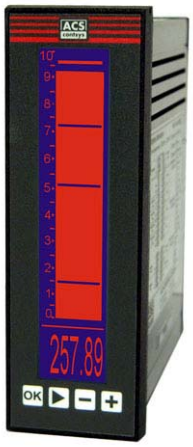
Technical manual BA 0110



Visualization

ECO – 400

Display and evaluation device

for indication, processing, conversion and
galvanic isolation of electrical standard signals

Evaluable input signals
- direct voltage 0...10V
- direct current 0...20mA

Output signals
- direct voltage 0…10V
- direct current 0…20mA
- 4 relay outputs with different control functions

Signal adjustment

Integrated measurand transducer supply

Galvanically safe isolation with 4kV~

ATEX II (2) G Ex ib IIC
Certification for the connection of signal transmitter in explosion hazardous areas

LCD display for digital value and bar graph indication

ACS-CONTROL-SYSTEM
know how mit system

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1. Application

The device **ECO – 400** is a multifunctional display and evaluation device for indication, processing, conversion and galvanic isolation of electrical standard signals also from explosive hazardous areas.

2. Function

The device is intended for the installation into a front panel.

Operation principle

The connected electrical standard signal in the range 0..10V resp. 0..20mA is measured by the evaluation circuit, adjusted according to the programmed settings and transmitted galvanically isolated to the output signal 0...10V or 0...20mA.

The integrated measurand transducer supply allows the direct connection and thus the supply of 2-wire and 3-wire transmitter.

Freely programmable relay switching levels can be assigned to the input signal.

The conversion input to display as well as display to analogue output can be freely scaled. This allows e.g. the indication of the filling level of a container in litre.

In some applications it is necessary to compensate heavy signal fluctuations that may be produced by mixing machines or at fill-in resp. emptying of containers, to avoid spurious switching actions.
By this a signal damping of up 99 seconds can be adjusted.

The indication of the measuring value is made as analogue bar and as digital value.

The programmed settings are stored durable in an internal non-volatile memory.

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3. Safety notes

Each person that is engaged with inauguration and operation of this device, must have read and understood this technical manual and especially the safety notes.

Installation, electrical connection, inauguration and operation of the device must be made by a qualified employee according to the informations in this technical manual and the relevant standards and rules.

The device may only be used within the permitted operation limits that are listed in this technical manual. Every use besides these limits as agreed can lead to serious dangers.

The device meets the legal requirements of all relevant EC directives. CE **0158**

Safety notes for electrical operating supplies for explosive hazardous areas

If a device is installed and operated in explosive hazardous areas, the general Ex construction standards (EN60079-14, VDE0165), this safety notes and the enclosed EC conformity certificate must be observed. The installation of explosive hazardous systems must be carried out principally by specialist staff.

The device meets the classification: **II (2) G [Ex ib] IIC**

The device is a affiliated operating supply and may only be used outside explosion hazardous areas.

The installation class of the installed device must be at minimum IP20 acc. to EN 60529..

The two clamps PA at the bottom of the device must be connected to the potential compensation of the Ex-area.

All intrinsically save clamps (17-20 / 37-40) must be covered with the enclosed clamp housings. These clamps may only be plugged by their clamp numbers (placed already on the back of the housing). Because of wrong plugging of the clamps (intrinsically save and not intrinsically save clamps) there is the danger of removing intrinsically safety.

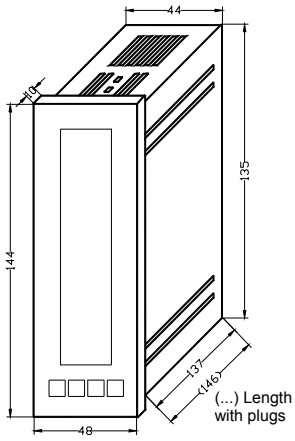
The intrinsically save input circuits are galvanically connected with earthing potential. Due to this there must be a potential compensation in the complete area of the installed intrinsically safe circuits.

4. Installation

The device is intended for the installation into a front panel with a mounting opening 48x144mm.

The device must be installed protected, e.g. in control stations or in a suitable protection housing with a minimum protection classification IP55 acc. to DIN EN 60529.

The devices must be installed wheather and stroke protected, ideally at places without direct solar radiation. This is especially important in warm climatic regions.



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5. Electrical connection

The electrical connection of the device must be carried out according to the respective country specific standards. Incorrect installation or adjustment could cause applicationally conditioned risks.

Power supply input, measuring input, analogue output and relay output channels are safe galvanically isolated from each other. This is also valid for four relay output channels among each other.

The potential compensation must be connected by the shortest way to the connections pins 3 and 11.

The protective earth on terminal 11 should be connected separated from the protective earth connection of mains – terminal 3 – and leaded as short as possible to protection earth.

Connection of the signalling transmitter resp. measuring transducer – measuring input

For the two or three-wire connection cable between the evaluation device and the signalling transmitter resp. measuring transducer a standard installation cable or multi-wire cable for measuring intends with a maximum of 25 Ω per wire can be used.

The use of a shielded signal cable is recommended, if strong electromagnetic influences could happens, e.g. due to machines or radio equipment. In that case the shielding of the cable should be connected to earth only at the side of signalling transmitter resp. measuring transducer.
The signal cable should be installed separated from power leading wires.

The connected signalling transmitter resp. measuring transducer can be powered by the integrated measuring transducer supply. The supply is overload and short circuit protected.

The maximum values of the inputs of the device (current input maximum 50mA - 6V / voltage input 14V) may not be transgressed.

Connection of the output

For the two-wire connection cable between the evaluation device and the connected devices a standard installation cable or multi-wire cable for measuring intends with a maximum of 25 Ω per wire can be used.

The use of a shielded signal cable is recommended, if strong electromagnetic influences could happens, e.g. due to machines or radio equipment. In that case the shielding of the cable should be connected to earth only at the side of the connected device. When connecting a SPS input stage there must be paid attention that mostly the signal circuit must be connected to earth by connection the minus terminal with measuring earth.
The signal cable should be installed separated from power leading wires.

For inauguration it is suggested, to deactivate all connected control devices, to avoid unwanted control reactions.

Connection of the signalling and control equipments – relay outputs

Inductive loads at the relay contacts, e.g. auxiliary contactors or magnetic vents may only be used with a free-wheeling diode or a RC protection circuit to avoid high voltage peaks.

For inauguration it is suggested, to deactivate all connected control devices, to avoid unwanted control reactions.

Connection of the power supply voltage

A switch, that is marked as separator as well as a over current protection switch (nominal current ≤ 10 A) must be installed near the device into the supply lead.

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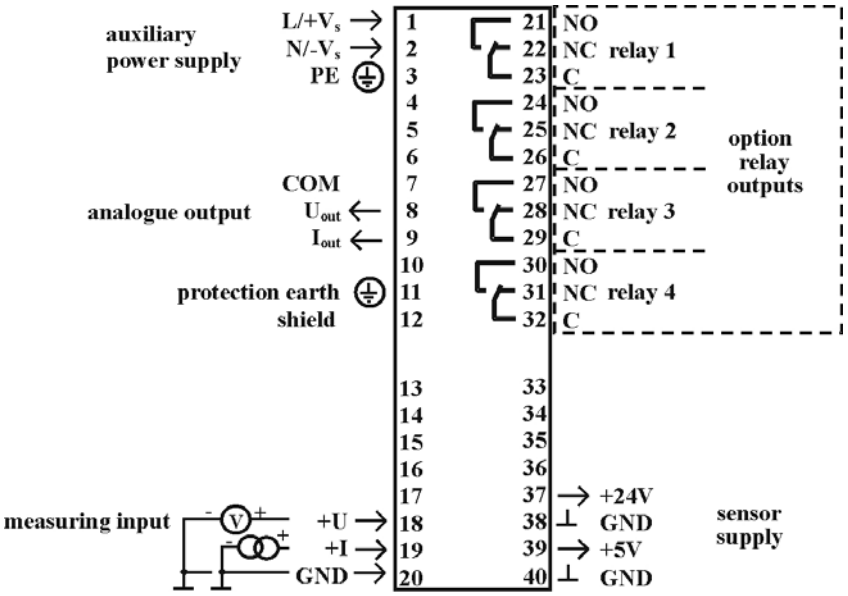
Pin assignment ECO – 400

The illustration shows the view of the device to the back side of the device.
Depending of the options the contact pins of the relays can be not connected.



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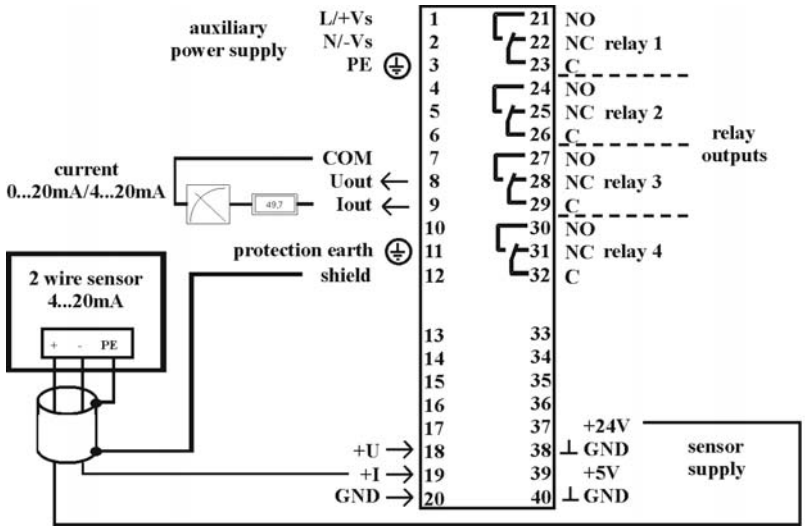
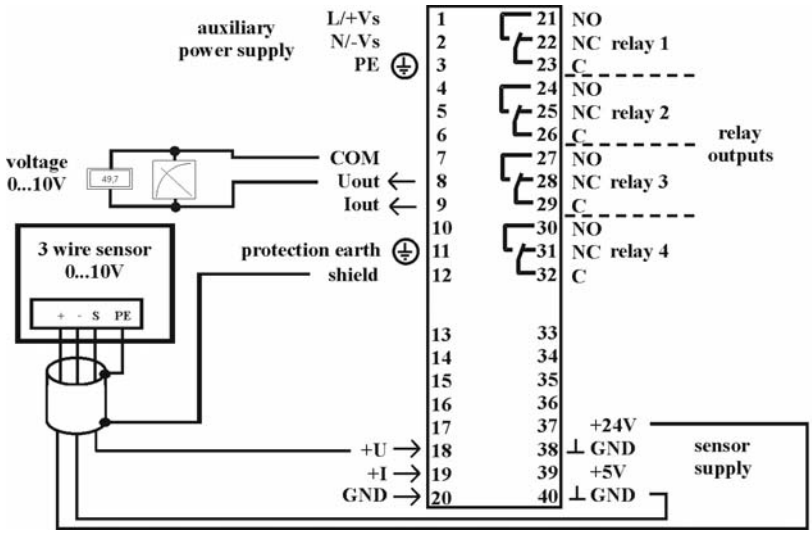
Connection example ECO – 400

Input 2 wire sensor 4...20mA
Output current 0...20mA / 4...20mA



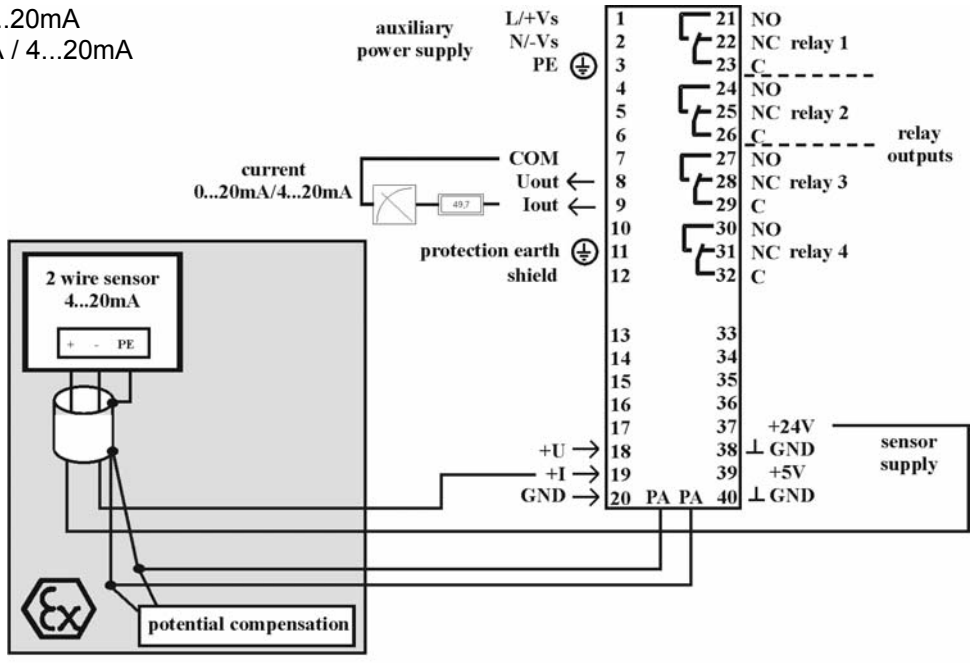
Connection example ECO – 400

Input 3 wire sensor 0...10V
Output voltage 0...10V



Connection example ECO - 400 Ex

Input 2 wire sensor 4...20mA
Output current 0...20mA / 4...20mA



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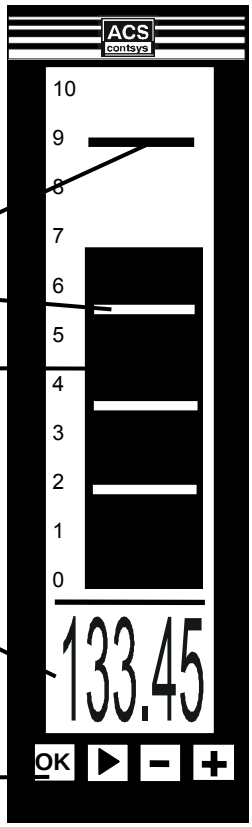
6. Operation

Display elements and keys



limit values:
The limit values are shown as strokes in the allocated bar graph.

bar graph:
160 segments with displayed limit values

digital value
displayed in the chosen scale.

If the value that should be displayed is lower than –29999 or higher than 29999, e.g. if the chosen scale is unfavorable (independent of the decimal places), than the device shows

"....EEE...."

instead of the allocated value.

keyboard:

key "OK“:	jump into menus / leaving the change mode
key " “▶	start change mode / step from number to number in change mode for values
key "-":	cursor up / decreasing value in change mode
key "+“:	cursor down / increasing value in change mode

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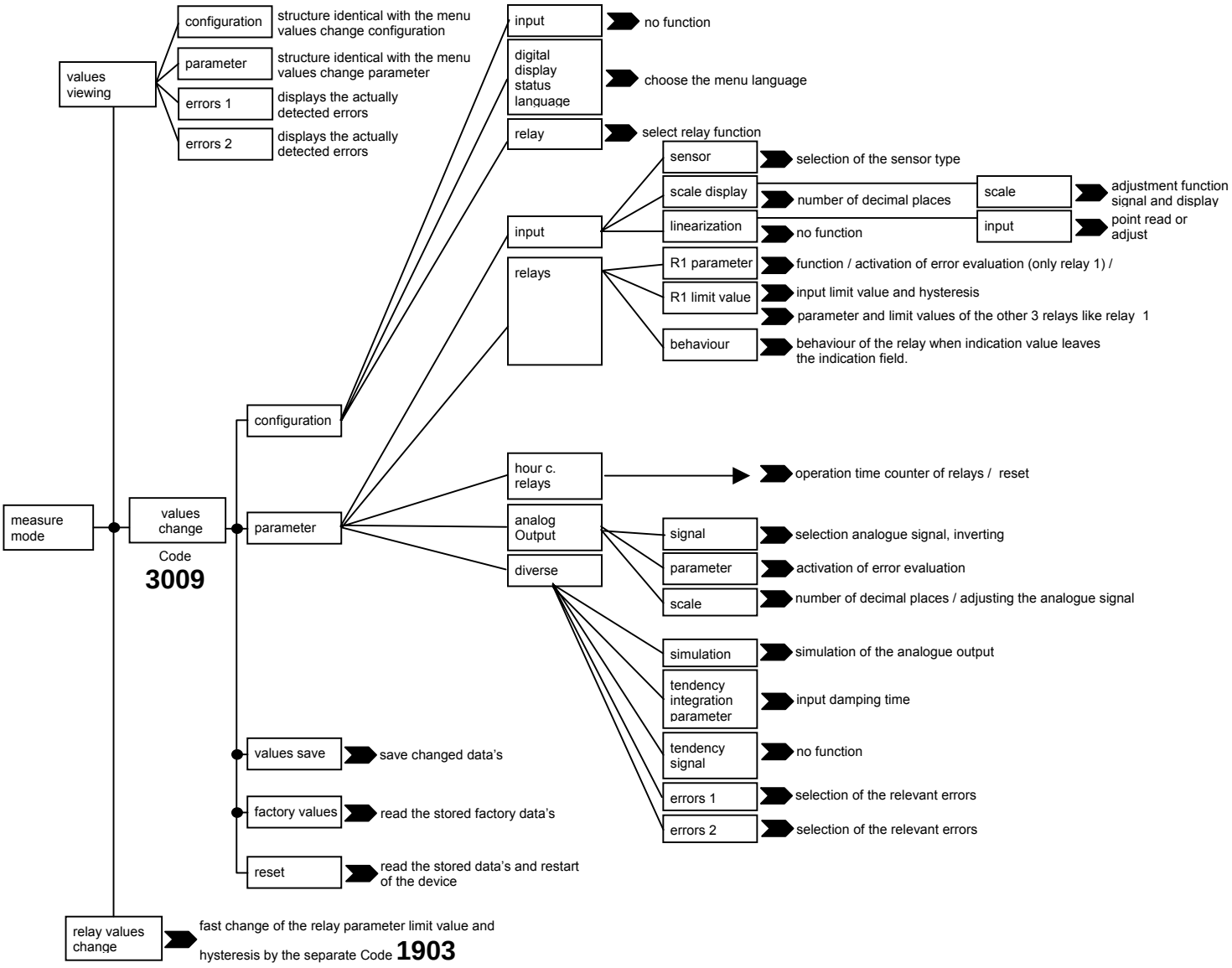
menu short structure / using menu

Note: Dependent on version and options, some of the following described functions can not be chosen.



Use the key **„OK“** to enter the **main menu**. From here **each menu** can be selected, using the keys **„+“** or **„-“** and entered, using the key **„OK“**.
Changing's can only be made in the menu structure „values change“, but the relay data also, using the menu „relay values change“.
In each menu you can find the button <-OK. Activating this button, using the key **„OK“** switches to the menu **before**.
Configuration and **parameter setting** are executed by two ways. Either activation or deactivation of an option by a square or the adjustment of a changeable value.
To activate an option, select at first this option with the keys **„+“** or **„-“** and **activate** the **change mode**, using the key **„>“**. Now by using the keys **„+“** bzw. **„-“,** the option can be activated or deactivated or the value can be increased or decreased number by number.
In the case of a **multiple option selection** it is necessary to deactivate at first the actual option before activating an option positioned under the actual option.
When adjusting an value, you can step from **number to number**, using the key **„>“**. If you want to change the **polarity sign**, step to the place left of the value by **multiple** using the key **„>“**. Now the polarity sign can be changed, using the keys **„+“** or **„-“.**
By using the key **„OK“** you can **leave** now the **change mode**.
All changes are **taken over** by the device **at once** but they are **not** jet stored.
Only by activating the menu „**save**“ in the menu „values change“ the changed data will be saved **durable**.

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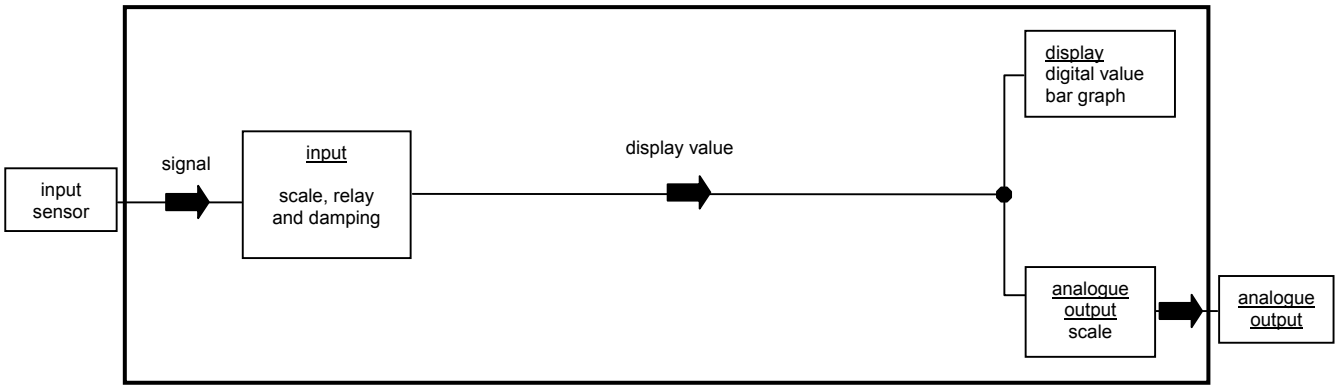
Signal flow schematic



Adjustment display

menu language **values change ➔ configuration ➔ display digital status language**

Choose here the language of the menu.
The languages german and english are available.

Adjustment input

select sensor **values change ➔ parameter ➔ input ➔ sensor**

Select here the desired sensor (0..10 V / 0..20 mA). Only one sensor can be activated.

decimal places **values change ➔ parameter ➔ input ➔ scale**

Select here in the field **display** the number of decimal places (max.3) that should be indicated at the display
The number of decimal places in the field **signal** belongs to the sensor signal and shows the accuracy of the measurement value in the following scaling menu.
Dependent on the chosen sensor, this value changes automatically. You can't change this value.

Adjustment **values change ➔ parameter ➔ input ➔ scale ➔ scale**

Input here the desired sensor signal field and the allocated indication value field.

Input the sensor signal in the fields **signal 0% and 100%** in correct physical unit (mA or V), e.g. for a desired sensor signal from 6..15 mA in the field signal 0% 06.000 and in the field signal 100% 15.000.
Input the indication values in the fields **display 0% and 100%** that should be displayed at the selected sensor signals 0% and 100%.
If you want to adjust the input with a connected sensor, than input at first the desired indicator values in the fields **display 0% and 100%**. Than set the sensor zero signal at the connected sensor and adjust the value in the field **signal 0%** as long as the allocated value below the menus displays the same value as in the field **display 0%**.
Than set the sensor end signal at the connected sensor and adjust the value in the field **signal 100%** as long as the allocated value below the menus displays the same value as in the field **display 100%**.

Adjustment signal damping

adjustment **values change ➔ parameter ➔ diverse ➔ tendency integration parameter**

In many applications it's necessary to damp the input signals, e.g. strongly wave movements caused by a stirring engine.
By increasing the value in the field **signal integration** (to maximal 99) the signal gets more and more artificially damped.
After the selected time in seconds, a step of the input signal is also carried out to the indication value.

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Adjustment relays – limit value function

basic function **values change ➔ configuration ➔ relay**

Choose here the relay function **normal function.** Choose **RESET**.

function **values change ➔ parameter ➔ relay**

➔ R1parameter (or R2parameter, R3parameter, R4parameter)

Choose here, if the allocated relay should work in quiescent or working current principle.
working current principle = relay switches on when the referred signal exceeds the limit value.
quiescent current principle = relay switches off when the referred signal exceeds the limit value. (INVERSE-function)

Choose here, only for relay 1, if it should work as fault detection relays. This means that it will be activated if any one of the selected errors in the error evaluation occurs.
If you choose relay 1 for the error evaluation, it will no more longer work in limit value function.

adjustment **values change ➔ parameter ➔ relay**

➔ R1parameter (or R2parameter, R3parameter, R4parameter

Input here in the field **limit value** the **indication value of the input**, where the relay should be activated.

Input here in the field **hysteresis** the value, by which the indication value of the input must be decreased to switch off the relay

behaviour **values change ➔ parameter ➔ relay ➔ behaviour**

Choose here the reaction of each relay, if the indication value leaves the selected indication field of the input.
If **ON** is chosen, the relay switches on, if **OFF** is chosen, the relay switches off.
Do not choose **ON** and **OFF** together.

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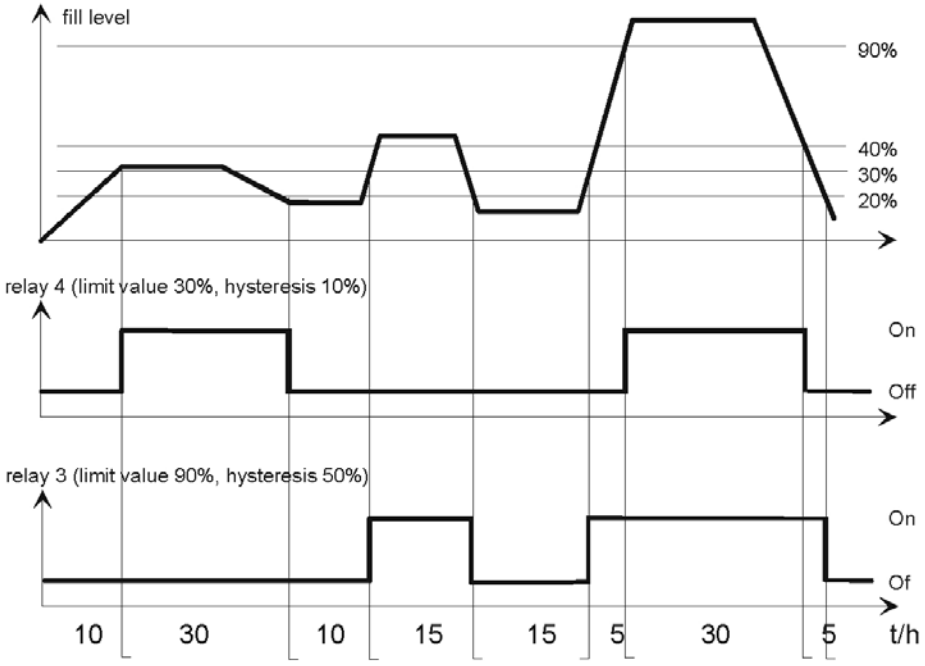
Adjustment relays – alternating relay function

Dependent on the chosen limit values and the actual activation time of the relevant relay the will be between 2 and 4 relay activated by that way that their activation time is equal in the middle value. There will be more relays activated (emptying) or deactivated (filling) than more the measurement value increases. This function results in a considerable increasing of the life time of the connected units (e.g. pumps). There can be controlled an rising (for emptying) but also a falling (for filling) measurement value. To choose this kind of function the relay 4 must set for rising measurement values (emptying) to working current principle an for falling measurement values (filling) to quiescent current principle.
If e.g. for rising measurement value (emptying) the limit value of relay 4 is exceeded, that one relay, dependent on the activation time of all relevant relays, will be activated, that has the lowest activation.
If the limit value of the relay 3 is also exceeded, that one of the remaining deactivated relay will be activated, that has the lowest activation time.
The limit values of the relays 2 and 1 functions equal, if they are also activated for alternating relay function.
If a point for switch off is achieved, that relay with the highest activation time will be switched off first.
The time criterion for choosing one relay are **full hours** corresponding to the values of the activation time counter.
The activation time counter however calculates **exactly by seconds**.
If the relay 1 or 2 are activated for alternating relay function, relay 1 can't be used for error indication and relay 2 can't be used for tendency indication.
If one relay is **not** activated for alternating relay function, it will work in normal limit function.



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Adjustment relays – alternating relay function

function **values change ➔ configuration ➔ relays**

Choose here the relay function **alternating function.**

selection **values change ➔ parameter ➔ relays**

➔ R1parameter (or R2parameter, R3parameter, R4parameter

Choose here in the menu of relay 4 if the alternating function should work for rising of falling measurement value.
The settings of the other for the alternating function used relays are adjusted automatically.
working current principle = relay switches on when the signal exceeds the limit value. (rising value = emptying).
quiescent current principle = relay switches off when the signal exceeds the limit value. (falling value = filling).

Choose here, only for relay 1, if it should work as fault detection relays. This means that it will be activated if any one of the selected errors in the error evaluation occurs.
If you choose relay 1 for the error evaluation, it will no more longer work in limit value function. If the alternating function of relay 1 is activated, the fault detection function will be deactivated.

Select here if the respective relay should work in alternating function. The relays 3 and 4 are automatically activated for this function and could not be used for limit function. If you need more than 2 relays for alternating function, activate at first relay 2 and at last relay 1.

adjustment **values change ➔ parameter ➔ relays**

➔ R1parameter (or R2parameter, R3parameter, R4parameter

If you use two or more relay for alternating function, input the limit values of the relay as **display values of the input** in correct order. The points for switching off result by using the respective hysteresis
limit value 4 ➔ one relay activated limit value 3 ➔ two relays activated
limit value 2 ➔ three relays activated limit value 1 ➔ four relays activated

<u>If you use the relays 2 or 1 for limit function and not for alternating function than input here:</u>

Input here in the field **limit value** the **indication value of the input**, where the relay should be activated

Input here in the field **hysteresis** the value, by which the indication value of the input must be decreased to switch off the relay

behaviour **values change ➔ parameter ➔ relays ➔ behaviour**

Choose here the reaction of each relay, if the indication value leaves the selected indication field of the input.
If for one relay nothing is choose, the relay keeps it's status.
If **ON** is chosen, the relay switches on, if **OFF** is chosen, the relay switches off.
Do not choose **ON** and **OFF** together.

activation time counter **values change ➔ parameter ➔ hour c. relays**

The activation time of each relay is displayed here in hours. This value can be changed or preset.
Every hour the activation times are stored one times and are kept in the case of disconnecting the auxiliary voltage.
If the maximal value of 29952 hours is exceeded all four counters are set to 00000 hours automatically.
By the button **reset** you can manually clear all activation time counters.

restart **values change ➔ reset**

Make a RESET, that means a restart of the device, to surely execute all changed and stored settings.

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Adjustment analogue output

signal selection **values change ➔ parameter ➔ analogue output ➔ signal**

Choose here the requested analogue signal.
Possible is 0..20 mA, 4..20 mA, 20..0 mA, 20..4 mA, 0..10V, 10..0 V. Choose only one signal.

activation **values change ➔ parameter ➔ analogue output ➔ parameter**

Activate here the analogue output.

Choose her, if the respective analogue output should work as fault indicator output. In that case, the voltage output signals 11 V or the current output signals 22 mA if one of the chosen errors in the error evaluation occurs.

adjustment **values change ➔ parameter ➔ analogue output ➔ scale**

Input here the area of the indication field that should be signalled by the analogue output.

Input here in the field **decimal** the number of decimal places with which the values below should be indicated.

Input here in the field **0%** the indication value of the input that forces the analogue output to signal 0 V, 0 mA o 4 mA . This value has to be lower than the value in the field **100%**.

Input here in the field **100%** the indication value of the input that forces the analogue output to signal 10 V or 20 mA.

simulation **values change ➔ parameter ➔ diverse ➔ simulation 0..10 V (or 0..20 mA)**

You can force the analogue output to signal the selected value independent from the running measurement. Dependent on the menu used to enter the simulation, the desired value is constantly provided in volt or milliampere.

Adjustment error evaluation

Error selection **values change ➔ parameter ➔ diverse ➔ error 1 (resp. error 2)**

Choose here, which errors should result in a message on the display, relay 1 or on the analogue output.

The sensor signal can be supervised on exceeding by more than 3% or fall under the nominal measure range (0..10 V, 0..20 mA) and the current analogue output on wire break down. In addition to this, the indication field of the input and the chosen field for the analogue output can be supervised on exceeding or falling down.
The actually detected errors are visualised in the following menu:

values viewing ➔ DXM state error 1 (resp. error 2)

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Factory settings

The device, depending on version and options, is provided with special factory data.

Input:	sensor 0...20 mA signal 04.000 = indication 000.00 and signal 20.000 = indication 100.00
Analogue output:	active, signal 4...20 mA from 000.00 to 100.00, error evaluation not active
Relays:	all active for limit value function with working current principle, relay 1: limit value = 020.00, hysteresis = 005.00 relay 2: limit value = 040.00, hysteresis = 005.00 relay 3: limit value = 060.00, hysteresis = 005.00 relay 4: limit value = 080.00, hysteresis = 005.00 behaviour at measuring range exceeding: state will not be changed
Damping:	01 seconds
Language:	german
Error evaluation:	fault indicator relay R1 not active, output to analogue output not active, all errors deactivated

LCD illumination brightness

The illumination brightness of the LCD display can be adjusted in a wide range by a rotary switch, e.g. to achieve a more pleasant readability in dark environment.
The adjustment can be set in 5 steps, from 0 = dark to 1, 3, 7 to F = bright.

The rotary switch is placed at the top side of the device.

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7. Maintenance

The device is free of maintenance.

8. Repair

A repair may only be carried out by the manufacturer. When sending back the device, add a note with the description of the error and the application.

9. Technical Data

Auxiliary power supply

Permitted supply voltage:	230V AC +/-10% 24V DC +/-10% maximum permitted external voltage	48...62 Hz reverse polarity protected U_m = 253 V AC
Power consumption:	≤ 9 VA / 9 W	depending on version
Overvoltage category:	II	acc. to DIN EN 61010-1
Protection classification:	II	double or reinforced insulation
Isolation voltage:	4kV~	Auxiliary power to signal inputs to signal outputs
Galvanic isolation:	All supply, analogue input, analogue output and relay output channels among each other as well as the four relay outputs from each other are safe galvanically isolated.	

Signal input

Direct voltage:	0…10,5 V / max. 14V / input resistor 250kΩ	
Direct current:	0…21mA / max. 50mA at 30V / input resistor 59Ω ± 1%	
Adjustment range:	Amplification maximum 1:30 = minimum measuring range 3,3% Maximum zero value increasement 96,5%	
Characteristic deviation:	<0,05%	of measuring range end value
Nonlinearity:	<0,02%	of measuring range end value
Temperature deviation:	<0,03%/10K	of measuring range end value
Long term deviation:	≤ ±0,1%	of measuring range end value / year
Measurand transducer supply:	overload and short circuit protected	
▪ ECO – 400-V	24V+/-7% 5V +/-0,5%	max. 23 mA max. 23 mA
▪ ECO – 400ExV	20,4V +/-5% -(90mV per 1mA) >=18,6V at 20mA U_o = 23,1V / I_o = 37 mA / P_o = 850 mW / C_i < 1 nF / L_i < 1 mH 5V +/-0,5% -(0,4 mV per 1mA) U_o = 5,9V / I_o = 37 mA / P_o = 210 mW / C_i = 230 nF / L_i < 1 mH	

Analogue output

Direct voltage:	0…10 V, max. 11V, minimum load 5kΩ	
Direct current:	0…20mA / max. 22mA, maximum load 800Ω	
Characteristic deviation:	≤ 0,05%	of respective nominal output signal range
Nonlinearity:	<0,02%	of respective nominal output signal range
Temperature deviation:	≤ 0,05% / 10 K	of respective nominal output signal range
Long term deviation:	≤ ±0,1%	of respective nominal output signal range / year
Influence output load:	≤ 0,05%	of respective nominal output signal range

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Relay outputs

Function: 4x potential-free changeover contact

Switching power of the contacts:
U~ maximum 250 V AC
I~ maximum 10 A AC
P~ maximum2500 VA at ohmic load / 500 VA at cos φ ≥ 0,7

at U-	maximum I-	maximum P-
30 V	10 A	300 W
110 V	0,3 A	33 W
220 V	0,12 A	26,4 W

Switching cycles: ≥ 100.000 switching cycles at maximum contact load

Materials

Connection housing: PVC – polyvinylchloride

Front panel: PE – polyester

Connection terminals

Screw terminal plug 6-/4pin 0,2 to 2,5 mm^2, solid and stranded
Terminals PA 0,4 to 4,0 mm^2, solid and stranded

Housing style

Housing: Front panel installation housing for mounting opening 48 x 144mm

Weight: Version supply 230V AC 800 g
Version supply 24V DC 580 g

Environmental conditions

Environmental temperature: – 20°C...+65°C

Climatic classification: 3K3 bzw. 3M2 DIN EN 60721-3-3

Protection classification:			
	Front side	IP54	DIN EN 60529
	Housing	IP20	DIN EN 60529
	Terminals	IP00	DIN EN 60529

EM – compatibility:			
	emission	DIN EN 61326-1	operation device class B
	immunity	DIN EN 61326-1	industrial range

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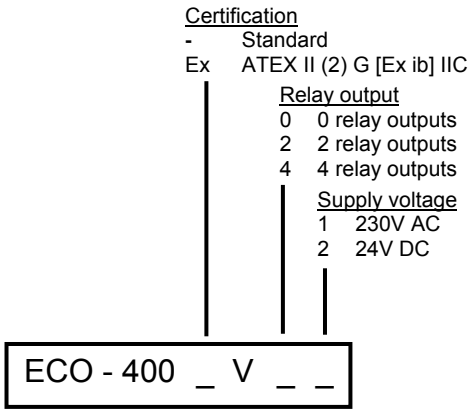
10. Order code ECO – 400



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