

# Manual AP40

## Display Controller



- 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, incremental encoders, analog and Start/Stop sensors
- CAN-bus, RS232, RS422/RS485
- 4 Digital inputs and 4 digital outputs
- 24 Programmable cams / 4 outputs
- 48 Programmable nominal values
- Dynamic cam-adjustment (cycle time 250 $\mu$ S)
- Programmable analog input (16 bit)
- Programmable analog output (16 bit)
- All connectors removable

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## 1 Introduction

### 1.1 General

With the microcontroller based AP40 it is possible to connect the following encoder types:

- Incremental with quadrature (two 90°) signals
- Incremental with pulssignal and directionsignal
- Absolute with SSI (Synchron Serial Interface)
- Absolute with start/stop (MTS Sensors)
- Absolute with analogsignal

It is standard equipped with 4 digital inputs and 4 digital outputs, all free programmable. The AP40 features a CAN-bus, RS232 communication, RS422/485 communication, and a analog in- and output. All in- and outputs, including the communication-ports, are electrically isolated.

With the 24 programmable cams several functions can be realized like limit detection.

Another feature of the AP40 is the memory for the nominal values. The 48 programmable values can be used to determine the positions of the cams.

Up to 4 values can be read from external thumbwheel switches. These values can be used as positions for the cams or as preset values.

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 AP40 is configurable for numerous applications by adjusting its parameters.

The AP40 can be programmed with the DST40 PC-based software.

## **1.2 Important information**

- ✓ The AP40 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 AP40.
- ✓ If through a failure or fault of the AP40 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 AP40.
- ✓ Necessary repairs to the AP40 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 AP40:

- ✓ 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-B04 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      | <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) |

## 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)

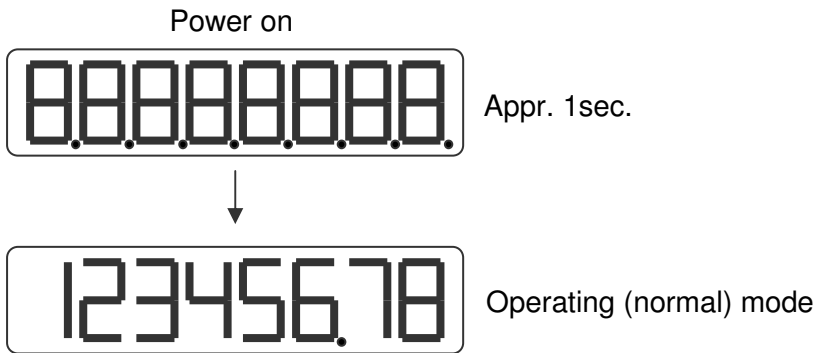


[Enter] key

- 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

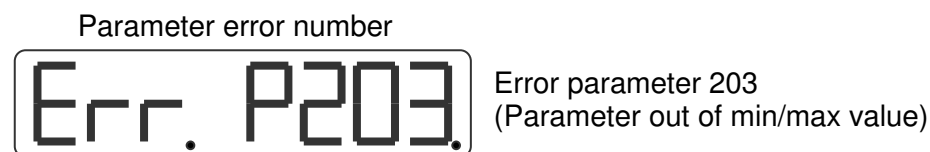


### 2.3.2 Error messages

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:



### **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]  $\geq$  Counting range P[004]

701 = Adjustment value SSI P[005]  $\geq$  Counting range  
or Adjustment SSI P[005]  $<$  Offset P[002] (only if adjustment  
type = 1,2, or 4)

702 = Adjustment value parallel P[005]  $\geq$  Counting range

703 = Number of active SSI databits  $>$  number of SSI Clock pulses

704 = Transmitting and receiving with AP-Link not possible with the  
same address

705 = Offset SSI P[002]  $>$  Counting range

708 = No Hold-Reset possible (only possible with incremental and  
internal frequency)

716 = Umin  $\geq$  Umax (analog output)

717 = Imin  $\geq$  Imax (analog output)

720 = Changelock nominal values active

721 = Changelock parameters active

725 = Serial RS232 and RS485 both with ASCII at the same time not possible

726 = U1  $\geq$  U2 (analog input)

727 = I1  $\geq$  I2 (analog input)

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

733 = Function input-3 not valid (equal to input-1...input-2)

734 = Function input-4 not valid (equal to input-1...input-3)

800 = SSI error delta-s

801 = SSI error cable failure

810 = Start/Stop error no magnet detected

811 = Start/Stop error time-out no stop signal detected

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 ( $2 * \text{Hysteresis}$ ) + 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

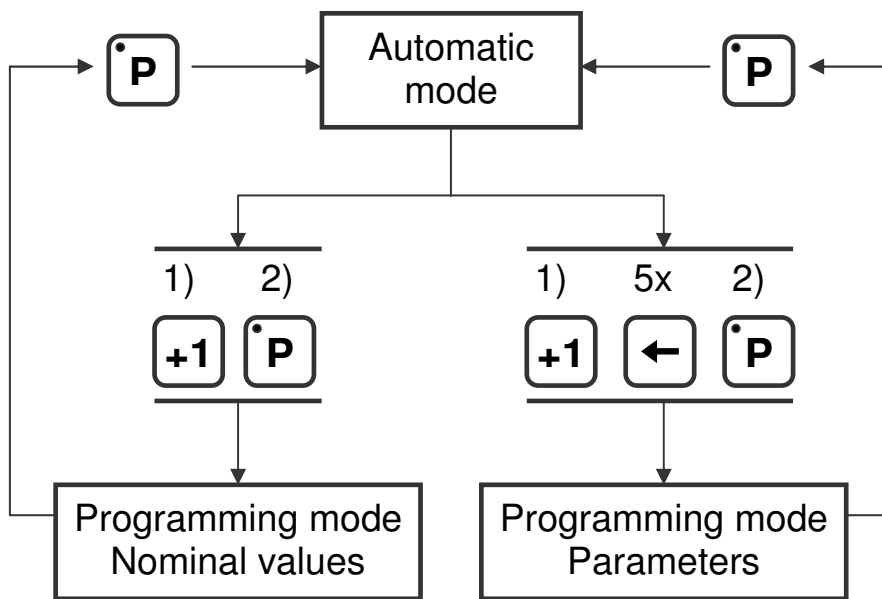
er 6 = data invalid (outside min/max value)

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

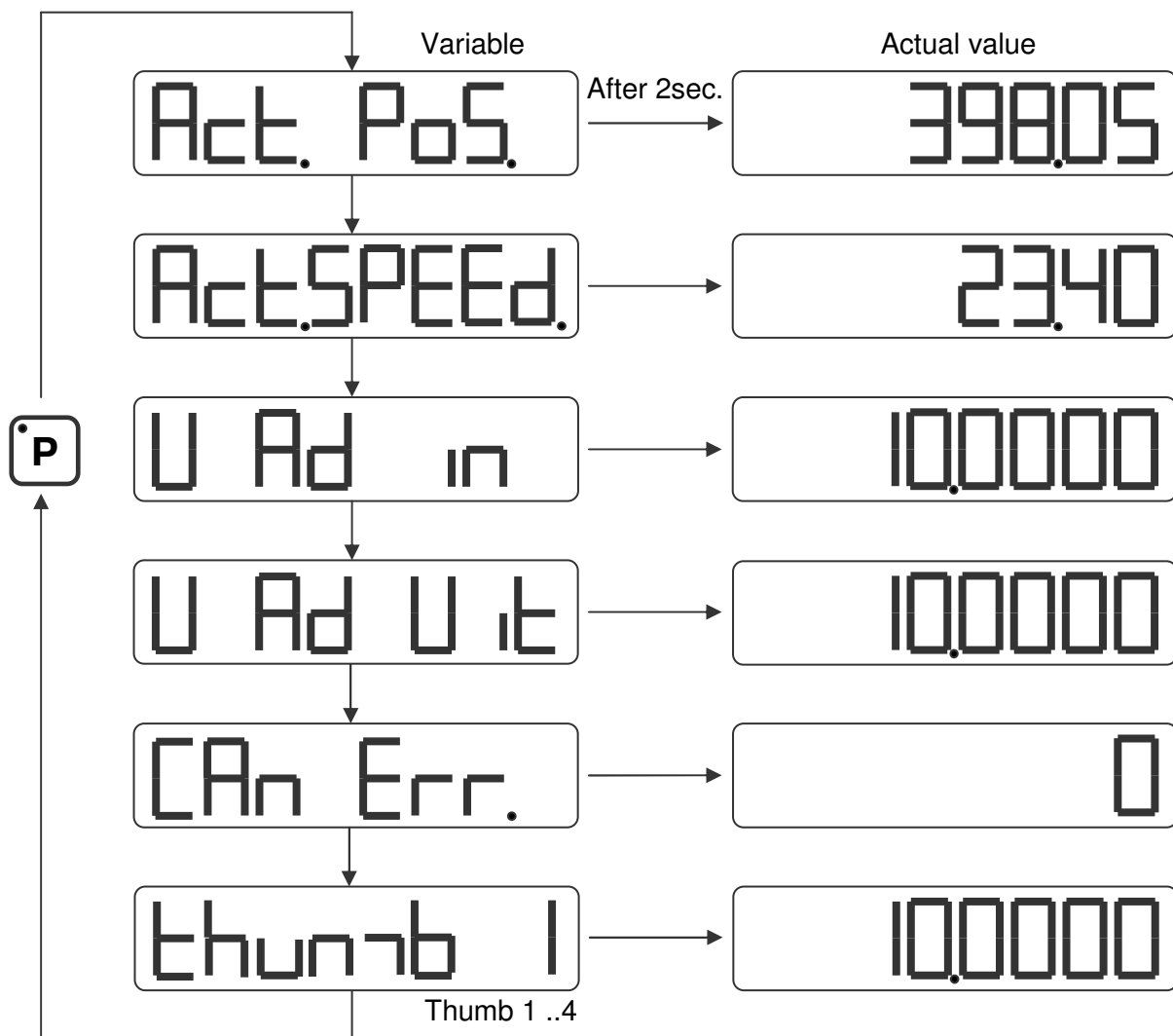
#### 3.1 Automatic mode

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

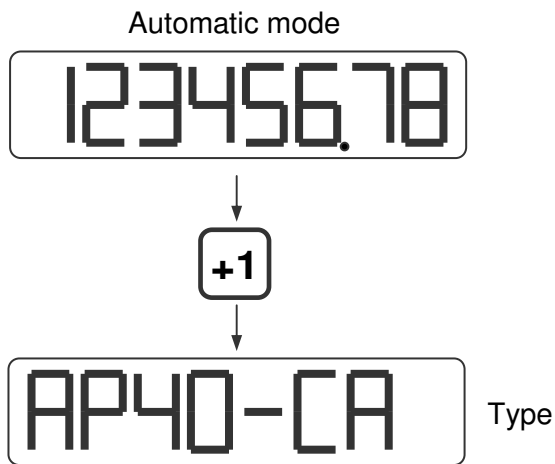
In automatic mode different variables can be displayed. By using the [P] key one can cycle through the different pages:

- Actual position
- Actual velocity
- Voltage or current of the AD (analog in)
- Voltage or current of the DA (analog out)
- CANbus error
- Actual values thumbwheel sets

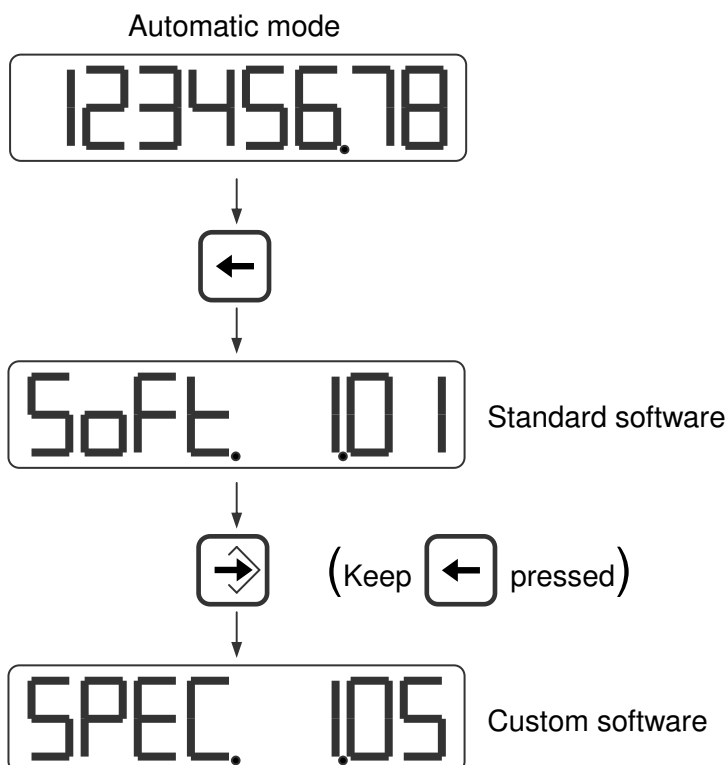


Parameter P[208] determines which option is visible after start-up.  
 Parameter P[222] determines which option “Act.SPEEd” or “Act time” is displayed.

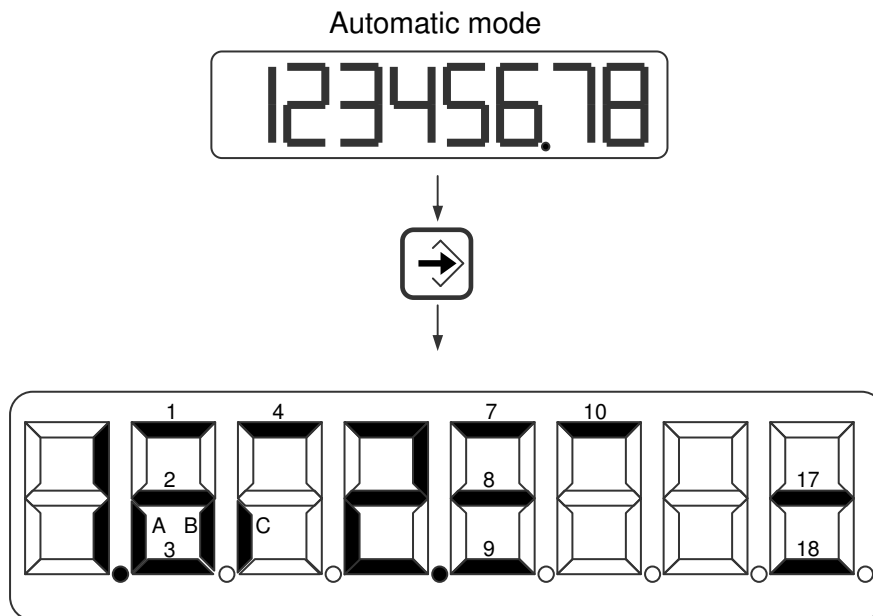
### 3.1.2 *Displaying the type number*



### 3.1.3 *Displaying the software-version*



### 3.1.4 Status in- and outputs



Inputs

- 1 = input-1
- 2 = input-2
- 3 = input-3
- 4 = input-4
- A = input K1
- B = input K2
- C = input K0

Outputs

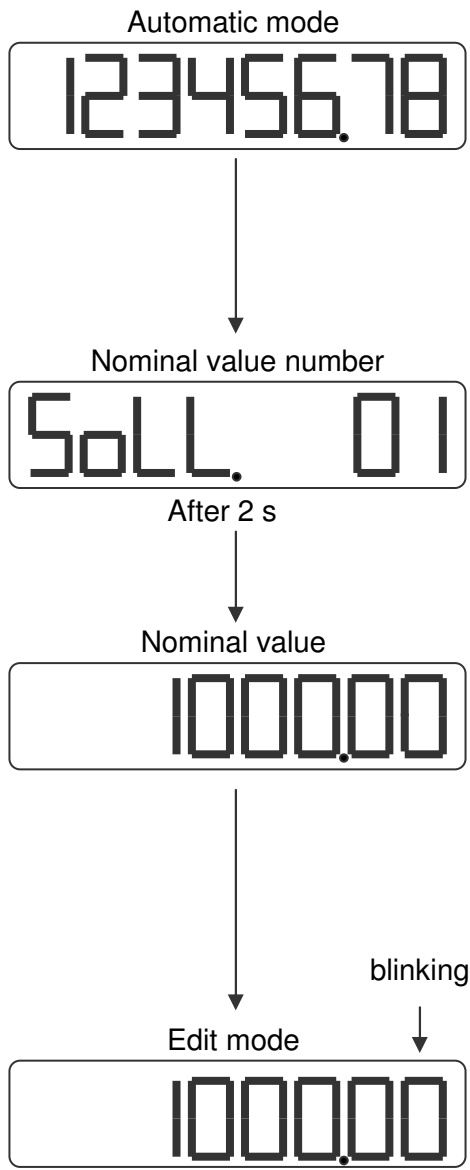
- 7 = output-1
- 8 = output -2
- 9 = output -3
- 10 = output -4

Outputs

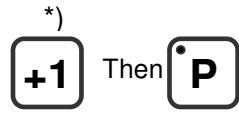
- 17 = Hold/Reset active
- 18 = Cams active



### 3.2 Changing nominal values



#### Access to nominal values



#### Select nominal values

- Exit programming mode
- Nominal value number +1
- Activate edit mode
- Nominal value number +1

#### Changing values

- Exit edit mode
- Increase digit
- Move one digit left
- Confirm change
- \*) Then Clear input

\*) keep pressed

### **3.3 Changing parameters**

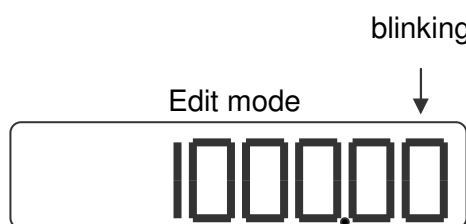
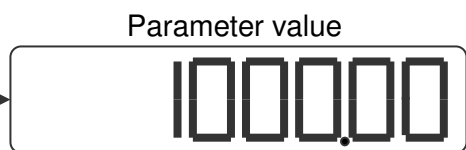
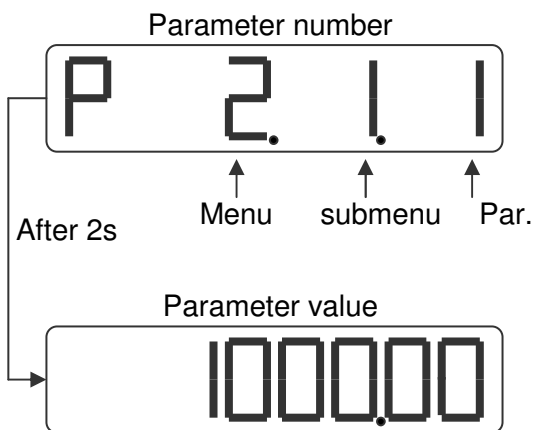
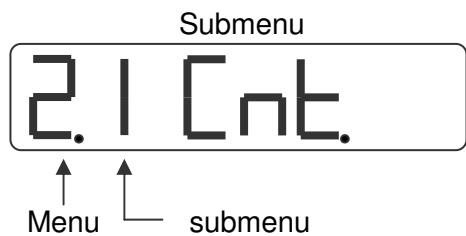
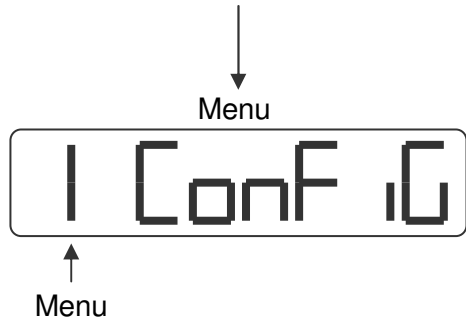
#### **3.3.1 Menus**

The parameters are displayed in different menus and submenus:

- 1 ConFiG
- 2 ActuAL
  - 2.1 Cnt.
  - 2.2 SSI
  - 2.3 FrEG.
  - 2.4 Par.
  - 2.5 CAnAP
  - 2.6 StStP
- 3 CAnbus
  - 3.1 ConFG.
  - 3.2 Obj/PDO in
  - 3.3 Obj/PDO out
- 4 SEriAL
  - 4.1 ConFG.
  - 4.2 SEr-1
  - 4.3 SEr-2
- 5 InPut
- 6 OutPut
  - 6.1 OP1
  - 6.2 op2
  - 6.3 op3
  - 6.4 OP4
- 7 An in
  - 7.1 ConFG.
  - 7.2 Ad-U
  - 7.2 Ad-I
- 8 An out
  - 8.1 ConFG.
  - 8.2 dA-U
  - 8.3 dA-I
- 9 Cam
  - 9.1 CA1
  - ... ..
  - ... ..
  - 9.24 CA24
- 10 D-SEt
  - 10.1 ConF.
  - 10.2 SEt-1
  - 10.3 SEt-2
  - 10.4 SEt-3
  - 10.5 SEt-4

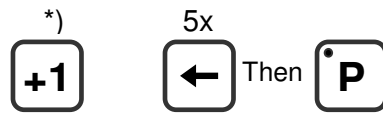
*Example:  
PAr. 6.1.1 means  
menu 6, submenu 1, parameter 1*

### 3.3.2 Input parameters



\*) keep pressed down

#### Access parameters



#### Menu selection

- Exit programming mode
- Menu item +1
- To submenu/parameter number

#### Submenu selection

- Back to menu
- Submenu item +1
- To parameter number

#### Selecting parameters

- Back to menu/submenu
- Parameter number +1
- Activate edit mode
- Parameter number +1

#### Changing parameters

- Exit edit mode
- Increase digit-value
- Move 1 digit to the left
- Confirm input
- \*) Then Clear input

## 4 Functions

### 4.1 Basic function

The basic function of the AP40 is programmed at P[200].  
 Factory setting P[200] = 0, where the sensor-value will be shown on the display.

When using the counter-input or internal frequency (P[201] = 0 or 2) there is a special function available called "Hold/Reset". In this function the displayed value will be refreshed based upon an external start- and stopsignal.

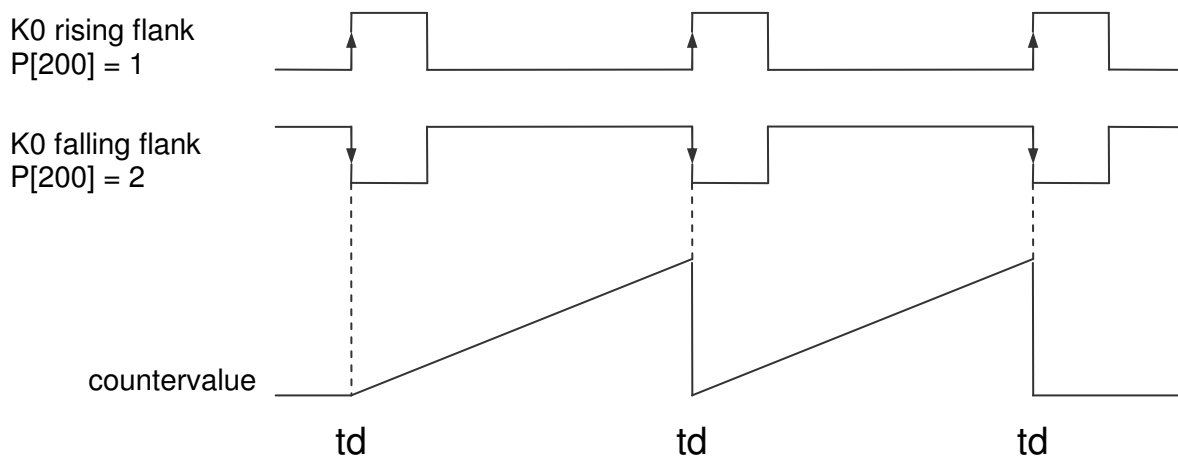
start: internal countervalue is set to 0  
 stop: display will be refreshed with internal countervalue

#### Standard (P[200] = 0)

Standard function.

#### Hold/Reset K0 L →H and Hold/Reset K0 H →L (P[200] = 1 or 2)

Hold/Reset start and stop with rising- or falling flank from input K0

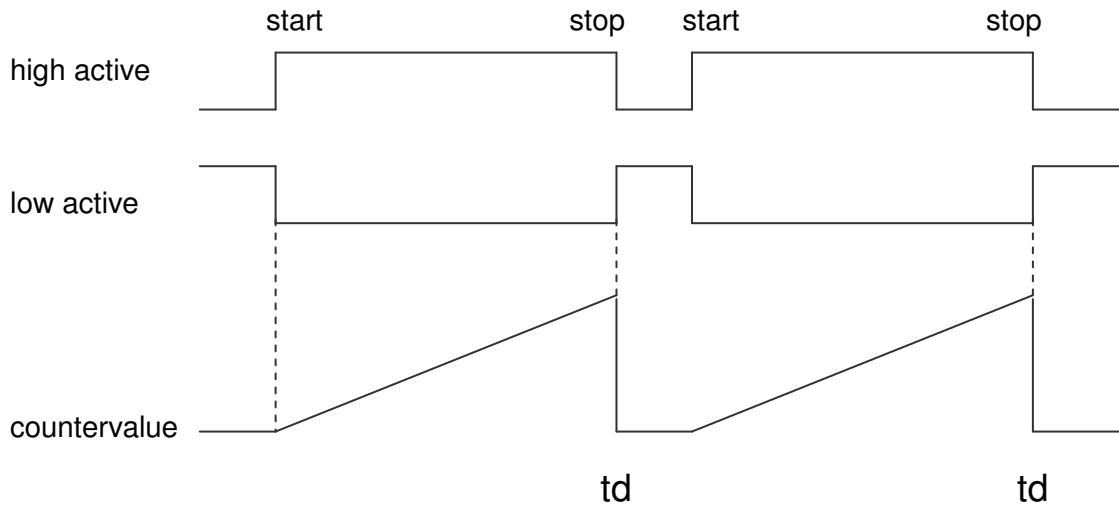


td = countervalue →display

If the Hold/Reset function 3...6 is active, the inputs for start and stop will have to be selected with P[249] ... [254].

**Hold/Reset start/stop H and Hold/Reset start/stop L** (P[200] = 3 or 4)

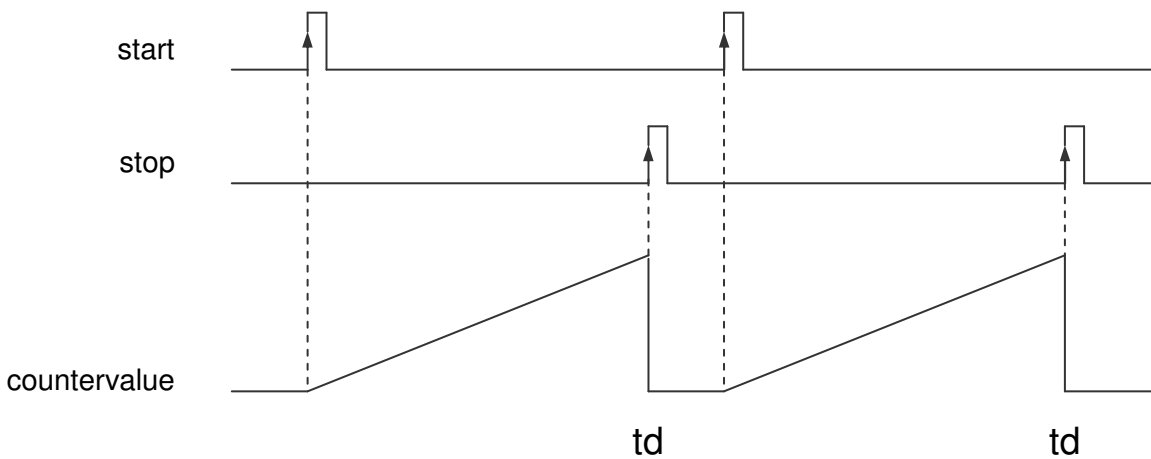
Hold/Reset start and stop using input (1...6) high and low active



td = countervalue →display

**Hold/Reset start/stop L →H** (P[200] = 5)

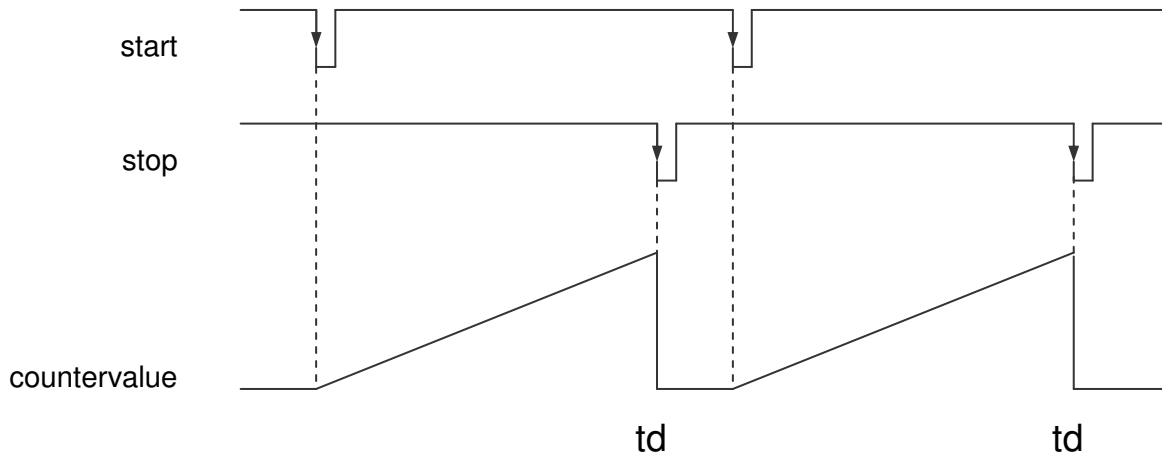
Hold/Reset start and stop using input 1...6 rising flank.



td = countervalue →display

**Hold/Reset start/stop H → L** (P[200] = 6)

Hold/Reset start and stop using input 1...6 falling flank



td = countervalue →display

## 4.2 Actual position

The actual position shown on the display is depending on the selected sensor input (P[201]) and several parameters.

Counterinput and internal frequency:

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

SSI, Start/Stop and analog input:

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

|     |                             |        |
|-----|-----------------------------|--------|
| FL  | = edgemultiplier            | P[210] |
| Mt  | = multiplicator numerator   | P[000] |
| Mn  | = multiplicator denominator | P[001] |
| N   | = offset                    | P[002] |
| dir | = direction (x1 or x -1)    | P[211] |

## 4.3 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.*

#### 4.4 *Displaying Actual Velocity*

Active when: **P[222] Function velocity measurement** = variant: "0  
Standard"

The actual velocity can be displayed using the [P]-key (always AWE/s)  
Parameter P[223] has no influence.

#### 4.5 *Displaying 1/f function (time measurement)*

Active when:

**P[222] ] Function velocity measurement** = variant: "1 1/f time  
measurement"

The value 1/f will be displayed based upon the velocity measurement, which  
is in AWE/s. The result is a time and reciprocal to the frequency.

It is possible to display process times, for example a baking time or cooking  
time. The higher the velocity the shorter the process time and vice versa.

The function 1/f is configured by using the following 3 parameters.

##### **P[116] = 1/f Frequency (AWE/s)**

The frequency can be programmed here (in AWE/s) that corresponds with the  
value on the display (programmable at P[117]).

##### **P[117] = 1/f Display (AWE)**

The display value can be programmed here that corresponds with the fre-  
quency programmed at P[116].

##### **P[223] = Display format**

variant: "0 Standard dp as P[203]

variant: "1 no dp"

variant: "2 XXXXXXX.X"

variant: "3 XXXXXX.XX"

variant: "4 XXXXX.XXX"

variant: "5 XXXXXX.XX m.sec of h.min"

variant: "6 XXXX.XX.XX h.min.sec"



Calculation display value at 1/f (time measurement):

$$\text{Display value} = \frac{1/f \text{ Frequency } P[116] \times 1/f \text{ Display } P[117]}{\text{Actual velocity (AWE/s)}}$$

In case the actual velocity becomes smaller than 10% of Parameter 1/f Frequency P[116], the following message will be displayed:



Example 1:

*1/f Frequency P[116] = 1000, 1/f Display [117] = 400*

*Display format P203] = 1;*

*Assuming Mt P[000] and Mn P[001] are equal (multiplier = x1)*

*At the actual velocity of 1000 AWE/s the display value 400 will be displayed.*

*At the actual velocity of 500 the value 800 will be displayed.*

Example 2:

*A furnace with an encoder that is measuring the speed of the transport.*

*At 200 impulses/s the baking time is 3 hours 28 minutes. The format of the display should be 3.28.00 (h.min.sec).*

*The actual velocity is  $200 \times 4 = 400$  AWE/s. The encoder input is set to x4 (edge multiplication). Assuming Mt P[000] and Mn P[001] are equal (multiplier x1).*

*3h28min equals 12480 sec  $\rightarrow (3 \times 3600) + (28 \times 60)$ . In other words, 400 AWE/s equals 12480 seconds.*

*The value 400 AWE/s (frequency) should be programmed at P[116] and the display value 12480 should be programmed at P[117]. It is possible to check this by choosing variant 1 at P[223] (no decimal point). The display will show 12480 at an input frequency of 200 Hz. In order to have the time displayed in the correct unit P[223] should be programmed to variant 6: **XXXX.XX.XX h.min.sec**.*

## **4.6 Multiplier**

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

*Example:*

*Encoder with 90° shifted signal and 1024 increments/revolution will have 4096 edges/revolution. If the desired value in the display is 360,0 (= 3600 AWE), the multiplier will be  $3600/4096 = 0,87890625$ .*

*It is possible to program the exact values (3600 and 4096) instead of the fraction.*

*Multiplier (numerator)    P[000] = 3600*

*Multiplier (denominator) P[001] = 4096*

*Through P[203] it is possible to adjust the decimal point.*

## **4.7 Power failure protection**

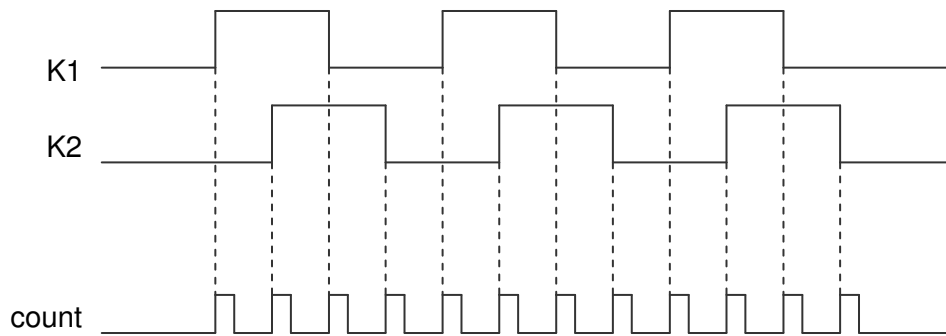
If P[206] = 1 then the actual position of the AP40 will be stored in EEPROM when power is shut down. After power up this value will be restored.

The power failure protection has no meaning with an absolute encoder (SSI, analog or Start/Stop).

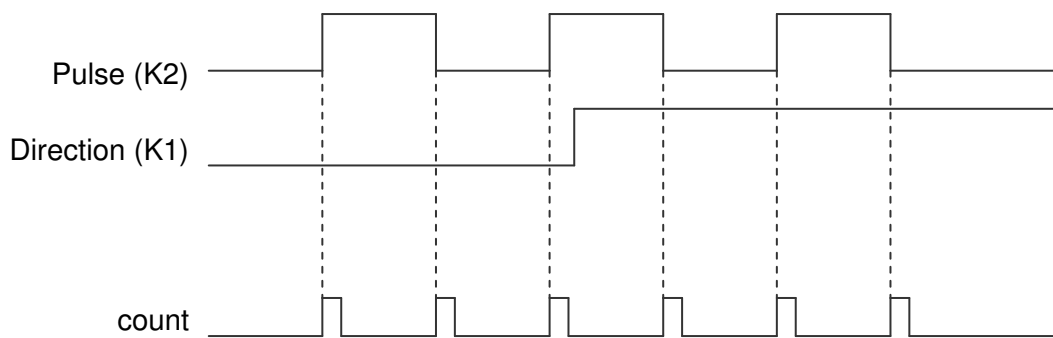
### 4.8 Edge multiplication (counter input)

There are two possibilities for the counter input:

**V-signal x4:** edge multiplication x4, 90° shifted encoder signals.



**S-signal x2:** edge multiplication x2, encoder signal with directional signal.



## 4.9 Preset (counter input and internal frequency)

The preset function can be used in 3 ways:

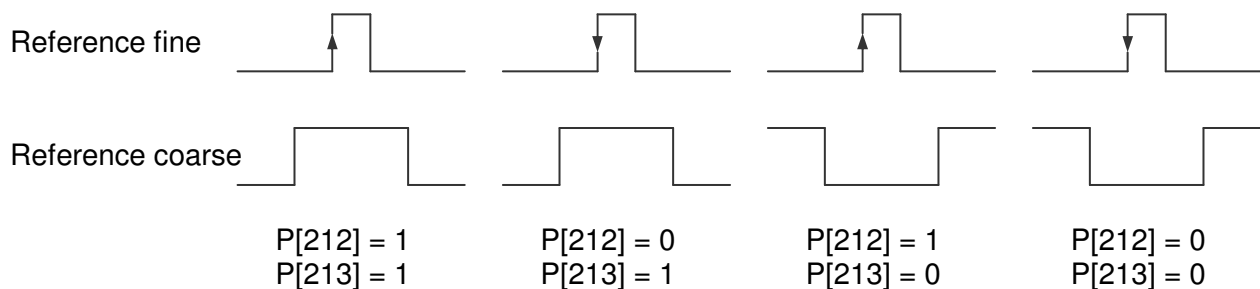
- Using input K0 (in combination with reference coarse)
- Using parameter service functions P[207]
- Using front keys

### 4.9.1 Preset using input K0

The function preset is used to set the actual value to a programmed value, stored in P[003], P[102] or external thumbwheel-1.

The value will be set in case of an active edge from the reference fine signal K0.

If reference coarse has been activated (P[213] <> 0) one of the inputs has to be programmed to "1 - Reference Coarse".



### 4.9.2 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.

### 4.9.3 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"

### 4.10 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 number of increments is programmed, ignoring the decimal point.

#### Counting range P[004]

- 0 = function not active
- 1 ... counting range

*Example:*

*Incremental encoder, 90° 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.*

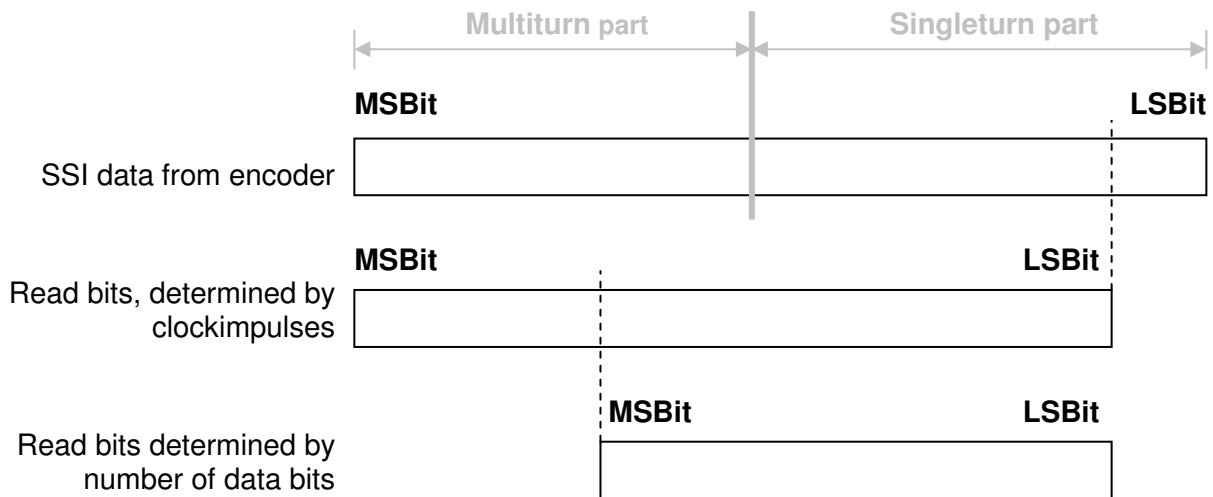
Display will show:

→ 359,8 ... 359,9 ... 0,0 ... 0,1 ... 0,2 ←

### 4.11 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]



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 AP40. 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)*

#### **4.12 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.

### 4.12.1 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)

### 4.12.2 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 DST40
- Serial communication (ASCII)
- Set one of the inputs 1...4 to "**4 Reset SSI error**" and apply a high signal

## 4.13 Justage absolute sensors

The justage of absolute sensors can be done in 4 ways:

- Using the parameter "Adjustment absolute value" P[005]
- Using the input K0
- Using parameter service functions P[207]
- Using front keys

### 4.13.1 Preset using the parameter "Adjustment absolute value"

This function is applicable for absolute sensors and is active when parameter "Adjustment" P[218] or P[219] 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.

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



### 4.13.2 Using the input K0

In this function the actual position can be preset to a certain value. The function is active when parameter "adjustment" P[218] or P[219] is set to one of the following options:

|            |                          |                   |
|------------|--------------------------|-------------------|
| option: "1 | L→H K0 RAM"              | (rising edge K0)  |
| option: "2 | H→L K0 RAM"              | (falling edge K0) |
| option: "4 | L→H K0 EEPROM"           | (rising edge K0)  |
| option: "6 | L→H K0 RAM thumbwheel-1" | (rising edge K0)  |
| option: "7 | H→L K0 RAM thumbwheel-1" | (falling edge K0) |

Parameter "adjustment value" P[005] (or thumbwheel-1) can be set to a value to which the actual position will be adjusted when K0 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...4 (P[249]...P[252]).

The calculated offset will be stored in either RAM or EEPROM depending on the option chosen in parameter "adjustment" P[218] or P[219]. When storing into RAM-memory (option 1 and 2) this will occur on an 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.

### 4.13.3 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.

#### ***4.13.4 Justage using front 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:

Sensor type SSI en Start/Stop

P[218] = variant "5 front keys"

Sensor type analog

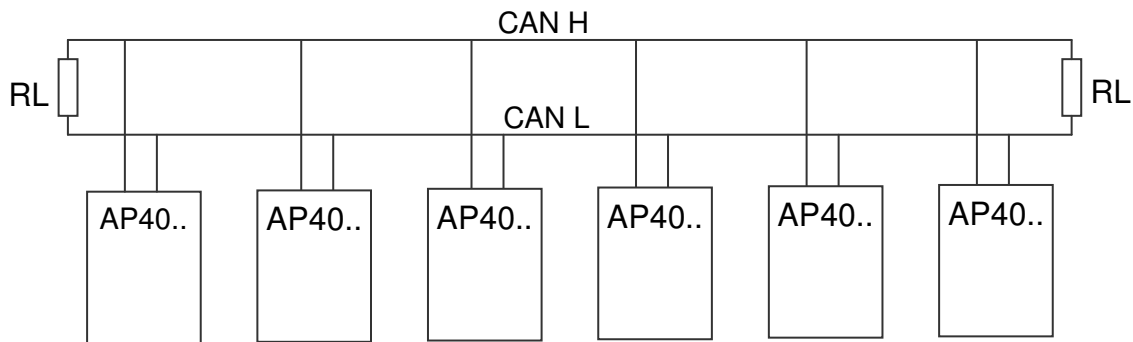
P[219] = variant "5 front keys"

#### ***4.14 min/max limit for actual position***

This function is active when Parameter P[227] is set to variant "1 – **min/max**". The actual position is limited by P[113] for the minimum value and P[114] for the maximum value.

### 4.15 CAN-bus

The baudrate for the CAN-bus is stored in parameter P[228] and has a maximum of 1 Mbit/s. The highest usable baudrate is depending on used cable type and length. The first and last unit must have terminal resistors.

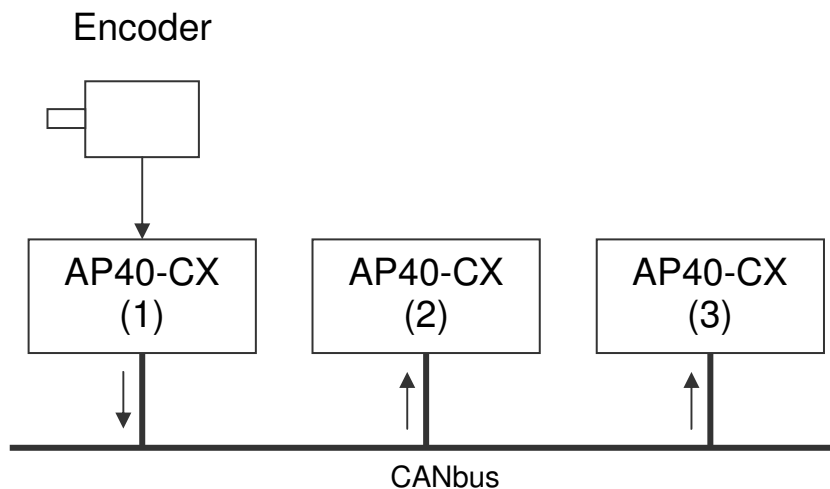


Using switch S3 enables the terminal resistor (120E).

The CAN-bus can be monitored on the display (see also paragraph 3.1.1), where “0” = no error and “1” = bus off.

#### 4.15.1 AP-Link

Using the CAN-bus it is possible to sent the actual position and velocity in just one message to one or more other AP40’s (AP80,s). Example:



- AP40-CX (1) sending data on CANbus
- AP40-CX (2) receiving data from AP40-CX (1)
- AP40-CX (3) receiving data from AP40-CX (1)

Settings for example as shown above

|                        | PAR    | AP40 (1) | AP40 (2) | AP40 (3) |
|------------------------|--------|----------|----------|----------|
| Input actual position  | P[201] | 0...3    | 4        | 4        |
| Baudrate               | P[228] | 5        | 5        | 5        |
| Obj1/PDO1 In adress    | P[089] | -        | 1        | 1        |
| Obj1/PDO1 In function  | P[229] | 0        | 1        | 1        |
| Obj1/PDO1 Out adress   | P[090] | 1        | -        | -        |
| Obj1/PDO1 Out function | P[230] | 1        | 0        | 0        |
| Time-out AP-Link       | P[079] | -        | > 0      | > 0      |
| Reset Time-out AP-Link | P[215] | -        | 0 or 1   | 0 or 1   |

In this example the first AP40 (1) is sending the actual position and velocity to adress 1 with 500 kbit/s (dataframe COB-ID 385...511).

AP40 (2) and (3) receive this data as actual position and velocity.

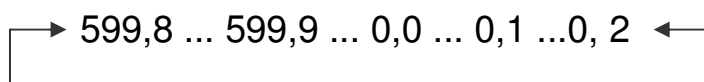
If the time-out value stored in P[079] is exceeded, the display will blink and an output will be set (programmable option).

This time-out error will be reset automatically when new data has been received, or by performing a reset through one of the inputs 1..6 (choose option 14: "reset time-out error AP-link").

**ATTENTION!**

If there are (dynamic) cams positioned on the 0-position while using a closed counting range, the display-counting range P[103] must be programmed.

For example the master (AP40) is sending:



The display counting range should be set to 6000.

Parameter P[103] has no influence on the displayed value and is only used for calculating the cams.

P[103] is calculated as follows:

**Incremental encoders and internal frequency (P[201] = 0 or 2):**

$$\text{Display counting range P[103]} = \frac{\text{Counting range P[004]} * \text{Multiplier (numerator) P[000]}}{\text{Multiplier (denominator) P[001]}}$$

**SSI encoders (P[201] = 1):**

$$\text{Display counting range P[103]} = \frac{\text{Active data bits P[217]}}{2} - 1$$

**4.15.2 Start/Stop sensor**

The AP40 sends a start signal to the sensor and then waits for the stop signal to return from the sensor. The time between the start and stop signal is an measure for the sensor (magnet) position.

Every sensor has it's own characteristic internal sensor speed. This speed is defined as gradient in m/s. for example 2789,00 m/s.

For MTS sensors this gradient is written on the type shield.

The gradient value can be programmed as Parameter P[115] in the AP40. The measurement position will then be displayed correctly.

Parameter "Sensor length" P[118] can be set to the nominal sensor length so the AP40 can calculate the number of measurements per second.

## **4.16 ASCII protocol**

The serial ports of the AP40, both RS232 and RS422/485, are able to work with the ASCII protocol, however not at the same time.

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.

### **4.16.1 Overview functions**

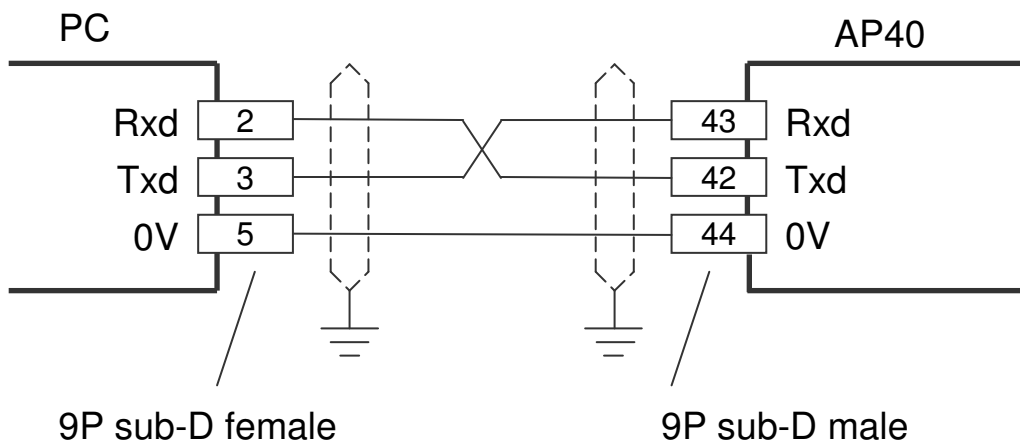
|           |                                                           |
|-----------|-----------------------------------------------------------|
| <b>sc</b> | <b>select AP40</b>                                        |
| <b>r0</b> | <b>Read actual position (AWE)</b>                         |
| <b>r1</b> | <b>Read actual velocity (AWE/s)</b>                       |
| <b>r2</b> | <b>Read actual voltage analog output (0,1mV units)</b>    |
| <b>r3</b> | <b>Read actual current analog output (0,1 mA units)</b>   |
| <b>r4</b> | <b>Read actual voltage analog input (0,1mV eenheden)</b>  |
| <b>r5</b> | <b>Read actual current analog input (0,1 mA eenheden)</b> |
| <b>r6</b> | <b>Read actual value analog input (AWE)</b>               |
| <b>ri</b> | <b>Read status inputs</b>                                 |
| <b>ru</b> | <b>Read status outputs</b>                                |
| <b>rk</b> | <b>Read status input K1, K2 and K0</b>                    |
| <b>wu</b> | <b>Write outputs</b>                                      |
| <b>rp</b> | <b>Read parameter</b>                                     |
| <b>wp</b> | <b>Write parameter (Only EEPROM)</b>                      |
| <b>rs</b> | <b>Read nominal value</b>                                 |
| <b>ws</b> | <b>Write nominal value (RAM + EEPROM)</b>                 |
| <b>rx</b> | <b>Read software version</b>                              |
| <b>rt</b> | <b>Read type number</b>                                   |
| <b>rh</b> | <b>Read hardware version</b>                              |
| <b>rf</b> | <b>Read error number</b>                                  |
| <b>wf</b> | <b>Reset SSI error</b>                                    |
| <b>rn</b> | <b>Read status bits</b>                                   |
| <b>rd</b> | <b>Read actual value thumbwheel sets</b>                  |
| <b>bp</b> | <b>Load and activate</b>                                  |

### 4.16.2 General

Through the ASCII protocol it is possible to communicate with the AP40.

Send: Data from PC, PLC → AP40

Receive: Data from AP40 → PC, PLC



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)*

### 4.16.3 Functions

#### **sc Select AP40**

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

The AP40 with the unit Id number is selected, all consecutive commands are relevant for this unit.

An AP40 with unit Id number 0 will always respond. This is the reason that only one unit is allowed to have unit Id number 0.

#### **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



**r4 Read actual voltage analog input (0,1mV units)**

send: **r4**  
receive: **r4 xxxxxxxx**  
transmitting parameter: none

**r5 Read actual current analog input (0,1 mA units)**

send: **r5**  
receive: **r5 xxxxxxxx**  
transmitting parameter: none

**r6 Read actual value analog input (AWE)**

send: **r6**  
receive: **r6 xxxxxxxx**  
transmitting parameter: none

**ri Read status inputs**

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

B0 = input K0  
B1 = input-1  
B2 = input-2  
B3 = input-3  
B4 = input-4  
B5 = 0  
B6 = 0  
B7 = 0

*Example: ri 23 gives the following answer:*

*23 → 17H, 0001 0111 B*

*K0 = "1"*

*input-1 = "1"*

*input-2 = "1"*

*input-3 = "0"*

*input-4 = "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, K2 and K0**

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

B0 = K0  
B1 = K1 or counting direction  
B2 = 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  
B2 = output-3  
B3 = output-4

*Example:*

*Output-2 and output-4 should be set to "1":*

*00001010B = AH = 10D*

*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 AP40**  
transmitting parameter: none

*Example:*

*send: rt*

*answer: rt AP40-CA*

**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 800 (SSI 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/adjustment set

*Example:*

*rn 3 gives the following answer:*  
*3 → 3H, 0011 B*  
*cams are active and ref/adjustment have been set*

**rd Read actual values thumbwheel sets**

send: **rd 1**  
receive: **rd 1 xxxxxxxx**  
transmitting parameter: thumbwheel number

**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)*

**4.16.4 Error messages**

In case of an error the AP40 will send 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

### **4.17 Analog input**

The AP40 has an optional, galvanic isolated analog input. Using parameter P[226] it is possible to choose between a current input or a voltage input. When using the current input DIP-switch 4 must be in the “on” position.

The analog input can be used as an actual position input when P[201] = 3.

The analog input value (voltage or current) is converted to AWE units.  
(for example 0 – 10V => 0 – 1200,0 mm)  
This measuring value can be used as actual position P[201] = 3.

If P[383] = 3 the analog input value can be connected directly to the analog output. A simple analog conversion (volt to current or current to volt) can be made. Furthermore the cam positions can be directly programmed on the analog input value (AWE). Even when there is already an encoder in used for the actual position of the AP40.

There are 2 Parameters who configure the dynamic response of the analog input:

#### **P[104] = measuring time**

The smaller the measurement time the more dynamic the analog input will be.

#### **P[225] = integrator**

The number of cycles are programmed. The average analog value (in AWE) of the programmed cycles is calculated.

*Example:*

*Measurement time = 60ms, integrator = 10.*

*The actual analog value will be refreshed every 60 ms and is the average velocity during the last 10 measurements.*

### 4.17.1 Voltage input

The voltage input has a resolution of  $305 \mu\text{V}$  and is programmable through the parameters below.

P[105] = U1 in V (input in 0,0001V units)

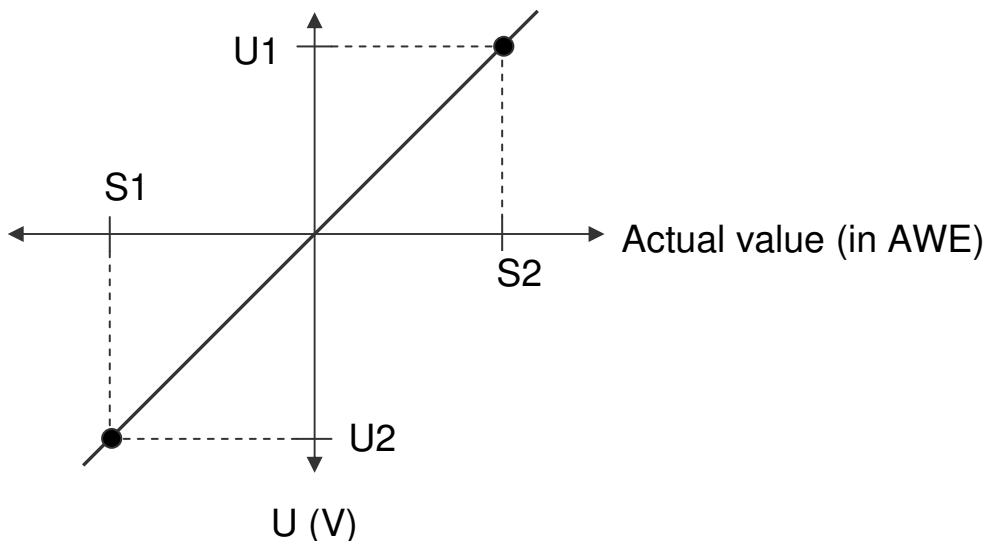
P[106] = U2 in V (input in 0,0001V units)

P[107] = S1 in AWE (actual value at U1)

P[108] = S2 in AWE (actual value at U2)

P[104] = measuring time analog

P[225] = integrator analog





### 4.17.2 Current input

The current input has a resolution of 610  $\mu\text{A}$  and is programmable through the parameters below.

P[109] = I1 [mA] (input in 0,0001mA units)

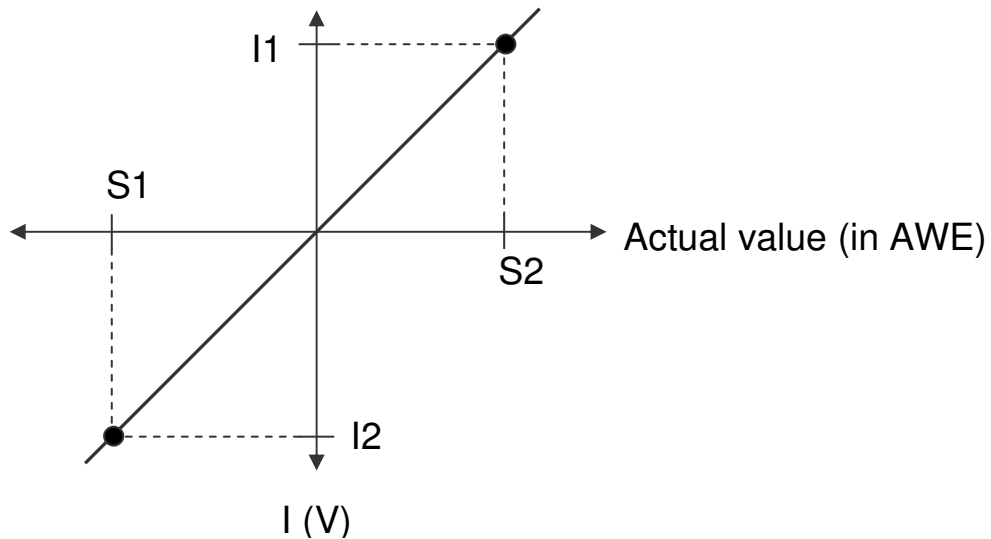
P[110] = I2 [mA] (input in 0,0001mA units)

P[111] = S1 in AWE (actual value at I1)

P[112] = S2 in AWE (actual value at I2)

P[104] = measuring time analog

P[225] = integrator analog



### 4.17.3 Example analog conversion

Conversion of an analog signal.

> analog input -8 to +8 V

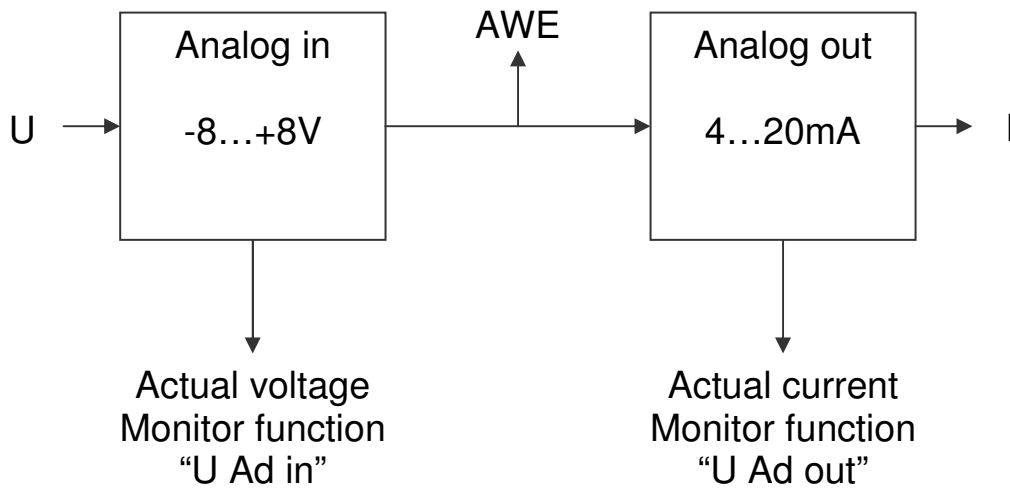
> analog output 4 to 20mA

#### Analog in

P[226] = 0 (Voltage)  
P[109] = -8,0000 V  
P[110] = +8,0000 V  
P[111] = -100000 AWE  
P[112] = +100000 AWE  
P[104] = 0,05 s  
P[225] = 10

#### Analog out

P[388] = 2 (current)  
P[383] = 2  
P[084] = 4,0000 mA  
P[085] = 20,0000 mA  
P[086] = -100000 AWE  
P[087] = +100000 AWE



## 4.18 Analog output

The AP40 has an optional, galvanically isolated analog output. Using parameter P[388] 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[383]).

### 4.18.1 Voltage output

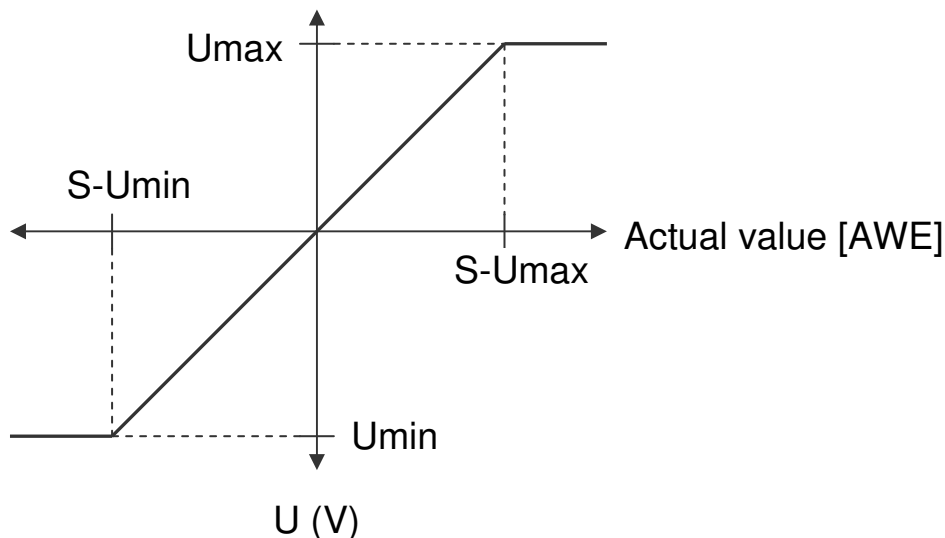
The voltage output has a resolution of 305  $\mu\text{V}$  and is programmable through P[080] ... P[083].

P[080] =  $U_{\text{min}}$  [V] (input in 0,0001V units)

P[081] =  $U_{\text{max}}$  [V] (input in 0,0001V units)

P[082] = S- $U_{\text{min}}$  [AWE] (actual value at  $U_{\text{min}}$ )

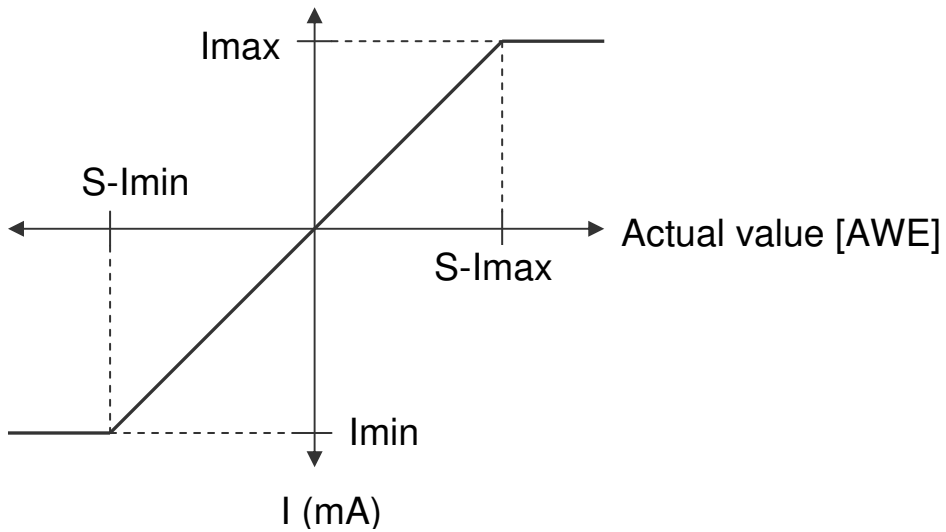
P[083] = S- $U_{\text{max}}$  [AWE] (actual value at  $U_{\text{max}}$ )



### 4.18.2 Current output

The current output has a resolution of 610  $\mu\text{A}$  and is programmable through P[084] ... P[087].

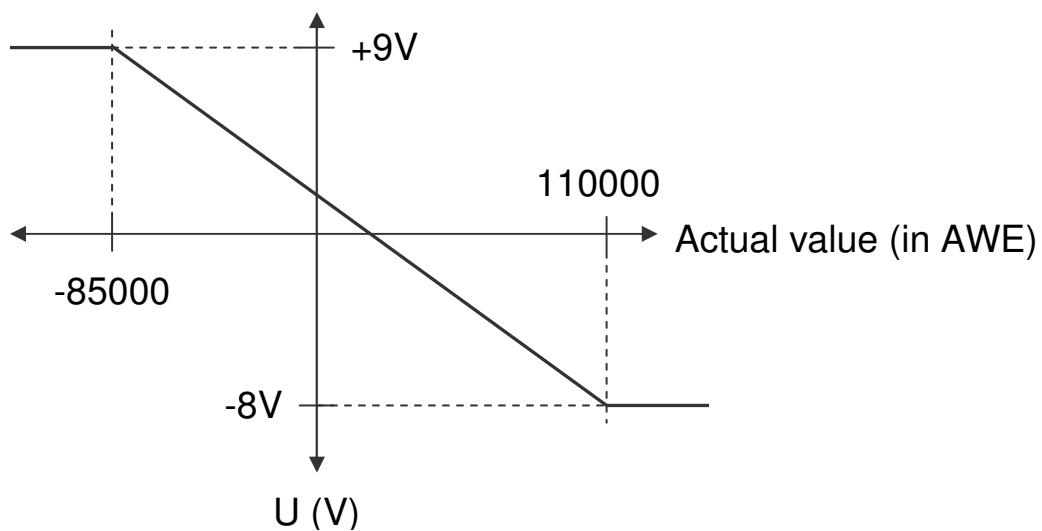
- P[084] =  $I_{\text{min}}$  [A] (input in 0,0001mA units)
- P[085] =  $I_{\text{max}}$  [A] (input in 0,0001mA units)
- P[086] = S- $I_{\text{min}}$  [AWE] (actual value at  $I_{\text{min}}$ )
- P[087] = S- $I_{\text{max}}$  [AWE] (actual value at  $I_{\text{max}}$ )



### 4.18.3 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] |



### 4.19 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 "15 DAC Set Smin" or variant "16 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 the actual position or the actual speed depending on parameter P[388]. The display will show "teach Lo" or "teach hi" for a short time.

## 4.20 Cams

### 4.20.1 General

The AP40 has a maximum of 24 programmable cams divided over a maximum of 4 outputs.

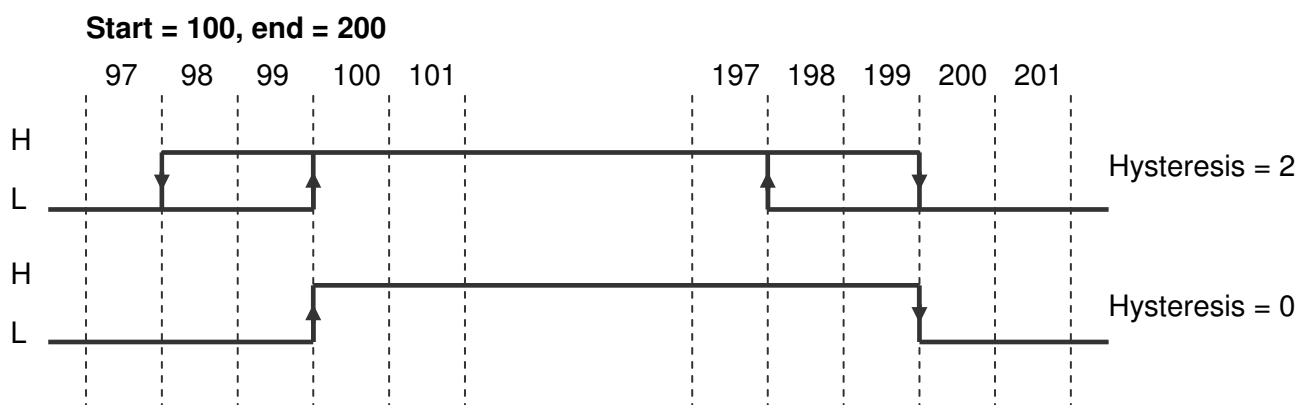
Programmable functions:

- 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, actual velocity or analog input)
- 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. In addition the external thumbwheel sets can be used as start and end value.

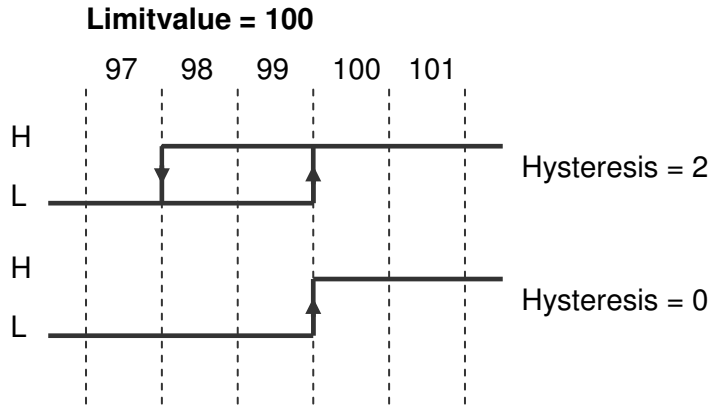
### 4.20.2 Cam with start- and end-value

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



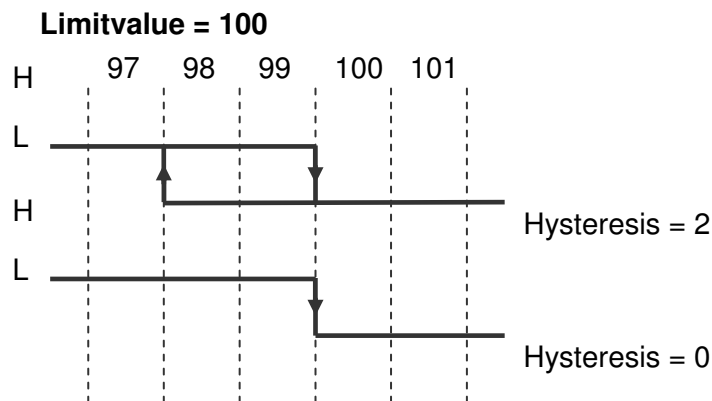
### 4.20.3 Greater than or equal to limit value

Only one limit value needs to be programmed.



### 4.20.4 Smaller than or equal to limit value

Only one limit value needs to be programmed.



### 4.20.5 Dynamic cams

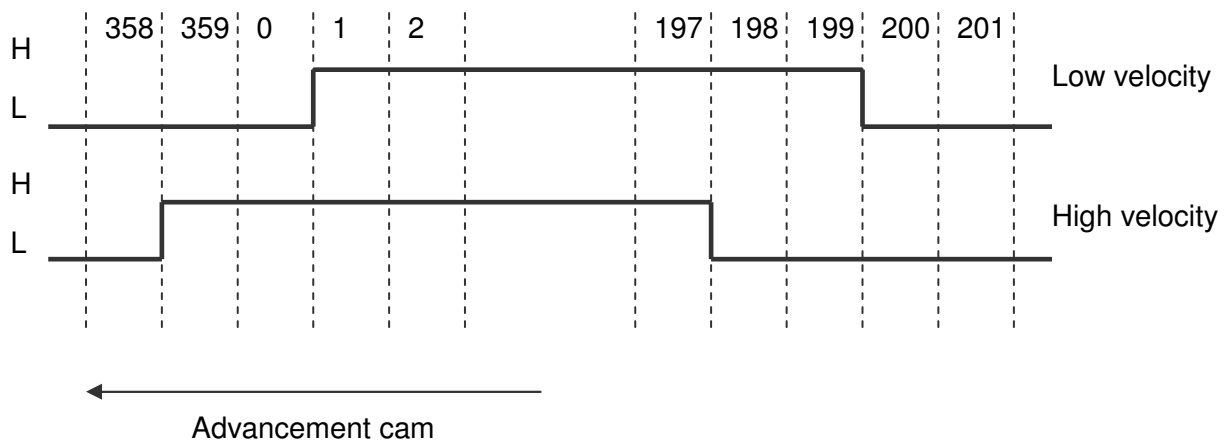
To compensate for actions with a static time, for example the switch time of a valve, it is possible to program a time for each output individually. The cams will be shifted according to this programmed time.

This function is only available for cams with a start- and end-value (P[256] ... P[279] = 1) and when the source of this cam is the actual position (P[280] ... P[303] = 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





### **4.20.6 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)

### **4.20.7 Output "Cams active"**

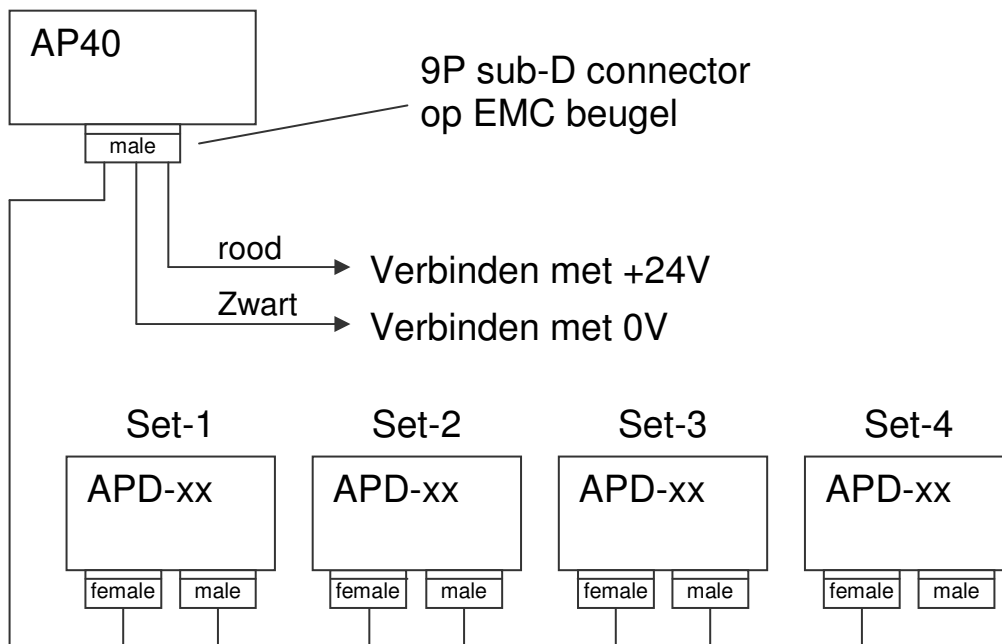
On one of the outputs 1...4 the signal "cams active" can be generated by choosing option "**4 cams active**" (high = cams enabled).

## 4.21 External thumbwheel sets

### 4.21.1 General

Up to 4 external thumbwheel sets can be connected to the AP40. The data is read by the RS422 serial interface (ser-2) and can be configured separately. The thumbwheel value can also be read by the monitor function in auto mode. They can be used for different functions such as begin and end values for the cams. Thumbwheel-1 can also be used for justage/presetting of the actual position.

### 4.21.2 Connecting thumbwheel sets



Cable KBL101-0003 (30cm): connection AP40 to first thumbwheel

Cable KBL102-0003 (30cm): connection between thumbwheel sets

#### Available types:

APD-04    4 decades  
 APD-05    5 decades  
 APD-06    6 decades  
 APD-07    7 decades

APD-T4    4 decades with sign  
 APD-T5    5 decades with sign  
 APD-T6    6 decades with sign

### 4.21.3 Parameter settings

P[245] must be set to 0 (if RS422/RS485 ser-2 is not active)

Parameter P[376] determines the number of thumbwheel sets that will be read.

P[377] determines the method of reading the thumbwheel value:

option: "0 auto"

option: "1 on ext. input" (rising edge)

When P[377] = 1 then one of the inputs must be programmed with option 18 "read thumbwheel switches"

For each thumbwheel set there are 4 parameters.

#### Parameter "Format" P[130] ... P[133]

option: "0 7654321" option: "7 -654321"

option: "1 x654321" option: "8 x-54321"

option: "2 xx54321" option: "9 xx-4321"

option: "3 xxx4321" option: "10 xxx-321"

option: "4 xxxx321" option: "11 xxxx-21"

option: "5 xxxxx21" option: "12 xxxxx-1"

option: "6 xxxxxx1"

#### Parameter "Min" P[120] ... P[123]

Definition of minimum input value

#### Parameter "Max" P[124] ... P[127]

Definition of maximum input value

#### Parameter "Multiplier" P[378] ... P[381]

Multiplies the value of the thumbwheel set

option: "0 x1"

option: "1 x10"

option: "2 x100"

## 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[200] | <b>0</b> ... 6 |
|---------------------------------------------------|--------|----------------|
| Basic function                                    |        |                |
| 0 = standard                                      |        |                |
| 1 = Hold/Reset K0 L →H (rising edge)              |        |                |
| 2 = Hold/Reset K0 H →L (falling edge)             |        |                |
| 3 = Hold/Reset start/stop H                       |        |                |
| 4 = Hold/Reset start/stop L                       |        |                |
| 5 = Hold/Reset start/stop L →H (rising edge)      |        |                |
| 6 = Hold/Reset start/stop H →L (falling edge)     |        |                |
| (1 ... 6 only possible for counter and frequency) |        |                |

| PAR: 1.0.2                | P[201] | <b>0</b> ... 4 |
|---------------------------|--------|----------------|
| Input for actual position |        |                |
| 0 = Counter               |        |                |
| 1 = SSI                   |        |                |
| 2 = Internal frequency    |        |                |
| 3 = Analog                |        |                |
| 4 = CAN-bus AP-Link       |        |                |
| 5 = Start/Stop            |        |                |

| PAR: 1.0.3                                                          | P[088] | 0 ... <b>40</b> ... 2500 |
|---------------------------------------------------------------------|--------|--------------------------|
| Measuring time velocity [AWE/s] (equal to refreshment time display) |        |                          |
| X.XXX (sec) input 0 .. 1.000s                                       |        |                          |

| PAR: 1.0.4                                                     | P[202] | 0 ... <b>10</b> ... 20 |
|----------------------------------------------------------------|--------|------------------------|
| Integrator velocity                                            |        |                        |
| Actual velocity is the average from the number of measurements |        |                        |
| 0 = not active                                                 |        |                        |
| 1...20 number of measurements                                  |        |                        |

|                    |        |         |
|--------------------|--------|---------|
| PAR: 1.0.5         | P[203] | 0 ... 6 |
| Number of decimals |        |         |
| X                  |        |         |

|                  |        |         |
|------------------|--------|---------|
| PAR: 1.0.6       | P[204] | 0 ... 1 |
| Store function   |        |         |
| 0 = no function  |        |         |
| 1 = only display |        |         |

|                 |        |         |
|-----------------|--------|---------|
| PAR: 1.0.7      | P[205] | 0 ... 2 |
| Store signal    |        |         |
| 0 = high active |        |         |
| 1 = low active  |        |         |

|                                                                           |        |         |
|---------------------------------------------------------------------------|--------|---------|
| PAR: 1.0.8                                                                | P[206] | 0 ... 1 |
| Power failure protection (no function when Hold/Reset is active (P[200])) |        |         |
| 0 = not active                                                            |        |         |
| 1 = active                                                                |        |         |

|                                                                       |        |           |
|-----------------------------------------------------------------------|--------|-----------|
| PAR: 1.0.9                                                            | P[207] | 0 ... 123 |
| Service functions                                                     |        |           |
| Only possible to activate through keyboard AP40                       |        |           |
| 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: 1.0.10                                             | P[208] | 0 ... 2 |
| Default monitor function                                |        |         |
| Determines the default which is visible after start-up. |        |         |
| 0 = Actual position                                     |        |         |
| 1 = Actual velocity                                     |        |         |
| 2 = Actual value AD (analog input)                      |        |         |
| 3 = Actual value DA (analog output)                     |        |         |

|                               |        |         |
|-------------------------------|--------|---------|
| PAR: 1.0.11                   | P[222] | 0 ... 1 |
| Function velocity measurement |        |         |
| 0 = standaard                 |        |         |
| 1 = 1/f time measurement      |        |         |

|                                                  |        |                |
|--------------------------------------------------|--------|----------------|
| PAR: 1.0.12                                      | P[116] | 0 ... 99999999 |
| 1/f Frequency AWE/s                              |        |                |
| Velocity where display value P[117] is displayed |        |                |
| XXXXXXXX (AWE/s)                                 |        |                |

|                                   |        |                |
|-----------------------------------|--------|----------------|
| PAR: 1.0.13                       | P[117] | 0 ... 99999999 |
| 1/f Display                       |        |                |
| Display value for velocity P[116] |        |                |
| XXXXXXXX (AWE)                    |        |                |

|                                  |        |         |
|----------------------------------|--------|---------|
| PAR: 1.0.14                      | P[223] | 0 ... 6 |
| 1/f Display format               |        |         |
| Format for display               |        |         |
| 0 = Standaard dp als P[203]      |        |         |
| 1 = geen dp                      |        |         |
| 2 = XXXXXXX.X                    |        |         |
| 3 = XXXXXX.XX                    |        |         |
| 4 = XXXXX.XXX                    |        |         |
| 5 = XXXXXX.XX (min.sec of h.min) |        |         |
| 6 = XXXXX.XX.X (h.min.sec)       |        |         |

## 5.2 Menu 2 Actual

### 5.2.1 Submenu 2.1 Counter

|                                                  |        |         |
|--------------------------------------------------|--------|---------|
| 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 |
| Multiplier numerator |        |                          |
| XXXXXXXX             |        |                          |

|                        |        |                          |
|------------------------|--------|--------------------------|
| PAR: 2.1.4             | P[001] | 0 ... 10000 ... 16777215 |
| Multiplier denominator |        |                          |
| XXXXXXXX               |        |                          |

|                                                 |        |         |
|-------------------------------------------------|--------|---------|
| PAR: 2.1.5                                      | P[212] | 0 ... 5 |
| Reference fine (input K0)                       |        |         |
| 0 = no function                                 |        |         |
| 1 = rising edge                                 |        |         |
| 2 = falling edge                                |        |         |
| 3 = front keys                                  |        |         |
| 4 = rising edge (reference value thumbwheel-1)  |        |         |
| 5 = falling edge (reference value thumbwheel-1) |        |         |

|                  |        |         |
|------------------|--------|---------|
| 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)                                                  |        |                |

|                   |        |                             |
|-------------------|--------|-----------------------------|
| PAR: 2.1.10       | P[102] | -9999999 ... 0 ... 99999999 |
| Reference value 2 |        |                             |
| -XXXXXXXX (AWE)   |        |                             |

### 5.2.2 Submenu 2.2 SSI

|            |        |         |
|------------|--------|---------|
| 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 ... <b>10000</b> ... 16777215 |
| Multiplier numerator |        |                                 |
| XXXXXXXX             |        |                                 |

|                        |        |                                 |
|------------------------|--------|---------------------------------|
| PAR: 2.2.6             | P[001] | 0 ... <b>10000</b> ... 16777215 |
| Multiplier denominator |        |                                 |
| XXXXXXXX               |        |                                 |

|                                                             |        |                |
|-------------------------------------------------------------|--------|----------------|
| PAR: 2.2.7                                                  | P[218] | <b>0</b> ... 7 |
| Adjustment                                                  |        |                |
| 0 = no function                                             |        |                |
| 1 = rising edge (K0) only temporary in RAM (on interrupt)   |        |                |
| 2 = falling edge (K0) only temporary in RAM (on interrupt)  |        |                |
| 3 = set with parameter adjustment value                     |        |                |
| 4 = rising edge (K0) permanent in EEPROM (not on interrupt) |        |                |
| 5 = front keys                                              |        |                |
| 6 = rising edge (K0) reference value thumbwheel-1           |        |                |
| 7 = falling edge (K0) reference value thumbwheel-1          |        |                |

|                  |        |                |
|------------------|--------|----------------|
| PAR: 2.2.8       | P[213] | <b>0</b> ... 2 |
| Reference coarse |        |                |
| 0 = no function  |        |                |
| 1 = high signal  |        |                |
| 2 = low signal   |        |                |

|                                         |        |                |
|-----------------------------------------|--------|----------------|
| PAR: 2.2.9                              | P[209] | <b>0</b> ... 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 ... <b>0</b> ... 99999999 |
| Offset          |        |                                    |
| -XXXXXXXX (AWE) |        |                                    |

|                                                 |        |                                    |
|-------------------------------------------------|--------|------------------------------------|
| PAR: 2.2.11                                     | P[005] | -9999999 ... <b>0</b> ... 99999999 |
| Adjustment value                                |        |                                    |
| -XXXXXXXX (AWE) input 0 means function inactive |        |                                    |

|                                                                               |        |                           |
|-------------------------------------------------------------------------------|--------|---------------------------|
| PAR: 2.2.12                                                                   | P[006] | 1 ... <b>50</b> ... 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 ... <b>2</b> ... 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 ... <b>3</b> |
| SSI monitoring                    |        |                |
| 0 = not active                    |        |                |
| 1 = only wiring                   |        |                |
| 2 = only Delta SSI monitoring     |        |                |
| 3 = wiring + Delta SSI monitoring |        |                |

### 5.2.3 Submenu 2.3 Internal frequency

|                |        |                |
|----------------|--------|----------------|
| PAR: 2.3.1     | P[224] | <b>0</b> ... 3 |
| Timebasis      |        |                |
| 0 = 78,125 kHz |        |                |
| 1 = 625 kHz    |        |                |
| 2 = 5 MHz      |        |                |
| 3 = 10 MHz     |        |                |

|                    |        |                |
|--------------------|--------|----------------|
| PAR: 2.3.2         | P[211] | <b>0</b> ... 1 |
| Counting direction |        |                |
| 0 = positive       |        |                |
| 1 = negative       |        |                |

|                      |        |                                 |
|----------------------|--------|---------------------------------|
| PAR: 2.3.3           | P[000] | 0 ... <b>10000</b> ... 16777215 |
| Multiplier numerator |        |                                 |
| XXXXXXXX             |        |                                 |

|                        |        |                          |
|------------------------|--------|--------------------------|
| PAR: 2.3.4             | P[001] | 0 ... 10000 ... 16777215 |
| Multiplier denominator |        |                          |
| XXXXXXXX               |        |                          |

|                           |        |         |
|---------------------------|--------|---------|
| PAR: 2.3.5                | P[212] | 0 ... 2 |
| Reference fine (input K0) |        |         |
| 0 = no function           |        |         |
| 1 = rising edge           |        |         |
| 2 = falling edge          |        |         |

|                                                    |        |         |
|----------------------------------------------------|--------|---------|
| PAR: 2.3.6                                         | P[213] | 0 ... 5 |
| Reference coarse                                   |        |         |
| 0 = no function                                    |        |         |
| 1 = high signal                                    |        |         |
| 2 = low signal                                     |        |         |
| 3 = front keys                                     |        |         |
| 4 = rising edge (K0) reference value thumbwheel-1  |        |         |
| 5 = falling edge (K0) reference value thumbwheel-1 |        |         |

|                                                |        |         |
|------------------------------------------------|--------|---------|
| PAR: 2.3.7                                     | P[209] | 0 ... 2 |
| Counting direction for setting reference value |        |         |
| 0 = independant from direction                 |        |         |
| 1 = upwards counting                           |        |         |
| 2 = downwards counting                         |        |         |

|                   |        |                             |
|-------------------|--------|-----------------------------|
| PAR: 2.3.8        | P[003] | -9999999 ... 0 ... 99999999 |
| Reference value 1 |        |                             |
| -XXXXXXXX (AWE)   |        |                             |

|                                                                 |        |                |
|-----------------------------------------------------------------|--------|----------------|
| PAR: 2.3.9                                                      | P[004] | 0 ... 99999999 |
| Counting range (no function when Hold/Reset is active (P[200])) |        |                |
| XXXXXXXX (AWE)                                                  |        |                |

### 5.2.4 Submenu 2.4 Analog

|                           |        |                             |
|---------------------------|--------|-----------------------------|
| PAR: 2.4.1                | P[005] | -9999999 ... 0 ... 99999999 |
| Adjustment absolute value |        |                             |
| XXXXXXXX                  |        |                             |

|                                                             |        |         |
|-------------------------------------------------------------|--------|---------|
| PAR: 2.4.2                                                  | P[219] | 0 ... 7 |
| Adjustment                                                  |        |         |
| 0 = no function                                             |        |         |
| 1 = rising edge (K0) only temporary in RAM (on interrupt)   |        |         |
| 2 = falling edge (K0) only temporary in RAM (on interrupt)  |        |         |
| 3 = set with parameter adjustment value                     |        |         |
| 4 = rising edge (K0) permanent in EEPROM (not on interrupt) |        |         |
| 5 = front keys                                              |        |         |
| 6 = rising edge (K0) reference value thumbwheel-1           |        |         |
| 7 = falling edge (K0) reference value thumbwheel-1          |        |         |

|                  |        |         |
|------------------|--------|---------|
| PAR: 2.4.3       | P[213] | 0 ... 2 |
| Reference coarse |        |         |
| 0 = no function  |        |         |
| 1 = high signal  |        |         |
| 2 = low signal   |        |         |

|                  |        |         |
|------------------|--------|---------|
| PAR: 2.4.4       | P[227] | 0 ... 1 |
| Min/max function |        |         |
| 0 = no function  |        |         |
| 1 = min/max      |        |         |

|                 |        |                             |
|-----------------|--------|-----------------------------|
| PAR: 2.4.5      | P[113] | -9999999 ... 0 ... 99999999 |
| Min. Value      |        |                             |
| -XXXXXXXX (AWE) |        |                             |

|                 |        |                             |
|-----------------|--------|-----------------------------|
| PAR: 2.4.6      | P[114] | -9999999 ... 0 ... 99999999 |
| Max. value      |        |                             |
| -XXXXXXXX (AWE) |        |                             |

### 5.2.5 Submenu 2.5 CAN AP-Link

|                        |        |                |
|------------------------|--------|----------------|
| PAR: 2.5.1             | P[103] | 0 ... 99999999 |
| Display counting range |        |                |
| XXXXXXXX (AWE)         |        |                |

|                               |        |            |
|-------------------------------|--------|------------|
| PAR: 2.5.2                    | P[079] | 0 ... 9999 |
| Time-out in 0,01 s units      |        |            |
| XX.XX (sec) input 0: inactive |        |            |

|                                                       |        |         |
|-------------------------------------------------------|--------|---------|
| PAR: 2.5.3                                            | P[215] | 0 ... 1 |
| Time-out reset                                        |        |         |
| 0 = auto reset (reset when new value has been stored) |        |         |
| 1 = reset by using an input                           |        |         |

### 5.2.6 Submenu 2.6 Start/Stop

|                                           |        |                       |
|-------------------------------------------|--------|-----------------------|
| PAR: 2.6.1                                | P[115] | 0 ... 28000 .. 999999 |
| Gradient                                  |        |                       |
| Actual signalspeed sensor internal in m/s |        |                       |
| (0 = 2800.00 m/s)                         |        |                       |
| XXXX.XX (m/s)                             |        |                       |

|                         |        |                      |
|-------------------------|--------|----------------------|
| PAR: 2.6.2              | P[118] | 0 ... 6000 ... 29999 |
| Measuring length sensor |        |                      |
| XXXXX mm                |        |                      |

|                    |        |         |
|--------------------|--------|---------|
| PAR: 2.6.3         | P[211] | 0 ... 1 |
| Counting direction |        |         |
| 0 = no reverse     |        |         |
| 1 = reverse        |        |         |

|                      |        |                          |
|----------------------|--------|--------------------------|
| PAR: 2.6.4           | P[000] | 0 ... 10000 ... 16777215 |
| Multiplier numerator |        |                          |
| XXXXXXXX             |        |                          |

|                        |        |                          |
|------------------------|--------|--------------------------|
| PAR: 2.6.5             | P[001] | 0 ... 10000 ... 16777215 |
| Multiplier denominator |        |                          |
| XXXXXXXX               |        |                          |

|                                                             |        |         |
|-------------------------------------------------------------|--------|---------|
| PAR: 2.6.6                                                  | P[219] | 0 ... 7 |
| Adjustment                                                  |        |         |
| 0 = no function                                             |        |         |
| 1 = rising edge (K0) only temporary in RAM (on interrupt)   |        |         |
| 2 = falling edge (K0) only temporary in RAM (on interrupt)  |        |         |
| 3 = set with parameter adjustment value                     |        |         |
| 4 = rising edge (K0) permanent in EEPROM (not on interrupt) |        |         |
| 5 = front keys                                              |        |         |
| 6 = rising edge (K0) reference value thumbwheel-1           |        |         |
| 7 = falling edge (K0) reference value thumbwheel-1          |        |         |

|                  |        |         |
|------------------|--------|---------|
| PAR: 2.6.7       | P[213] | 0 ... 2 |
| Reference coarse |        |         |
| 0 = no function  |        |         |
| 1 = high signal  |        |         |
| 2 = low signal   |        |         |

|                                         |        |         |
|-----------------------------------------|--------|---------|
| PAR: 2.6.8                              | P[209] | 0 ... 2 |
| Counting direction adjustment           |        |         |
| 0 = independant from direction          |        |         |
| 1 = when counting in positive direction |        |         |
| 2 = when counting in negative direction |        |         |

|                 |        |                             |
|-----------------|--------|-----------------------------|
| PAR: 2.6.10     | P[002] | -9999999 ... 0 ... 99999999 |
| Offset          |        |                             |
| -XXXXXXXX (AWE) |        |                             |

|                                                 |        |                             |
|-------------------------------------------------|--------|-----------------------------|
| PAR: 2.6.11                                     | P[005] | -9999999 ... 0 ... 99999999 |
| Adjustment value                                |        |                             |
| -XXXXXXXX (AWE) input 0 means function inactive |        |                             |

### 5.3 Menu 3 CAN-bus

#### 5.4 Submenu 3.1 Config

|                |        |               |
|----------------|--------|---------------|
| PAR: 3.1.1     | P[228] | 0 ... 5 ... 7 |
| Baudrate       |        |               |
| 0 = 20 kbit/s  |        |               |
| 1 = 50 kbit/s  |        |               |
| 2 = 100 kbit/s |        |               |
| 3 = 125 kbit/s |        |               |
| 4 = 250 kbit/s |        |               |
| 5 = 500 kbit/s |        |               |
| 6 = 800 kbit/s |        |               |
| 7 = 1 Mbit/s   |        |               |

#### 5.5 Submenu 3.2 Obj1/PDO1 In

|                        |        |                 |
|------------------------|--------|-----------------|
| PAR: 3.2.1             | P[089] | 0 ... 1 ... 127 |
| CAN adress Obj/PDO1 In |        |                 |
| XXX                    |        |                 |

|                                                    |        |         |
|----------------------------------------------------|--------|---------|
| PAR: 3.2.2                                         | P[229] | 0 ... 4 |
| Function Obj/PDO1 In                               |        |         |
| 0 = not active                                     |        |         |
| 1 = AP-Link (reading actual position and velocity) |        |         |

#### 5.6 Submenu 3.3 Obj1/PDO1 Out

|                         |        |                 |
|-------------------------|--------|-----------------|
| PAR: 3.3.1              | P[090] | 0 ... 1 ... 127 |
| CAN adress Obj/PDO1 Out |        |                 |
| XXX                     |        |                 |

|                                                    |        |         |
|----------------------------------------------------|--------|---------|
| PAR: 3.3.2                                         | P[230] | 0 ... 4 |
| Function Obj/PDO1 Out                              |        |         |
| 0 = not active                                     |        |         |
| 1 = AP-Link (sending actual position and velocity) |        |         |

## 5.7 Menu 4 Serial

### 5.7.1 Submenu 4.1 Config

|             |        |          |
|-------------|--------|----------|
| PAR: 4.1.1  | P[236] | 0 ... 31 |
| Unit adress |        |          |
| XX          |        |          |

### 5.7.2 Submenu 4.2 Ser-1 (RS232)

|            |        |               |
|------------|--------|---------------|
| PAR: 4.2.1 | P[237] | 0 ... 1 ... 4 |
| Baudrate   |        |               |
| 0 = 9600   |        |               |
| 1 = 19200  |        |               |
| 2 = 28800  |        |               |
| 3 = 38400  |        |               |
| 4 = 57600  |        |               |

|                    |        |         |
|--------------------|--------|---------|
| PAR: 4.2.2         | P[238] | 0 ... 1 |
| Number of stopbits |        |         |
| 0 = 1 Stopbit      |        |         |
| 1 = 2 Stopbits     |        |         |

|            |        |         |
|------------|--------|---------|
| PAR: 4.2.3 | P[239] | 0 ... 2 |
| Parity     |        |         |
| 0 = none   |        |         |
| 1 = odd    |        |         |
| 2 = even   |        |         |

|                 |        |         |
|-----------------|--------|---------|
| PAR: 4.2.4      | P[240] | 0 ... 1 |
| Protocol        |        |         |
| 0 = no function |        |         |
| 1 = ASCII       |        |         |



### 5.7.3 Submenu 4.3 Ser-2 (RS422/485)

|            |        |               |
|------------|--------|---------------|
| PAR: 4.3.1 | P[242] | 0 ... 1 ... 4 |
| Baudrate   |        |               |
| 0 = 9600   |        |               |
| 1 = 19200  |        |               |
| 2 = 28800  |        |               |
| 3 = 38400  |        |               |
| 4 = 57600  |        |               |

|                    |        |         |
|--------------------|--------|---------|
| PAR: 4.3.2         | P[243] | 0 ... 1 |
| Number of stopbits |        |         |
| 0 = 1 Stopbit      |        |         |
| 1 = 2 Stopbits     |        |         |

|            |        |         |
|------------|--------|---------|
| PAR: 4.3.3 | P[244] | 0 ... 2 |
| Parity     |        |         |
| 0 = none   |        |         |
| 1 = odd    |        |         |
| 2 = even   |        |         |

|                 |        |         |
|-----------------|--------|---------|
| PAR: 4.3.4      | P[245] | 0 ... 1 |
| Protocol        |        |         |
| 0 = no function |        |         |
| 1 = ASCII       |        |         |

### 5.8 Menu 5 Input

#### INPUT-1

|                                              |        |          |
|----------------------------------------------|--------|----------|
| PAR: 5.0.1                                   | P[249] | 0 ... 18 |
| Function input-1                             |        |          |
| 0 = no function                              |        |          |
| 1 = coarse                                   |        |          |
| 2 = store                                    |        |          |
| 3 = enable                                   |        |          |
| 4 = error reset SSI                          |        |          |
| 5 = start/stop cams                          |        |          |
| 6 = start cams                               |        |          |
| 7 = stop cams                                |        |          |
| 8 = Hold/Reset start/stop                    |        |          |
| 9 = Hold/Reset start                         |        |          |
| 10 = Hold/Reset stop                         |        |          |
| 11 = lock input nominal values               |        |          |
| 12 = lock input parameters                   |        |          |
| 13 = lock input nominal values + parameters  |        |          |
| 14 = reset time-out AP-Link                  |        |          |
| 15 = DAC Set Smin                            |        |          |
| 16 = DAC Set Smax                            |        |          |
| 17 = select reference value 1 or 2 (low = 1) |        |          |
| 18 = read external thumbwheel sets           |        |          |

#### INPUT-2

|                  |        |          |
|------------------|--------|----------|
| PAR: 5.0.2       | P[250] | 0 ... 18 |
| Function input-2 |        |          |
| XX (see input-1) |        |          |

#### INPUT-3

|                  |        |          |
|------------------|--------|----------|
| PAR: 5.0.3       | P[251] | 0 ... 18 |
| Function input-3 |        |          |
| XX (see input-1) |        |          |

#### INPUT-4

|                  |        |          |
|------------------|--------|----------|
| PAR: 5.0.4       | P[252] | 0 ... 18 |
| Function input-4 |        |          |
| XX (see input-1) |        |          |

## **5.9 Menu 6 Output**

### **5.9.1 Submenu 6.1 – 6.4 Op1...4**

#### OUTPUT 1...9

|                                                    |                 |                |
|----------------------------------------------------|-----------------|----------------|
| PAR: 6.x.1                                         | P[389]...P[397] | <b>0 ... 9</b> |
| Function output-1                                  |                 |                |
| 0 = cam                                            |                 |                |
| 1 = cam inverted                                   |                 |                |
| 2 = SSI error (high = no error)                    |                 |                |
| 3 = reference/adjustment                           |                 |                |
| 4 = cams active                                    |                 |                |
| 5 = Hold/Reset started (only when P[200] = 3 ...6) |                 |                |
| 6 = time-out AP-Link (high = no time-out)          |                 |                |
| 7 = ASCII protocol                                 |                 |                |
| 8 = Counting direction (high = downwards counting) |                 |                |
| 9 = Start/Stop error (no magnet or time-out)       |                 |                |

|                                                                    |                 |                   |
|--------------------------------------------------------------------|-----------------|-------------------|
| PAR: 6.x.2                                                         | P[094]...P[102] | <b>0 ... 5000</b> |
| Dynamic cams (only when output = cam and source = actual position) |                 |                   |
| X.XXX (sec) input 0 = no function                                  |                 |                   |

## 5.10 Menu 7 Analog input

### 5.10.1 Submenu 7.1 Config

|                    |        |         |
|--------------------|--------|---------|
| PAR: 7.1.1         | P[226] | 0 ... 1 |
| Selection AD input |        |         |
| 0 = voltage        |        |         |
| 1 = current        |        |         |

### 5.10.2 Submenu 7.2 AD-U (voltage)

|              |        |                   |
|--------------|--------|-------------------|
| PAR: 7.2.1   | P[105] | -100000 ... 99999 |
| U1 AD        |        |                   |
| -XX.XXXX (V) |        |                   |

|              |        |                   |
|--------------|--------|-------------------|
| PAR: 7.2.2   | P[106] | -99999 ... 100000 |
| U2 AD        |        |                   |
| -XX.XXXX (V) |        |                   |

|                  |        |                                  |
|------------------|--------|----------------------------------|
| PAR: 7.2.3       | P[107] | -9999999... -100000 ... 99999999 |
| S1 AD            |        |                                  |
| -XXXXXXXXX (AWE) |        |                                  |

|                  |        |                                  |
|------------------|--------|----------------------------------|
| PAR: 7.2.4       | P[108] | -9999999 ... 100000 ... 99999999 |
| S2 AD            |        |                                  |
| -XXXXXXXXX (AWE) |        |                                  |

|                             |        |                  |
|-----------------------------|--------|------------------|
| PAR: 7.2.5                  | P[104] | 0 ... 10 ... 100 |
| Measuring time analog input |        |                  |
| X.XX (sec) input 0 is 1.00s |        |                  |

|                                                             |        |                |
|-------------------------------------------------------------|--------|----------------|
| PAR: 7.2.6                                                  | P[225] | 0 ... 5 ... 50 |
| Integrator analog input                                     |        |                |
| Actual value is the average from the number of measurements |        |                |
| 0...50 (number of measurements) input 0 = 1                 |        |                |

### 5.10.3 Submenu 7.2 AD-I (current)

|               |        |                           |
|---------------|--------|---------------------------|
| PAR: 7.3.1    | P[109] | <b>-200000</b> ... 199999 |
| I1 AD         |        |                           |
| -XX.XXXX (mA) |        |                           |

|               |        |                           |
|---------------|--------|---------------------------|
| PAR: 7.3.2    | P[110] | -199999 ... <b>200000</b> |
| I2 AD         |        |                           |
| -XX.XXXX (mA) |        |                           |

|                  |        |                                         |
|------------------|--------|-----------------------------------------|
| PAR: 7.3.3       | P[111] | -9999999... <b>-200000</b> ... 99999999 |
| S1 AD            |        |                                         |
| -XXXXXXXXX (AWE) |        |                                         |

|                  |        |                                         |
|------------------|--------|-----------------------------------------|
| PAR: 7.3.4       | P[112] | -9999999 ... <b>200000</b> ... 99999999 |
| S2 AD            |        |                                         |
| -XXXXXXXXX (AWE) |        |                                         |

|                             |        |                         |
|-----------------------------|--------|-------------------------|
| PAR: 7.3.5                  | P[104] | 0 ... <b>10</b> ... 100 |
| Measuring time analog input |        |                         |
| X.XX (sec) input 0 is 1.00s |        |                         |

|                                                             |        |                       |
|-------------------------------------------------------------|--------|-----------------------|
| PAR: 7.3.6                                                  | P[225] | 0 ... <b>5</b> ... 50 |
| Integrator analog input                                     |        |                       |
| Actual value is the average from the number of measurements |        |                       |
| 0...50 (number of measurements) input 0 = 1                 |        |                       |

## 5.11 Menu 8 Analog output

### 5.11.1 Submenu 8.1 Config

|                     |        |         |
|---------------------|--------|---------|
| PAR: 8.1.1          | P[388] | 0 ... 2 |
| Selection DA output |        |         |
| 0 = inactive        |        |         |
| 1 = voltage         |        |         |
| 2 = current         |        |         |

|                     |        |         |
|---------------------|--------|---------|
| PAR: 8.1.2          | P[383] | 0 ... 1 |
| Selection DA source |        |         |
| 0 = actual position |        |         |
| 1 = actual velocity |        |         |

### 5.11.2 Submenu 8.2 DA-U (voltage)

DA PAR 8.2.1...8.2.4 = 0: DA not active

|              |        |                   |
|--------------|--------|-------------------|
| PAR: 8.2.1   | P[080] | -100000 ... 99999 |
| Umin DA      |        |                   |
| -XX.XXXX (V) |        |                   |

|              |        |                   |
|--------------|--------|-------------------|
| PAR: 8.2.2   | P[081] | -99999 ... 100000 |
| Umax DA      |        |                   |
| -XX.XXXX (V) |        |                   |

|                  |        |                                  |
|------------------|--------|----------------------------------|
| PAR: 8.2.3       | P[082] | -9999999... -100000 ... 99999999 |
| S-Umin DA        |        |                                  |
| -XXXXXXXXX (AWE) |        |                                  |

|                  |        |                                  |
|------------------|--------|----------------------------------|
| PAR: 8.2.4       | P[083] | -9999999 ... 100000 ... 99999999 |
| S-Umax DA        |        |                                  |
| -XXXXXXXXX (AWE) |        |                                  |

|                    |        |         |
|--------------------|--------|---------|
| PAR: 8.2.5         | P[234] | 0 ... 1 |
| Source for Smin    |        |         |
| 0 = parameter Smin |        |         |
| 1 = teach by input |        |         |

|                    |        |                |
|--------------------|--------|----------------|
| PAR: 8.2.6         | P[235] | <b>0 ... 1</b> |
| Source for Smax    |        |                |
| 0 = parameter Smax |        |                |
| 1 = teach by input |        |                |

### 5.11.3 Submenu 8.3 DA-I (current)

DA PAR 8.2.1...8.2.4 = 0: DA not active

|               |        |                           |
|---------------|--------|---------------------------|
| PAR: 8.3.1    | P[084] | <b>-200000 ... 199999</b> |
| Imin DA       |        |                           |
| -XX.XXXX (mA) |        |                           |

|               |        |                           |
|---------------|--------|---------------------------|
| PAR: 8.3.2    | P[085] | <b>-199999 ... 200000</b> |
| Imax DA       |        |                           |
| -XX.XXXX (mA) |        |                           |

|                  |        |                                          |
|------------------|--------|------------------------------------------|
| PAR: 8.3.3       | P[086] | <b>-9999999 ... -200000 ... 99999999</b> |
| S-Imin DA        |        |                                          |
| -XXXXXXXXX (AWE) |        |                                          |

|                  |        |                                         |
|------------------|--------|-----------------------------------------|
| PAR: 8.3.4       | P[087] | <b>-9999999 ... 200000 ... 99999999</b> |
| S-Imax DA        |        |                                         |
| -XXXXXXXXX (AWE) |        |                                         |

|                    |        |                |
|--------------------|--------|----------------|
| PAR: 8.3.5         | P[234] | <b>0 ... 1</b> |
| Source for Smin    |        |                |
| 0 = parameter Smin |        |                |
| 1 = teach by input |        |                |

|                    |        |                |
|--------------------|--------|----------------|
| PAR: 8.3.6         | P[235] | <b>0 ... 1</b> |
| Source for Smax    |        |                |
| 0 = parameter Smax |        |                |
| 1 = teach by input |        |                |

## 5.12 Menu 9 Cam

### 5.12.1 Submenu 9.1 ... 9.24 CA1...24

CAM-1...24

|                                    |                 |         |
|------------------------------------|-----------------|---------|
| PAR: 9.x.1                         | P[256]...P[279] | 0 ... 3 |
| Cam function                       |                 |         |
| 0 = no function                    |                 |         |
| 1 = range                          |                 |         |
| 2 = actual position >= limit value |                 |         |
| 3 = actual position <= limit value |                 |         |

|                                                  |                 |         |
|--------------------------------------------------|-----------------|---------|
| PAR: 9.x.2                                       | P[280]...P[303] | 0 ... 4 |
| Source                                           |                 |         |
| 0 = actual position                              |                 |         |
| 1 = actual velocity                              |                 |         |
| 2 = analog input (AWE)                           |                 |         |
| 3 = Thumbwheel-1 actual position (relative cams) |                 |         |
| 4 = Thumbwheel-2 actual position (relative cams) |                 |         |

|                                                                          |                 |          |
|--------------------------------------------------------------------------|-----------------|----------|
| PAR: 9.x.3                                                               | P[304]...P[327] | 0 ... 52 |
| Source cam begin / limit value<br>(limit value if cam function = 2 or 3) |                 |          |
| 0 = parameters cam begin                                                 |                 |          |
| 1...48 = Nominal value 1...48                                            |                 |          |
| 49...52 = Thumbwheel sets 1...4                                          |                 |          |

|                                 |                 |          |
|---------------------------------|-----------------|----------|
| PAR: 9.x.4                      | P[328]...P[351] | 0 ... 52 |
| Source cam end                  |                 |          |
| 0 = parameters cam end          |                 |          |
| 1...48 = Nominal value 1...48   |                 |          |
| 49...52 = Thumbwheel sets 1...4 |                 |          |

|                                                                   |                 |                                |
|-------------------------------------------------------------------|-----------------|--------------------------------|
| PAR: 9.x.5                                                        | P[007]...P[030] | -9999999 ... 1000 ... 99999999 |
| Cam begin / limit value<br>(limit value if cam function = 2 or 3) |                 |                                |
| -XXXXXXXX                                                         |                 |                                |

|            |                 |                                |
|------------|-----------------|--------------------------------|
| PAR: 9.x.6 | P[031]...P[054] | -9999999 ... 2000 ... 99999999 |
| Cam end    |                 |                                |
| -XXXXXXXX  |                 |                                |



|                |                 |              |
|----------------|-----------------|--------------|
| PAR: 9.x.7     | P[055]...P[078] | 0 ... 999999 |
| Hysteresis cam |                 |              |
| XXXXXX         |                 |              |

|                      |                 |         |
|----------------------|-----------------|---------|
| PAR: 9.x.8           | P[352]...P[375] | 0 ... 4 |
| Assign cam to output |                 |         |
| 0 = no output        |                 |         |
| 1...4 = output 1-4   |                 |         |

### **5.13 Menu 10 External thumbwheel sets**

#### **5.13.1 Submenu 10.1 Config**

|                           |        |         |
|---------------------------|--------|---------|
| PAR: 10.1.1               | P[376] | 0 ... 4 |
| Number of thumbwheel sets |        |         |
| 0 = inactive              |        |         |
| 1 = DW1                   |        |         |
| 2 = DW1+DW2               |        |         |
| 3 = DW1+DW2+DW3           |        |         |
| 4 = DW1+DW2+DW3+DW4       |        |         |

|                        |        |         |
|------------------------|--------|---------|
| PAR: 10.1.2            | P[377] | 0 ... 1 |
| Reading                |        |         |
| 0 = auto (every 100ms) |        |         |
| 1 = on ext. input      |        |         |

**5.13.2 Submenu 10.2 ...10.4 Set-1...4**

|                            |                 |                 |
|----------------------------|-----------------|-----------------|
| PAR: 10.x.1                | P[130]...P[133] | <b>0</b> ... 12 |
| Format                     |                 |                 |
| 0 = 7654321 (without sign) |                 |                 |
| 1 = x654321 (without sign) |                 |                 |
| 2 = xx54321 (without sign) |                 |                 |
| 3 = xxx4321 (without sign) |                 |                 |
| 4 = xxxx321 (without sign) |                 |                 |
| 5 = xxxxx21 (without sign) |                 |                 |
| 6 = xxxxxx1 (without sign) |                 |                 |
| 7 = -654321 (with sign)    |                 |                 |
| 8 = x-54321 (with sign)    |                 |                 |
| 9 = xx-4321 (with sign)    |                 |                 |
| 10= xxx-321 (with sign)    |                 |                 |
| 11= xxxx-21 (with sign)    |                 |                 |
| 12= xxxxx-1 (with sign)    |                 |                 |

|                              |                 |                            |
|------------------------------|-----------------|----------------------------|
| PAR: 10.x.2                  | P[120]...P[123] | <b>-999999</b> ... 9999999 |
| min                          |                 |                            |
| Definition of minimum value. |                 |                            |
| -XXXXXXXX                    |                 |                            |

|                              |                 |                            |
|------------------------------|-----------------|----------------------------|
| PAR: 10.x.3                  | P[124]...P[127] | -999999 ... <b>9999999</b> |
| Max                          |                 |                            |
| Definition of maximum value. |                 |                            |
| -XXXXXXXX                    |                 |                            |

|             |                 |                |
|-------------|-----------------|----------------|
| PAR: 10.x.4 | P[378]...P[381] | <b>0</b> ... 2 |
| Factor      |                 |                |
| 0 = x1      |                 |                |
| 1 = x10     |                 |                |
| 2 = x100    |                 |                |

## 5.14 Overview parameters

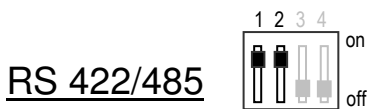
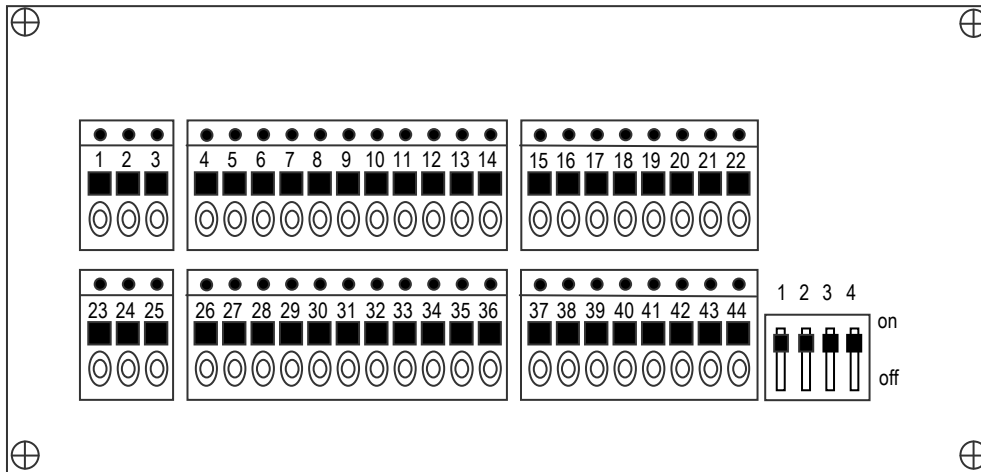
| <u>No</u>     | <u>Description</u>                 | <u>Menu</u>                   |
|---------------|------------------------------------|-------------------------------|
| [000]         | = Multiplier numerator             | 2.1.3/2.2.5/2.3.3/2.4.4/2.6.4 |
| [001]         | = Multiplier denominator           | 2.1.4/2.2.6/2.3.4/2.4.5/2.6.5 |
| [002]         | = Offset                           | 2.2.10/2.4.6/2.6.9            |
| [003]         | = Reference value 1                | 2.1.8/2.3.8                   |
| [004]         | = Counting range                   | 2.1.9/2.3.9                   |
| [005]         | = Adjustment value                 | 2.2.11/2.4.7/2.6.10           |
| [006]         | = Delta-SSI monitoring per cycle   | 2.2.12                        |
| [007]...[030] | = Cam begin / limit value          | 9.1.5...9.24.5                |
| [031]...[054] | = Cam end                          | 9.1.6...9.24.6                |
| [055]...[078] | = Hysteresis cam                   | 9.1.7...9.24.7                |
| [079]         | = Time-out in 0,01s units (APLink) | 2.5.2                         |
| [080]         | = Umin DA                          | 8.2.1                         |
| [081]         | = Umax DA                          | 8.2.2                         |
| [082]         | = S-Umin DA                        | 8.2.3                         |
| [083]         | = S-Umax DA                        | 8.2.4                         |
| [084]         | = Imin DA                          | 8.3.1                         |
| [085]         | = Imax DA                          | 8.3.2                         |
| [086]         | = S-Imin DA                        | 8.3.3                         |
| [087]         | = S-Imax DA                        | 8.3.4                         |
| [088]         | = Measuring time velocity          | 1.0.3                         |
| [089]         | = CAN adress Obj/PDO1 In           | 3.2.1                         |
| [090]         | = CAN adress Obj/PDO1 Out          | 3.3.1                         |
| [091]...[093] | = no function                      |                               |
| [094]...[97]  | = Dynamic cam output 1...9         | 6.1.2...6.9.2                 |
| [098]...[101] | = no function                      |                               |
| [102]         | = Reference value 2                | 2.1.10                        |
| [103]         | = Display counting range ( APLink) | 2.5.1                         |
| [104]         | = Measuring time analog input      | 7.2.5/7.3.5                   |
| [105]         | = U1 AD                            | 7.2.1                         |
| [106]         | = U2 AD                            | 7.2.2                         |
| [107]         | = S1 AD                            | 7.2.3                         |
| [108]         | = S2 AD                            | 7.2.4                         |
| [109]         | = I1 AD                            | 7.3.1                         |
| [110]         | = I2 AD                            | 7.3.2                         |
| [111]         | = S1 AD                            | 7.3.3                         |
| [112]         | = S2 AD                            | 7.3.4                         |
| [113]         | = min. value AD                    | 2.4.5                         |
| [114]         | = max. value AD                    | 2.4.6                         |
| [115]         | = gradient Start/Stop sensor       | 2.6.1                         |

| <u>No</u>     | <u>Description</u>                                | <u>Menu</u>                   |
|---------------|---------------------------------------------------|-------------------------------|
| [116]         | = 1/f Frequency                                   | 1.0.12                        |
| [117]         | = 1/f Display                                     | 1.0.13                        |
| [118]         | = measuring length Start/Stop sensor              | 2.6.2                         |
| [119]         | = geen functie                                    |                               |
| [120]...[123] | = min value thumbwheel sets                       | 10.2.2...10.5.2               |
| [124]...[127] | = max value thumbwheel sets                       | 10.2.3...10.5.3               |
| [128],[129]   | = geen functie                                    |                               |
| [130]...[133] | = format thumbwheel sets                          | 10.2.1...10.5.1               |
| [134]...[199] | = geen functie                                    |                               |
| [200]         | = Basic function                                  | 1.0.1                         |
| [201]         | = Input for actual position                       | 1.0.2                         |
| [202]         | = Integrator velocity                             | 1.0.4                         |
| [203]         | = Number of decimals                              | 1.0.5                         |
| [204]         | = Store function                                  | 1.0.6                         |
| [205]         | = Store signal                                    | 1.0.7                         |
| [206]         | = Power failure protection                        | 1.0.8                         |
| [207]         | = Service functions                               | 1.0.9                         |
| [208]         | = Default monitor function                        | 1.0.10                        |
| [209]         | = Counting direction ref. / zero-p.<br>adjustment | 2.1.7/2.2.9/2.3.7/2.6.8       |
| [210]         | = Input type and edge multiplication              | 2.1.1                         |
| [211]         | = Counting direction                              | 2.1.2/2.2.2/2.3.2/2.4.2/2.6.3 |
| [212]         | = Reference fine (input K0)                       | 2.1.5/2.3.5                   |
| [213]         | = Reference coarse                                | 2.1.6/2.2.8/2.3.6/2.6.7       |
| [214]         | = SSI code                                        | 2.2.1                         |
| [215]         | = Time-out reset (APLink)                         | 2.5.3                         |
| [216]         | = Number of SSI clockpulses                       | 2.2.3                         |
| [217]         | = Number of SSI databits                          | 2.2.4                         |
| [218]         | = adjustment (SSI)                                | 2.2.7                         |
| [219]         | = adjustment (Start/Stop)                         | 2.6.6                         |
| [220]         | = Maximum number of SSI errors                    | 2.2.13                        |
| [221]         | = SSI monitoring                                  | 2.2.14                        |
| [222]         | = no function                                     |                               |
| [223]         | = 1/f Display format                              | 1.0.14                        |
| [224]         | = Time basis (internal frequency)                 | 2.3.1                         |
| [225]         | = Integrator analog input                         | 7.2.6/7.3.6                   |
| [226]         | = Selection AD input                              | 7.1.1                         |
| [227]         | = min/max function AD                             | 2.4.4                         |
| [228]         | = Baudrate (Canbus)                               | 3.1.1                         |
| [229]         | = Function Obj/PDO1 In                            | 3.2.2                         |
| [230]         | = Function Obj/PDO1 Out                           | 3.3.2                         |
| [231]...[233] | = no function                                     |                               |

| <b>No</b>     | <b>Description</b>                 | <b>Menu</b>     |
|---------------|------------------------------------|-----------------|
| [234]         | = Source for Smin DA               | 8.2.5/8.3.5     |
| [235]         | = Source for Smax DA               | 8.2.6/8.3.6     |
| [236]         | = Unit adress                      | 4.1.1           |
| [237]         | = Baudrate (RS232)                 | 4.2.1           |
| [238]         | = Stopbits (RS232)                 | 4.2.2           |
| [239]         | = Parity (RS232)                   | 4.2.3           |
| [240]         | = Protocol (RS232)                 | 4.2.4           |
| [241]         | = no function                      |                 |
| [242]         | = Baudrate (RS422/485)             | 4.3.1           |
| [243]         | = Number of stopbits (RS422/485)   | 4.3.2           |
| [244]         | = Parity (RS422/485)               | 4.3.3           |
| [245]         | = Protocol (R422/485)              | 4.3.4           |
| [246]...[248] | = no function                      |                 |
| [249]...[252] | = Function input 1...4             | 5.0.1...5.0.4   |
| [253]         | = no function                      |                 |
| [256]...[279] | = Camfunction                      | 9.1.1...9.24.1  |
| [280]...[303] | = Source cam                       | 9.1.2...9.24.2  |
| [304]...[327] | = Source for cam begin/limit value | 9.1.3...9.24.3  |
| [328]...[351] | = Source for cam end               | 9.1.4...9.24.4  |
| [352]...[375] | = assign cam to output             | 9.1.8...9.24.8  |
| [376]         | = number of thumbwheel sets        | 10.1.1          |
| [377]         | = reading thumbwheel sets          | 10.1.2          |
| [378]...[381] | = factor thumbwheel sets           | 10.2.4...10.5.4 |
| [382]         | = geen functie                     |                 |
| [383]         | = Selection DA source              | 8.1.2           |
| [384]...[387] | = no function                      |                 |
| [388]         | = Selection DA output              | 8.1.1           |
| [389]...[392] | = Function output 1...4            | 6.1.1...6.4.1   |
| [393],[399]   | = no function                      |                 |

## 6 Connections

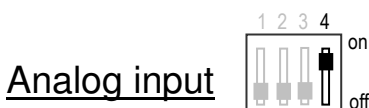
### Connections on the rear



If the AP40 is the last device, the DIP-switches 1 and 2 should be set to on.



If the AP40 is the last device in a CANbus network, DIP-switch 3 should be set to on.



When using the analog input as a current input, DIP-switch 4 should be set to on.

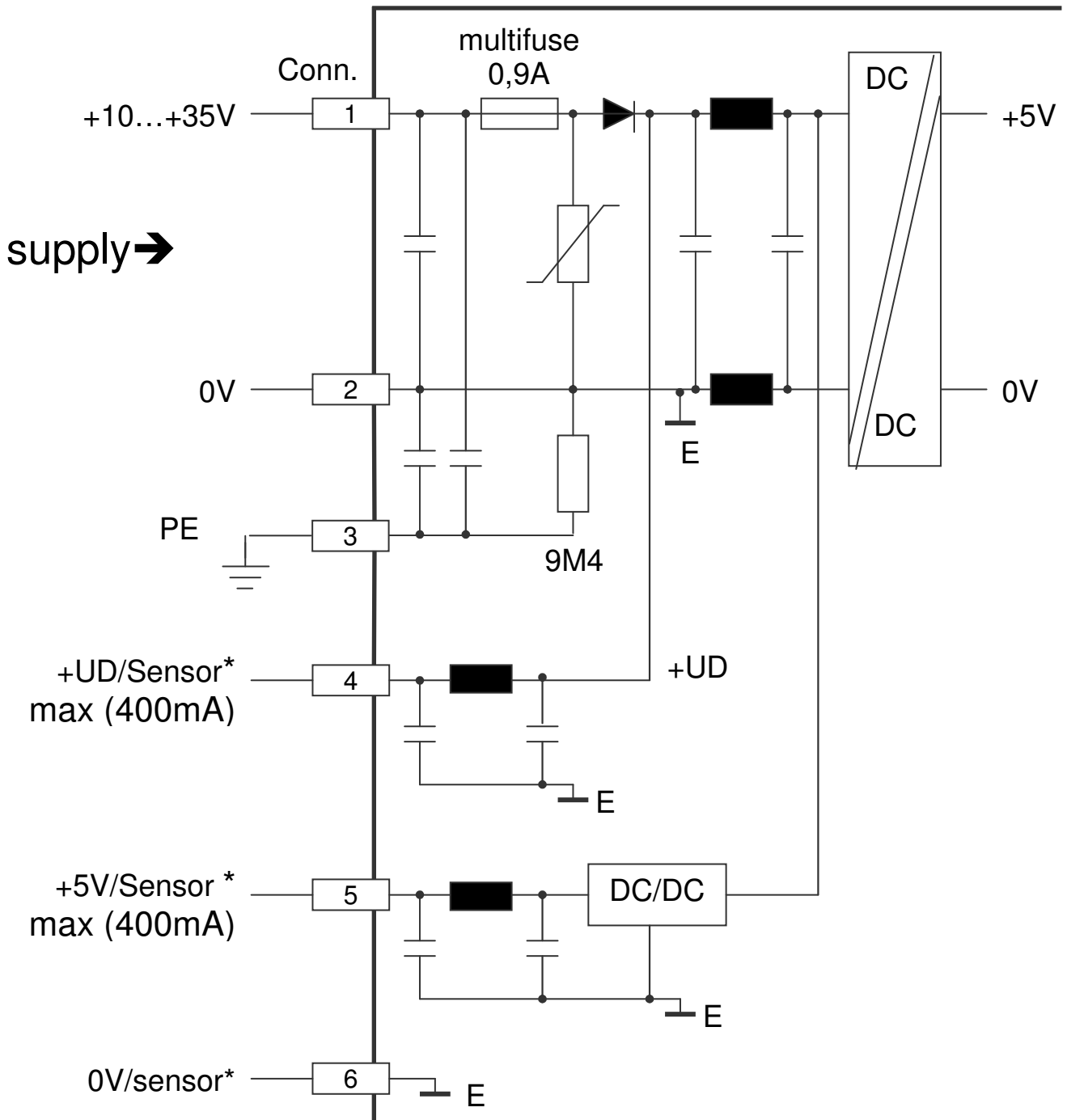
## **6.1 Overview clamp connections**

1. +10...+35V supply
2. 0V supply
3. PE supply
  
4. +10...35V DC supply output for sensor
5. +5V DC supply output for sensor
6. 0V for sensor
7. SSI-Clock+ or start+ signal Start/Stop sensor
8. SSI-Clock- or start- signal Start/Stop sensor
9. K1 or counting dir. or SSI-Data+ or stop+ signal Start/Stop sensor
10. /K1 or counting dir. or SSI-Data- or stop- signal Start/Stop sensor
11. K2 or counting pulse
12. /K2 or counting pulse
13. K0
14. /K0
  
15. +Analog in
16. –Analog in
17. 0V analog
18. U-Uit (0V is clamp 17)
19. I-Uit (0V is clamp 17)
20. CAN+ (0V is clamp 22)
21. CAN- (0V is clamp 22)
22. 0V Communication
  
23. +10...+35V supply (conected with clamp 1)
24. 0V supply (conected with clamp 2)
25. 0V supply (conected with clamp 2)
  
26. +U for outputs
27. 0V for outputs
28. Output-1
29. Output -2
30. Output -3
31. Output -4
32. Input-1
33. Input-2
34. Input-3
35. Input-4
36. common for inputs (0V)

- 37. Tx+
- 38. Tx-
- 39. Rx+
- 40. Rx-
- 41. 0V Communication
- 42. TxD
- 43. RxD
- 44. 0V Communication

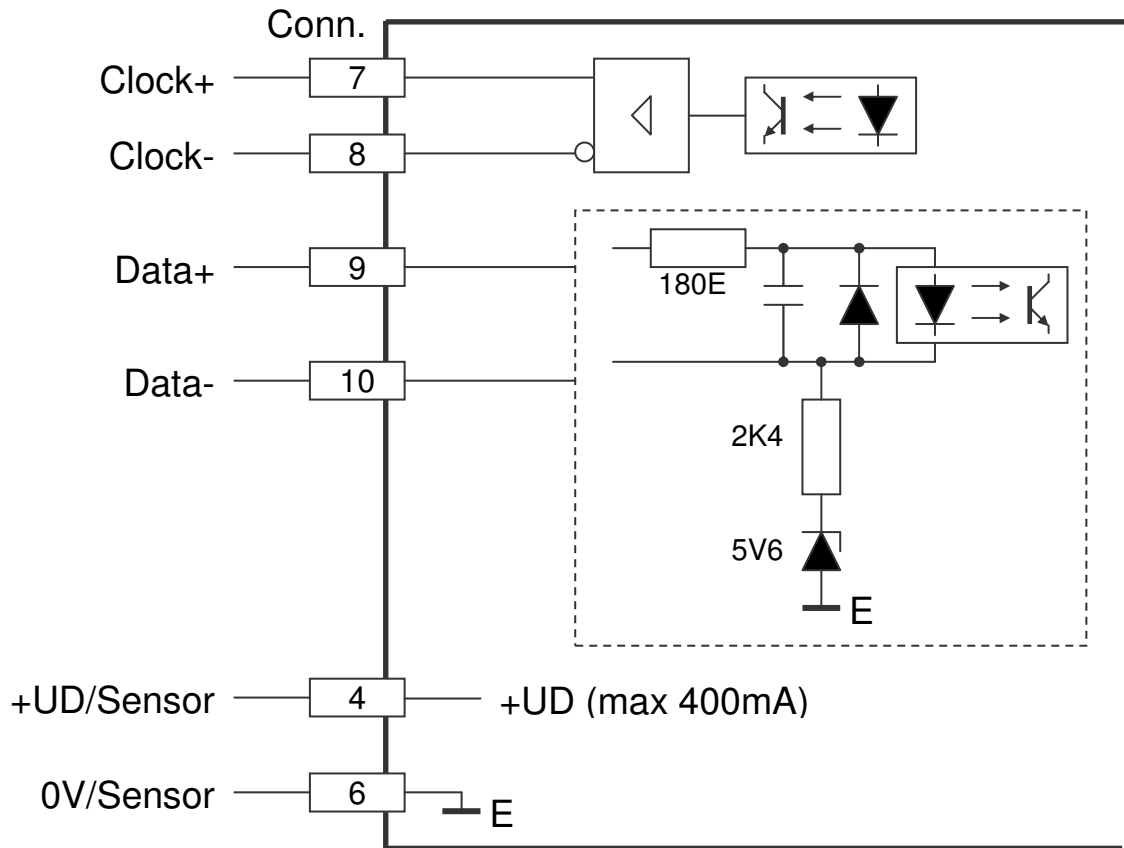


## 6.2 Supply

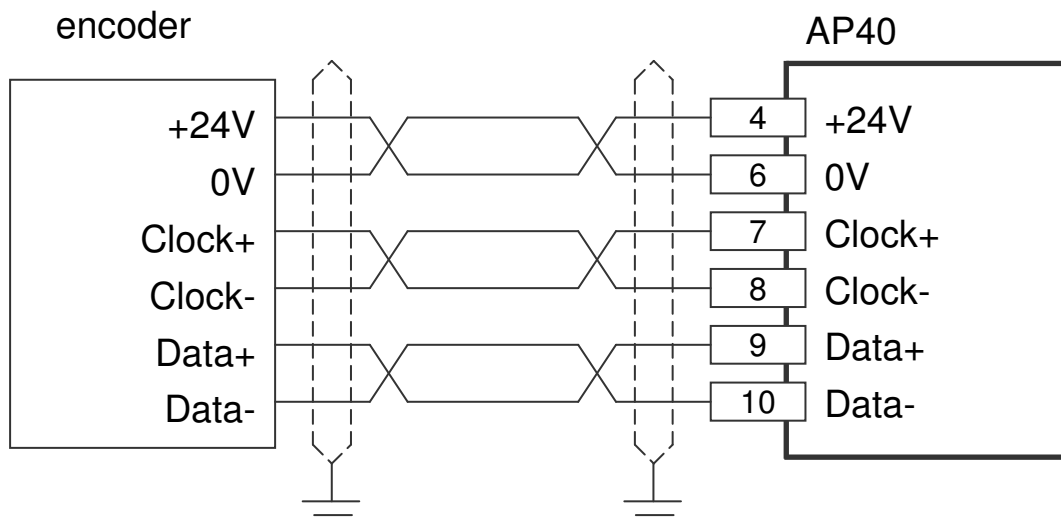


\* supply voltage for sensor

### 6.3 SSI input

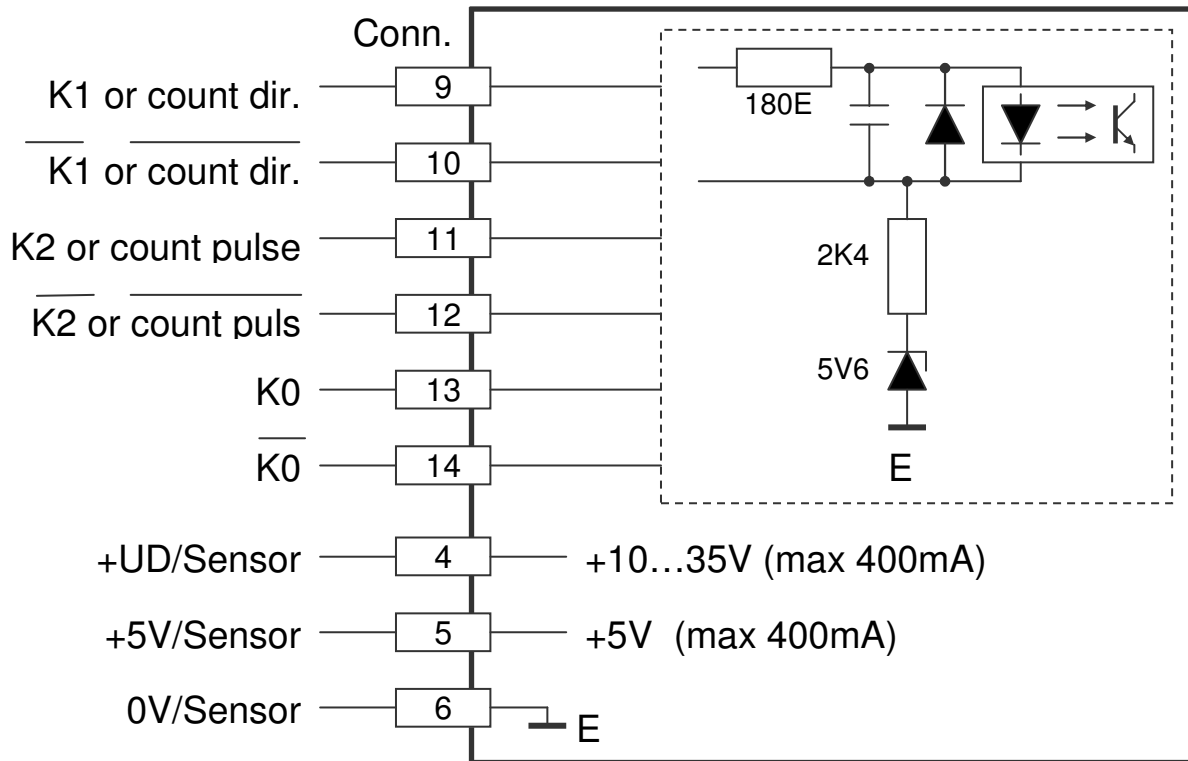


### 6.4 SSI encoder 24V



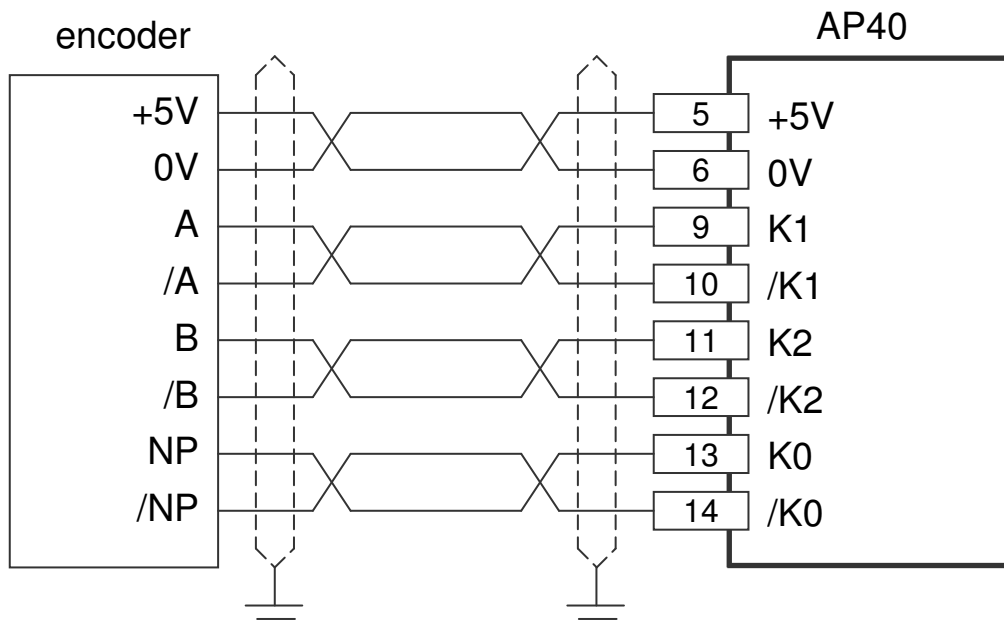
Supply voltage AP40 clamp 1 and 2 is 24V DC

### 6.5 Counting input

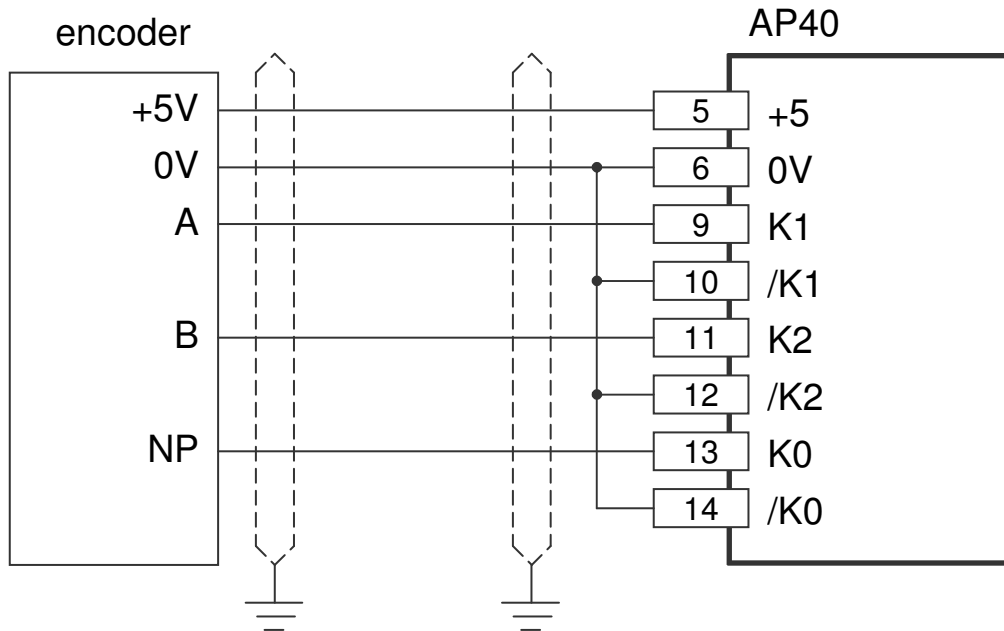


It is possible to use different voltage signals for K0 and K1, K2. For example: encoder signals (K1/K2) with a level of 5V and a reference fine (K0) with 24V level.

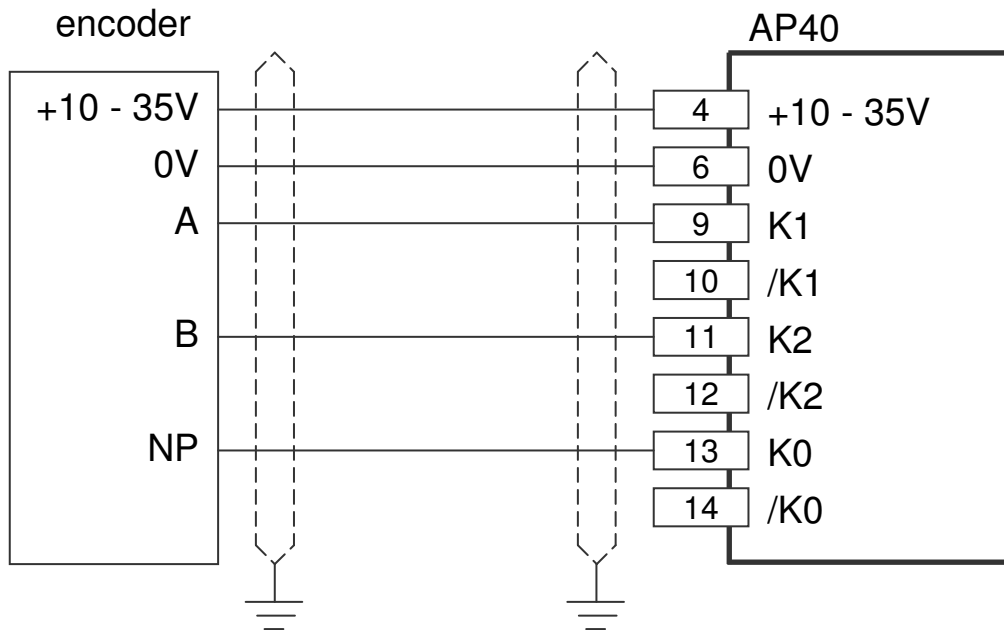
### 6.6 Encoder 5V with inverted signals



### 6.7 Encoder 5V without inverted signals

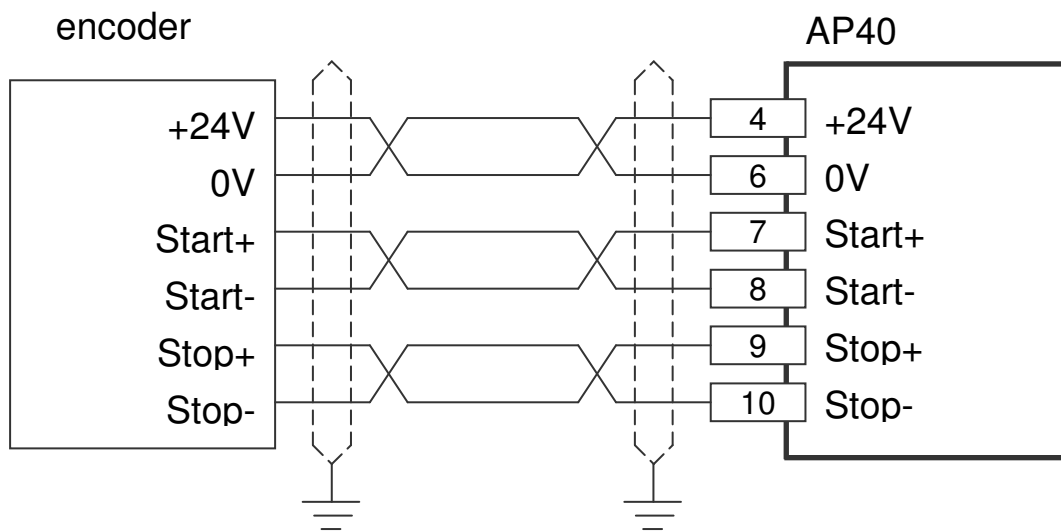


### 6.8 Encoder 10 – 30V



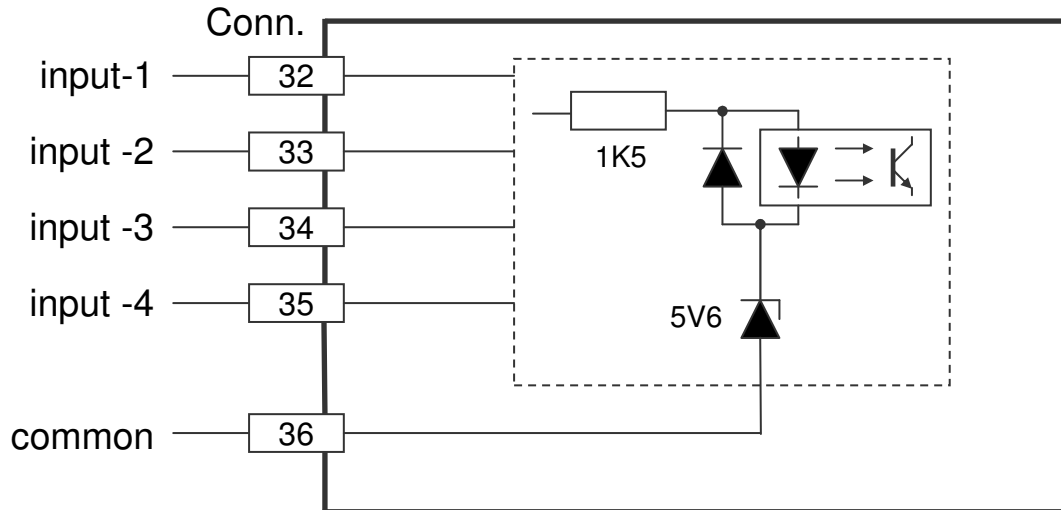
**CAUTION!**  
When using 24V encoders don't connect terminal 10,12 and 14.

### 6.9 Start/Stop sensor

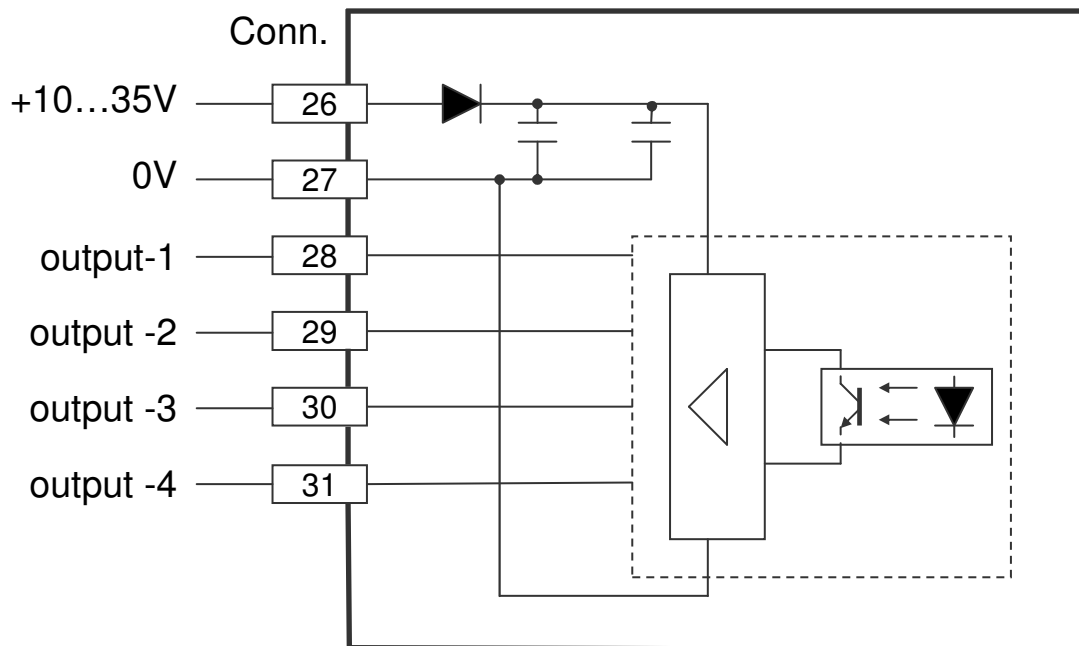


Supply voltage AP40 clamp 1 en 2 is 24V DC

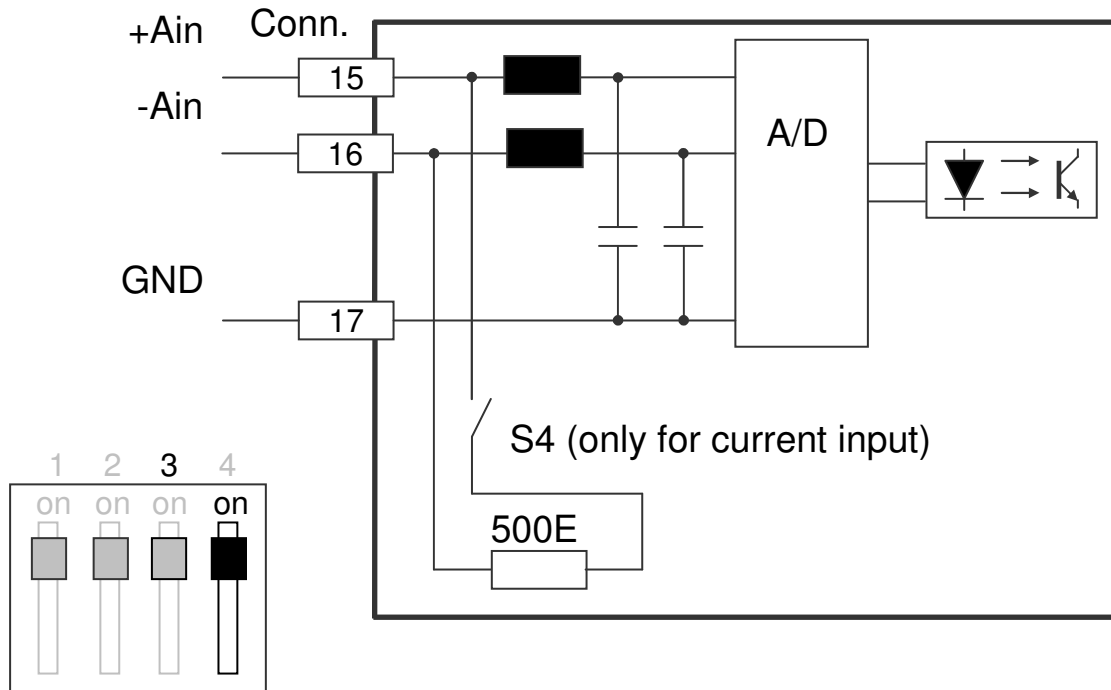
### 6.10 Digital inputs



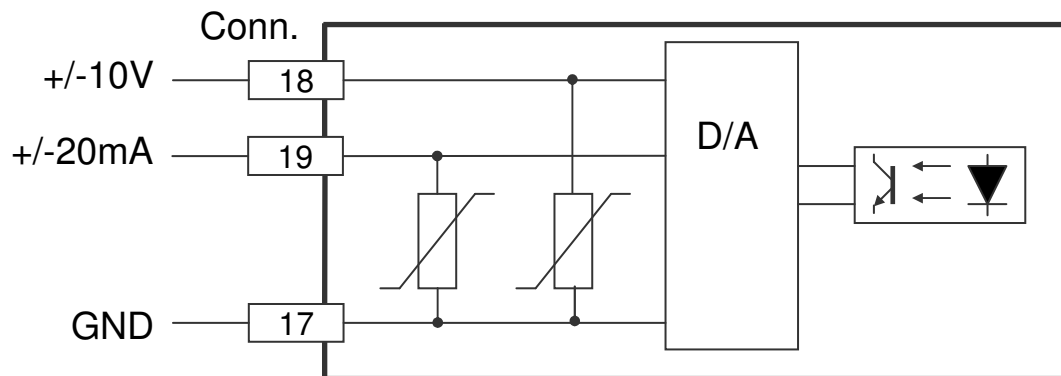
### 6.11 Digital outputs



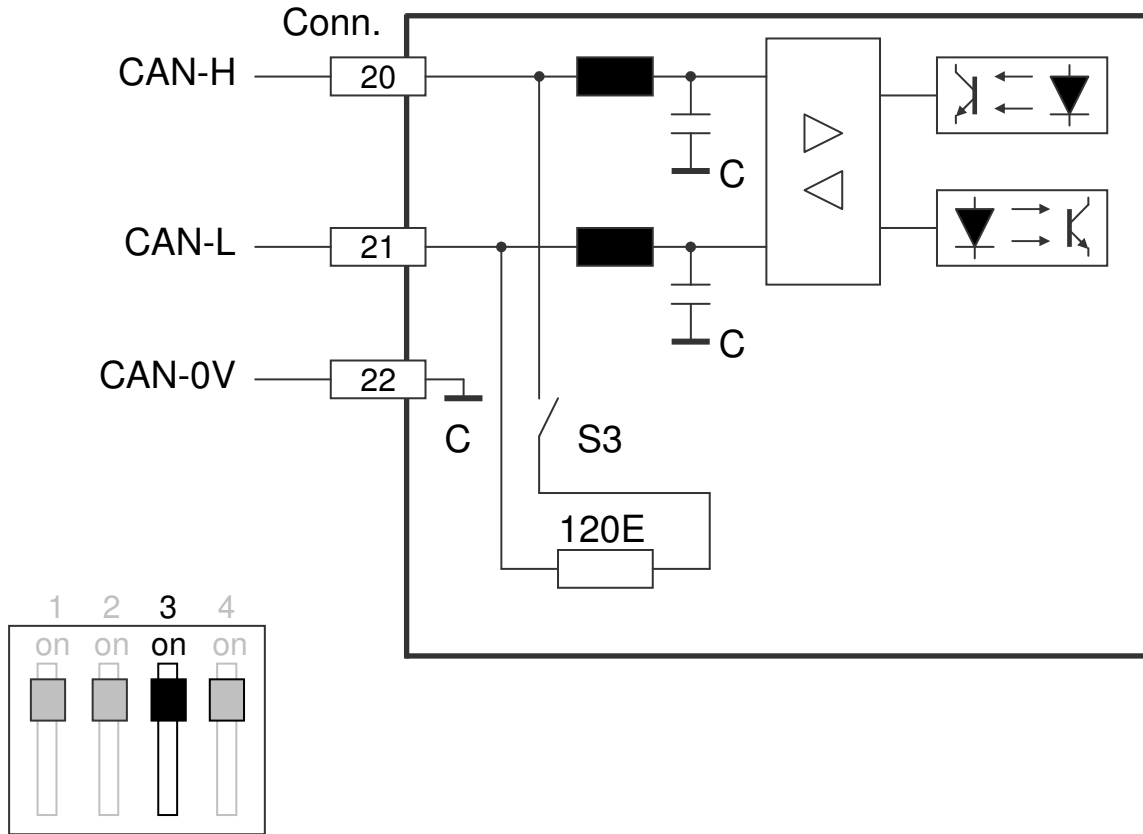
### 6.12 Analog input



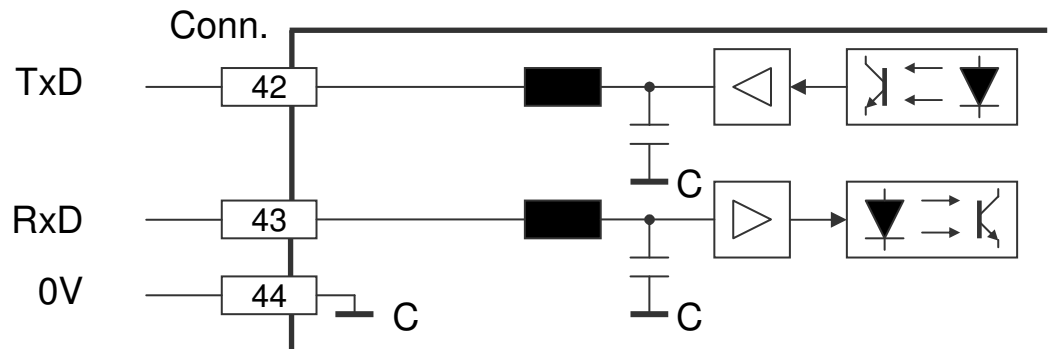
### 6.13 Analog output



### 6.14 CAN-bus

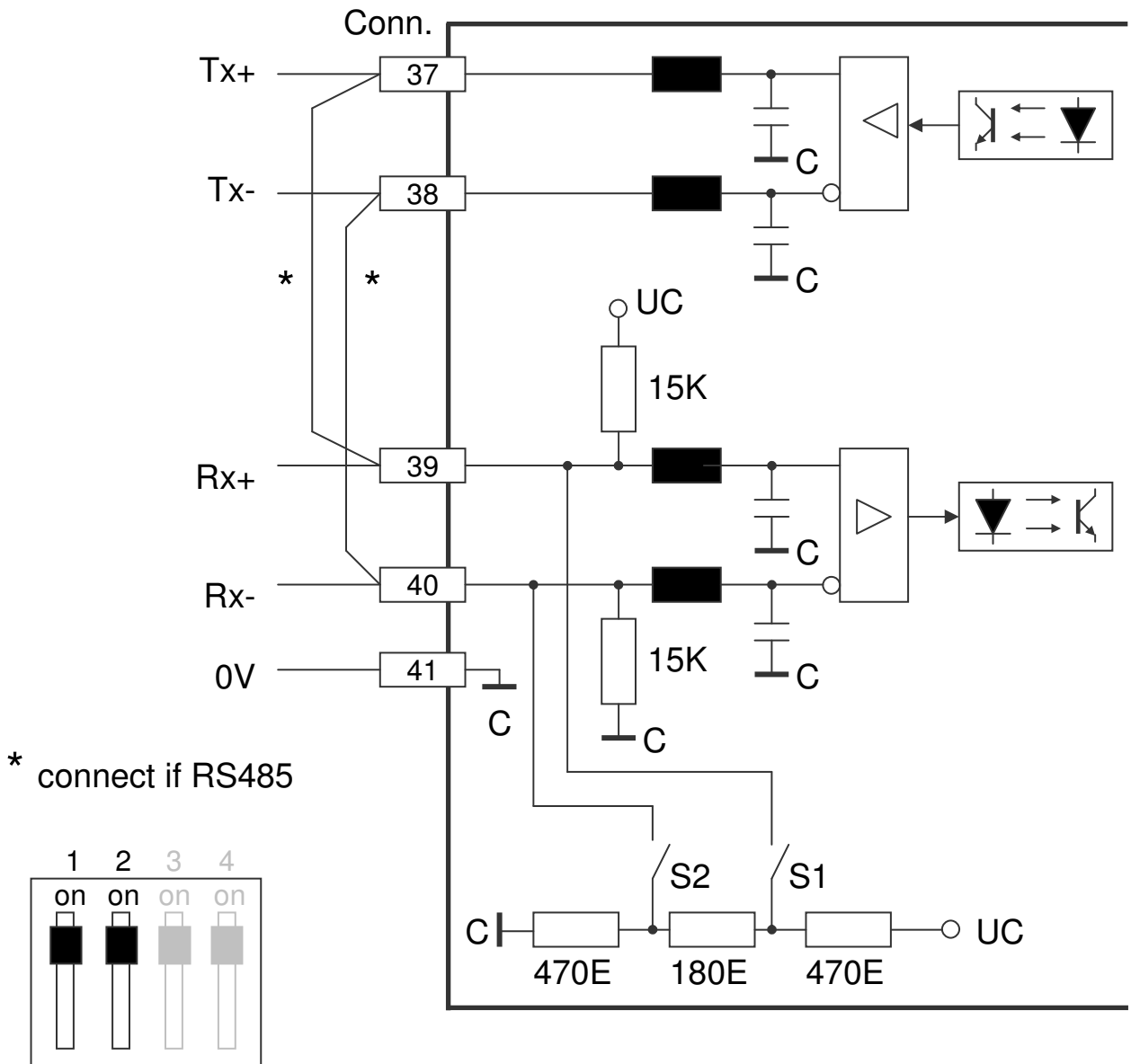


### 6.15 RS232 Ser-1





6.16 RS422/485 Ser-2



## 7 Technical specifications

### 7.1 Specifications

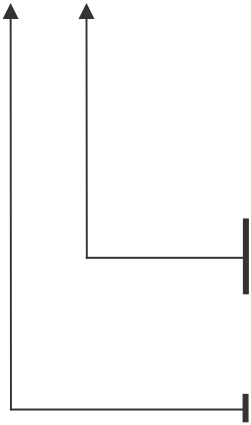
|                     |                                                                                                |
|---------------------|------------------------------------------------------------------------------------------------|
| - Supply voltage    | 10...35V DC (power failure not active)<br>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<br>high (5V): +2.8V...+5V<br>low (24V): 0...+5V<br>high (24V): +15V...+35V |
| voltage output      | 5,3V max. 350mA                                                                                |
| input resistor      | appr. 3kOhm at 24V<br>appr. 0.35kOhm at 5V                                                     |
| input frequency     | max. 150 kHz                                                                                   |
| impulswidth K0      | min. 2μ S                                                                                      |
| - SSI               | optically isolated                                                                             |
| data-input          | low 0...+0,8V<br>high +2,8V...+5V                                                              |
| clock-output        | driver (RS422)                                                                                 |
| clock-frequency     | 125 kHz (138,9 kHz if > 26 bit encoder signal)                                                 |
| - Start/Stop        | optically isolated                                                                             |
| stop-input          | low 0...+0,8V<br>high +2,8V...+5V                                                              |
| start-output        | driver (RS422)                                                                                 |

- Digital inputs 1...4
  - input resistor
 optically isolated  
 low: 0...+5V  
 high: +10V...+35V  
 appr. 1.8kOhm at 24V
  
- Digital outputs 1...4
  - I<sub>max</sub>
  - Supply voltage
 optically isolated, N FET, short-circuit proof  
 500 mA (min load 200 μA)  
 35V max.
  
- Voltage input
  - range
  - resolution
  - offset-temp. coeff.
  - R<sub>in</sub>
 galvanically isolated  
 max. -10V ... +10V  
 305 μV  
 < 20 ppm/ °C  
 30 Kohm
  
- Current input
  - range
  - resolution
  - offset-temp. coeff.
  - R<sub>in</sub>
 galvanically isolated  
 max. -20mA ... +20mA  
 610 μA  
 < 20 ppm/ °C  
 500 Ohm
  
- Voltage output
  - range
  - resolution
  - offset-temp. coeff.
  - I<sub>max</sub>
 galvanically isolated  
 max. -10V ... +10V  
 305 μV  
 < 20 ppm/ °C  
 +/-12mA
  
- Current output
  - range
  - resolution
  - offset-temp. coeff.
  - R<sub>max</sub>
 galvanically isolated  
 max. -20mA ... +20mA  
 610 μA  
 < 20 ppm/ °C  
 550 Ohm
  
- Serial communication
  - Ser-1
  - Ser-2
 RS232 C  
 RS422/485
  
- CAN-bus
  - protocol
  - input objects (PDOs)
  - output objects (PDOs)
 AP-Link  
 1 (each 64 bit data width)  
 1 (each 64 bit data width)



### 7.2 Typekey

AP40- C X



**Analog output**

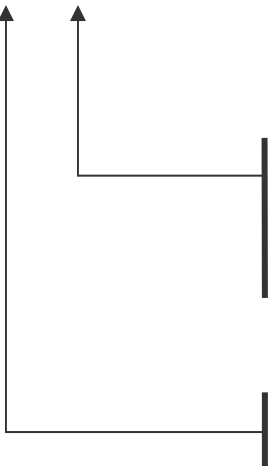
- 0 = no analog in- and output
- A = analog in- and output

**Serial communication**

- C = RS232, RS422/485 and CANbus

### 7.3 Typekey Thumbwheel sets

APD- X X



**Number of decades**

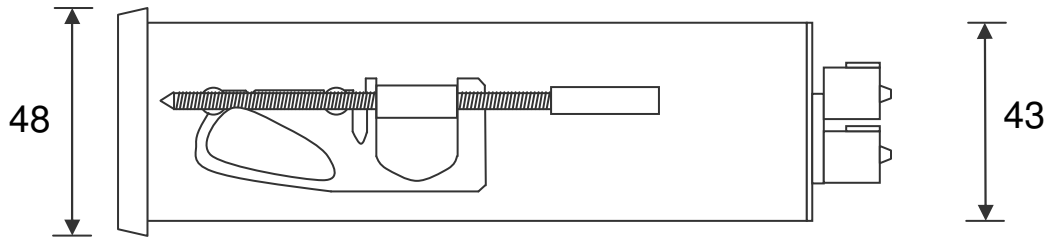
- 4 = 4 decade
- 5 = 5 decade
- 6 = 6 decade
- 7 = 7 decade (no sign possible)

**Sign**

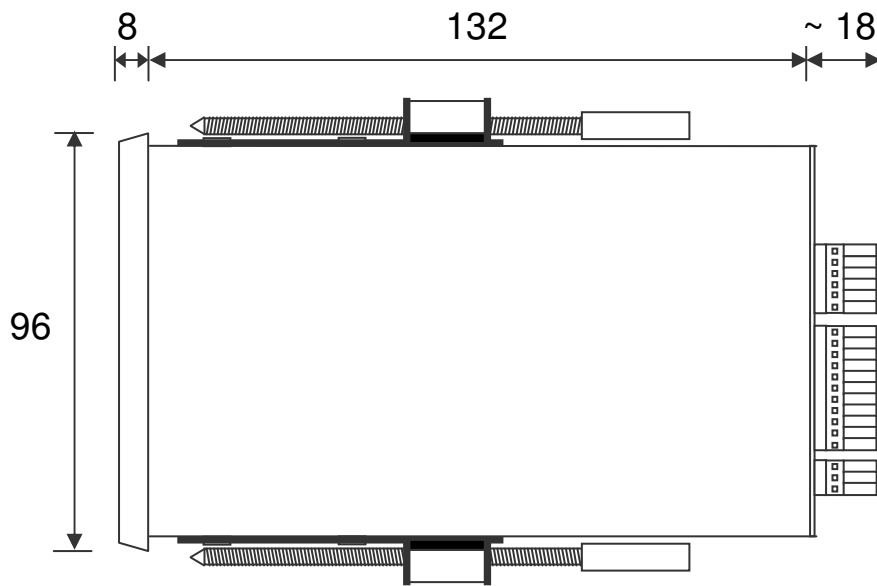
- 0 = no sign
- T = with sign

### 7.4 Dimensions AP40

Side view

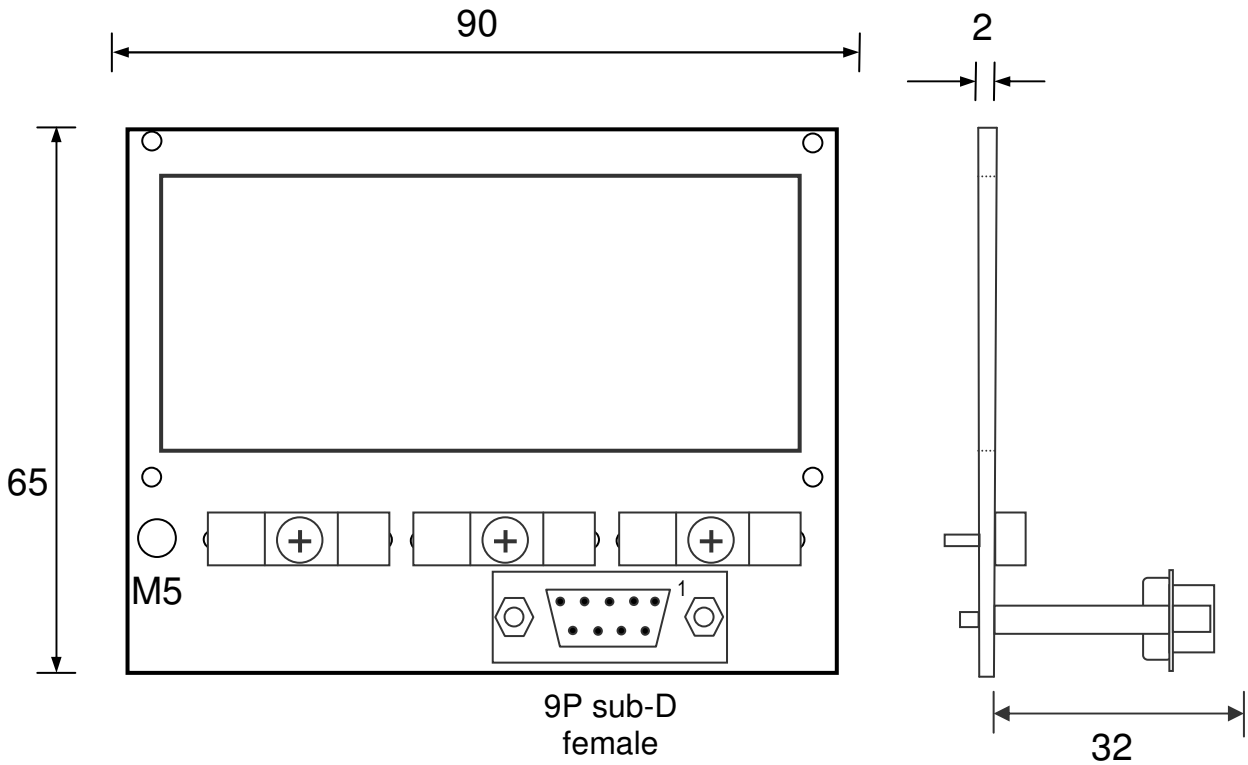


Top view

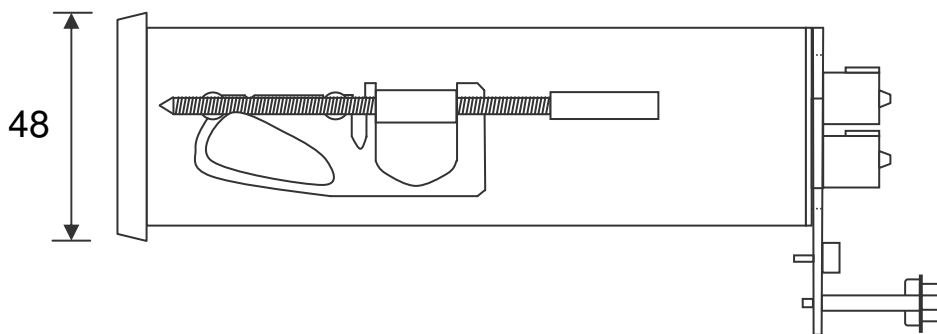


### 7.5 Dimensions EMC bracket type EMC-B04

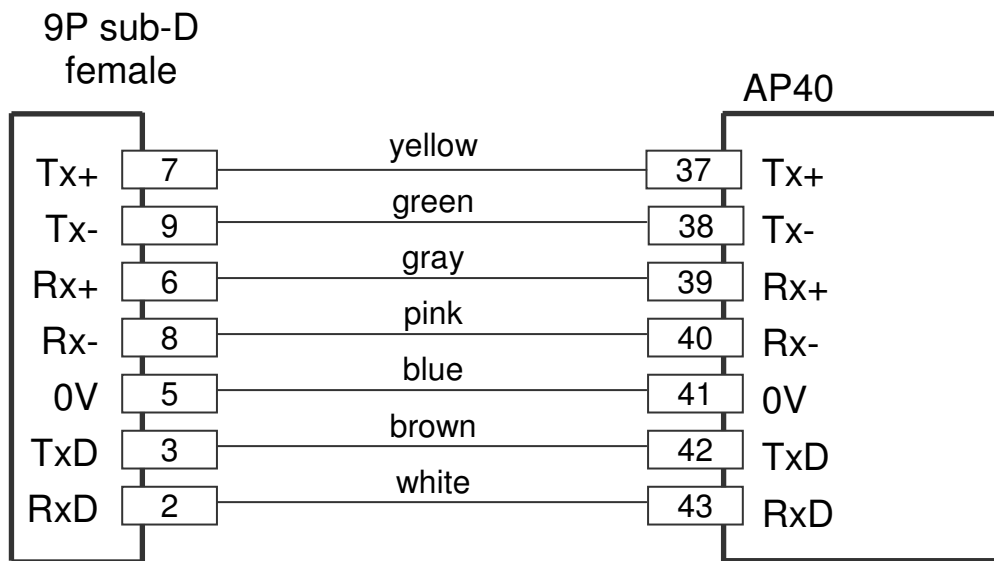
With RS232 and RS422/485 (9P sub-D) on EMC bracket



Side view EMC bracket

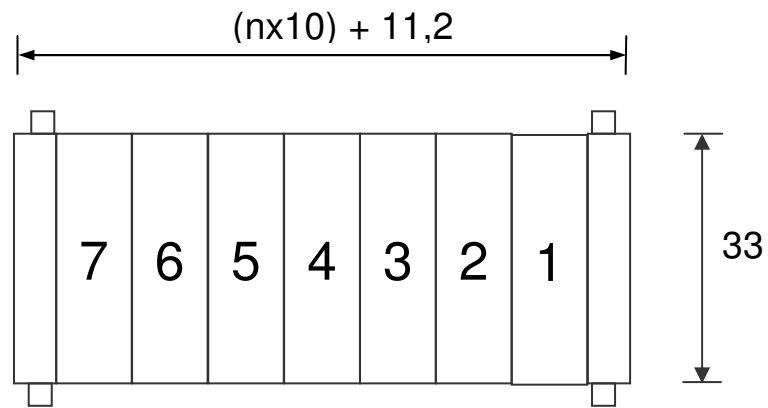


### 7.5.1 Connections RS232, RS422/485 on 9P sub-D connector

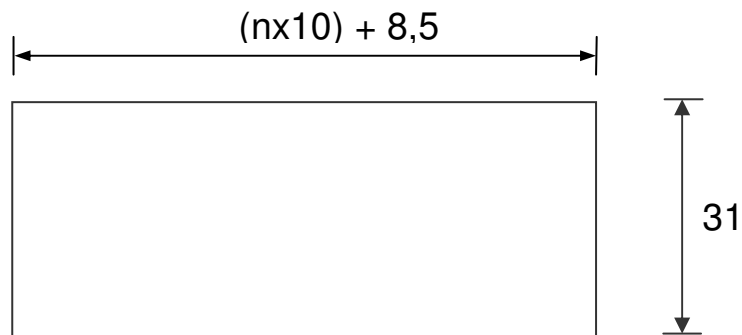




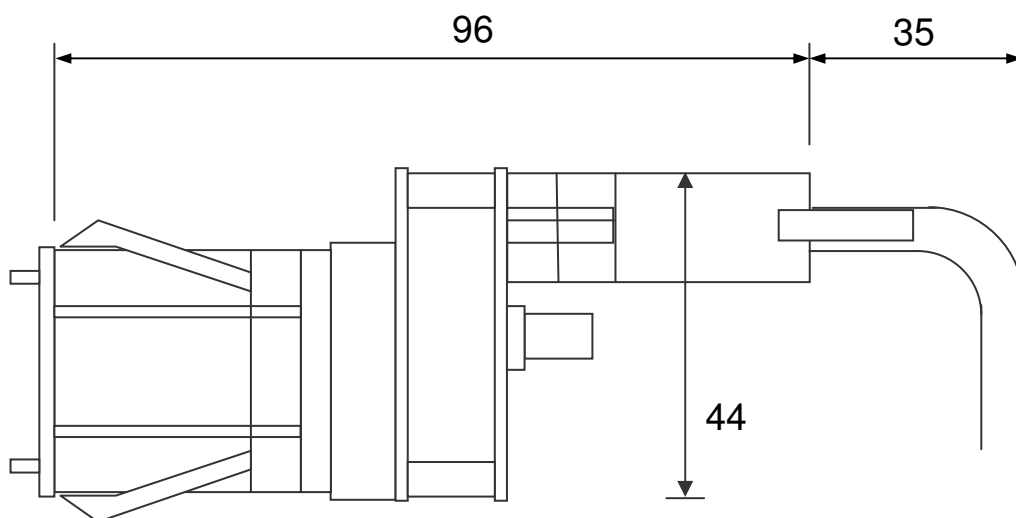
### 7.6 Dimensions thumbwheel switches APD-xx



Cut-out



Side view



### 7.7 Dimensions protective hood type CDS-B02

