Nokeval

Operators manual

Indicators 440 and 441

Panel meter 440 and 441

2 input channels

Display of 2 channels, A, B

Channel A

Channel B

Both channels accepts different kind of sensors.

Output:
- galvanic isolation
- 0/4..20 mA
- 0..10 V
- 1..5 V

800.0

Nokeval

Conf

K1

K2

Alarm relays
- max 240 VAC, 2A

Sensor types:
Thermocouples
RTD
Current 0/4..20 mA
Voltage 0..10V or 1..5V
Potentiometers
25, 50, 500 ja 1000 mV inputs
Strain-gauge sensors

Programming via front panel keys:
All inputs and outputs can be programmed and modified from the front panel.

Output and serial card as an option.
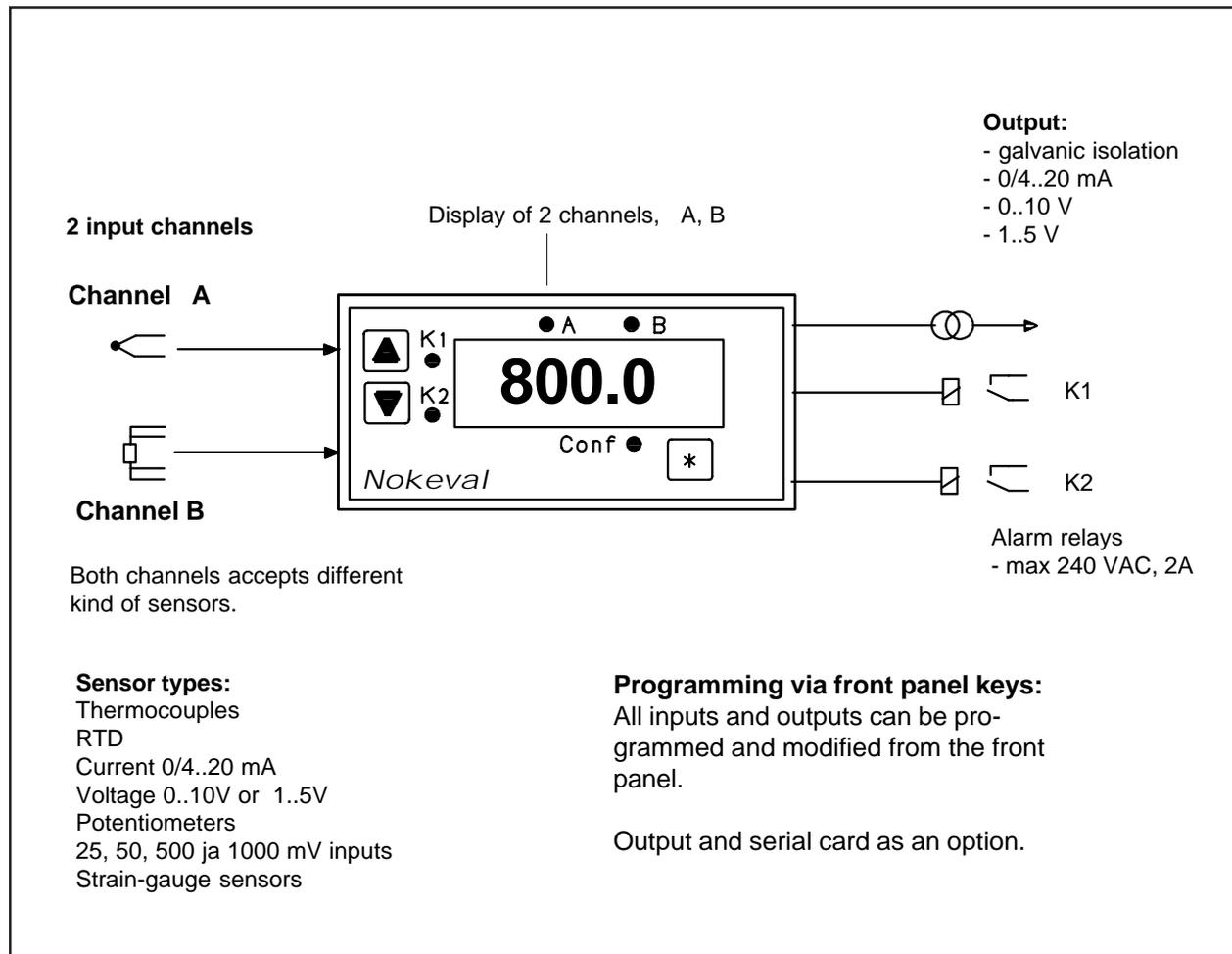
General description

Indicators 440 and 441 have two separate input channels. Model 440 has 14,5 mm digit height and case 48 x 96 mm and model 441 respectively 25 mm digit height and case 72 x 144 mm.
You may set to both channels functions like square root, logarithm, subraction, sum, etc. The channel, showing the calculation, may also have its own functions. You can freeze the automatic scanning or use only one channel. You can realize many applications without separate transmitters f.ex. differential temperature measurement or temperature compensation in flow metering. Four digit display (-999...+9999) has a resolution 1/32000. Smallest range (20 mV) has resolution of 0.7 µV. Floating decimal point widens display range within resolution limits. All settings are stored in non volatile EEPROM.

Inputs:

Both channels accept different input f.ex. channel A may have Pt100 sensor and channel B thermocouple K. Small mV ranges are 20, 50, 500, 1000 mV and scaleable current ranges 0/4..20 mA, voltage 0..5/10 V and 0..1V. You can teach on site indicator to remember real path of a potentiometer.
440/441 accepts strain gauge input; 20, 50, 500 mV, but as presetted, factory calibrated. In this case indicator has only one input channel. Scaling is affected by front panel keys. Various sensor types are stored in memory and are freely programmable.

Alarms:

You can set two separate alarm levels to each channel by front panel keys. Meter has two relay alarms which may be set to each channel or also to math function channel. Relays can control line voltage (230 VAC) devices.

You can program low or high alarm. Reset function is also available. With alarms you may realize special functions like comparing which channel is larger and giving relay information about relation of inputs.
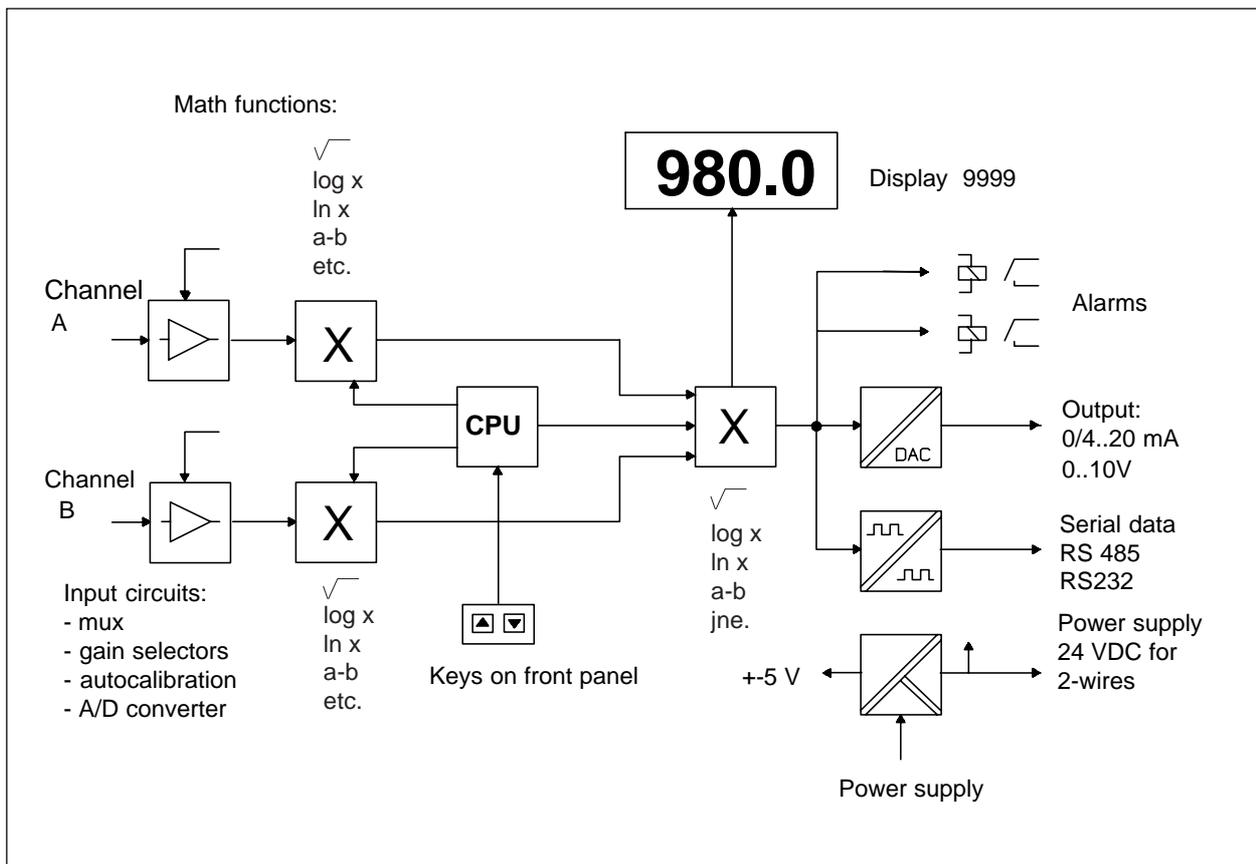
Output signal

Standard output card 0..20 mA, 4..20 mA, 0..5 V, 1..5 V and 0..10 V as option. Either input channel or function channel can get output signal which is galvanic isolated from input signal. In many applications meter replaces transmitters by using output card. If output card is not used, you can get 24 VDC supply for 2-wire transmitters. You may customize output signal f.ex. by adjusting recorder scale by front panel keys.
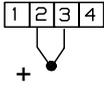
Serial output RS232 or RS485

Serial output is alternative for analog output. Meters can be connected parellel to serial cable and their content are to be read. Firstly you send an addres and thereafter the meter with that address answers by giving number of channel in question. Serial output is galvanic isolated.
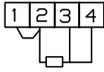
Math functions:
√
log x
ln x
a-b
etc.

Channel A

Channel B

Input circuits:
- mux
- gain selectors
- autocalibration
- A/D converter

X

X

√
log x
ln x
a-b
etc.

CPU

Keys on front panel

980.0   Display 9999

X

√
log x
ln x
a-b
jne.

Alarms

DAC

Output:
0/4..20 mA
0..10V

Serial data
RS 485
RS232

Power supply
24 VDC for
2-wires

+-5 V

Power supply

Connections:

Thermocouple and mV-input:

Input: 0/1..5/10VDC:

Pt100 3-wire.

Current 0/4..20 mA:

Pt100 4-wire.
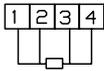
Potentiometer:

Pt100 2-wire.
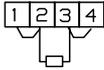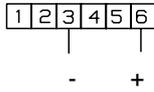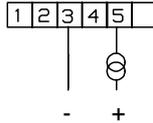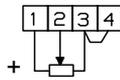
Output (V) 0/1...5/10 V

Output (mA): (0) 4..20 mA

Channel B

5/10 V

mA

TC mV

Pt100 2,3 tai 4-wire

Contacts: selectable NC or No

Alarms max. 240 V, 2 A

K1   K2

13 14 15 16 17 18 19 20 21 22 23 24

+ - c + +

+ - c + +   + -

1 2 3 4 5 6 7 8 9 10 11 12

B

A

Pt100 2,3 4-wire

TC mV

mA

5/10 V

Channel A

N   L

4..20 mA or 24VDC

0/1-5/10V Note 1 ja 2

Power supply 10 ja 12 Standard: 220 V AC
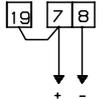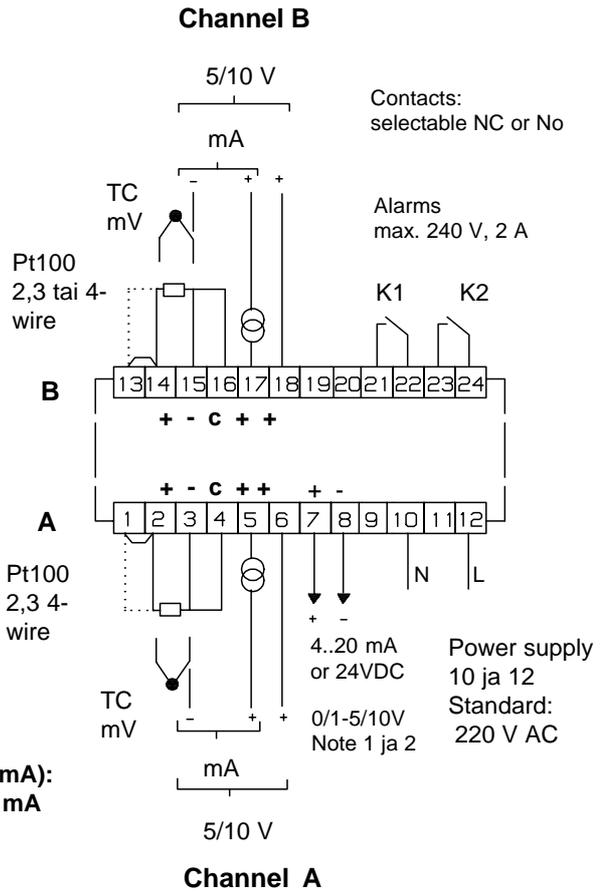
Connections for channel B as channel A.

RS-232 and RS-485 connections in page 20.

Connection of remote contact

13 14 15 16 17 18 19 20 21 22 23 24

1 2 3 4 5 6 7 8 9 10 11 12

Power supply

Closing contact

Note 1.
Output 0/1..5/10 : Connect jumper to connectors 7 and 19.

Note 2.
Power supply 24 DC (non-regulated) for 2- wire transmitters from output connectors 7(+) and 8(-) if output not used.

Power supply:
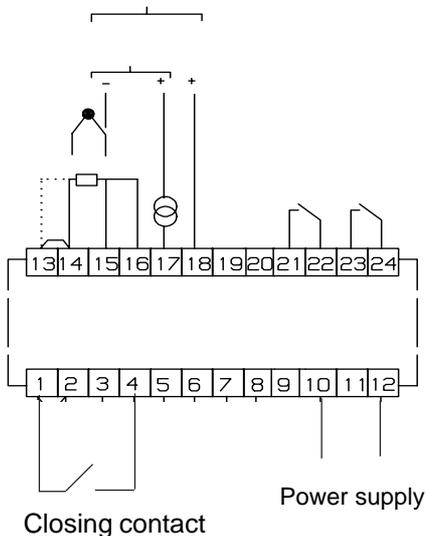Standard 230 VAC, others 110, 24 VAC or 24 VDC 24 VDC = (connectors) 12(+) ja 10 (-).

Use of remote contact

You may use remote contact in taring the display, in seguential calculating of average value etc., depending on program version and selected function. You can create the same function by pressing simultaneously the both arrow- keys on front panel. Two Pt100 sensors can not be used when remote contact function is selected (Pt100 sensor on B-channel only).

Remote contact function is optional and must be mentioned in order.

Dimensions:

Model 440

96

145

48

145

Inputs — Relays

Channel B

Channel A — Power supply

Connectors , max. 2.5 mm2

Cut out

43.5

90.5

Model 441

144

145

72

145

Inputs — Relays

Channel B

Channel A — Power supply

Connectors , max. 2.5 mm2

Cut out

66.5

136.5
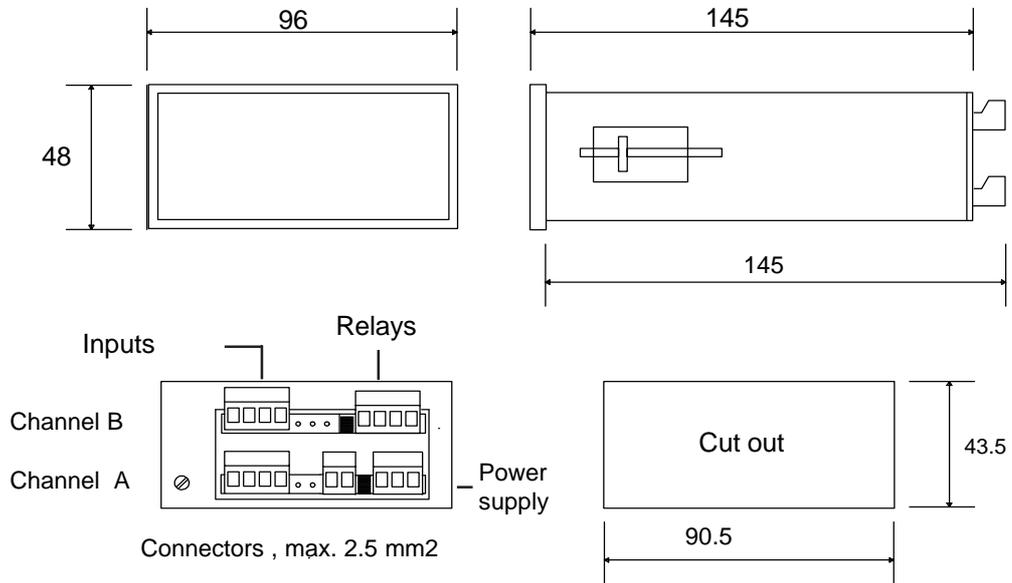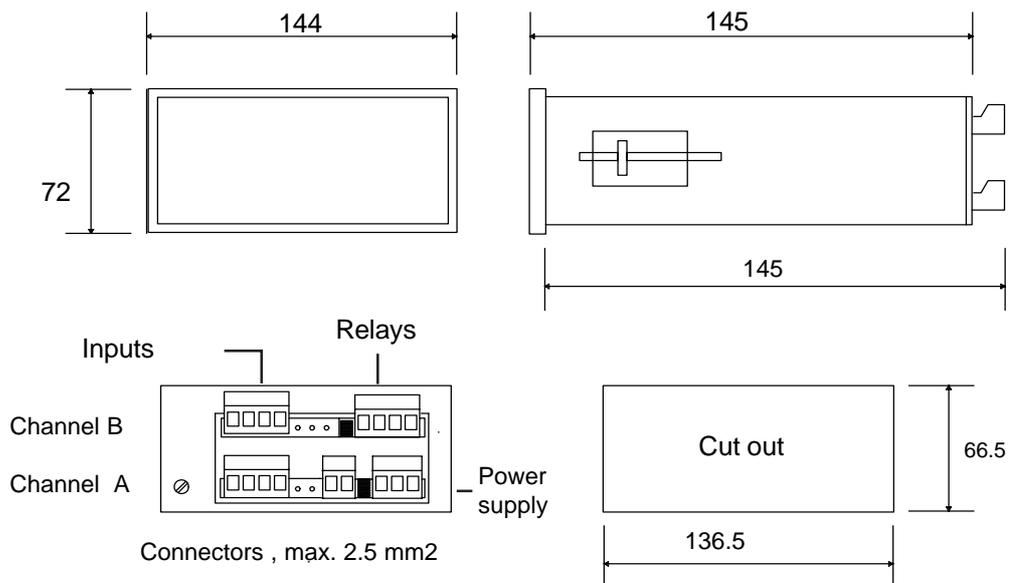
2-wire transmitter connection

You can connect 2-wire transmitters direct to input without separate power supply. Meter connectors supply unregulated 24 VDC, max. 50 mA, for 2-wire transmitters. Active transmitters, having their own power supply, are connected normally. Extra card provides one galvanic isolated output. In this case, internal 24 VDC power supply for 2-wire transmitter can not be used.

Connection of 2-wire transmitter using external power supply

Indicator 440, 441

Channel B

Power supply

24 VDC
+ -

2-wire transmitter

13 14 15 16 17 18 19   21 22 23 24

50 ohm

1 2 3 4 5 6 7 8   10   12

Channel A

Power supply

+

+

Connection of 2-wire transmitter without external power supply

Channel B

13 14 15 16 17 18 19   21 22 23 24

50 ohm

2-wire transmitter

1 2 3 4 5 6 7 8   10   12

+ -

ChannelA

Power supply

Power supply 24 VDC:
terminal scews 7(+) ja 8(-).

+

+

Technical specificatios

Input channels:
2 separate, differential input channels.
2-, 3-, or 4- wire connection, depending on sensor.

RTD- sensor Pt100:
Range -200...700 °C
Resolution 0.1 or 1 °C
Accuracy 0.05 % or 0.1 °C by 4-wire conn.
Accuracy 0.05 % or 0.2 °C by 3-wire conn.
Differencies between channels max. ±1 °C
Line resistor effect 0.005%/W (3-wire)
Temperature drift negligible.

Thermocouples:

K	-100...1250 °C
J, J/DIN	-100...+900 °C
T	-50...+350 °C
E	-50...+350 °C
R,S	0....+1700 °C

Accuracy 1 °C ±1 digit
S,R: 2 °C ±1 digit
Sensor wires have no effect below 1000 W.
Cold junction effect below 0.05 °C/°C.

Input signal 0/4...20 mA:
Scaleable range -999...+9999.
floatting decimal point 0.001...9999.
Input resistance 50 W.
Accuracy 0.05 % of range.

Voltage inputs:
Scaleable ranges:
0-1, 0-5, 1-5, 0-10VDC
on range -999...9999.
Input resistance 1 MW

Voltage ranges: 20, 50, 500, 1000 mV.
Input resistance 1MW, ranges 500 and 1000 mV.
Input resistance 10 kW ranges 20 and 50 mV.
Floating decimal point.
Accuracy 0.05% of range

Potentiometer inputs:
Potentiometers 25...1000 W as standard, 1..10 kW
as factory calibrated.
440 can be teached to remember min/max. position
of pot and save it in memory. Settings via instrument
front panel buttons. You can scale display to desired
range, not depending on teaching function. Factory
calibration to desired pot. value.

Mathematical functions:
You can set separate functions to channel 1 and 2.
The third channel displays the calculation between
input channels 1 and 2, f.ex. difference, sum, aver-
age, square root etc., according to a separate table.
All 3 channels may have output signal. However, only
1 output signal at a time.

Output signals:
Ranges: 0..20 , 4...20 mA, 0..5. 1...5, 0..10 VDC.
output signal is scaleble over whole display range.
Each channel may have different values. Configura-
tion via front panel keys.
Accuracy 0.05% of display.
The output signal is isolated.
Max load 600 W.

Alarms:
2 alarm levels to be set to any channel and if desired,
to steer 1 or 2 relays.
2 relay outputs, 240 VAC, 2 A, closing or opening
contact to be set K1 or K2 alarm.
Freely selectable hysteresis.
Programmable or automatic reset (on/off function).

Serial port
RS232 or RS485 serial port on a separate card.
Severtal indicators may be connected to the same
serial cable. You can not use serial port simultaneusly
with an analog card.

General information
2 freely programmable input channels.
4 digit, red, 14 mm, LED display
Configuration via push buttons on instrument front.
Case 48 x 96 x145 mm and 72 x 144 x 145.
Operating temperature -5...+50 °C
Storage temperature -40...+70 °C
Removable connectors, max. 2.5 mm²
Line voltage 230VAC, 50/60 Hz as a standard, 110, 24
VAC or 24 VDC as an option.
Weight 900 g.

Instrument front panel

Alarm lights

Channel lights A , B and AB

Push buttons

You can change display values by up- down (arrow) buttons in programming state.

Indicating light **CONF informs always that display does not show measured value**. Instruments is in configuration stage and you can change settings.
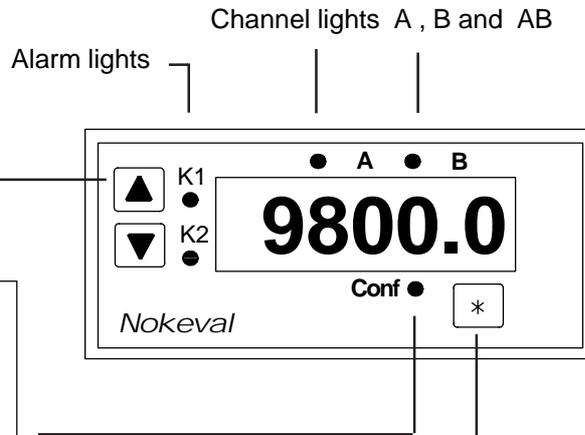
Reset of min/max. value:
Stop channel. Press both arrow keys simultaneusly. Only chosen channel (A, B or AB) will be reseted.

Eerom reset:
If You want to reset all settings it can be done by holding down the *-key and connecting simultaneously supply voltage. Display shows **CodE** and waits for access code, enter 1919 with arrow keys and press *-key, (You may still exit by switching power off). After reset text Conf appears to display, unit is in configuration mode. Eeprom reset clears all information from memory and configuration must be done from the beginning.

Change of channel
When you press *-key channel changes in order A, B, AB and then automatic scanning starts. When CONF indication blinks and A led lits, display shows A-channel and when B light is on channel B is in display. When both indication lights lit display shows third channel AB, f.ex. subtraction A-B. Interruption of automatic scanning returns display always to channel A.

Alarm settings

Checking of alarm value

Indication light start to blink and display shows alarm value.

Select first the channel which alarm level you like to change.
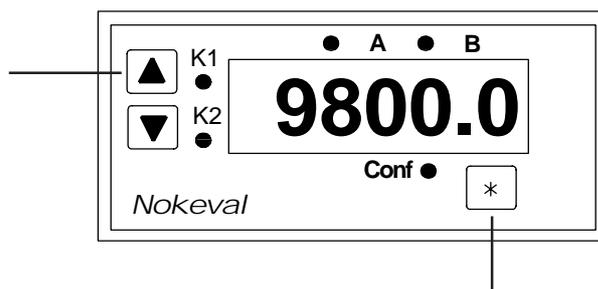
Setpoint changing:
Stop automatic scanning by pressing *-key. Press arrow key K1 or K2, display shows alarm level. Press simultaneusly *-key until symbol Conf starts to blink. When both indication lights blinks you can change set point by arrow keys.

Setting:
Change blinking number (0..9) by arrow keys and move to next number by *-key. When all numbers are changed blinking stops and display shows set point. Exit by pressing *-key or you can start from begining by arrow key.

Reset functions of alarms:
If manual reset is selected, press arrow-key for reset.
Reset K1 = up-key
Reset K2 = down-key

Configuration

You can configurate the meter by three push buttons on meter front. Display will show symbols, which can be changed, or the settings that may be controlled only. *-button will not change settings but it transfers display and program to next stage.

Select configuration stage by pressing both arrow buttons and the *-button at the same time.
CONF-text appears on the display. Now you are ready to start configuration.
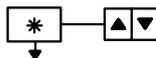
Common settings

You can select the number of channels, output etc.

Display	Buttons	

| CONF | ✳—▲▼ | Turn off lights A ja B by arrow keys and press *-button. |

br 7 — Brigthness control 0..15, 15 = brighest.
SP — Display scanning time between channels, 0...7. 0 = fastest.
dS (0) — How many measurements will be displayed, max 7 samples/ second/ channel. You can damp the fast changing display by dS-function (0...7). 0= each measurement is displayed. 7 = seven measurement are skipped.

oU 0 — Output signal 0/4..20 mA or 0/1..5/10VDC, 0=not in use, 1=in use.
1 no — Relay K1 Contact: nc= normal closed, no= normal open
2 no — Relay K2 Contact: nc= normal closed, no= normal open
F 50 — Select line 50 or 60 Hz (default 50 Hz)
4800 — Select baud rate (only for serial output)
EE 0 — Select serial output protocol: EE=1, continuous transmit e.g. to displays (master). EE=0, answers only when asked (slave). See pages 20..21.
SA — Serial address 0..99, only when EE=0 (i.e. slave function).
CCxx (0) — Potentiometer (page 17) and output (page 18) calibration. Function selections must be made before in Channel settings- mode.
xx = 11 Potentiometer calibration, channel A
xx = 12 Potentiometer calibration, channel B
xx= 21 Output calibration, 0/4..20 mA
xx= 22 Output calibration, 0..10 V

Secret code setting

You can select two different access codes, one for the programming stage and other for the alarm settings.
Setting code for programming CC=88 and for alarms CC=89
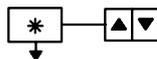
| CC 00 | ✳—▲▼ | Select number (88 or 89) with down arrow. |

| CODE | ✳—▲▼ | Display shows text **CODE**. Push *-key. |
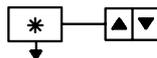
0000 — Display will show number 0000 and first 0 is blinking. Choose any number between 0..9 with arrow keys and make following number to blink by *-button. When 4 number code is set press *-button. Exit by choosing CC90 and press *-button. **NOTE!** Secret code is saved when you leave program stage (END). Code number 0000 is not in use. You may select any number between 0001...9999.

You cannot access to programming or alarm stages if You do not know the right code! As a factory setting code is not in use.

Channel settings

You can configure both channels individually. Sensor types, alarms, display scaling and output signals. Before channel configuration you must decide in chapter "Common Settings" whether to use one or two channels, secret codes etc. See chapter "Common settings".

CONF	✳—▲▼

SExx

Select channel A , B or AB (lights on front)

Select measuring sensor, xx = 0 ... 74

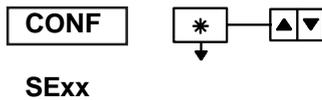| 0 | Channel not in use | |
1	0..20 mA	Scaleable display
2	4..20 mA	Scaleable display
3	(0..20mA)²	Squared current input
4	(4..20mA)²	Squared current input
11	Pt100	3-wire
12	Pt100	4-wire
13	Pt250	3-wire
14	Pt250	4-wire
31	TC B	Thermocouple
32	TC E	Thermocouple
33	TC J	Thermocouple ANSI FeCuNi
34	TC J/DIN	Thermocouple (Feko) DIN FeCuNi
35	TC K	Thermocouple
36	TC N	Thermocouple
37	TC R	Thermocouple
38	TC S	Thermocouple
39	TC T	Thermocouple
41	TC W3	Thermocouple W3, W3%-Re
42	TC W5	Thermocouple W5, W5%-Re
51	0...10 V	Scaleable display
52	0...5 V	Scaleable display
53	1...5 V	Scaleable display
54	0...1000 mV	Scaleable display
61	Potentiometer max. 0-1000 W(Option 10 kW L1 = ON)	
62	Potentiometer max. 0-500 W (Option 5 kW L1 = ON)	
63	Potentiometer max. 0-50 W (Option 500 W L1 = ON)	
64	Potentiometer max. 0-25 W (Option 250 kW L1 = ON)	
71	1000 mV	
72	500 mV	
73	50 mV	
74	25 mV	

Numbers 13, 14, 31, 40-42 delivered on special request. Connector L1 is located on analog card, delivered also on special request.

FiLt	✳—▲▼

1.000

Digital filter for measured value
Filter is used to eliminate momentary deviations to displayed value. Filter factor can vary 0.001..1.000. When 1.000 selected, filter not in use. With smaller factor the measured change comes slowlier to the display. Display value is calculated as follows:

Display = (1 - factor) • former display + factor • measured value

Selecting factor: Select value with arrow-keys, move to next digit

FU x	✳ — ▲▼
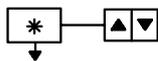
Select function for channel A or B
Mathematical functions for channel AB are descriped in page 17.
When x=0 no mathematical function used.

0   No function used
1   $\sqrt{C1}$ from scaled display (compare sensors 3 and 4)
2   C^2
3   $\log_{10} C$
4   $\ln C$
5   10^C
6   e^C
7   average(C_{t-2}, C_{t-1}, C_t) 3 measured values
8   average ($C_{t-4}, C_{t-3}, C_{t-2}, C_{t-1}, C_t$) 5 measured values
9   min. value Reset: push both arrow keys simultaneusly
10 max. value Reset: push both arrow keys simultaneusly.
    Min. and Max. value reset: Stop automatic scanning to desired channel and push both arrow keys at the same time. Min. and Max. values can also be connected to AB-channel, A and B displays can then be real-time values.
11 Average value starting from desired moment. Stop the channel wanted and push both arrow keys at the same time. Device starts calculating average until a new calculation is started.
12 Zero level reset from front panel or with remote switch. (Span doesn't change). e.g. Input 4..20 mA, scaling 0..100, span 100°C. When zero reset is made in 50 % of span, new range is then -50°..+50°C.
    Resetting procedure: Stop the channel wanted and push both arrow keys at the same time until the display is 0000. Remote reset with closing switch, connect to pins 1 and 4.
13 Average calculating when remote switch is closed. Hold when switch is open. Starts allways when switch closes.

EN x	✳ — ▲▼
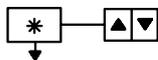
ED x
DE x

Select whether the channel will be displayed by automatic scanning
x =0 (not displayed), 1= (displayed)
External display, 0=Off, 1=On (only for serial output)
Decimals in display , x = 0 ... 3

Scaleable inputs:
If selected sensor number is 1, 2, 51-54 or 61-64, you have to select min/max display as follows:
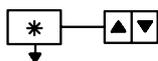
LO	✳ — ▲▼
xxxx	
HI	
xxxx	

Low-end of display (f.ex.. 4mA=0.0)
Select value
High-end of display (f.es. 20 mA=100.0)
Select value.

LOFF
xxxx

Offset changing, f.ex. -1.0 degrees below measured value
Select offset value. You can change it any time.

OC x	✳ — ▲▼
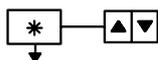
Select output type,   x = 0 ... 5
0   No output
1   0 ... 20 mA
2   4 ... 20 mA
3   0 ... 5 V
4   1 ... 5 V
5   0 ... 10 V

	Output scaling:
LO	Low-end of display, f.ex 0.0
xxxx	Select value
HI	High-end of display, f.ex. 100.0
xxxx	Select value
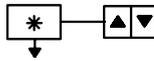
Select alarm type for light K1, 0 ... 15

AC xx	✳—▲▼	

0   No alarm K1
1   Low alarm, automatic ON/OFF
2   High alarm, automatic ON/OFF
3   Low alarm, manual reset, K1=arrow-up, K2=arrow-down
4   High alarm, with reset, K1=arrow-up, K2=arrow-down
5   Channel B ± set point follows channel A low level setpoint
6   Channel B ± set point follows channel A high level setpoint
7   Like number 5 but with manual reset.
8   Like number 6 but with manual reset.
9   Alarm outside of window. See chapter "alarm functions".
10   Alarm inside of window.
11   As number 9 but with manual reset.
12   As number 10 but with manual reset.
13   Alarm outside window, with two relays. K1=above setpoint, K2=below setpoint. No alarms inside window.
14   As number 13 but manual reset. Reset: Stop channel (A,B, AB) and press arrow keys simultaneously.

AL x	Select alarm relay 1 or 2.
- AL -	Select alarm value (operator can also do it later) .
⊢AL⊣	Select alarm value (only for AC=9,10,11,12,13,14).
⎡ AL ⎤	Select "window" (only for AC=9,10,11,12,13,14).
xxxx	Select value
HYS	Hysteresis, 0...90%.
xxxx	Select value.

Select alarm type for light K2, 0 ... 15

AC xx	✳—▲▼	

0   No alarm K2
1   Low alarm, automatic ON/OFF
2   High alarm, automatic ON/OFF
3   Low alarm, manual reset, K1=arrow-up, K2=arrow-down
4   High alarm, with reset, K1=arrow-up, K2=arrow-down
5   Channel B ± set point follows channel A low level setpoint
6   Channel B ± set point follows channel A high level setpoint
7   Like number 5 but with manual reset.
8   Like number 6 but with manual reset.
9   Alarm outside of window. See chapter "alarm functions".
10   Alarm inside of window.
11   As number 9 but with manual reset.
12   As number 10 but with manual reset.
13   Alarm outside window, with two relays. K1=above setpoint, K2=below setpoint. No alarms inside window.
14   As number 13 but manual reset. Reset: Stop channel (A,B, AB) and press arrow keys simultaneously.

AL x	Select alarm relay 1 or 2.
- AL -	Select alarm value (operator can also do it later) .
⊢AL⊣	Select alarm value (only for AC=9,10,11,12,13,14).
⎡ AL ⎤	Select "window" (only for AC=9,10,11,12,13,14).
xxxx	Select value
HYS	Hysteresis, from display value (0..9999).
xxxx	Select value.

Select END by arrow buttons and press *-button. When text [DONE] appears,
all parameter are saved to memory and indicator is ready to measure in a few seconds.

```
  ┌─→
  │   ┌──────┐        ┌──────┐      ┌──────┐      ┌──────┐
  └─  │ CONF │────────│ CONF │──────│ CONF │──────│ END  │
      └──────┘        └──────┘      └──────┘      └──────┘
         A               B             AB             │
                                                  ┌─────┐
      Light A                                     │  *  │   Press *-button
                                                  └─────┘
         End of configuration                  ┌────────┐
                                               │  DONE  │
                                               └────────┘
```
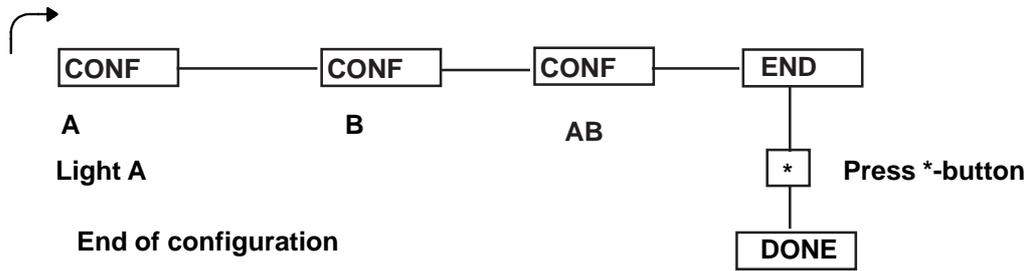
Alarm messages:

— — — —   Display value too big to fit in window. Decrease amount of decimals.
Display value is scaled too big before decimal amount programming.
e.g. Display is scaled to value 5 000, after that two decimals are added.
That means that the real value is 5000.00 which is too big to fit in display.

Er   External display selected but not in use. If You don't have external display
set ED=0.

Alarm functions

Alarm functions are selected in programming stage. Alarm levels can be changed via front panel keys. Access to alarm level modification can be denied with a secret code.

Both channels can have two different alarm levels (also for third channel AB). Channel alarm can activate both relays K1 or K2. Relay can also be as a common alarm, when all alarms are connected to same relay. When using third channel (AB), it is possible to generate simple logic functions: which channel is gretaer or smaller. Heater/cooler function is also possible. Using alarm mode 13 or 14 low level steers other relay and high level steers other. Relays can operate as normally closed (NC) or normally open NO, functions is selected in common setting.

Possible alarm functions in configuration (Conf).

0	No alarm used
1	Low level, automatic reset (On-Off function).
2	High level, automatic reset (On-Off function).
3	Low level, manual reset by front panel puttons.
4	High level, manual reset by front panel puttons.

Reset: Stop automatic scanning to desired channel (A,B or AB) and push arrow key K1 or K2 depending which light lits.

5	Channel B ± set point follows channel A low level setpoint
6	Channel B ± set point follows channel A high level setpoint
7	Like number 5 but with manual reset. Reset by pushing both arrow keys at the same time.
8	Like number 6 but with manual reset.

> **Resetting alarms**: Stop automatic scanning to desired channel (A,B or AB) and push arrow key K1 or K2 depending which alarm is wanted to reset.

9	Alarm outside of window. Window size can be changed in configuration.
10	Alarm inside of window. Window size can be changed in configuration.

E.g. If the window size is 20 digits and setpoint is 1000, alarm will occur ± 10 digits both sides of setpoint. Setpoint value can be changed from the font panel keys, without entering to configuration mode. Window size can be changed only in configuration mode.

11	Like number 9 but with manual reset. Reset by pushing both arrow keys at the same time.
12	Like number 10 but with manual reset. Reset by pushing both arrow keys at the same time.

13   Actuator steering with two relays. Alarm light K1, relay operates above setpoint and alarm light K2 under setpoint. Alarm light K1 and K2 can be programmed to follow relay operation. When measured value is inside the window, either of the relays are active. Window size can be changed only in configuration mode, setpoint value can be changed from the font panel keys.

14   Actuator steering with two relays, manual reset from front panel. Reset: push both arrow keys at the same time. Automatic scannig must be stopped before resetting.

Hysteresis is freely adjustable in all alarm functions including window alarm. Select allways the widest possible hysteresis to avoid unnecessary alarms. Especially when the measured values are close to setpoint value.

Alarm functions are programmed in configuration, mode AC x.

Alarm Functions

Low and high alarms

Alarm lights are selectable high or
low alarm.

Relays are selectable to the one or two
channels. Both alarms can control to
one   relay.

High alarm   K1

Low alarm

Hysteresis

Relay 1

Relay 2
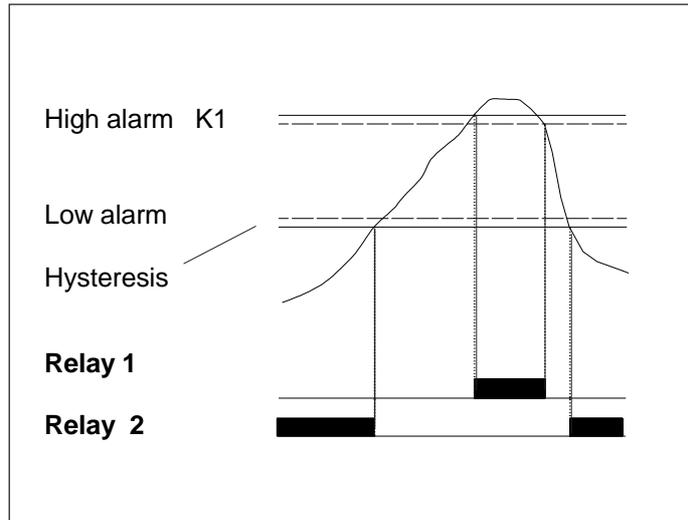
One setpoint for two channels

Setpoint of B channel follows
value of A channel setting.

Deviation alarm on one channel

Alarm K2 follows the setpoint of K1.
Alarm K2 is deviation alarm of K1.

Setpoint K1
in channel A

Alarm level K2 is
deviation of K1 (+-).
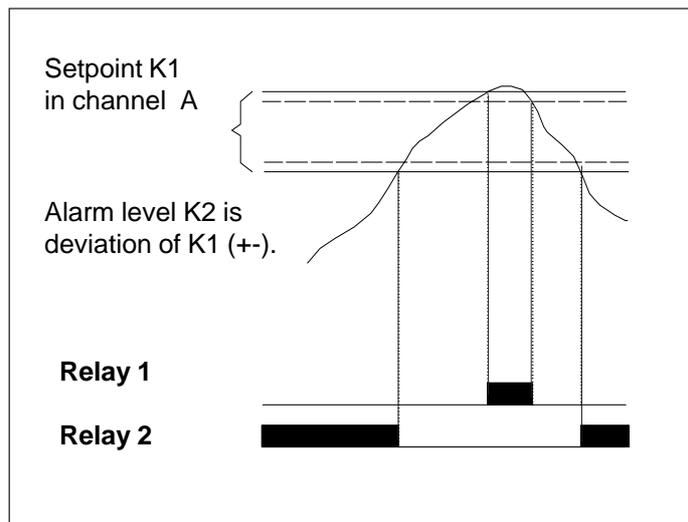
Relay 1

Relay 2

Window alarm, outside or inside

You can select alarm inside or outside
window.

User sets only setpoint, window value
is chosen in configuration mode.

You can also control actuators by choosing
relays working low (1) and high (2) side
of window.

High edge of
 window (+)

Setpoint

Low edge of
 window (-)

Relay 1

Relay 2
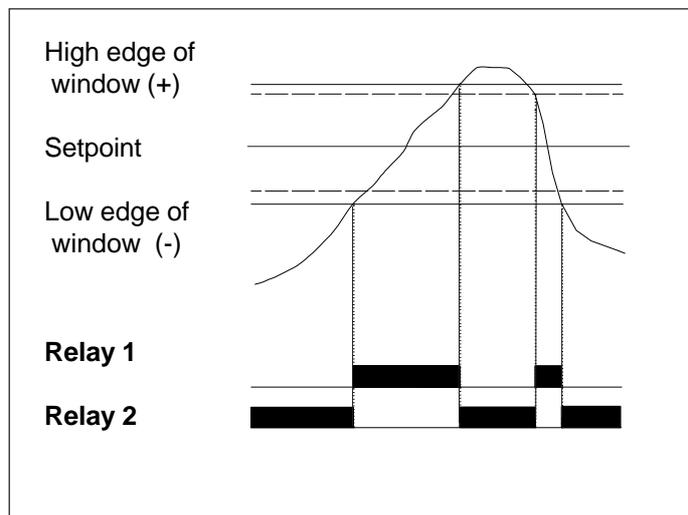
Definition of mathematical functions for third channel (AB)

The display may show the third (extended channel) i.e. the result of the calculations between the two channels. The both signal lights A and B lit at the same time. The third channel operates excactly like the physical channels and may have alarms and output signal. In automatic scanning channel A or B, or both may not be shown, if desired. However, you can look at all channels by bush buttons on instrument front or freeze the display at any time.

Definition of functions to channel AB

Choose channel AB to display by arrow buttons and press *-key. Configuration follows the same procedure as channels A and B.

CONF	CONF	Lights A....AB	CONF	END
(A)	(B)		(AB)	

| | * | Press *-button |

| **Channel A or B** |

Third channel AB
The lights A and B (AB) indicate that display shows the result of calcutation, which can be used as a separate channel. You can select the functions like sum, subtraction, square root etc. in a separate table.

| FU | | ✳ — ▲▼ | Choosing the function. See table 2 |
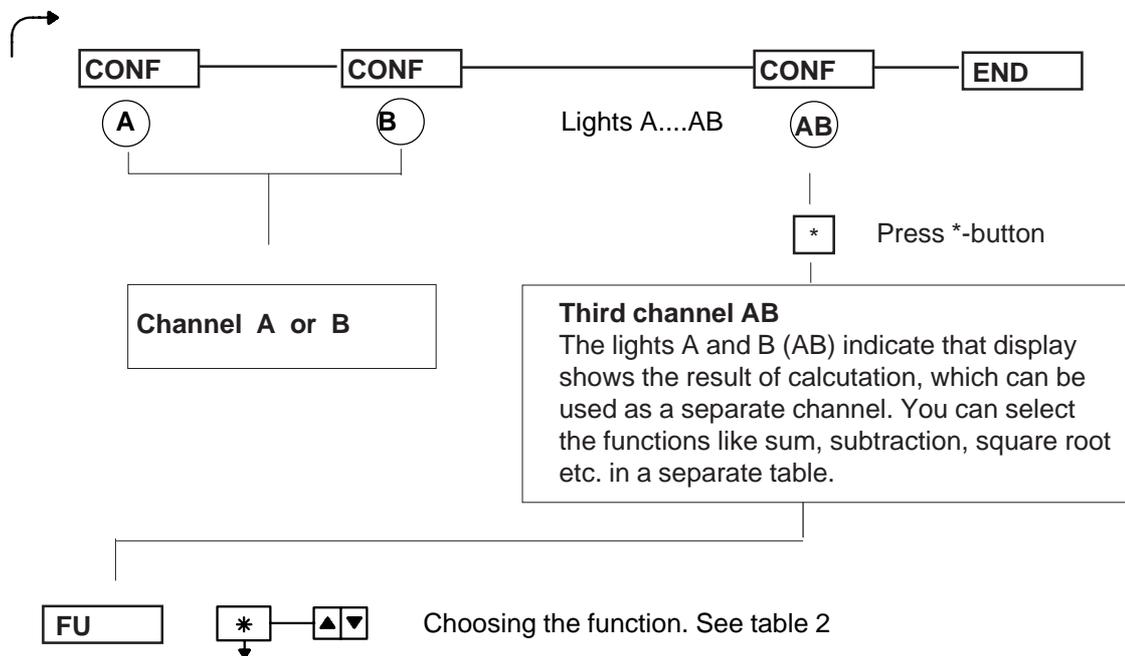
EN x	You can pass a channel in automatic scanning, 0=pass, 1=shows
ED x	External display 0=OFF, 1=ON
DE x	Number of decimals, x = 0 ... 3
etc.	

Other settings as channel A and B.
See section "Channel settings".

Functions

Table 1 for channel A and B

No	Function
1	$\sqrt{C}$
2	C^2
3	$\log_{10} C$
4	ln C1
5	10^C
6	e^C
7	avg (3 measurements)
8	avg (5 measurements)
9	min. value with reset
10	max. value with reset
11	Average when remote switch is open
12	Tare function with remote switch
13	Cyclic average from channel B, remote switch
0	No function

Table 2 Functions of channel AB (extended channel)

No	Function
0	No function selected
1	$\sqrt{C1}$ (channel A)
2	$\sqrt{C2}$ (channel B)
3	$C1^2$ (channel A)
4	$C2^2$ (channel B)
5	$\log_{10} C1$ (channel A)
6	$\log_{10} C2$ (channel B)
7	lnC1 (channel A)
8	lnC2 (channel B)
9	10^{C1} (channel A)
1o	10^{C2} (channel B)
11	e^{C1} (channel A)
12	e^{C2} (channel B)
13	avg (3 measurements) channel A
14	avg (3 measurements), channel B
15	avg (5 measurements), channel A
16	avg (5 measurements), channel B
17	A-B
18	A+B
19	A•B
20	A/ B
21	A/B% ration in percents
22	avg(A, B)
23	min. value from channel A with reset
24	min. value from channel B with reset
25	max. value from channel A with reset
26	max. value from channel B with reset
	Reset: press both arrow keys simultaneously
27	avg of channel A starting from reset
28	avg of channel B starting from reset
29	Tared display from channel A
30	Tared display from channel B
31	Output from A or B, which one is lower value
32	Output from A or B, which one is higher value
33	avg from ch A as long as closed external contact. Display hold when open contact.
34	As function 33, but channel B

avg = average value

W

Channel A
4-20 mA input
Range 0..1000

Channel B
Pt100 sensor-
Range 0..600 C → Alarm K2

Channel AB
Function 17
Channels A-B

→ Output 4..20 mA

→ Alarm K2
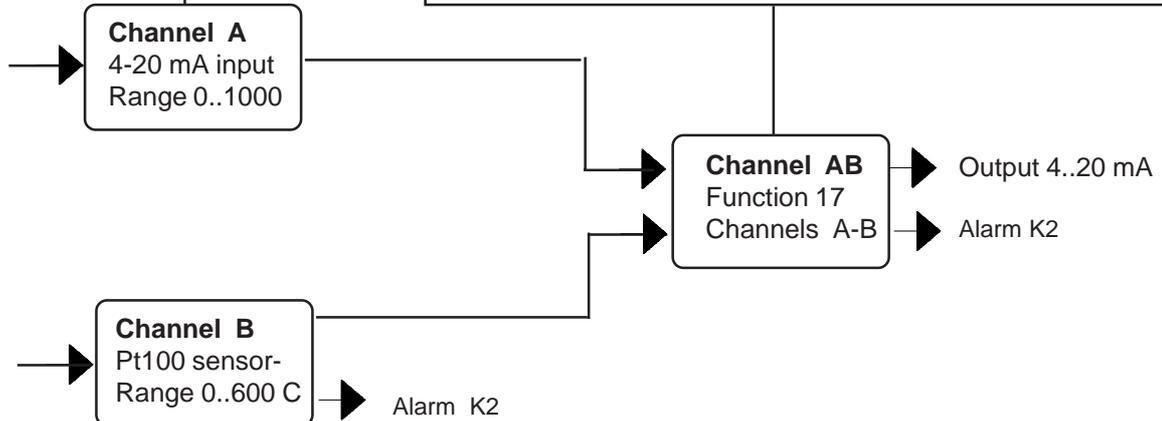
Potentiometer input

Meter accepts potentiometer input in both channels, each having its own scaling. Standard ranges are 0..25...1000 W. Inside the meter you can change two resistor for 10 times greater range, i.e. 0..250...10000 W. If you use the expanded range you can not use RTD´s. Standard range allows RTD, or some other sensor on the other channel. You can set all mathematical functions also to potentiometer input as f. ex. logaritmic scaling display. You can also have output signal by adding output card.

Teaching potentiometer position
If the path of the actuator is not from zero to max. value but, only a part of it, you may calibrate meter to correspond the real-path. 440 saves to its memory min./max. positions and this does not change the scaling of the display. F.ex. display is scaled 0..100% corresponding 0-1000 W. In the field, however, when the valve is closed the real value is 70 W and when closed the real value is 872 W. This means that display do not show 0-100% as desired. This drawback can be easily corrected as follows:

| CONF | — | CONF | — | CONF | — | END |

(A)   (B)   Lights A....AB   (AB)   End of configuration

You can select the number of channels, output etc.

Display   Push buttons

| CONF | ✳ — ▲▼   Turn off lights A ja B by arrow keys and press ✳-button.

CH x — Select one or two input channels, x, 1=1 2=2 channels
br — Display brightness
SP 0 — Scanning time between channels
. — See programming
.
CCxx — Customized calibration of potentiometers and current output
    xx = 11, Potentiometer, channel A
    xx = 12, Potentiometer, channel B
    xx = 21, Current output 0/4..20 mA
    xx = 22, Voltage output, 0/1..5/10 V

| CC xx | ✳ — ▲▼   Select number by arrow-keys CC 11(ch A) or CC 12 (ch B).

1. Run potentiometer to min. position (or max. position in reversed function) when display shows   symbol P_lo and press then ✳-button. Resp. when display shows P_Hi.

2. Return by arrow-key symbol 0 and press ✳-button so many times until display shows configuration symbol CONF. You can now get symbol END by arrow buttons. Confirm exit by ✳-button. The display shows now symbol DONE and the meter is calibrated for the real path angle.

Output signal calibration

You may calibrate output 0/4..20 mA or 0/10V invidually, f.ex. zero transfer or range fine tuning for recorder. Calibration is made by front panel keys. Concerning scaling see chapter "programming".

Output card is delivered always calibrated to standard ranges 0/4..20 mA or 0..5/10V.

1. Select programming stage by pressing both keys at the time and then simultaneously still *-key.

```
  ┌─→
  │
     ┌────────┐      ┌────────┐           ┌────────┐    ┌────────┐
     │ CONF   ├──────┤ CONF   ├───────────┤ CONF   ├────┤ END    │
     └────────┘      └────────┘           └────────┘    └────────┘
        A               B      Lights A....AB   A+B          End of
                                            Light off    configuration
           │
           │
  Display Push buttons

     ┌────────┐      ┌───┬──────┐
     │ CONF   │      │ * ─┤▲│▼│          Turn off lights  A ja B by arrow keys  and press *-button.
     └────────┘      └───┴──────┘
                       ↓
     CH  x                              Select one or two  input channels, x, 1=1  2=2  channels
     br                                 Display brightness
     SP  0                              Scanning time between channels
     .                                  See programming steps
     .
     CCxx                               Customized calibration of potentiometers and current output
                                            xx = 21, Current output 0/4..20 mA
                                            xx = 22, Voltage output, 0/1..5/10 V
```

2. Connect current or voltage meter (4 1/2 digits) to output according to actual output and choose text **CC** to display by pressing *-key. **Select by arrow keys number 21 or 22**, depending on output type. Press *-key. Display shows text **dA_L**. Output goes down to zero level **4.00 mA or 1.00V.** Adjust output zero level, (4.00 mA or 1.00 V), by arrow keys. When output is calibrated, press *-key.

3. Display shows text **dA_H**. Output rises to its max. value, **20 mA or 10 V.** Max. current is programmed to 20 mA and voltage to 10 V. Adjust output by arrow keys to desired value 20.000 mA or 10.000 V.

4. After adjustment, select **CC20** by arrow keys and **press *-key.**

> Exit by pressing down arrow key until display shows END.
> Confirm exit by *-key. Now display will show text DONE and soon thereafter measuring value.

Adding output card:

It is possible to add output or RS-232/RS-485 card afterwards:

1. Remove electronics from case. Loose fastening screw on the rear cover and remove the front panel.

3. Add output card to connector as shown in picture. Remove two jumpers from connector if installed.

4. After intallation of card , the output card have to calibrate (see page "Output signal calibration").

Output card 0/4..20 mA
or RS-232 / RS-485

Optional cards:

Eeprom changeable (special software)

CPU-card 440CPU

Pulse input card
440-pulse
Model 450

Analog card
440-ANA

Serial card
440-RS232 or RS485

Output card
440-OUT
0/4..20 mA, 0..10V
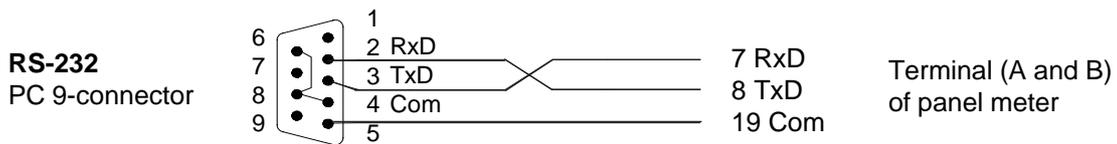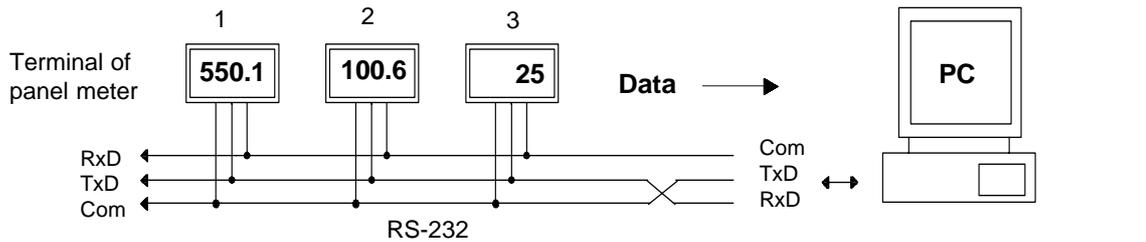
Mother board 440 or 441

Front panel
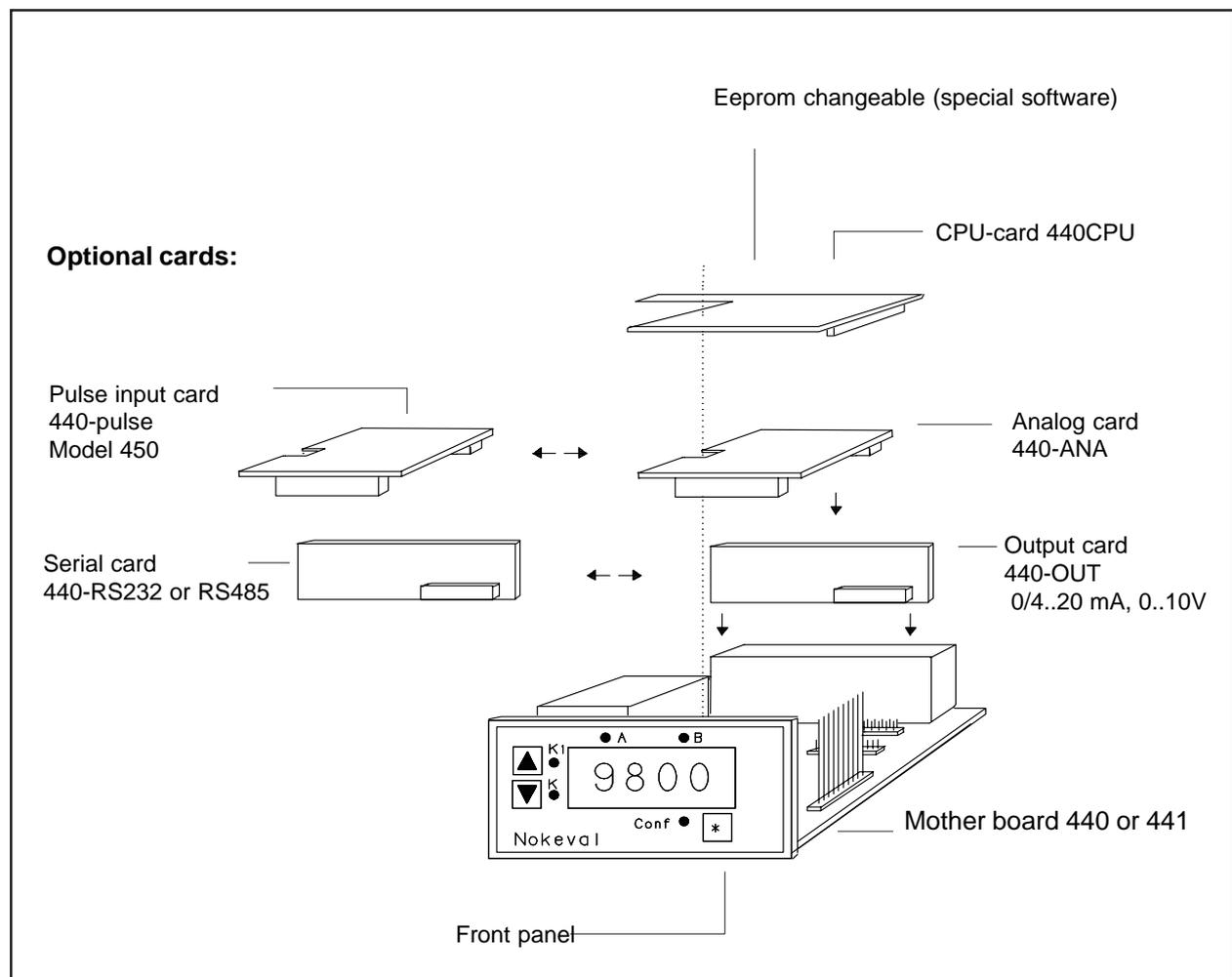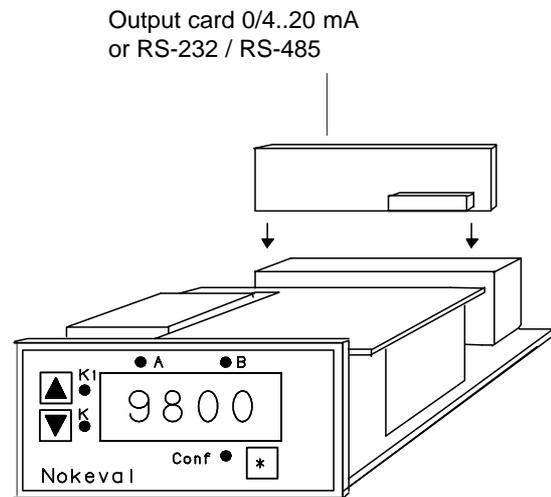
Serial data RS-232 and RS-485

You may fit serial card RS-232 to panel meter 440. It is interchangeable and alternative to mA- output card.

Calculated measurement can be sent to serial bus immediately or, alternatively, when asked, after having first sent address and channel number of 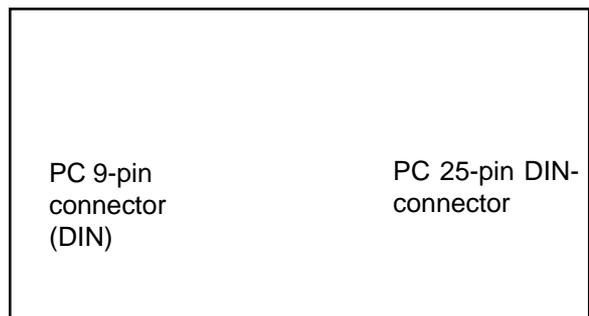meter. Function mode is selectable in configuration stage. Programming can be made also using serial port and menu based PC-program. Six panel meters (12 measuring channels) may be connected parallel to same serial port. Serial signal RS232 is suitable for short distances. RS-485 signal or 20 mA current loop is available for long distances. Serial cards RS-232 RS-485 and current loop card are interchangeable.

Parallel connection of panel meters   **Data collector asks for measurements**

RS-232
PC 9-connector

	440-meter
2 RxD	7 RxD
3 TxD	8 TxD
4 Com	19 Com

Terminal (A and B) of panel meter

RS232 PC 25-pin DIN-connector

25-pin DIN-connector   440-meter

pin nr		
7 com		19 Com
3 RxD		7 RxD
2 TxD		8 TxD
5 CTS		
6 DSR	short cut	
20 DTR		

PC 9-pin connector (DIN)   PC 25-pin DIN-connector
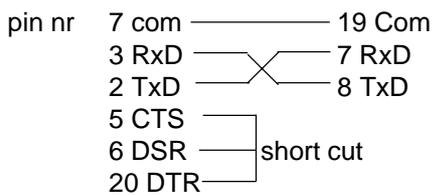
RS-485 connection

PC 9-pin connector   440-meter
pins 1,4 ——————— - A = 7 RxD
pins 2,3 ——————— + B = 8 TxD
Shortcut pins:
1--4 and 2--3.

25-pin connector   440-meter
pins 10, 11 ——————— - A = 7 RxD
pins 22, 23 ——————— + B = 8 TxD
Shortcut pins:
10--11 and 22--23.

Serial communication protocol

Master device (f.ex. PC)

Transmits: Address 128 + 0...99
(Module number)
F.ex. Module 6 (128+6) = 134
Transmits [command]:   20
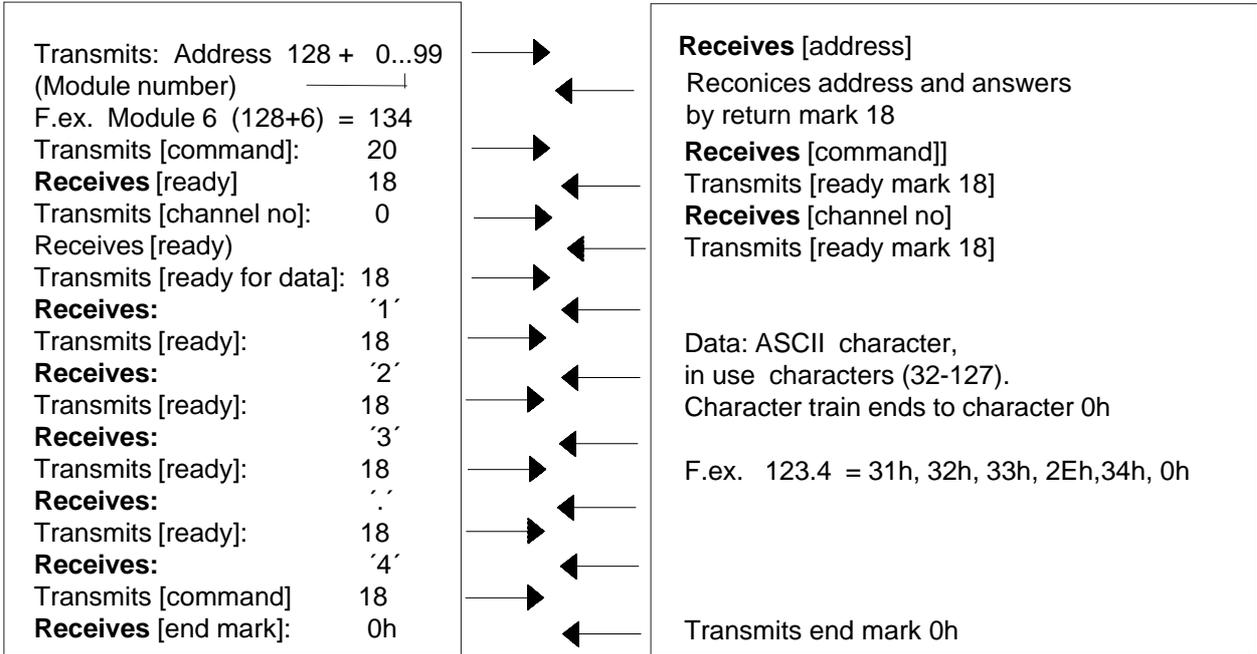**Receives** [ready]   18
Transmits [channel no]:   0
Receives [ready)
Transmits [ready for data]: 18
Receives: ´1´
Transmits [ready]:   18
Receives: ´2´
Transmits [ready]:   18
Receives: ´3´
Transmits [ready]:   18
Receives: ´.´
Transmits [ready]:   18
Receives: ´4´
Transmits [command]   18
Receives [end mark]:   0h

Indicator 440 (slave)

Receives [address]
Reconices address and answers
by return mark 18
Receives [command]]
Transmits [ready mark 18]
Receives [channel no]
Transmits [ready mark 18]

Data: ASCII character,
in use characters (32-127).
Character train ends to character 0h

F.ex.   123.4 = 31h, 32h, 33h, 2Eh,34h, 0h
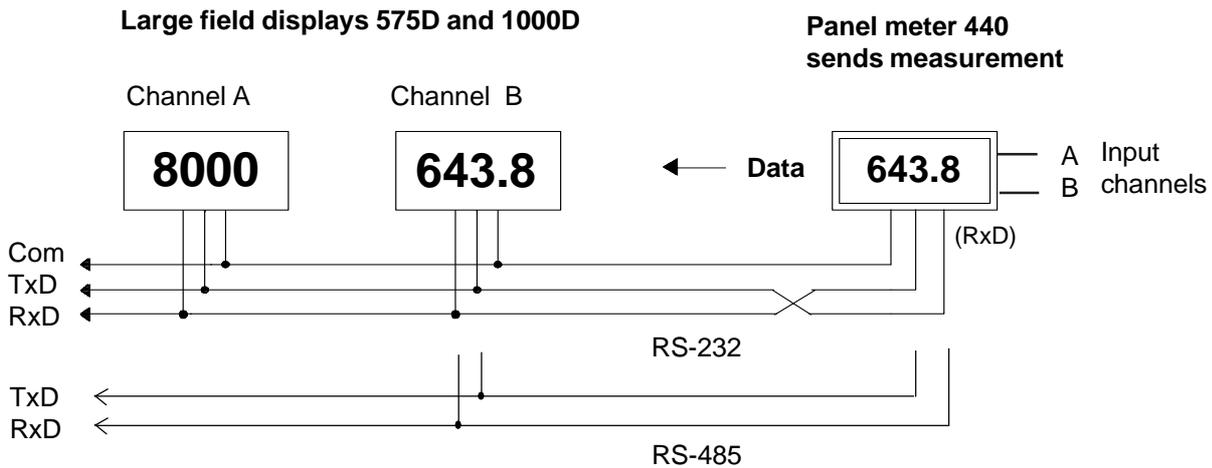
Transmits end mark 0h

Note

Data collection uses inquiring method.
Selection in configuration **EE=0**

Each panel meter must have its own address
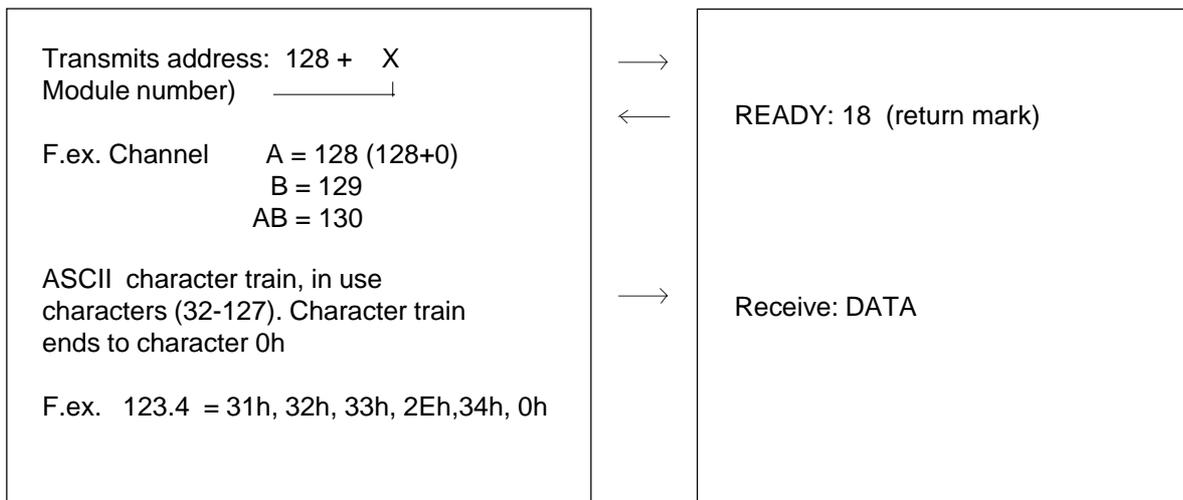between 0..99

Use of large displays via RS-232 port

Large field displays may be connected with panel meter, provided with RS-232 or RS-485 card. Panel meter transmits measured values one after another. When calculated measurement is ready, meter transmits address into bus and waits for answer from receiving instrument. When panel meter reconices return mark it transfer DATA to display. In configuration stage you have to select in "initial settings"output EE=1. Displays will be provided with address of channel to be shown (A,B or AB). Same measurement may be shown parallel in many displays, having same address.

Large field displays 575D and 1000D

Panel meter 440 sends measurement

Channel A   Channel B

| 8000 | 643.8 | ← Data | 643.8 | A Input |
| | | | | B channels |

(RxD)

Com
TxD
RxD

RS-232

TxD
RxD

RS-485

Serial signal protocol for field displays (master-function)

Panel meter 440

Transmits address: 128 + X
Module number) ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

F.ex. Channel   A = 128 (128+0)
                  B = 129
                  AB = 130

ASCII character train, in use characters (32-127). Character train ends to character 0h

F.ex. 123.4 = 31h, 32h, 33h, 2Eh,34h, 0h

⟶

⟵   READY: 18 (return mark)

⟶   Receive: DATA

Select in configuration stage "initial settings", and point EE=1. Panel meter sends measurement immediately after calculation, first channel A, then channel B (and). Typical measuring time is 60 mS.

PC configuration

440 panel meter, having RS-232 or RS-485 card fitted, can be connected to PC serial port by serial cable. Several panel meters may be connected parallel to same serial port. Each meter must have its own address, between 0..99. The necessary program is delirered on diskette (3½") and is started by writing 440conf. Software works in DOS-environment.
RS-232

It is not recommend more than six meters parallel to same serial port. Max distance around 30 meters. Each meter can be configured individually.

RS-485
This serial bus type accepts 31 meters along its 1000 meter long cable. Even more units can be added when RS485 Repeater is used.

Main menu

```
                                    440 CONFIG PROGRAM

     ┌─────────────────────┐
     │  Port:    Com1       │
     │  Speed:   4800       │        ┌──────────────────────────────┐
     │  Address: 0          │        │  Port      Baud rate    Addr  │
     └─────────────────────┘        └──────────────────────────────┘

     ┌─────────────────────┐        ┌────────┐ ┌────────┐ ┌────────┐
     │  COMM. SETTINGS      │        │ Com1   │ │ 4800   │ │ 0      │
     │  LOAD FROM DISK      │        │ Com2   │ │ 300    │ │        │
     │  GET F ROM DEVICE    │        │ Com3   │ └────────┘ └────────┘
     │  SAVE TO DISK        │        │ Com4   │
     │  SEND TO DEVICE      │        └────────┘
     │  COMMON SETTINGS     │
     │  CHANNEL SETTINGS    │
     │  SHOW  ALL SETTINGS  │
     │  DEVICE CALIBRATION  │
     │  SETTING  REPORT     │
     │  DISPLAY RESULTS     │
     │  QUIT                │
     └─────────────────────┘
```

Menu based program is started by writing 440conf. Arrow keys moves the cursor. Confirm selection by enter-Key. Exit from menu by ESC-key. Start configuration by initial definition COMM.SETTINGS. Choose port, baud rate and address of programmable meter. In case of wrong address, you program wrong meter.

Before PC-programming you have to set address by front panel keys to each meter. Default address is always 0. Abstracts in menu and function is described in chapter "configuration".

Main menu

Comm. settings Choose serial port, baud rate and address of transmitter.

Load from disk Get peviously saved settings from diskette or from hard disk.

Get from device Get settings from transmitter memory. This command confirms which settings are saved in transmitter memory.

Save to disk Send settings to transmitter memory. New settings cancel previous values.

Send to device Save settings to disk.

Device settings Transmitter initial settings, f. ex. amount of channels.

Channel settings Settings by channel, sensor selections, resolution etc.

Show all settings Settings survey

Device calibration Transmitter calibration. If transmitter sends incorrect measurement you may recalibrate it. Precision calibrators (0.003 %) are necessary.

Setting report Sends setting report to printer.

Display results Shows measurements of all channels.

Quit Exit from program

Port: Com1
Speed: 4800
Address: 0

COMM. SETTINGS
LOAD FROM DISK
GET F ROM DEVICE
SAVE TO DISK
SEND TO DEVICE
COMMON SETTINGS
CHANNEL SETTINGS
SHOW ALL SETTINGS
DEVICE CALIBRATION
SETTING REPORT
DISPLAY RESULTS
QUIT

CHANNEL SETTINGS

Channel	A	B	AB
Sensor	Pt100 3-W	4..20 mA	
Function	None	None	C1-C2
Resolution	0.1	0.1	0.1
Low	****	0.0	****
High	****	500.0	****
Output	4...20 mA	0..10V	None
Line	Output_1	Output_2	****
Low	0.0	0.0	****
High	300.0	400.0	****
Alarm 1	Lo_aut	None	None
line	Alarm_1	None	****
Value	250.0	*****	****
Min value	*****	****	****
Hystersis	1.0	****	****
Alarm 2	*****	L0_aut	None
Line	*****	Alarm_2	****
Value	*****	300.0	****
Hysteris	*****	1.5	****

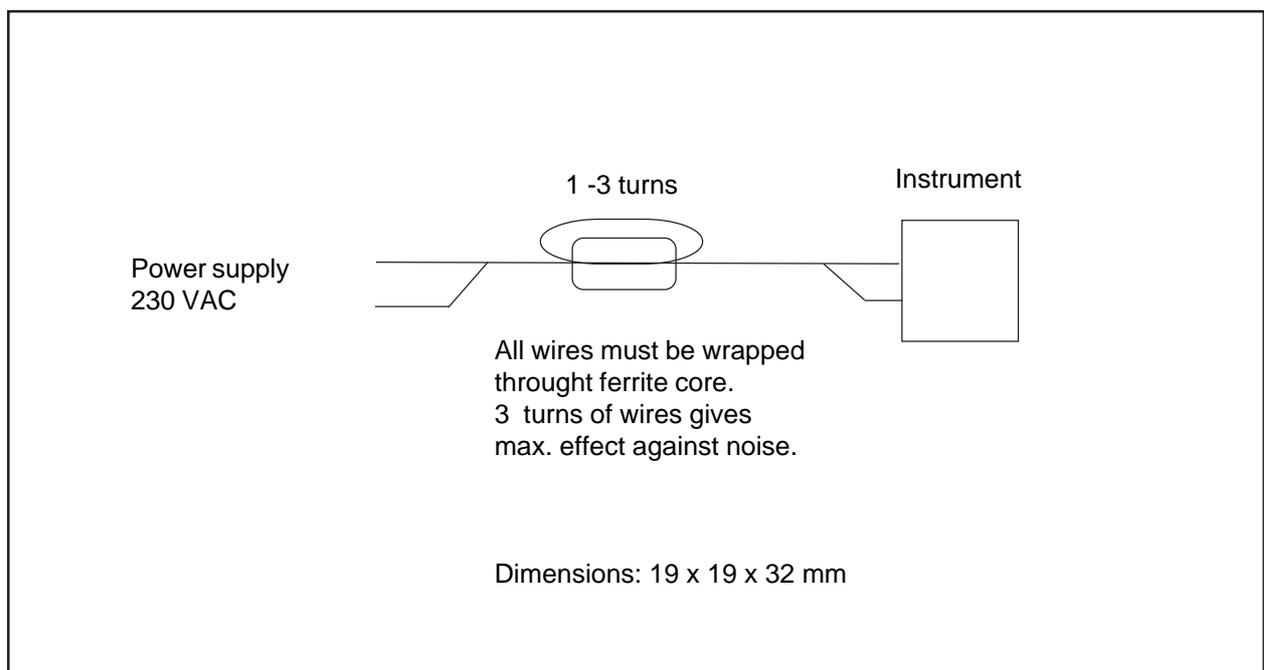# Ferrite core eliminates peaks from the power supply lines.

A range of easy to fit line filters provides a simple solution to the problems of radiated noise emissions generated by electronic equipment.

Installing:
The filter is installed simply by clipsing it around the powercable. Ferrit core is locked by compressing it tightly with no need to disconnect the cable or to remove connectors.

Features:

* High performance EMC components dramatically reducts electromagnetic noise.
* High-performance ferrites with againts high freguency noise.
* Easy installation for cable
* Can be added as first-aid, on -the-spot noise, when interferences occur.

1 -3 turns

Instrument

Power supply
230 VAC

All wires must be wrapped throught ferrite core.
3 turns of wires gives
max. effect against noise.

Dimensions: 19 x 19 x 32 mm