

# User Manual

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2011-02-21, firmware V1.1

## 2-wire field indicator 311 / 312

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**Nokeval**

# Introduction

The field display 311 is a versatile instrument combining a two wire 4-20 mA transmitter and an LED display accepting almost all common sensor inputs. It can be powered with a 10...30 VDC supply if an analog output is not needed.

The galvanic isolation provided is especially important with thermocouples, but helps to avoid potential differences in other applications too.

The device can be configured with the front panel buttons. The device is housed in a splash proof wall-mounted enclosure.

The model 312 is equipped with two semiconductor relay alarm outputs. The relays are rated for 250 VAC.

## Warnings

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Although the input circuitry is galvanically isolated, the isolation is purely functional and intended to prevent the problems associated with ground loops and potential differences. The input signal must not be connected to a voltage higher than 120 VDC or 50 VAC with respect to earth.

When using a line voltage with the alarm relays, the associated wires must be tied so that they can't come in contact with the other parts inside the unit in case of accidentally detaching from the connector.

## Trademarks

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Exergen is a registered trademark of Exergen Corporation, USA.

## Manufacturer

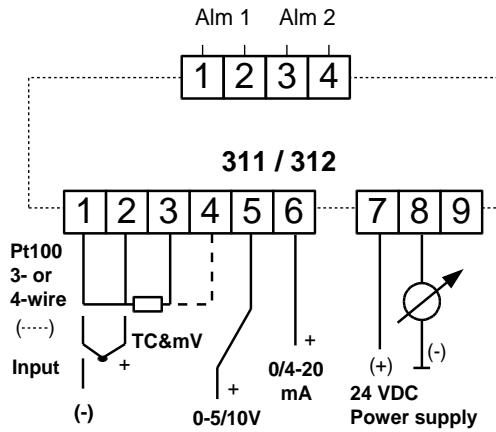
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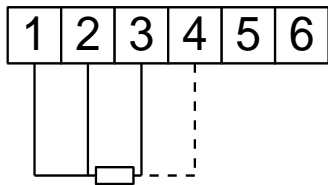
# Installing

## Connections

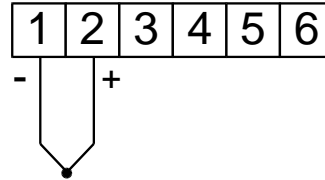
The connector blocks are detachable.



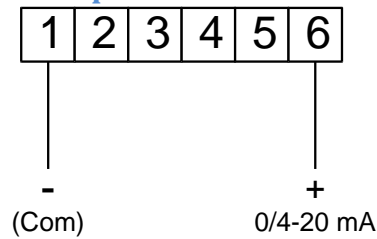
### Pt100



### Thermocouples



### mA input



## Jumpers

There are no user-configurable jumpers.

## Configuration

### Using the front panel keys

This device can be fully configured using the front panel keys. Using the keys is described in chapter The device can be cleaned externally with a soft cloth and soap water. Cleaning with a small amount of isopropyl alcohol is also allowed.

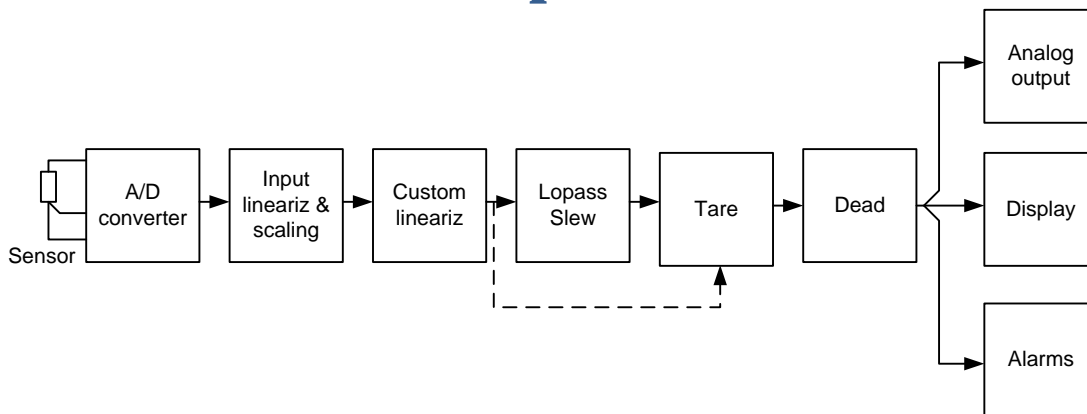
User interface. The settings are explained in chapter Configuration menu.

### With a configuration software

Using a configuration cable POL-RS232 or DCS772 and an adapter POL-3PIN, Nokeval Mekuwin configuration software can be used for convenient configuration. This is especially useful when configuring large number of devices as the settings may be saved to a file and then retrieved. The settings are explained in chapter Configuration menu.

There is a pin header marked as POL on the circuit board. Connect the adapter cable to this. Start the software and select 9600 baud and the appropriate COM port. Use address 0 or 126.

# Operation



The input signal or sensor is measured with an analog-to-digital converter and other circuitry. A new reading is obtained 3 to 4 times per second. The input circuitry is galvanically isolated from the analog output.

The reading can be scaled or adjusted linearly, and optionally treated with a 6-point linearization table.

Two digital filters are provided: 1<sup>st</sup> degree lowpass filter and a slew limiter. These can be used to decrease input noise and response to transient fluctuations.

A tare function is provided for weighing applications. When taring the device with the \* button, the reading is offset appropriately to get a zero reading at this input signal. The tare value is retained even in a power-off situation.

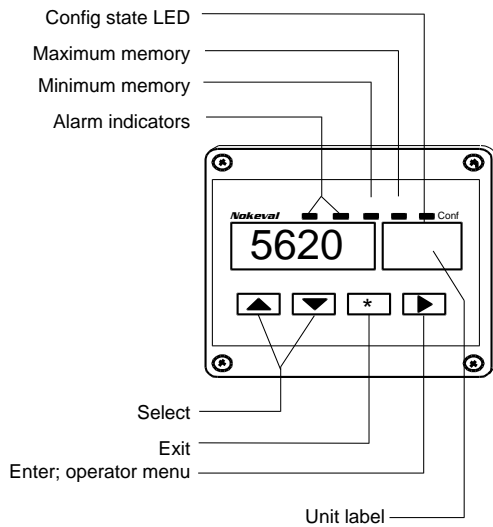
The Dead function allows preventing small or negative readings, useful in weighing and flow measurement applications.

The analog output and the alarms follow the displayed reading, processed with all of the functions mentioned above.

# Cleaning

The device can be cleaned externally with a soft cloth and soap water. Cleaning with a small amount of isopropyl alcohol is also allowed.

# User interface



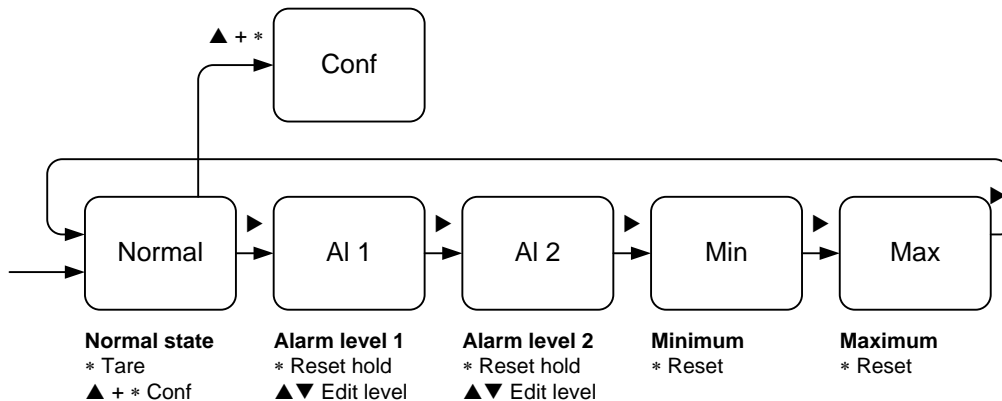
## Normal state

In normal state, this device displays the current measurement value continuously functioning as an indicator. The A1 and A2 LEDs indicate the current state of the alarms. The device is in this state after power-up.

If the tare function is enabled in the configuration menu, you can tare the unit by pressing the \* key for one second.

## Operator menu

The alarm levels and the minimum/maximum memory can be accessed without entering the configuration state. Use the ► key to select function (Alarm level 1 – Alarm level 2 – Minimum – Maximum – Normal); the blinking indicator LEDs indicate the current function.



When an alarm LED is blinking, the alarm level can be changed. Press ▲ or ▼ until the first digit starts blinking, then edit as described in chapter Editing.

When an alarm (A1 or A2) or minimum (M1) or maximum (M2) LED is blinking, the associated alarm hold or minimum/maximum memory can be reset by pressing \* for one second.

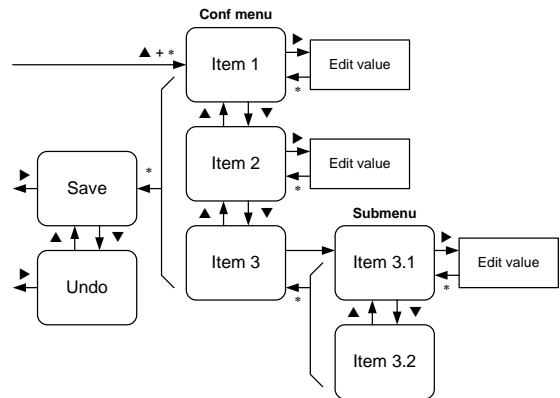
If a password has been set (Alcode in configuration menu), the alarm levels can't be changed nor functions reset without entering the correct password.

## Configuration state

Press ▲ and \* simultaneously for two seconds to enter the configuration state. When entered, the Conf LED will light.

If a configuration password is set, you will need to enter it now (Cod.0 displayed). In case the password is not known, switch the power off, hold \* and ► keys pressed and switch the power on again.

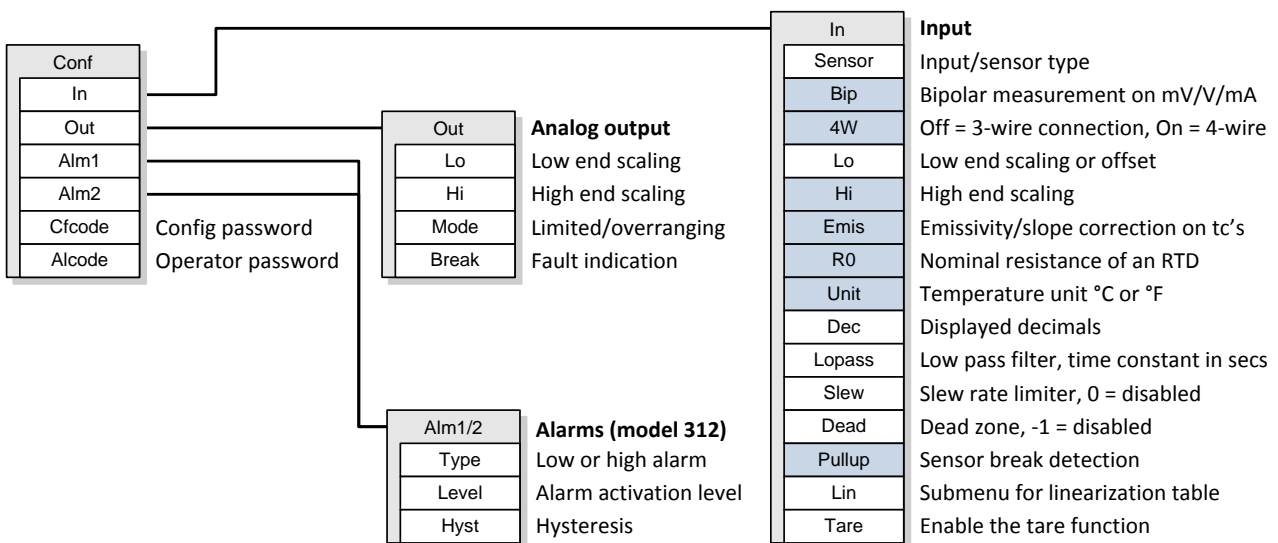
The first item of the main level of the configuration menu is shown: In. Move within the menu using ▲▼ keys. Enter a submenu with ►. To edit the value of a setting, push ► to start editing. Use ▲▼► to edit, and \* to get back to the menu.



The menu is organized hierarchically. You can enter Out, Alm1, Alm2, and Lin submenus by selecting them with ▲▼ keys, and entering the submenu with the ► key. See the menu chart.

When all settings are done, exit from the menu with \* key. Two options are shown: save to keep the settings made, and undo, to discard all changes. Select Save or Undo and push ►.

The contents of the configuration state are detailed in the chapter Configuration menu. A quick overview is shown below. The items on the shaded background are hidden in certain cases.



# Configuration menu

## Main level

<b>In</b>	Submenu for input settings.
<b>Out</b>	Submenu for analog output settings.
<b>Alm1</b>	Submenu for alarm 1 settings.
<b>Alm2</b>	Submenu for alarm 2 settings.
<b>Cfcode</b>	Password for the configuration menu.
<b>Alcode</b>	Password for the operator menu (quick editing the alarm values and resetting the minimum/maximum memory).

## Input settings

These settings are located in the In submenu of the configuration menu.

### Sensor

Input sensor or signal type.

Selection	Explanation	Lo-Hi scaling
<b>mV</b>	Millivolts up to 100 mV	
<b>V</b>	Volts up to 10 V	
<b>mA</b>	Milliamps up to 20 mA	
<b>0-5V</b>	0-5 V scaled input	Yes
<b>0-10V</b>	0-10 V scaled input	Yes
<b>0-20mA</b>	0-20 mA scaled input	Yes
<b>4-20mA</b>	4-20 mA scaled input	Yes
<b>TcB, TcC, TcD, TcE, TcG, TcJ, TcK, TcL, TcN, TcR, TcS, TcT</b>	Thermocouples	
<b>E140, E440</b>	Exergen infrared thermocouples	
<b>Ohm</b>	Resistance measurement , including a potentiometer in a variable resistance configuration	
<b>Pt, Ni</b>	RTD sensors	
<b>Pot</b>	Potentiometer in a "slidewire" configuration	Yes

### Bip

Bipolar measurement on mV, V, and mA signals.

<b>Off</b>	The device can't measure below 0 V nor 0 mA
<b>On</b>	The device can measure down to -100 mV, -10 V, and -20 mA, but with slightly diminished resolution.

### 4W

Four-wire connection on RTD's and resistance measurement.

<b>Off</b>	3-wire measurement
<b>On</b>	4-wire measurement

## Lo

With 0-5V, 0-10V, 0-20mA, 4-20mA, and Pot inputs: The low end scaling, i.e. the reading displayed on the low end of the range.

With other inputs: Offset correction, will be added to the reading. Usually 0.

## Hi

With 0-5V, 0-10V, 0-20mA, 4-20mA, and Pot inputs: The high end scaling, i.e. the reading displayed on the high end of the range.

With mV, V, mA, and ohm: A multiplier applied to the reading before applying the offset (Lo setting).

## Emis

Slope correction for thermocouples or emissivity correction for Exergen infrared thermocouples. Normally set to 1.

The temperature difference between the measured sensor temperature and the ambient temperature is divided by the Emis setting and added to the ambient temperature to get the displayed reading. In other words, the slope of the thermocouple reading is amplified by  $1/\text{Emis}$  when distancing from the ambient temperature. The ambient temperature is obtained from the internal cold junction compensation.

## R0

The nominal resistance of the Pt or Ni sensor, i.e. the resistance at 0 °C. For a Pt100, select 100. This can also be used to fine-tune the slope. If the resistance of the sensor has been calibrated at 0 °C, the exact resistance can be entered here.

## Unit

Measurement unit °C or °F. Only for Pt, Ni, and thermocouples.

## Dec

The number of digits displayed on the right hand side of the decimal point. Selectable between -2 and 3. If the digits won't fit in the display, the decimal count is automatically decreased temporarily.

A negative value means that there are no decimals and that the corresponding amount of rightmost digits will be rounded off. E.g. Dec=-2, the display is rounded to 0, 100, 200 etc.

## Lopass

A first order digital lowpass filter for input. Used to damp noise and transient disturbances in the reading. Set the time constant (to 63% of step change) in seconds. Recommended value 1. To disable the filtering, set to 0.

## Slew

Slew rate limiter. Prevents the input reading from changing too rapidly. Defines how much the new reading can differ from the previous one. New readings are acquired about 3 times/second, so a setting of 1 limits the slew rate to about 3 °C/s. To disable, set to 0.

## Dead

Dead zone around zero. If the input reading is smaller than the Dead value, the display is rounded to zero. This is useful in weighing and flow measurement applications.

To prevent negative values only, set Dead to 0. To disable the dead zone function, set Dead to -1 or any other negative value.



## Pullup

Sensor break detection by injecting a small current in the sensor wires. Normally enabled, but can be switched off if the current is disturbing a high-impedance sensor.

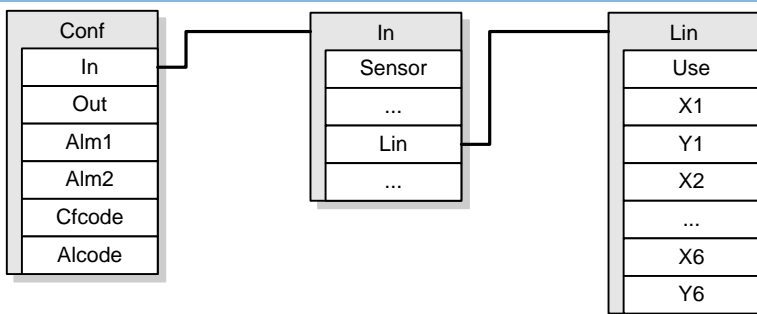
## Lin

A submenu for a six-point linearization table. See below.

## Tare

Tare function, used in weighing applications. If switched on, this unit can be tared (zeroed) on the front panel. Press \* in the normal state to tare. Current reading will be stored in non-volatile memory and subtracted from all readings this on. There are no means to de-tare except by switching this setting off.

## Lin submenu

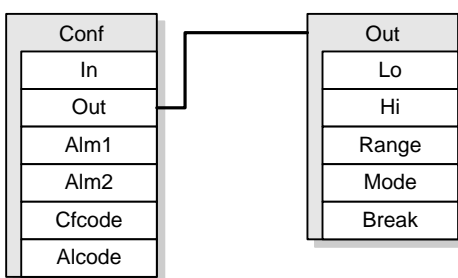


The Lin submenu is used for custom linearization of the input. To enable the linearization, set Use=Yes.

Enter six sample pairs. X values are unlinearized, scaled input values (°C, °F, mV or whatever), while Y values are the corresponding linearized display values. The X and Y values may be selected freely, but the X values must be in ascending order (the smallest first). Linear interpolation/extrapolation is used between/outside the points.

## Out submenu

The Out submenu is used for the analog output signal settings.



## Lo

The displayed (engineering) reading at which the output signal is at its lowest value, 4 mA.

## Hi

The displayed reading at which the output signal is at its highest value, 20 mA.

To achieve an inverted output (20-4mA), swap the Lo and Hi values.

## Mode

**Off** The output not used, fixed at 8 mA. The display is at the maximum intensity all the time.

<b>Limit</b>	Limited between 4 and 20 mA (no overranging).
<b>Full</b>	Can overrange from approx 3.8 mA to approx 21 mA.

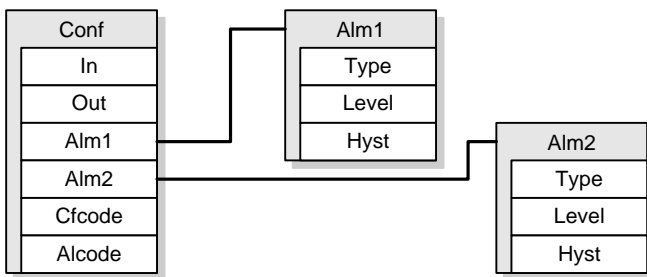
### Break

Output state at sensor/wire fault.

<b>Dscale</b>	The output driven to its minimum value (3.8 or 4.0 mA depending on Mode).
<b>Uscale</b>	The output driven to its maximum value (20 or 21 mA).

## Alarm submenus

There are two alarm submenus, Alm1 and Alm2, for two alarm relays. These are identical. If the alarm option is not fitted, the alarms can still be used for visual indication at the front panel.



### Type

The alarm type: Lo, Hi, LoNc and HiNc. Lo means low level alarm and Hi high level alarm. Nc means inverse operation at the relay: the contacts open when the alarm activates.

### Level

The alarm activation level in the display/engineering units.

### Hyst

The alarm hysteresis. When the alarm has activated, the input reading must fall under the level (Hi alarm) or rise above the level (Lo alarm) by the Hyst value for the alarm to deactivate. Example: High level alarm at 100 C, Hyst=5. The alarm activates at 100 and deactivates at 95 C. Set the hysteresis in the display/engineering units, not percent, and always positive.

Manual reset (hold): If the Hyst value is very large (e.g. 9999), the alarm will never deactivate, unless manually reset in the Operator menu; see chapter Operator menu on the page 5.

# Specifications

## Environmental

Operating temperature	0..60 °C
Storage temperature	-20...+70 °C
Humidity	0..95 %RH
Protection	IP 65
Pollution degree	2
Altitude	Max 2000 m

## Inputs

### Common

Galvanic isolation	1000 VDC 1 min
Measuring rate	3...4 samples/s.
Connectors	2.5 mm <sup>2</sup> , detachable

### Thermocouples

Types and ranges	B (400...1700 °C) C (0...2200 °C) D (0...2200 °C) E (-100...900 °C) G (1000...2200 °C) J (-150...900 °C) K (-150...1350 °C) L (-100...900 °C) N (0...1300 °C) R (0...1700 °C) S (0...1700 °C) T (-150...400 °C)
Cold junction	Internal
Calibration accuracy	0.1 % of span or 1 °C
Linearization error	0.4 °C
CJ compensation error	0.05 °C/°C
Sensor wire influence	Negligible below 1 kΩ

### Pt100

Range	-200...+700 °C
Alpha	0.00385
Connection	3- or 4-wire
Sensor current	approx 0.3 mA
Accuracy at 25 °C	0.15 °C + 0.05 % rdg
Thermal drift	0.03 °C/°C
Max. wire resistance	<30 Ω/wire

### Pt500, Pt1000

Range	-200...+300 °C
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### Ni100

Range	-60...+175 °C
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### Potentiometer input

Two-wire (resistance)	0...1000 Ω
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Three-wire (slidewire)	50...500 Ω
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### mV input

Range	-100...+100 mV
Accuracy at 25 °C	10 μV + 0.02% rdg
Linearity	0.01%
Input impedance	> 10 MΩ

### V input

Measurement range	-10...+10 V
Standard ranges	0-5 V, 0-10 V
Input impedance	1 MΩ
Accuracy at 25 °C	3 mV
Linearity	1 mV

### mA input

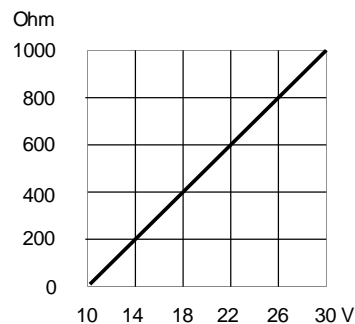
Measurement range	-20...+20 mA
Standard ranges	0..20 mA, 4..20 mA
Input impedance	5 Ω
Accuracy at 25 °C	6 μA
Linearity	0.01%

### IR sensors

Types	Exergen 140F-K and 440F-K
Range 140F-K	-40...+350 °C
Range 440F-K	-30...+600 °C
Emissivity correction	Freely adjustable

## Output

Range	4-20 mA or 20-4 mA
Accuracy at 25 °C	0.1% of span
Output limiter	21 mA typ
Sensor break indication	3.8 or 21 mA
Power supply range	10...28 VDC



Thermal drift	0.005 %/°C
Connectors	2.5 mm <sup>2</sup> , detachable

## Configuration

With front panel keys, or alternatively:

Connection	Nokeval POL at a three-pin header
Baud rate	9600 bps
Serial protocol	Nokeval SCL-Meku 1, address 0, slot 0

## Display

Digits	4 digits, red LED
Digit height	14 mm

## Alarms (model 312)

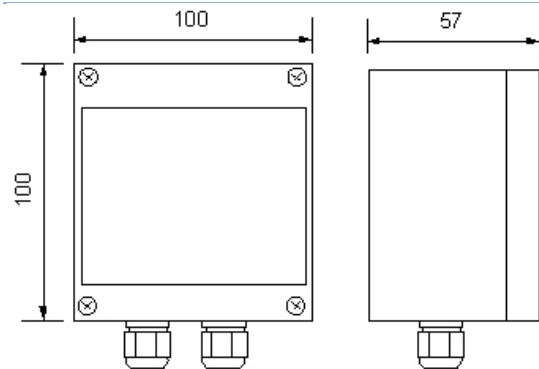
Relay type	2 solid state relays
Relay ratings	250 VAC, 150 mA resistive load
Alarm reset	Automatic or manual with front panel key
Alarm mode	High or low level, one alarm per relay
Normally closed	Selectable
Hysteresis	Selectable 0...100 %
Connectors	1.5 mm <sup>2</sup>

Note: Both relays can't operate simultaneously!

## EMC

Immunity	EN 61326, industrial
Emissions	EN 61326, class B

## Dimensions and weight



Weight 200 g