

# AX 346

## Versatile Process Indicator With Two Analogue Inputs and Adjustable Analogue Output



- Two analogue inputs, each +/- 10V oder 0/4 – 20 mA with individual scaling
- Operation modes to display input A, input B or combined values A+B, A-B, AxB and A:B
- Selectable linearisation function with 16 interpolation points
- Adjustable analogue output, +/-10 V or 0/4 – 20 mA, proportional to the display
- Power supply 115/230 VAC and 17 – 30 VDC in one unit
- Auxiliary output 24 VDC / 100 mA for sensor supply

## Operating Instructions



## Safety Instructions

- This manual is an essential part of the unit and contains important hints about function, correct handling and commissioning. Non-observance can result in damage to the unit or the machine, or even in injury to persons using the equipment !
- The unit must only be installed, connected and activated by a qualified electrician
- It is a must to observe all general and also all country-specific and application-specific safety standards
- When this unit is used with applications where failure or maloperation could cause damage to a machine or hazard to the operating staff, it is indispensable to meet effective precautions in order to avoid such consequences
- Regarding installation, wiring, environmental conditions, screening of cables and earthing, you must follow the general standards of industrial automation industry
- - Errors and omissions excepted –

Version:	Description:
AX34601a_e_A5/Feb06/HK/KK	Original edition

# Table of contents

1.	Introduction .....	4
2.	Electrical Connections.....	5
2.1.	Power Supply .....	5
2.2.	Auxiliary Power Output .....	5
2.3.	Analogue Inputs A and B .....	6
2.4.	Adjustable Analogue Output.....	6
2.5.	GND Potential Considerations .....	6
3.	Configuration of the Analogue Inputs.....	7
4.	How to Operate the Front Keys.....	9
5.	Basic Set-Up and Operational Parameters .....	10
5.1.	Basic Set-Up .....	10
5.2.	Operational Parameters .....	11
5.2.1.	Operational parameters with single channel mode .....	11
5.2.2.	Operational parameters with dual channel mode .....	12
5.2.3.	Operational parameters for the combined modes ( A+B, A-B, AxB, A:B ).....	13
5.2.4.	Parameters for scaling of the analogue output .....	14
5.2.5.	Parameters for generation of a linearisation curve .....	15
6.	Technical Appendix.....	17
6.1.	Compendium of the Operator Menu .....	17
6.2.	Dimensions .....	18
6.3.	Technical Specifications .....	19
6.4.	Parameter Table.....	20

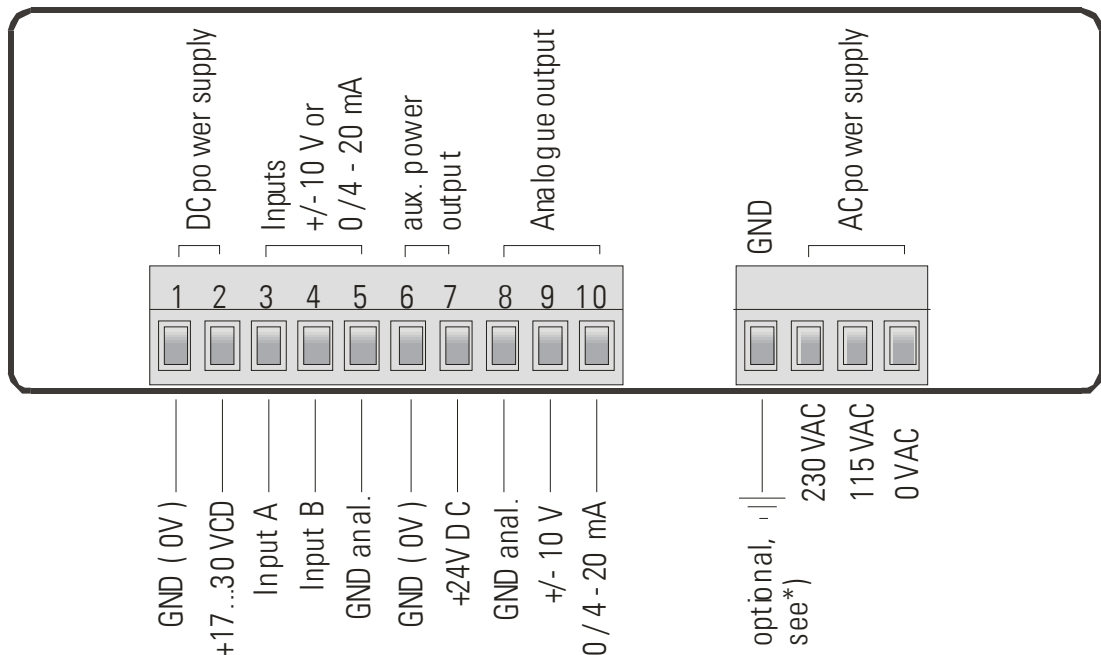
# 1. Introduction

The AX346 process indicator has been designed for applications requiring superior measuring technology. The unit provides two separate analogue inputs with individual scaling parameters, a 6-decade LED display and an adjustable analogue output.

Because of the possibilities to calculate combined values like difference or ratio of the two inputs, and by the in-built facility of programmable linearisation, this unit is also suitable to operate as a signal converter (e.g. to convert the ratio of two analogue signals into a programmable curve and to form a new analogue signal from the result again).

The unit is easy to set-up by means of the front keys and a clear menu structure. AX346 is built into a standard DIN housing, designed for front panel mounting.

## 2. Electrical Connections



\*) This grounding terminal is internally connected to the GND potential. Grounding of this terminal is not necessary, neither for safety nor for EMC reasons. With some applications however it may be desirable to connect the measuring GND to another ground or earth potential.

Please note that earthing of this terminal will tie to earth all internal analogue and digital GND potentials. Multiple earthing should be avoided (e.g. if the minus pole of your DC power supply should already be earthed externally)

### 2.1. Power Supply

Terminals 1 and 2 provide DC supply from a 17 to 30 volts DC power unit. The current consumption depends on the level of the input voltage and is typically 130 mA with 17 volts and 80 mA with 30 volts (sensor current taken from the aux. output not included).

Terminals 0 VAC, 115 VAC and 230 VAC provide supply of the unit directly from the mains. The total AC power rating is 7.5 VA.

### 2.2. Auxiliary Power Output

Terminal 7 provides a 24 volts DC output (max. 100 mA) for supply of transducers or sensors. This output is available with AC power supply and DC power supply as well.

## 2.3. Analogue Inputs A and B

The unit provides two analogue inputs with a common GND potential (input A and input B). Both input signals refer to the „Analogue GND“ potential of terminal 5, which internally is connected to the other GND terminals 1, 6 and GND. Both inputs are individually adjustable as voltage inputs (+/-10 volts) or current inputs (0/4 – 20 mA), by means of internal jumpers (see 3.)

Ex factory all jumpers are set to current inputs

## 2.4. Adjustable Analogue Output

The unit provides a voltage output with ranges 0 – 10 volts or -10 to + 10 volts (output current max. 2 mA), and a current output 0/4 – 20 mA (external load 0 – 300 Ohms). The resolution of the output is 14 bits and the update time of the output is approx. 7 milliseconds.

## 2.5. GND Potential Considerations

Internally, the GND terminals of the analogue inputs and the analogue outputs are all connected to the negative terminal of the DC power input. For this reason it is not possible to loop analogue current signals through several units, except these units are supplied by the AC terminals, or by means of separate and isolated DC power units.

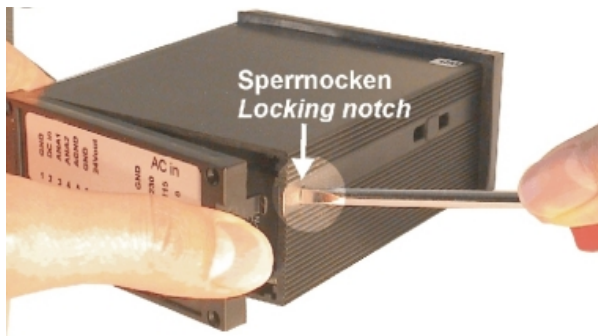
### 3. Configuration of the Analogue Inputs

Depending on the application of the analogue inputs it may be necessary to set the internal jumpers correspondingly.

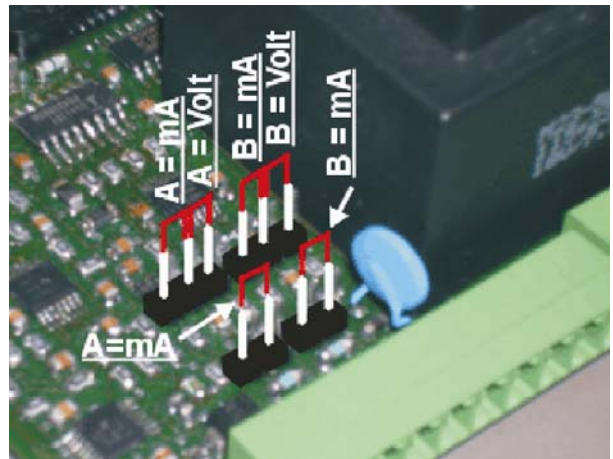
Where your input signals are current signals (0-20 mA or 4-20 mA), there is no need to change any jumper settings and you may skip this section.

Where however one or both inputs should be used for voltage, it is necessary to set the jumpers as shown below.

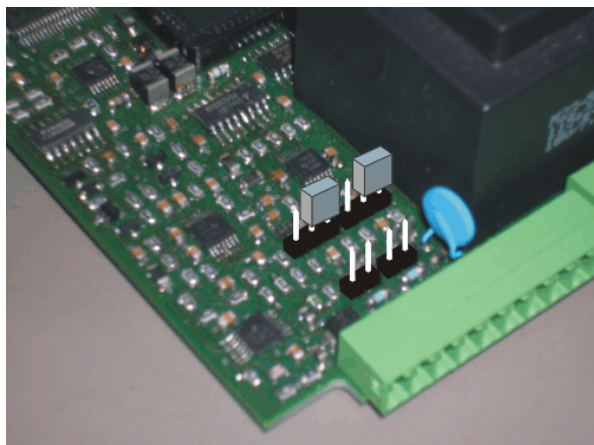
To access the jumpers, please disconnect all screw terminal strips first, then remove the back panel of the unit and pull out the PCB.



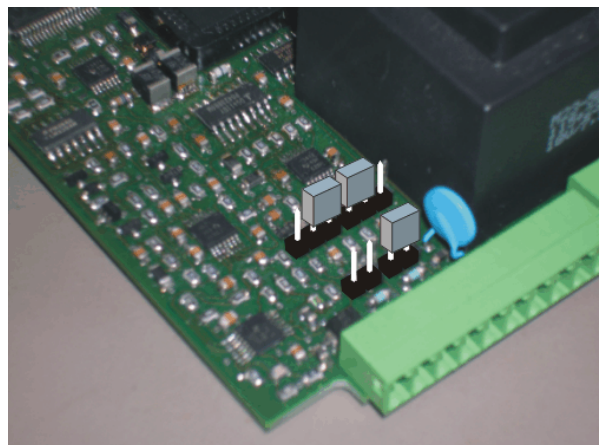
Remove the back plane



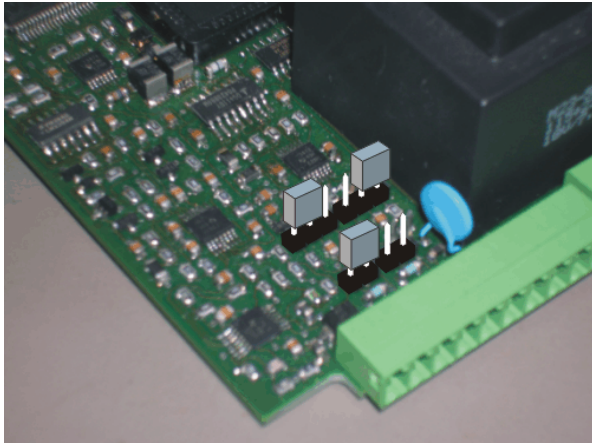
Location and function of the jumpers



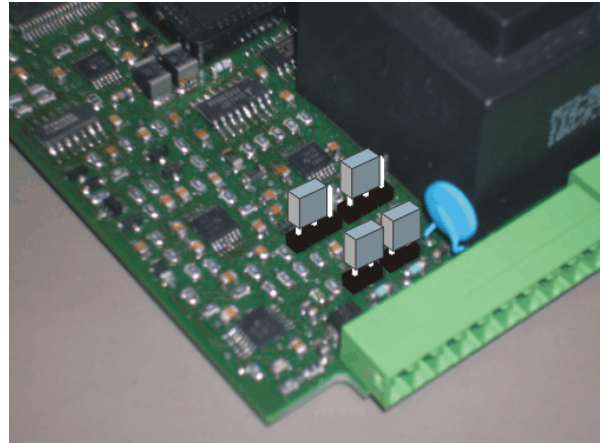
Input A = voltage, Input B = voltage



Input A = voltage, Input B = current



Input A = current, Input B = voltage



**Default factory setting:**  
Input A = current, Input B = current



- Current inputs are automatically set to an input signal range of 0 to 20 mA or 4 to 20 mA
- Voltage inputs are set to an input signal range of -10 volts to +10 volts.

Where your application needs a different voltage range, you can modify the corresponding input to accept voltages up to 120 volts, by adding a serial resistor to the input terminal (please observe safety standards!)

The subsequent formula shows how to calculate the serial resistor.

$$R_x [k\Omega] = 3 \times U_x [V] - 30$$

R<sub>x</sub> = Wert des Vorwiderstandes  
U<sub>x</sub> = Maximale Eingangsspannung





Example: If your input range should be 100 volts:  $R_x = 300 - 30 (k\Omega) = 270 k\Omega$

When afterwards you set the scaling of the display, your individual input range will be treated like a 10 volts input signal without an external resistor.



## 4. How to Operate the Front Keys

All settings are done by means of two front keys. A third key on the utmost right side of the panel is reserved for special key operations, but not in use with standard AX346 units.

-  ENTER key: scrolls through the menu headlines.
-  SET key: selects the actual menu and allows to choose the desired setting or to adjust the desired numeric value of the actual parameter.
-  ENTER key: confirms and stores the actual parameter choice and changes over to the next menu item.
-  Key reserved for special operations (not in use with standard AX346 units)

**To start the menu dialogue, please keep ENTER down for at least 3 seconds.**

With numerical entries, at first the lowest digit will blink. When keeping the SET key down, the highlighted digit will scroll in a continuous loop from 0 ... 9 ... 0 ... 9. When you release the SET key, the actual digit will remain and the next digit will be highlighted (blink). This procedure allows to set all digits to the desired values. After the most significant digit has been set, the low order digit will blink again and you can do corrections if necessary. With signed parameters, the high order digit will only scroll between the values "0" (positive) and "-" (negative) To store the actual setting, press the ENTER key, which will also automatically scroll forward the menu.

The unit changes from programming mode to normal operation when you keep down the ENTER key again for at least 3 seconds.

Furthermore a "time-out" function will automatically conclude every menu level, when for a break period of 10 seconds no key has been touched. In this case, any entry which has not been confirmed by ENTER yet would remain unconsidered.

At any time it is possible to **Reset all parameters to the Factory Default Settings**

To do this, power the unit down, and keep the ENTER key down while you power the unit up again. This will set the unit to the factory default state. See the parameter default values from the parameter list at the end of this manual.

# 5. Basic Set-Up and Operational Parameters

## 5.1. Basic Set-Up

The basic settings described below are in general non-recurring and must only be done upon the very first commissioning of the unit. The basic menu includes the selection of the desired operation mode and the desired brightness of the LED display.

To start the basic set-up procedure, keep down both front keys at a time for at least 3 seconds.

Menu	Selection	Text	Description
MODE		Mode	Operating mode of the unit
	SINGLE	Single	Single channel (input A only)
	DUAL	Dual	Dual channel (input A and input B separately)
	A + B	A + B	Summing mode (input A + input B)
	A - B	A - B	Differential mode (input A - input B)
	A ÷ B	A ÷ B	Ratio mode (input A : input B)
	A * B	A * B	Multiply mode (input A x input B)
BRIGHT		Bright	Brightness of display ( 20, 40, 60, 80 or 100 % )
UPDATE		Update	Update time Updates the display every x.xxx seconds.
CODE		Code	Access code for the programming keys
	no	no	Keys are open for programming
	ALL	ALL	Keys are locked for all operations
LINEAR		Linear	Linearisation mode
	no	no	Linearisation is off, all linearisation parameters are irrelevant
	1-QUA	1-qua	Linearisation in the range 0 - 99999.
	4-QUA	4-qua	Linearisation in the range -99999 bis +99999.
A-CHAR		A-CHAR	Analogue output characteristics
	-10_10	-10_10	Full voltage range, -10V bis +10V
	0_10	0_10	Positive voltage range only, 0 - 10V
	0_20	0_20	Current range 0 - 20 mA
	4_20	4_20	Current range 4 - 20 mA

Menu	Selection	Text	Description
GA in		GAin	Maximum output swing of the analogue output Setting 1000 results in an output swing of 10 volts or 20 mA. Setting 200 reduces the swing to 2 volts or 4mA
OFFSEt		OFFSEt	Zero output of the analogue output Setting 0.000: Output generates 0 volts respectively 0 mA with zero in display. Setting 5.000: Output generates already 5 volts respectively 10 mA with zero in display

## 5.2. Operational Parameters

After completion of the basic set-up we are ready to set the operational parameters.

**To start the menu, keep the ENTER key down for at least 3 seconds.**

The operational menu will now appear in the display.

Parameters to set the analogue output appear at the end of every menu and are absolutely identical with all modes. Therefore these parameters are described only once and separately under section 5.2.4.

To exit the parameter menu you can either press the ENTER key for 3 another seconds again, or just wait for automatic exit via time-out function.

Where your keypad is locked by the access code locking, every key action will first display



If this is true, you can unlock the keys by pressing the keys in the sequence



within 10 seconds. If not, the unit would automatically return to the normal display function.

### 5.2.1. Operational parameters with single channel mode

Menu	Selection	Text	Description
InPut A		Input A	Input range A
	in U	in U	Voltage input 0 - +/-10 V
	in i0	in i0	Current input 0 – 20 mA
	in i4	in i4	Current input 4 – 20 mA
StArT A		Start A	Start value which the unit will display with a zero input signal of 0 volts or 0/4 mA
End A		End A	End value which the unit will display with a full scale input of 10 volts or 20 mA

Menu	Selection	Text	Description
FILT A		Filt A	Digital filter to smooth unsteady display caused by ripple or fluctuation of the input signal.
	OFF	OFF	Filtering off
	16	2, 4, 8, 16	Filter with 2, 4, 8 or 16 floating average determinations
dPoi A		dPoiA	Decimal point position of channel A display Choose from the formats shown in the display

### 5.2.2. Operational parameters with dual channel mode

With this mode the SET key provides a toggle function between channel A and channel B. Both channels can be scaled fully separately.

A LED bar in the most significant decade of the display indicates if your actual reading is channel A or channel B.

Menu	Selection	Text	Description
InPut A		Input A	Input range channel A
	in U	in U	Voltage input 0 - +/-10 V
	in .0	in i0	Current input 0 – 20 mA
	in .4	in i4	Current input 4 – 20 mA
StArT A		Start A	Start value which the unit will display with a zero input signal of 0 volts or 0/4 mA
End A		End A	End value which the unit will display with a full scale input of 10 volts or 20 mA
FILT A		Filt A	Digital filter to smooth unsteady display caused by ripple or fluctuation of the input signal.
	OFF	OFF	Filtering off
	16	2, 4, 8, 16	Filter with 2, 4, 8 or 16 floating average determinations
dPoi A		dPoiA	Decimal point position of channel A display Choose from the formats shown in the display

Menu	Selection	Text	Description
InPut b		Input B	Input range channel B
	in U	in U	Voltage input 0 - +/-10 V
	in .0	in i0	Current input 0 – 20 mA
	in .4	in i4	Current input 4 – 20 mA
StArt b		Start B	Start value which the unit will display with a zero input signal of 0 volts or 0/4 mA
End b		End B	End value which the unit will display with a full scale input of 10 volts or 20 mA
Filt b		Filt B	Digital filter to smooth unsteady display caused by ripple or fluctuation of the input signal.
	off	OFF	Filtering off
	16	2, 4, 8, 16	Filter with 2, 4, 8 or 16 floating average determinations
dPoi b		dPoiB	Decimal point position of channel B display Choose from the formats shown in the display

### 5.2.3. Operational parameters for the combined modes ( A+B, A-B, AxB, A:B )

This mode provides the possibility to display the single channel results A or B, or the result of the selected combination <AB>.

You can toggle between these three display modes by means of the SET key.

The upper bar on the display indicates that you are watching channel A.

The lower bar on the display indicates that you are watching channel B.

Where no bar appears, you are watching the calculated result from the combination <AB>

A → 

B → 

<AB> 

When you use one of the combined modes, the same parameters as shown under „Dual Mode“ will first appear, in order to scale both channels A and B (see 5.2.2) The combined result will then be calculated from both inputs according to this scaling.

The result of the calculation <AB> can then have a final scaling to receive user-friendly engineering units, by means of the following scaling factors:

Menu	Selection	Text	Description
<b>m Fac</b>		m_Fac	<b>Proportional Factor</b> Multiplies the result by this setting
<b>d Fac</b>		d_Fac	<b>Reciprocal Factor</b> Divides the result by this setting.
<b>P Fac</b>		P_Fac	<b>Additive Factor</b> Adds this setting to the result, under consideration of the sign
<b>dPoint</b>		dPoint	<b>Decimal Point</b> Sets the decimal point to the final display

$$\text{Final Display Value} = \text{Result from combination <AB>} \times \frac{\text{m\_Fac}}{\text{d\_Fac}} \pm \text{P\_Fac}$$

#### 5.2.4. Parameters for scaling of the analogue output

The analogue output depends only from the value shown in the display of the unit, and from the scaling parameters shown below. Therefore the analogue signal would also contain possible combinations and calculations, and potential linearisation as well.

Total output swing and zero output have already been defined by the basic setup parameters. The operating range or window of the output can be set by means of the following parameters:

Menu	Selection	Text	Description
<b>AnAbEG</b>		AnAbeG	Analogue beginning
<b>AnAEnd</b>		AnAEnd	Analogue end
			These parameters will map a user-defined window of the total display range onto the selected analogue output range. <u>Example:</u> Anabeg = „-1500“ and Anaend = „2100“ will generate the analogue zero output signal at a display of „-1500“ (see Offset), and the analogue full scale output signal at a display of „2100“ (see Gain)

### 5.2.5. Parameters for generation of a linearisation curve

Parameters described under this section will not appear in the menu when the linearisation has been switched off by setting „Linearisation Mode“ to „no“.

„Linearisation Mode“ has to be set to either „1-quA“ or „4-quA“ to enable the linearisation function. This will change the linear measuring results into a non-linear display and a corresponding analogue output.

There are 16 interpolation points available, which can be freely arranged over the whole measuring range in any distance. Between two points the unit automatically will interpolate straight lines. For this reason it is advisable to set many points into areas with strong bending, and to use only a few points in areas with little bending.

Parameters **P01\_x** to **P16\_x** select 16 x- coordinates, representing the display values which the unit would normally show in the display.

With parameters **P01\_y** to **P16\_y** you can specify now, which values you would like to display instead of the corresponding x values.

This means e.g. that the unit will replace the previous P02\_x value by the new P02\_y value.



x- registers have to use continuously increasing values, e.g. the lowest display value must be set to register P01\_x, and the highest display value must be set to P16\_x

Independent of the selected linearisation mode, the possible setting range of all registers P01\_x, P01\_y, ..., P16\_x, P16\_y is always -99999 ... 99999.

1. Linearisation-Mode = no

All linearisation is switched off and the linearisation parameters do not appear in the menu

2. Linearisation-Mode = 1 quA

Linearisation is defined for positive values only, e.g. for display values 0, ..., 99999.

Negative display values will appear as a mirror of the positive settings.

To avoid discontinuity it is advisable to set the (P01\_x, P01\_y) coordinates to the zero point of the measuring range. Negative settings are allowed for y-coordinates only, but not for x-coordinates.

3. Linearisation-Mode = 4 quA

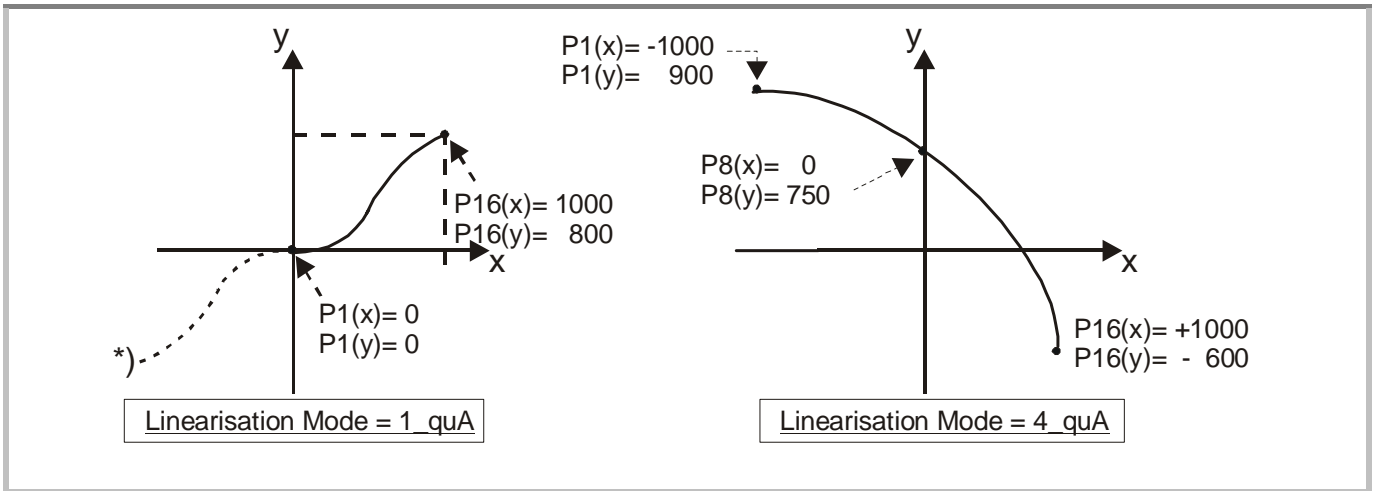
Linearisation is defined over the full numeric range (i.e. -99999, ..., 99999)

4. For measuring values outside of the defined linearisation range, please note:

If the measuring value is lower than P01\_x, the linearisation result will always be P01\_y.

If the measuring value is higher than P16\_x, the linearisation result will always be P16\_y.

The following picture explains the difference between the linearisation modes „1\_quA“ und „4\_quA“.



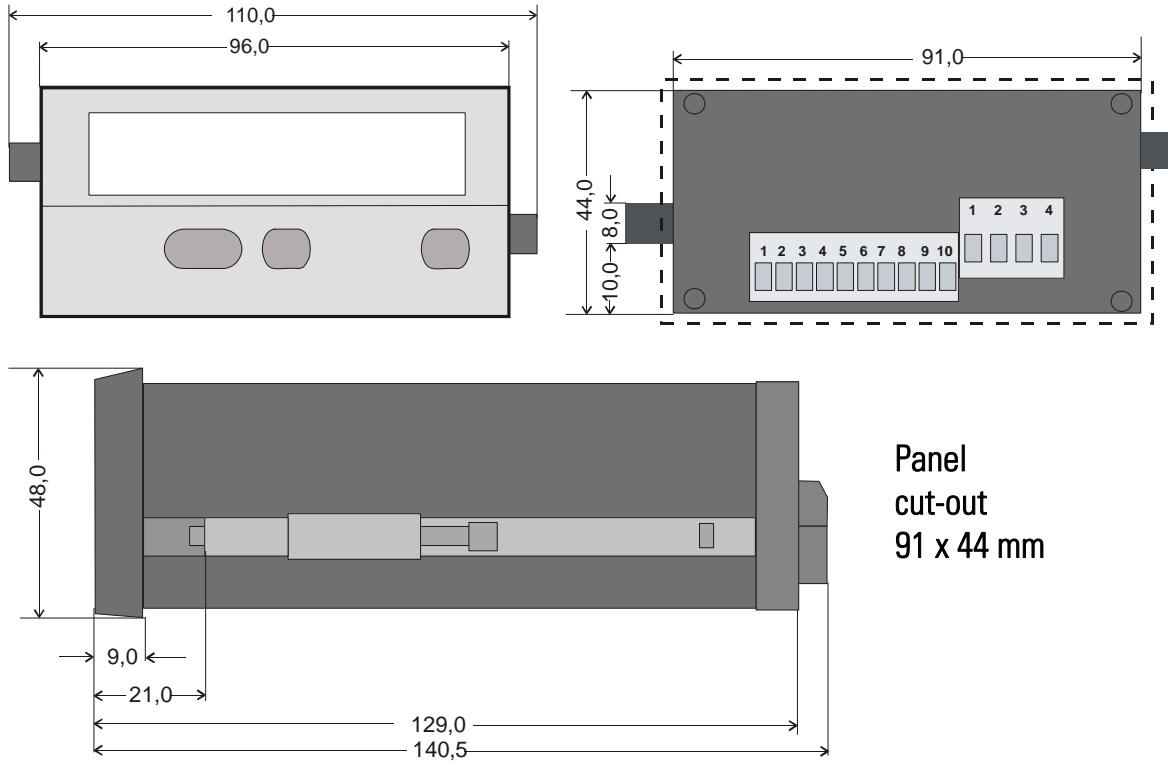


# 6. Technical Appendix

## 6.1. Compendium of the Operator Menu

Menu <u>Basic parameters</u>	Menu <u>Operational parameters</u>			
	Single mode	Dual mode	Combined modes	Linearisation
"modE "	"inPutA"	"inPutA"	"inPutA"	
"briGht"	"StArtA"	"StArtA"	"StArtA"	
"UPdAt"	"End A"	"End A"	"End A"	
"CodE "	"dPoi A"	"dPoi A"	"dPoi A"	
"LinEAr"	"FiLt A"	"FiLt A"	"FiLt A"	
"A-CHAr"		"inPutb"	"inPutb"	
"GAin "		"StArtb"	"StArtb"	
"OFFSEt"		"End b"	"End b"	
		"dPoi b"	"dPoi b"	
		"FiLt b"	"FiLt b"	
			"n) FAc"	
			"d FAc"	
			"P FAc"	
		"dPoint"		
	"An-bEG"			
	"An-End"			
			"P01_H "	
			"P01_Y "	
			"P02_H "	
			..	
			..	
			"P15_Y "	
			"P16_H "	
			"P16_Y "	

## 6.2. Dimensions



### 6.3. Technical Specifications

AC power supply	:	115/230 V (+/- 12,5 %), 7,5 VA
DC power supply	:	24V (17 – 30V), approx. 100 mA (without sensor)
Aux. output for sensor	:	24V DC, +/- 15%, 100mA (with AC and DC power)
Inputs	:	2 analogue inputs (+/-10V, 0..20mA, 4..20mA)
Input impedance	:	Current: Ri = 100 Ohms, voltage: Ri = 30 kOhms
Resolution	:	14 bits (13 bit + sign)
Accuracy	:	+/- 0.1%, +/- 1 digit
Analogue outputs	:	0/4...20mA (max.300 Ohms) 0... +/- 10V (max. 2 mA)
Ambient temperature	:	0° - 45° (operation), -25° - +70° (storage)
Housing	:	Norly UL94 – V-0
Display	:	6 digit, LED, high- efficiency red, 15mm size
Protection class	:	IP65 on the front side, IP20 on the back
Terminal strips	:	Signals max. 1.5 mm <sup>2</sup> , AC supply max. 2.5 mm <sup>2</sup>
Conformity and standards:		EMC 89/336/EEC: EN 61000-6-2 EN 61000-6-3 LV73/23/EEC: EN 61010-1
Sampling time	:	25 msec (alternating channels 1 and 2)

## 6.4. Parameter Table

Bezeichnung	Text	Min-Wert	Max-Wert	Default	Stellen	Ser. Code
Operation mode	<b>mode</b>	0	5	0	1	00
Brightness	<b>brght</b>	0	4	0	1	01
Display update	<b>UPdAt</b>	40	9999	300	4	28
Keypad lock	<b>Code</b>	0	1	0	1	20
Linearisation	<b>LinEAR</b>	0	2	0	1	D2
Input Mode A	<b>inPut A</b>	0	2	1	1	06
Start value A	<b>StArt A</b>	-99999	99999	0	+/- 5	07
End value A	<b>End A</b>	-99999	99999	1000	+/- 5	08
Decimal point A	<b>dPo, A</b>	0	5	1	1	10
Average Filter A	<b>Filt A</b>	0	4	1	1	09
Input Mode B	<b>inPut b</b>	0	2	1	1	11
Start value B	<b>StArt b</b>	-99999	+99999	0	+/- 5	12
End value B.	<b>End b</b>	-99999	+99999	1000	+/- 5	13
Decimal point B	<b>dPo, b</b>	0	5	0	1	15
Average filter B	<b>Filt b</b>	0	4	0	1	14
Proportional Factor	<b>nn FAc</b>	-10000	10000	1000	+/- 5	03
Reciprocal Factor	<b>d FAc</b>	1	99999	1000	5	04
Additive Factor	<b>P FAc</b>	-99999	99999	0	+/- 5	05
Decimal point	<b>dPo, nt</b>	0	5	0	1	02
Analogue out mode	<b>A-CHAR</b>	0	3	0	1	23
Analogue out begin	<b>AnAbEG</b>	-99999	99999	0	+/- 5	24
Analogue out end	<b>AnAEnd</b>	-99999	99999	0	+/- 5	25
Analogue out Gain	<b>GA in</b>	0	1000	1000	4	26
Analogue out Offset	<b>OFFSEt</b>	-9999	9999	0	+/-4	27
P01_x – P16_x	<b>POI_H</b>	-99999	+99999	+99999	+/- 5	A0, A2, A4, ...D0
P01_y - P16_y	<b>POI_P</b>	-99.999	+99.999	+99999	+/- 5	A1, A3, A5, ...D1