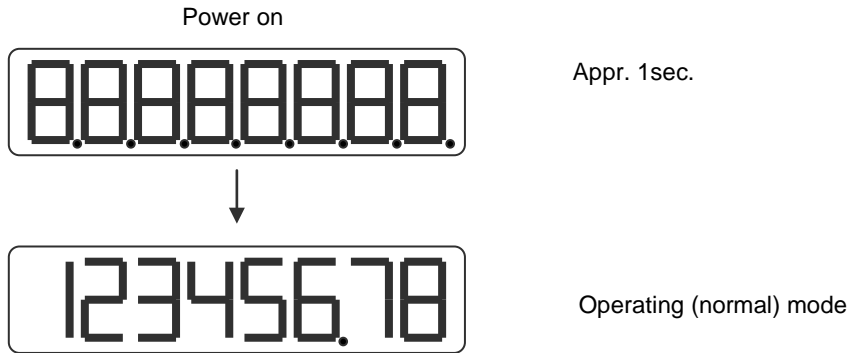
2.3.2   Error messages

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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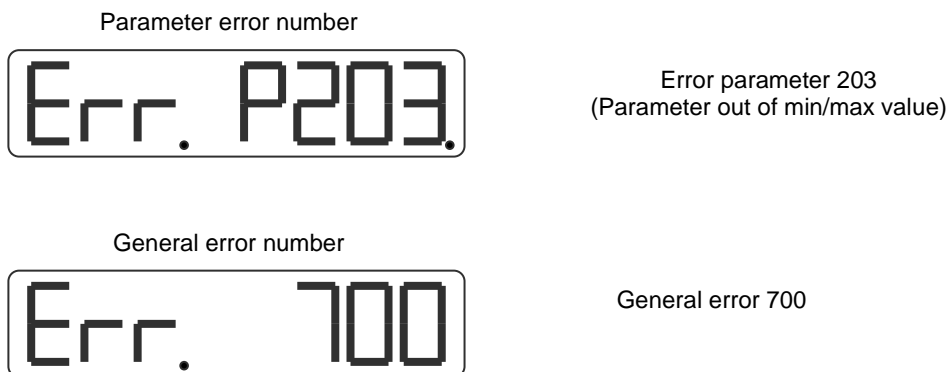
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2.3.3 Survey of error messages

Error no:
000...499   Parameter error is displayed as PXXX on the display.

701 = Adjustment value SSI P[005] >= Counting range
         or Adjustment SSI P[005] < Offset P[002]
703 = Number of active SSI databits > number of SSI Clock pulses
705 = Offset SSI P[002] > Counting range
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)
800 = SSI error delta-s
801 = SSI error cable failure

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
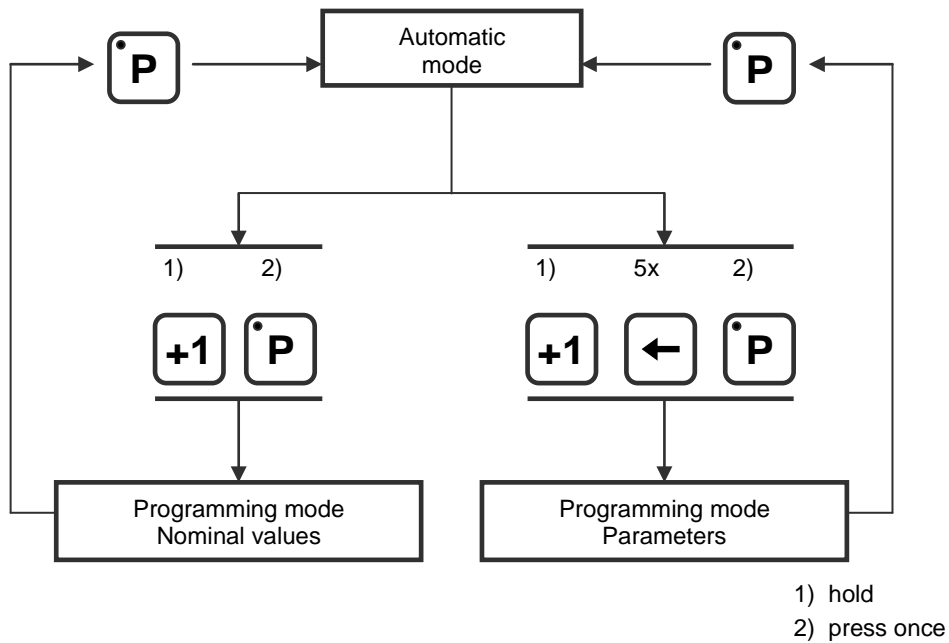
3.1   Automatic mode

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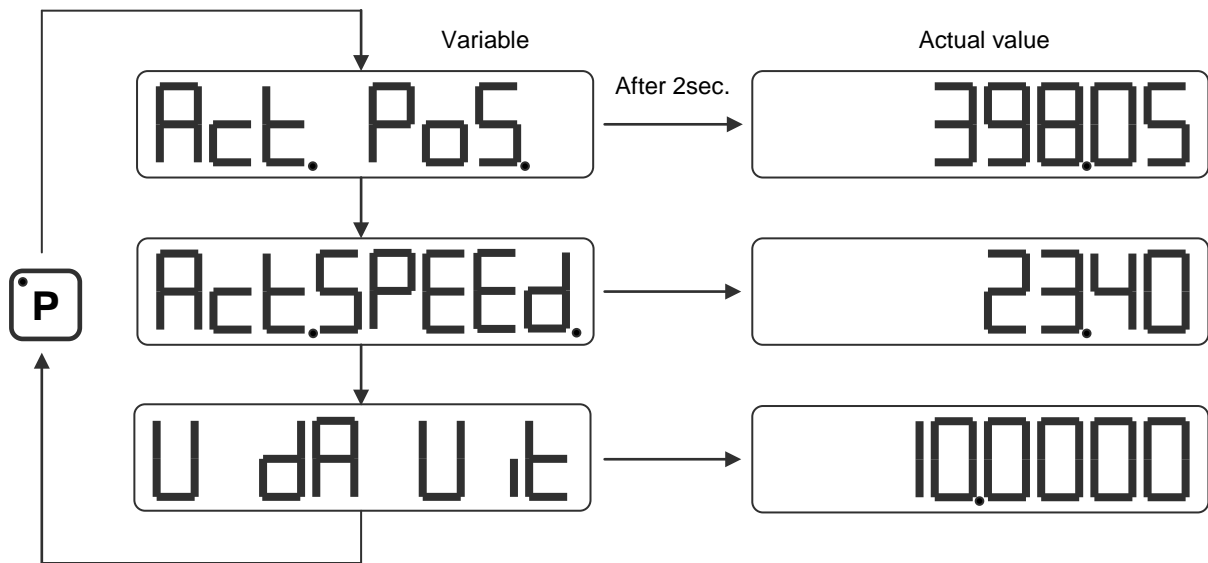
Parameter P[208] determines which option is visible after start-up.

3.1.2 Displaying the type number

Automatic mode

```
12345678
```

$$\text{—} \boxed{+1} \qquad \text{Type}$$

```
AP2O-CA
```
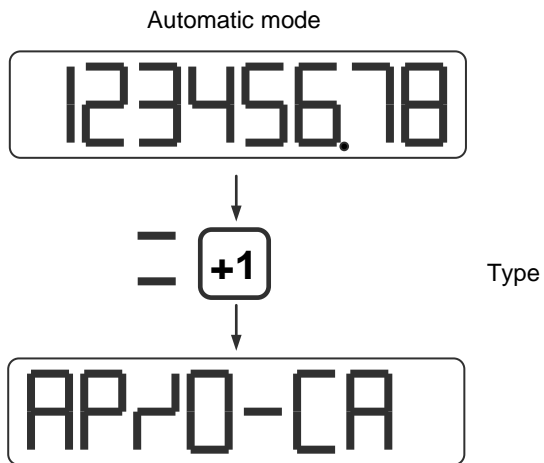
3.1.3 Displaying the software-version

Automatic mode

```
12345678
```

$$\boxed{\leftarrow}$$

```
SoFt.  1.0 1      Standard software
```

$$\boxed{\Rightarrow} \qquad (\text{Keep} \boxed{\leftarrow} \text{ pressed})$$

```
SPEC.  1.05      Custom software
```
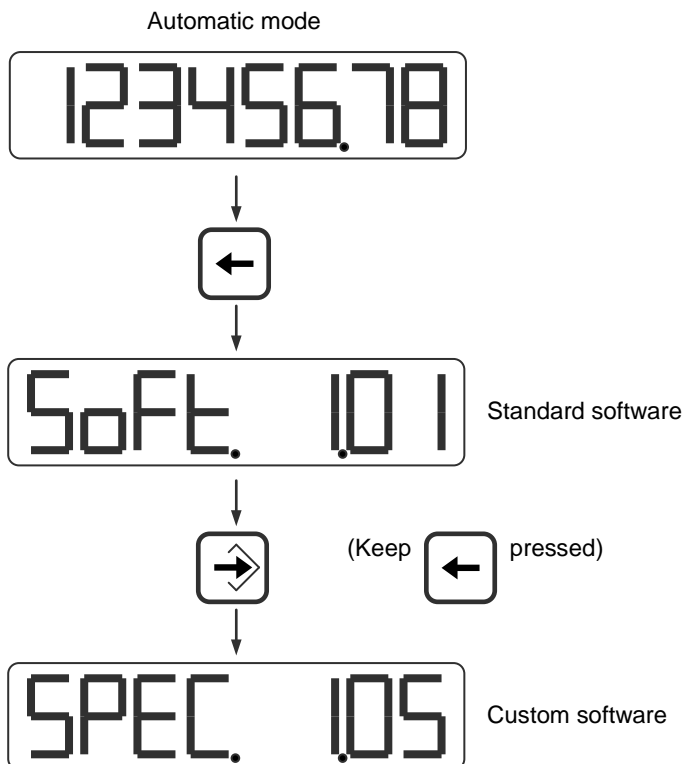
3.1.4 Status in- and outputs

Automatic mode
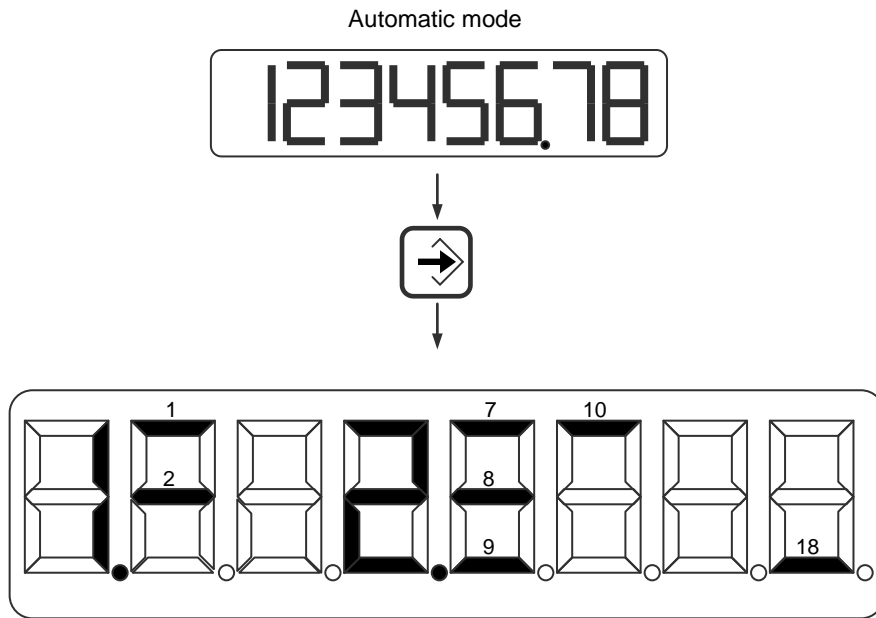
Inputs	Outputs	Outputs
1 = input-1	7 = output-1	18 = Cams active
2 = input-2	8 = output -2	
	9 = output -3	
	10 = output -4	

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3.2   Changing nominal values

Automatic mode
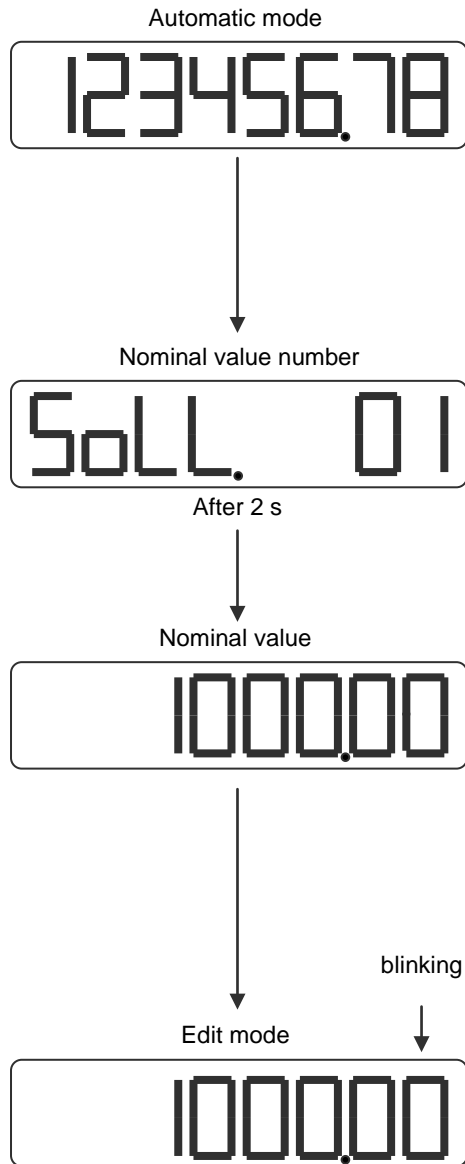
Access to nominal values

+1   Then   P   *)

Nominal value number

After 2 s

Select nominal values

P   Exit programming mode

+1   Nominal value number +1

←   Activate edit mode

→   Nominal value number +1

Nominal value

Changing values

blinking

P   Exit edit mode

Edit mode

+1   Increase digit

←   Move one digit left

→   Confirm change

←   Then   →   Clear input   *)
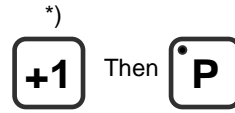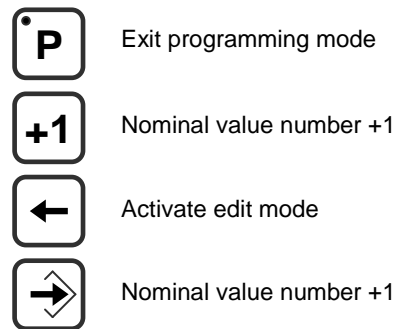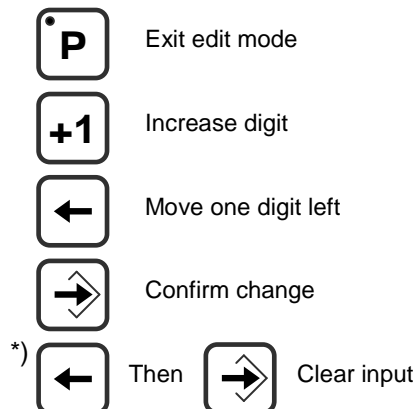
*) keep pressed

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   *Example:*
7.1 ConFG.   *PAr. 6.1.1 means*
7.2 dA-U   *menu 6, submenu 1, parameter 1*
7.3 dA-I

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3.3.2 Input parameters

Automatic mode

Menu

Menu

Submenu

Menu — submenu

Parameter number

After 2s — Menu — submenu — Par.

Parameter value

blinking

Edit mode
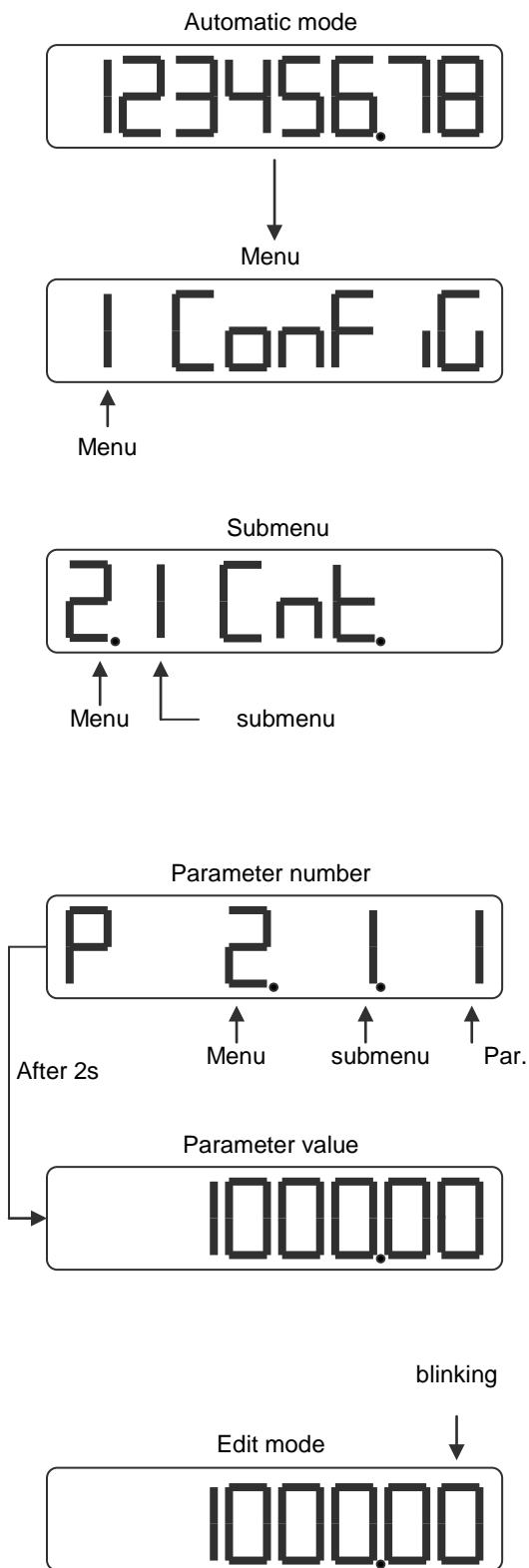
*) keep pressed down

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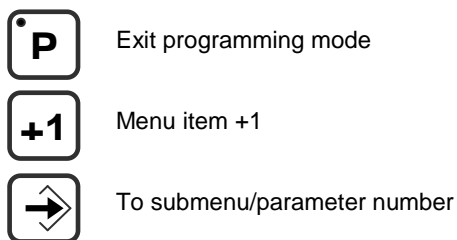
*) +1 | 5x ← Then P

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
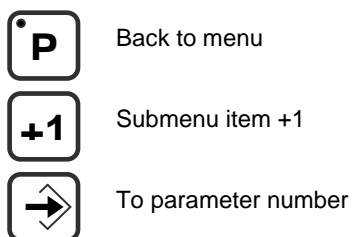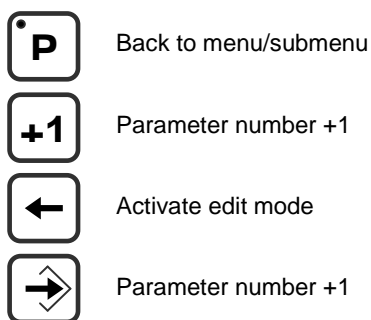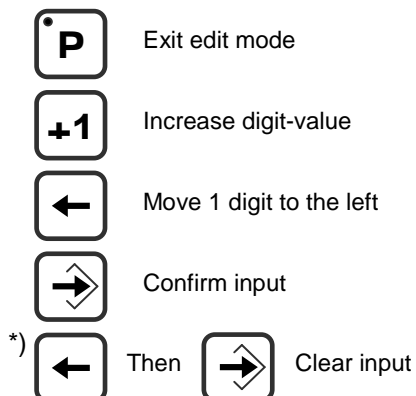
4   Functions

4.1   Actual position

The actual position shown on the display.

$$\text{Actual position} = SSI \times dir \times \frac{Mt}{Mn} + N$$

Mt	=	multiplicator numerator	P[000]
Mn	=	multiplicator denominator	P[001]
N	=	offset	P[002]
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 SSI 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   Number of bits SSI

To read the sensor values of SSI-encoders two parameters are important:

Number of clock impulses   P[216]
Number of data bits   P[217]

	Multiturn part	**Singleturn part**
	MSBit	**LSBit**
SSI data from encoder		
	MSBit	**LSBit**
Read bits, determined by clockimpulses		
	MSBit	**LSBit**
Read bits determined by number of data bits		
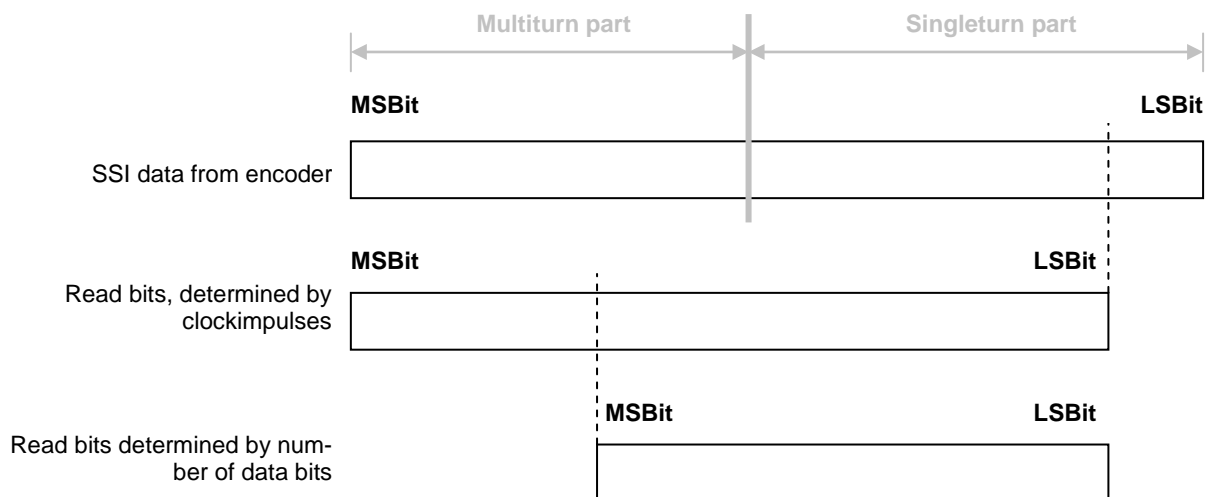
Normally the most significant bit (MSB) is transmitted first by the encoder.

The number of clock pulses determine the number of bits that will be read by the AP21. Basically this will be the number of bits that the encoder transmits.

> *Example:*
> *The SSI-encoder has a resolution of 4096 positions per revolution and 4096 coded revolutions.*
> *The number of clock pulses will be 12 (bit) + 12 (bit) = 24 (bit).*

The number of data bits will normally be the same: 24.
In some cases however it can be desirable to change the number of clock pulses and/or data bits.

> *Example:*
> *The SSI-encoder has 16 single turn bits (65535 positions/rev.) and 14 multi turn bits (16384 coded revolutions).*
>
> *The resolution should be 8192 positions/rev. = 13 bit. The number of revolutions should not be changed (remains 14).*
>
> *Number of clock pulses will be: P[216] = 27   (13+14)*
> *Number of data bits will be: P[217] = 27   (13+14)*

4.5   SSI monitoring

The SSI-value is being read and processed every single cycle (250µs).
Due to external electromagnetic interference it may happen that during 1 cycle incorrect information has been read.
To prevent unwanted cam actions switching actions, the SSI value can be monitored.

There are two different ways of monitoring the SSI-value: detection of cable-failure (see also P[232], P[252]) and monitoring the delta-SSI.

The delta-SSI value is a maximum value that two separate readings may differ from each other (P[006]). It is possible to set the number of times that this value may be overrun (P[220]).

If there is a reading which is exceeding the max. difference, the last reading is interpolated. When the max overrun counting is reached there will be a SSI error generated.

4.5.1   Output "SSI error"

It is possible to create a SSI-error signal using one of the outputs 1..4:

Output SSI error
Output-x = option **"2 SSI error"**   (Low = SSI error)

4.5.2   Reset "SSI error"

The SSI error-signal can be reset by using one of the following options:

- Activate and exit programming mode parameters
- Reset with PC-program DST2
- Serial communication (ASCII)
- Set one of the inputs 1…2 to **"4 Reset SSI error"** and apply a high signal

4.6   Justage SSI

The justage of absolute sensors can be done in 4 ways:
- Using the parameter "Adjustment absolute value" P[005]
- Using the input input 1 or 2)
- Using parameter service functions P[207]
- Using front keys

4.6.1 Preset using the parameter "Adjustment absolute value"

This function is applicable for absolute sensors and is active when parameter "Adjustment" P[218] has been set to: **"3 PAR"**

Parameter "Adjustment absolute value" P[005] can be set to a value to adjust the encoder. This value (which can be negative and positive) will be added to the actual value and for SSI sensors compensated with the display counting range.

$$\text{Display counting range} = \frac{\text{max SSI value} * \text{Multiplicator (numerator) P[000]}}{\text{Multiplicator (denominator) P[001]}}$$

4.6.2 Using the input (input 1 or 2)

In this function the actual position can be preset to a certain value. The function is active when parameter "adjustment" P[218] is set to one of the following options:

option: **"1 L→H Input RAM"**   (rising edge input)
option: **"2 H→L Input RAM"**   (falling edge input)
option: **"4 L→H Input EEPROM"**   (rising edge input)

Parameter "adjustment value" P[005] can be set to a value to which the actual position will be adjusted when Input 1 or 2 detects a rising edge, possibly combined with a reference coarse signal ([P213]).
If through parameter [P213] reference coarse has been activated ([P213] <> 0]), the option **"1 – Reference coarse"** should be selected for one of the inputs 1...2 (P[249]...P[250]).
The calculated offset will be stored in either RAM or EEPROM depending on the option chosen in parameter "adjustment" P[218]. When storing into RAM-memory (option 1 and 2) this will occur on a interrupt basis and can be performed during movement. The memory however is volatile and the value will not be permanently stored.

Storing the value into EEPROM (option 4) is not initiated by an interrupt. It is recommendable to perform this only when not moving or moving very slow. This value will be stored permanently.

4.6.3 Using service parameter P[207]

When P[207] has the value 111 then the actual position is adjusted to the value of P[005] when the programming mode is left.
After executing this function parameter P[207] will have the value 0 again.

4.6.4 Justage using keys

The function preset the absolute position can be executed with the key combination [Enter] + [P].
Holding down the [Enter] key and push the [P] key once. Then the actual position is preset to the value of P[005].

This function is active when: P[218] = variant **"5 front keys"**

4.7   ASCII protocol

The serial port of the AP21 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.

4.7.1   Overview functions

sc   **select AP21**
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**
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**
wf   **Reset SSI error**
rn   **Read status bits**
bp   **Load and activate**

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4.7.2 General

Through the ASCII protocol it is possible to communicate with the AP21.

Send: Data from PC, PLC → AP21

Receive: Data from AP21 → PC, PLC

Connection without EMC bracket
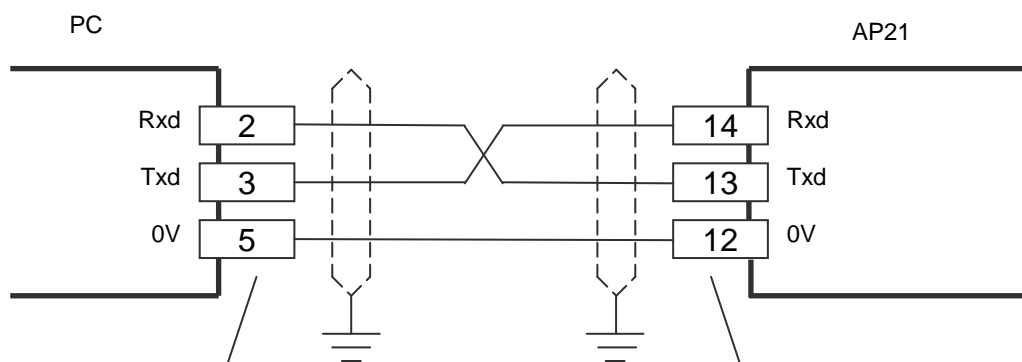
Connection with EMC bracket (EMC-B02)
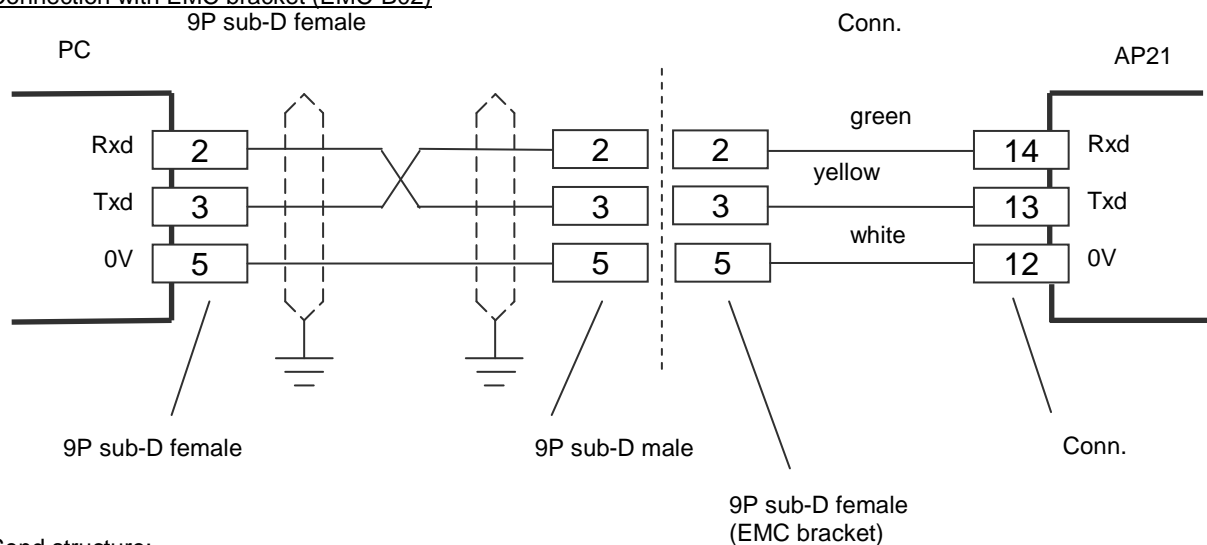
Send structure:
Functioncode (space) [argument 1](space)[argument 2] <CR>

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)*

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4.7.3 Functions

sc   Select AP21

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

The AP21 with the unit Id number is selected, all consecutive commands are relevant for this unit. An AP21 with unit Id number 1 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

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.

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 AP21-DA**
    transmitting parameter: none

          Example:
          send: *rt*
          answer: *rt AP21-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)*

wf **Reset SSI error**

    send: **wf**
    receive: **wf**
    transmitting parameter: none

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)*

4.7.4 Error messages

In case of an error the AP21 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

4.8   Analog output

The AP21 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]).

4.8.1   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)
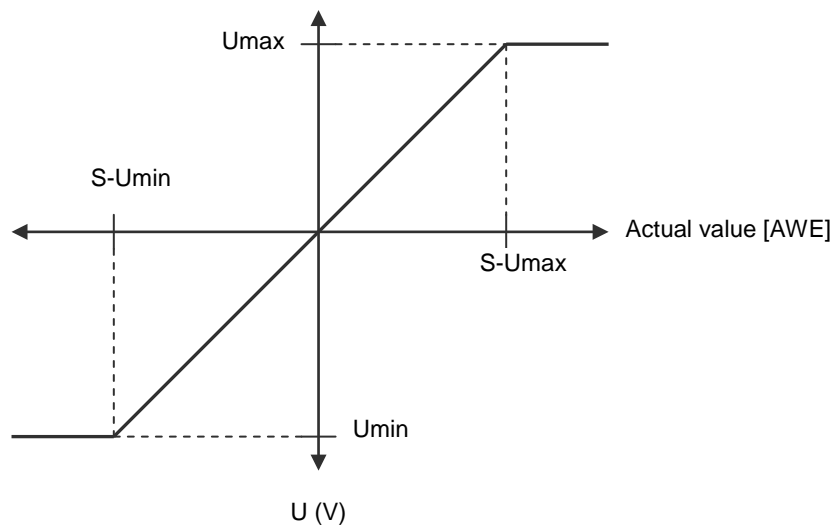
4.8.2 Current output

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)
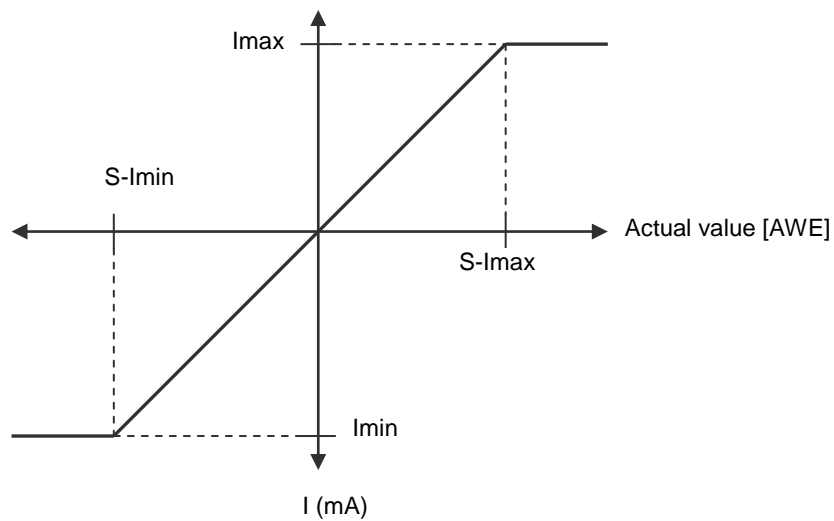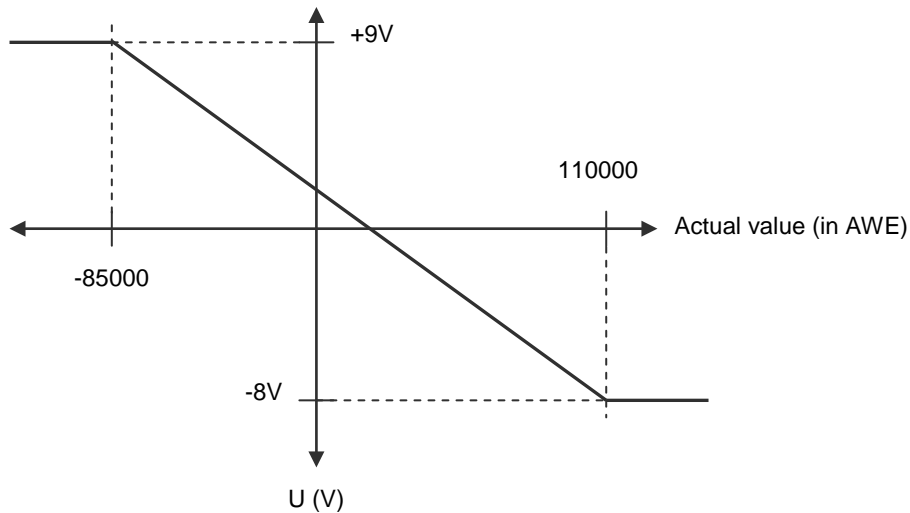
4.8.3 Example programming voltage output

> 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]

4.9   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.

4.10   Cams

4.10.1 General

The AP21 has a maximum of 12 programmable cams divided over a maximum of 4 outputs.

Programmable functions:
- Type
    1. Cam with start- and end-value
    2. Greater than or equal to limit value
    3. 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.
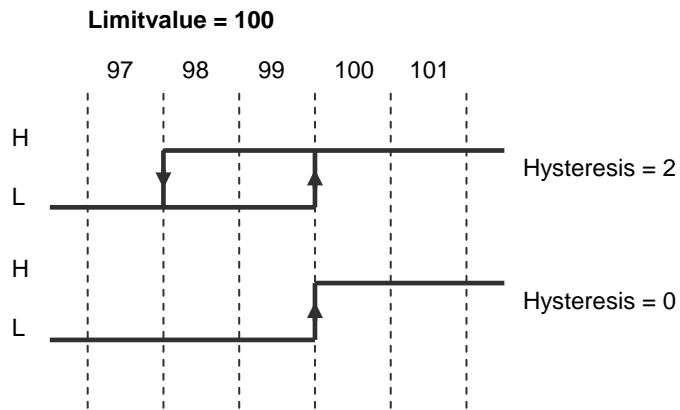
4.10.2 Cam with start- and end-value

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

Start = 100, end = 200
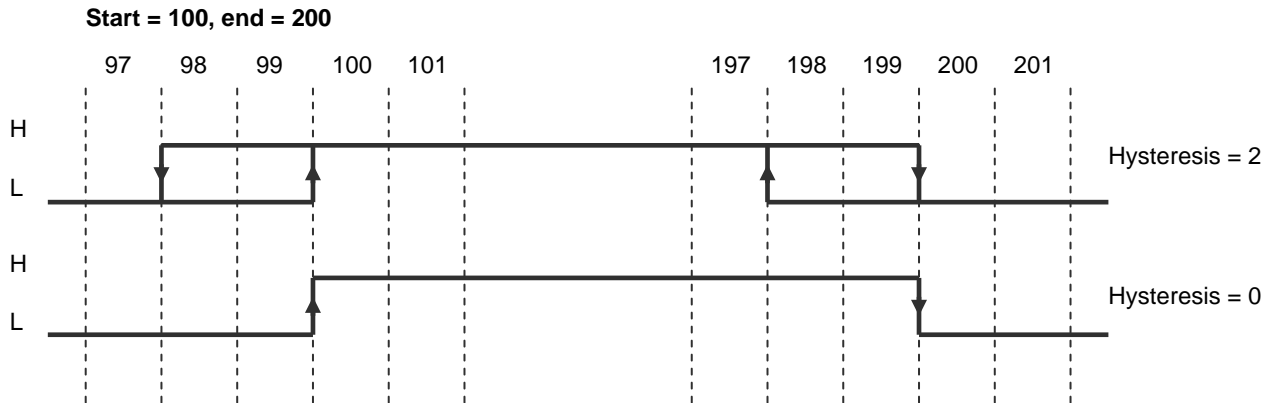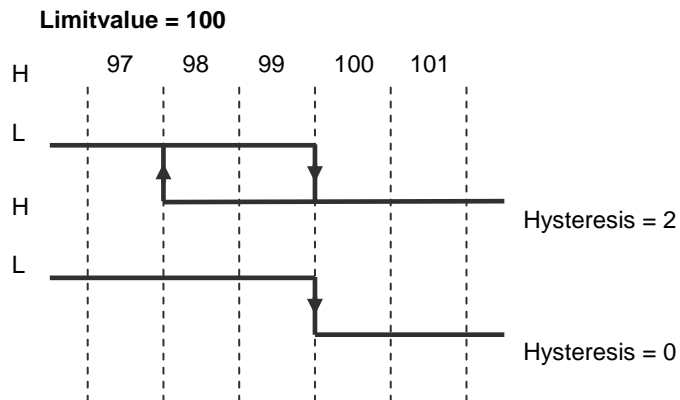
4.10.3 Greater than or equal to limit value

Only one limit value needs to be programmed.

Limitvalue = 100

4.10.4 Smaller than or equal to limit value

Only one limit value needs to be programmed.

Limitvalue = 100

AP21 SSI DISPLAY

4.10.5 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)

4.10.6 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 (only AP20)		
0 = not active		
1 = active		

PAR: 1.0.7	P[207]	**0** … 123
Service functions		
Only possible to activate through keyboard AP21		
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: 2.2.1	P[214]	**0** … 1

SSI code

0 = gray
1 = binary

PAR: 2.2.2	P[211]	**0** … 1

Counting direction

0 = no reverse
1 = reverse

PAR: 2.2.3	P[216]	0 … **24** … 30

Number of SSI clockpulses

XX

PAR: 2.2.4	P[217]	0 … **24** … 30

Number of SSI databits

XX

PAR: 2.2.5	P[000]	0 … **10000** … 16777215

Multiplicator numerator

XXXXXXX

PAR: 2.2.6	P[001]	0 … **10000** … 16777215

Multiplicator denominator

XXXXXXX

PAR: 2.2.7	P[218]	**0** … 6

Adjustment

0 = no function
1 = rising edge (input) only temporary in RAM (on interrupt)
2 = falling edge (input) only temporary in RAM (on interrupt)
3 = set with parameter adjustment value
4   = rising edge (input) permanent in EEPROM (not on interrupt)
5   = front keys

PAR: 2.2.8	P[213]	**0** … 2

Reference coarse

0 = no function
1 = high signal
2 = low signal

PAR: 2.2.9	P[209]	**0** … 2

Counting direction adjustment

0 = independant from direction
1 = when counting in positive direction
2 = when counting in negative direction

PAR: 2.2.10	P[002]	-9999999 … **0** … 99999999

Offset

-XXXXXXX (AWE)

PAR: 2.2.11	P[005]	-9999999 … **0** … 99999999

Adjustment value

-XXXXXXX   (AWE) input 0 means function inactive

AP21 SSI DISPLAY

PAR: 2.2.12	P[006]	1 … **50** … 99999

Monitoring delta-SSI per cycletime (250 µs)
Unprocessed SSI-value, only depending on number of active SSI-databits P[217]

XXXXX

PAR: 2.2.13	P[220]	0 … **2** … 9

Maximum number of SSI errors to set external SSI-error. At every SSI-error the actual value is determined by interpolation of the last valid value

X

PAR: 2.2.14	P[221]	0 … **3**

SSI monitoring

0 = not active
1 = only wiring
2 = only Delta SSI monitoring
3 = wiring + Delta SSI monitoring

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
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	2.2.5
[001]	= Multiplicator denominator	2.2.6
[002]	= Offset	2.2.10
[003]	= Reference value	2.1.8
[004]	= Counting range	2.1.9
[005]	= Adjustment value	2.2.11
[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 for justage	2.2.9
[210]	= no function	
[211]	= Counting direction	2.2.2
[212]	= no function	
[213]	= Reference coarse	2.2.8
[214]	= SSI code	2.2.1
[216]	= Number of SSI clockpulses	2.2.3
[217]	= Number of SSI databits	2.2.4
[218]	= Adjustment (SSI)	2.2.7

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No	Description	Menu
[219]	= no function	
[220]	= Maximum number of SSI errors	2.2.13
[221]	= SSI monitoring	2.2.14
[222]…[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	

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6   Connections

Connections on the rear
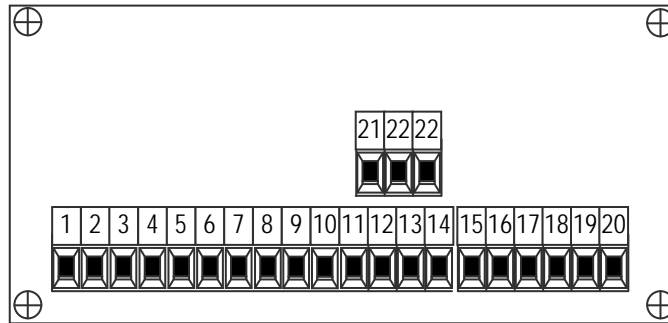
6.1   Overview clamp connections

1.   +10…+35V supply
2.   0V supply
3.   Data+
4.   Data-
5.   Clock+
6.   Clock-
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
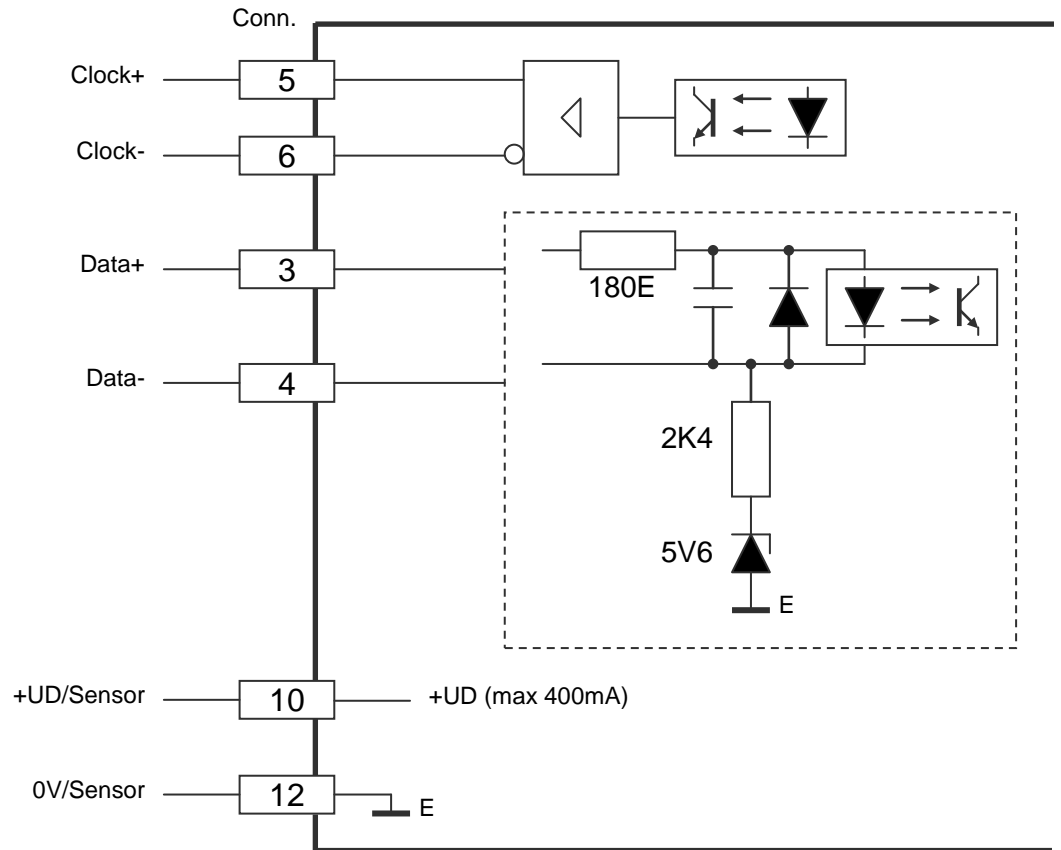18.   Output -4
19.   0V for outputs
20.   +U for outputs

21.   0V analog
22.   U-out
23.   I-out
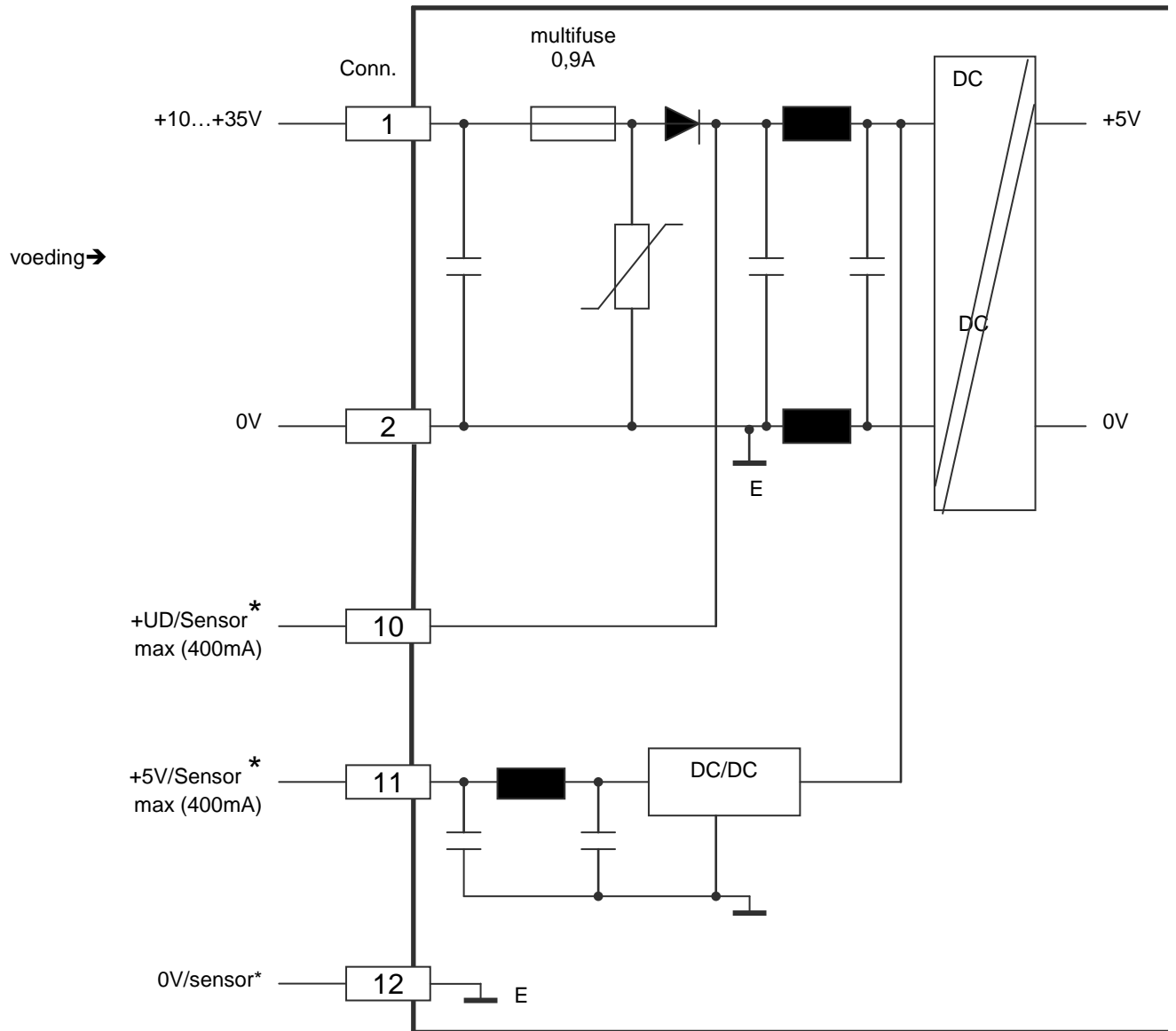
6.2 Supply

6.3   SSI input

6.4   SSI encoder 24 V
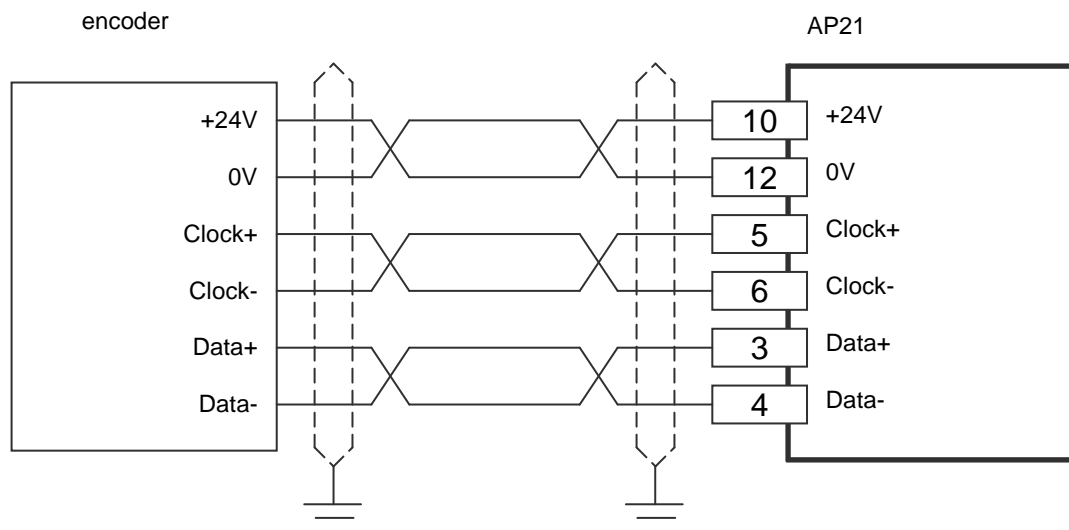
Supply voltage AP21 clamp 1 and 2 is 24V DC

6.5 Digital inputs
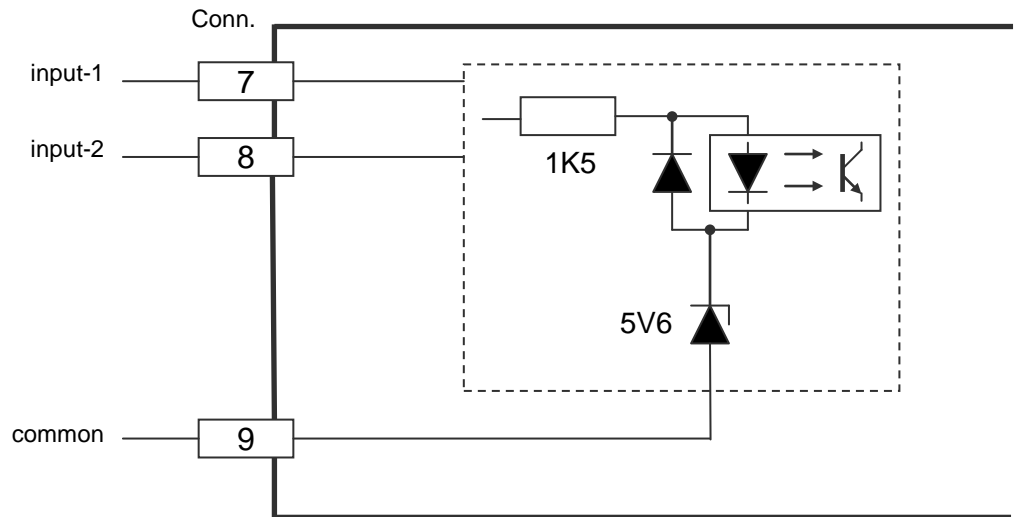
6.6 Digital outputs
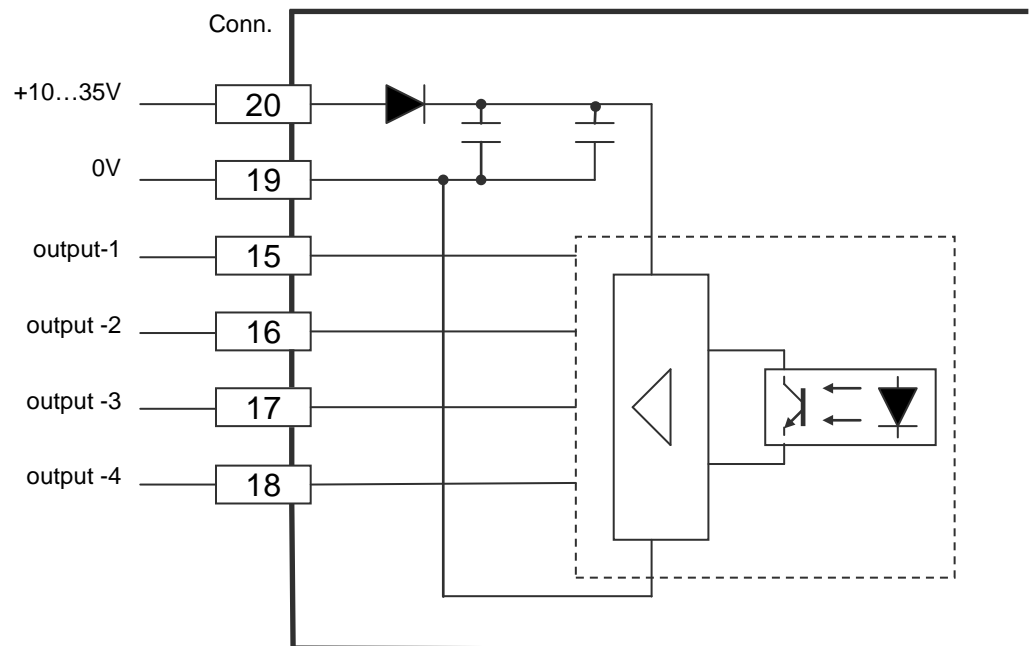
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6.7   RS232

Conn.

TxD   13

RxD   14

0V   12   E

6.8   Analog output

Conn.

+/-20mA   23

+/-10V   22   D/A

GND   21

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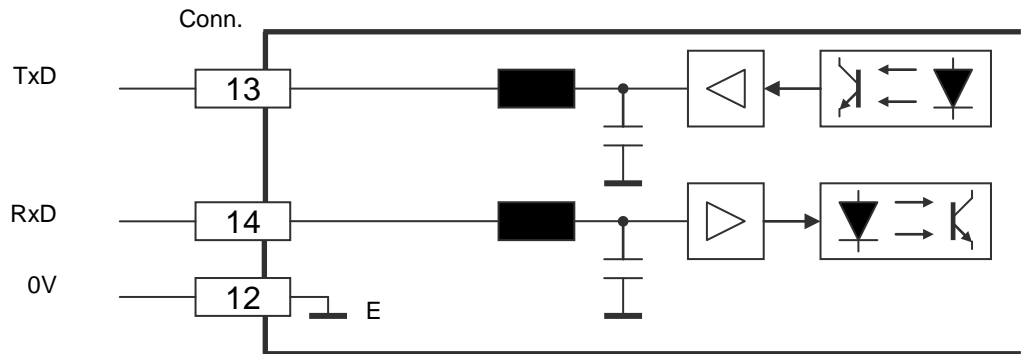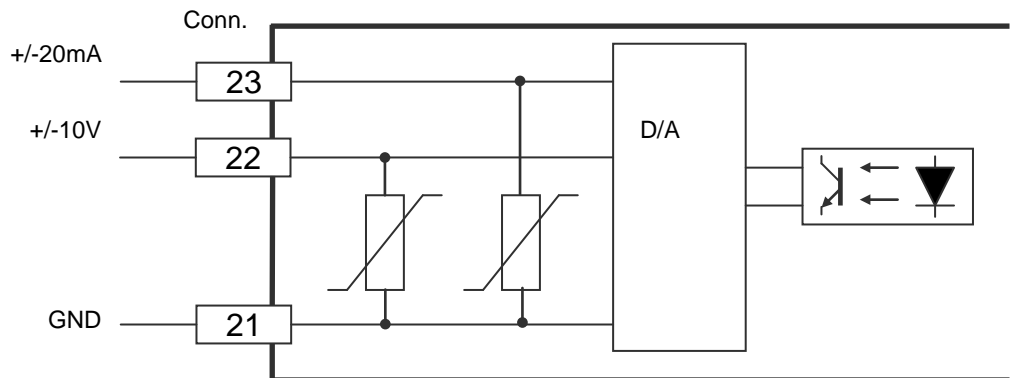
AP21 SSI DISPLAY

7 Technical specifications

7.1 Specifications

- Supply voltage	10…35V DC
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
- SSI	optically isolated
data-input	low 0…+0,8V
	high +2,8V…+5V
clock-output	driver (RS422)
clock-frequency	125 kHz (138,9 kHz if > 26 bit encoder signal)
- 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)

AP21 SSI DISPLAY

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

- Weight	< 0.25 kg
- Sealing	front IP50, with protective hood IP54 rear IP20

7.2   Typekey

AP21- X X

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

Digital outputs
0 = no digital outputs
D = 4 digital outputs
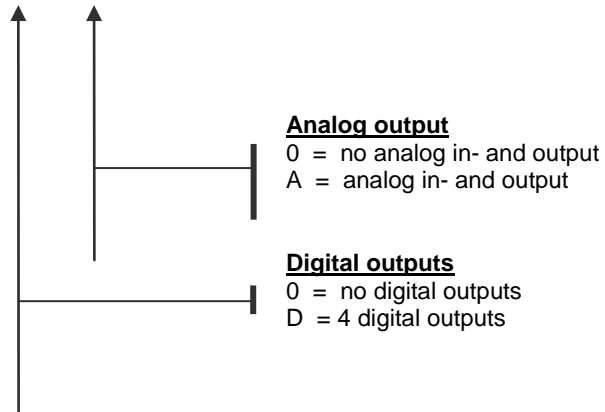
7.3   Dimensions AP21

Side view
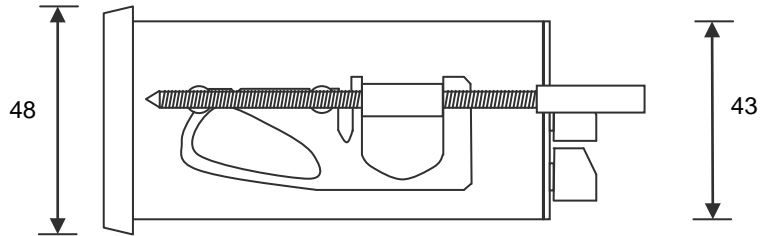
Top view
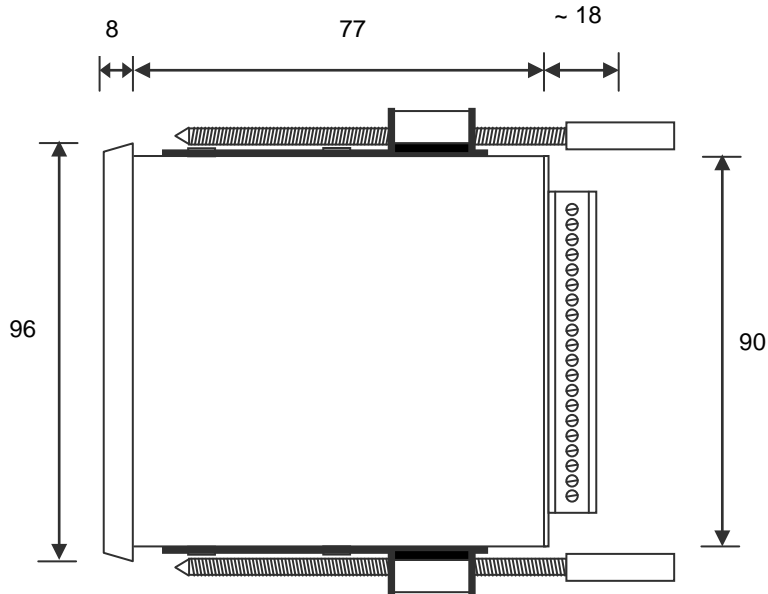
7.4   Dimensions EMC bracket type EMC-B02
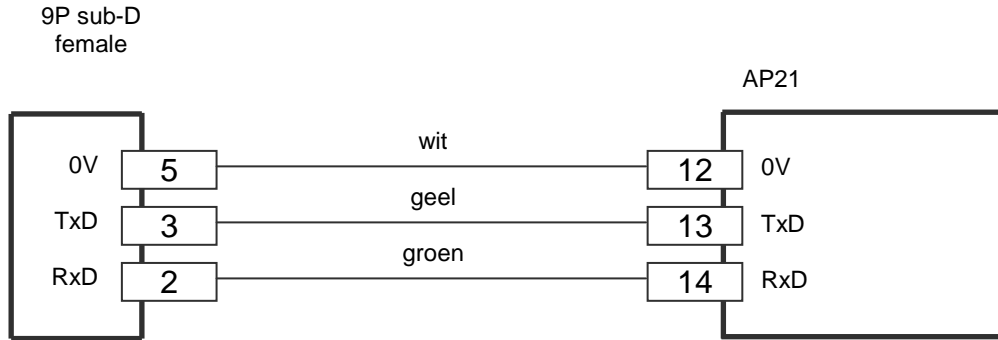
With RS232 (9P sub-D) on EMC bracket

90

2

65

M5

9P sub-D
female

1

32
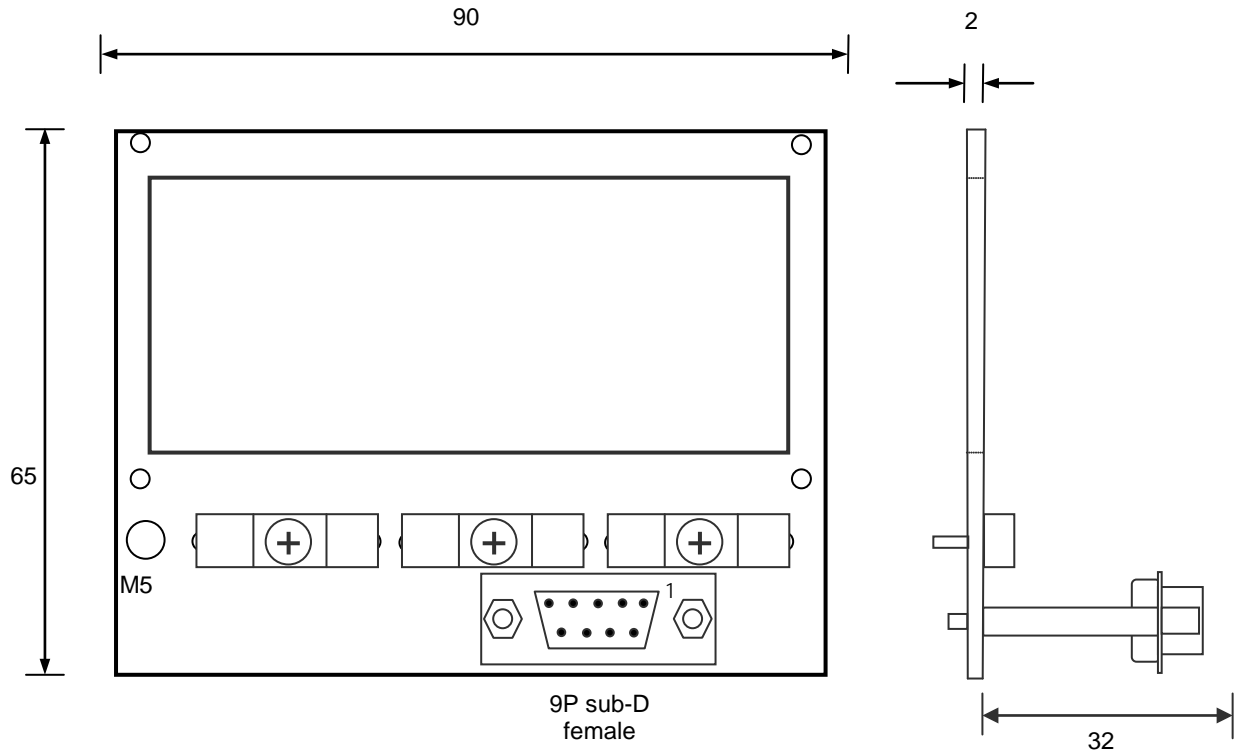
Side view with EMC bracket

48
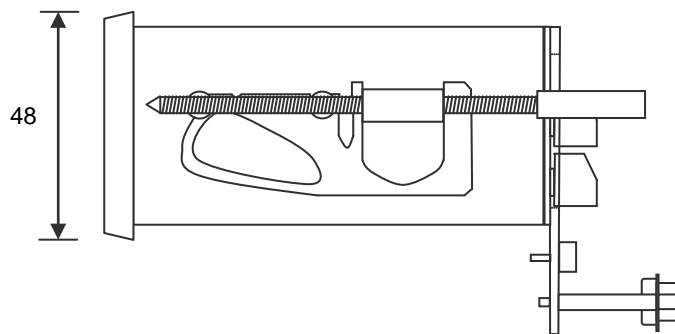
7.4.1 Connections RS232 on 9P sub-D connector

9P sub-D
female

AP21

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

7.5 Dimensions protective hood type CDS-B02
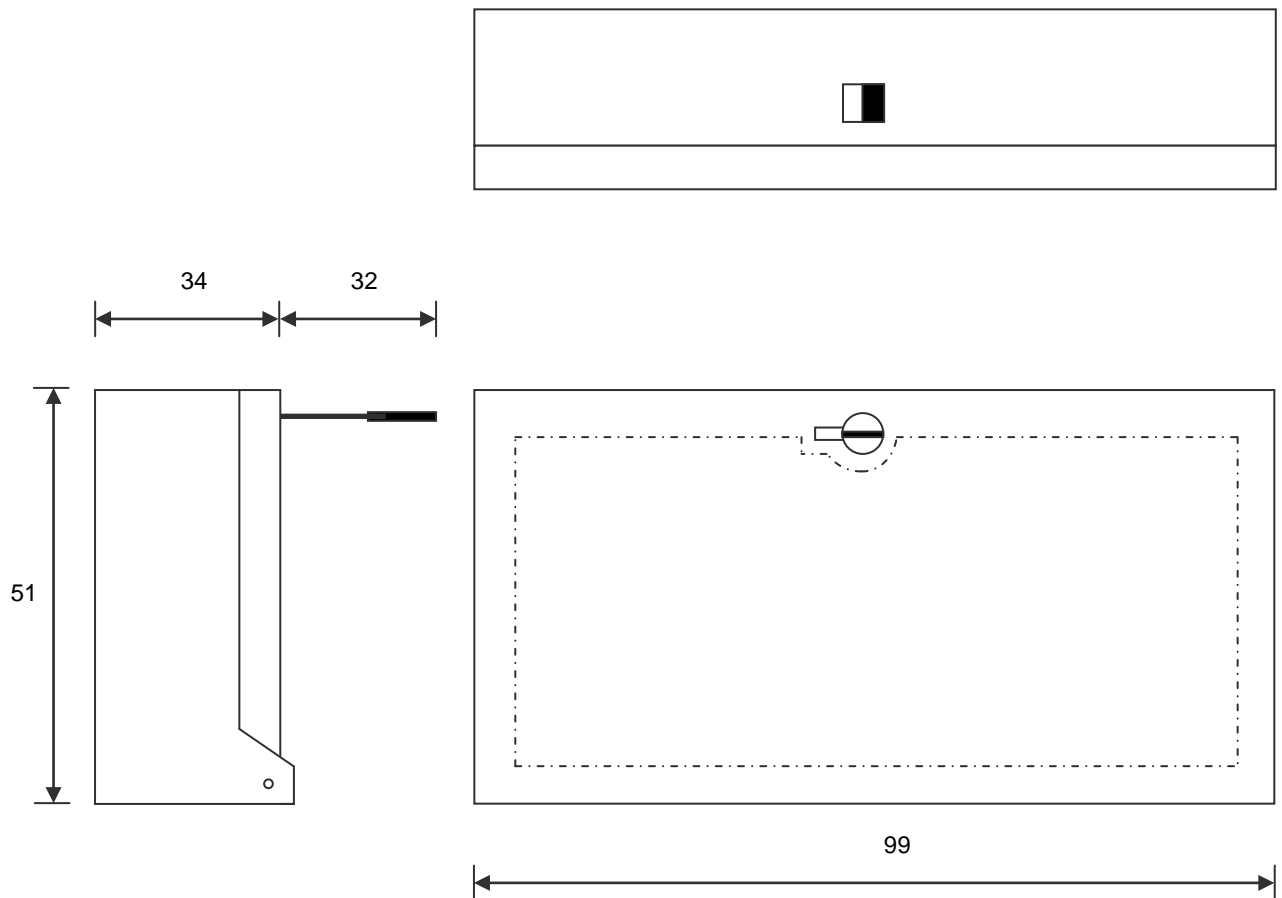
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AP21 SSI DISPLAY

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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.