ECO24
Mini controller



PC configurable!

- High-precision universal input
- Accurate control behaviour with 250 ms scanning cycle
- Up to three plug-in output modules for mA, V, relay, SSR driver or Triac
- Output function selectable as control, alarm, or measurement signal
- Comprehensive galvanic isolation
- External contact for 2nd setpoint or Auto/Manual switchover
- Selectable setpoint ramp
- RS 485 with Modbus RTU protocol
- Front panel protection mode IP 66
- cULus recognised

economy line

GENERAL

Due to its extremely compact dimensions, the ECO24 can be installed even in the smallest machines. Its universal input and the flexible modular concept for a wide range of output types enable the controller to be adapted perfectly to the most varied automation tasks.

Similarly, the unit is configurable as signaller, continuous, 2-point or 3-point controller for heating or cooling, as well as heating/cooling tasks, i.e. for universal applications.

Moreover, 'split-range' operation is possible in all combinations (e.g. continuous/switching), and various alarm functions put a finishing touch to the comprehensive package.

SAFE OPERATION

The unit is operated by means of just 4 front-panel keys. Menu guidance simplifies navigation through the following levels:

- Operation
- Parameter adjustment
- Configuration
- Product information
- Self-tuning

Access codes prevent unauthorized adjustments. The extended Operating Level enables both setpoints to be adjusted, as well as the output value for manual operation.

Short texts for all adjustment parameters simplify the unit's configuration via the front panel.
Alternatively, every unit comes with an interface for remote configuration via a PC.

DISPLAYS

Two large 4-digit LED displays for process value (PV) and setpoint (SP) ensure easy reading. Other display colour combinations such as red / red can be ordered.
Up to 6 predefined display and operating strategies are configurable, e.g.

- upper display = process value
- lower display = target setpoint (effective setpoint can be changed).

In addition, indicator LEDs show the following operating conditions:

- Manual (MAN blinking) / Parameter mode
- Self-tuning function enabled (AT)
- Common alarm (AL)
- Positive control output, e.g. heating
- Negative control output, e.g. cooling

Fault display

The following faults are signalled in the lower display:

- Device not configured
- Process value outside the measuring range
- Sensor or control loop fault
- Module fault (Options 1, 2, 3, A).

Information mode

The information mode can be called via the operating menu (module type per Option, firmware version, date of manufacture, etc.).

MODULAR CONCEPT

Up to four Options modules can be inserted. Changing and retrofitting is possible on-site without recalibration. Modules are detected automatically, i.e. there is no need for recalibration. Depending on the selected type, the unit's output function is configurable as control, alarm, or measurement signal.

Options 1, 2 and 3

The modules are available with relay, logic (SSR), mA, V, or Triac output.

Option A

Serial RS 485 interface (Modbus RTU) or control input (potential-free contact).

UNIVERSAL INPUT

The input is configurable for all conventional signal and sensor types. With thermocouple or Pt 100 input, the resolution can be selected with or without decimals.

Apart from °C, the display can be changed to °F or to linear engineering units.
Current and voltage inputs are scalable in the range -1999 ... 9999, with up to 3 decimals (999,9...9,999).

The setpoint limits are adjustable within the measuring ranges.
In case of a sensor fault, the control outputs are switched off (0% output).

Offset

For the purpose of measurement correction, a constant value can be added to the measurement signal.

CONTROLLER FUNCTIONS

Either PID, PD, PI or P behaviour is configurable. Various plug-in modules are available for the control outputs.

Self-tuning function

The start-up tuning function (advance tuning) determined the best PID parameters by means of a 100% step change of the output, either at the push of a button (operating menu) or automatically at power-up.
The tuning attempt is started as soon as the control deviation exceeds 5% of the measuring range.

Alternatively, the self-tuning function can be used at the setpoint. In this case, an oscillation test (1 period) is started automatically, if the control deviation exceeds 0,15% of the measuring range.

Setpoint

Apart from the main setpoint SP1, a second setpoint SP2 can be adjusted from the front (adjustment can be disabled). The setpoint limits are adjustable. Switchover to SP2 is done via a control input or a serial interface (Option A required).

Setpoint ramp

The function 'Setpoint ramp with adjustable gradient' can be enabled. In case of a setpoint change, the ramp starts from the actual process value.

Manual operation

Switchover to manual operation is done either with the A/M key in the front panel, or via a control input (Option A required). The front panel key can be disabled.

Auto/manual switchover

The controller can be switched to manual operation from the front. If switchover is done via a control input (Option A), the front panel key is disabled.

Control output limiting

The maximum output value for heating is adjustable. During manual operation, the limit is not effective.

Operating sense

The operating sense for heating can be switched from 'inverse' to 'direct'. The operating sense for cooling is fixed to 'direct'.

Neutral zone (dead band)

With 3-point controllers and split-range operation, a neutral zone is adjustable in the range -20...+20%. Hereby, the two characteristics (heating / cooling) can overlap.

CONFIGURABLE ALARM OUTPUTS

Both alarm outputs work in the normally de-energized mode: Alarm relays or logic signals are energized in case of an alarm, and the corresponding red LED lights up.

The switching differential is separately adjustable. Alarm functions are configurable as absolute or relative measurement value alarms (min. or max.), bandwidth alarm (symmetrical to setpoint) or for control loop monitoring.

The two alarm outputs can be AND or OR-linked, and be used as common alarms.

Furthermore, the alarm behaviour is configurable: Alarm suppression after power up and after a setpoint change. Normally energized or de-energized operating mode is also selectable.

Control loop alarm

Automatic detection if there is no response of the process value after a change in the output.

INTERFACE / DIGITAL INPUT (OPTION A)

All parameters are accessible via the digital RS 485 interface with Modbus RTU protocol.

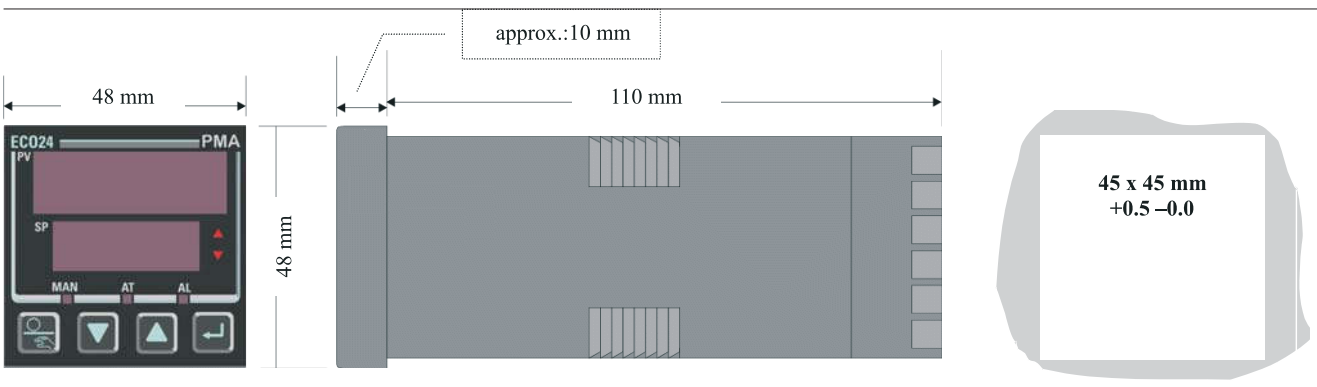
An external control contact can be used either to select a 2nd setpoint (w/W2) or for auto/manual switchover.

GALVANIC ISOLATION

All outputs are galvanically isolated from each other, from the universal input, and from the power supply.

Important: An SSR output is not isolated from the universal input or from other SSR outputs!

Overall dimensions (in mm)



TECHNICAL DATA

UNIVERSAL INPUT

Scanning cycle

250 ms

Digital input filter

0; 0,5…100 s, adjustable in steps of 0,5 s.

Input resolution

Approx. 14 bits; ¼ of the display resolution

Input resistance

10 V DC: 47 kΩ
20 mA DC: 5 Ω
Other ranges: >10 MΩ

MEASURING RANGES

Thermocouples

Types: L; J; K; N; R; S; T; C; B; PtRh20%/PtRh40%

Characteristic

Temperature-linear

Sensor monitoring

Response time: 2 s
Controller outputs are switched off (output value 0%).

Measurement error

0,1% of measuring range ± 1 digit (valid for Type B: from 600 °C, and PtRh 20%/PtRh 40% from 800 °C)

Linearization

Error: < 0,2 °C (typically 0,05 °C)
Without decimals: < ±0,5 °C

Cold-junction compensation

< ±0,7 °C under reference conditions.
< ±1 °C under operating conditions.

Temperature stability

< 0,01% / K change of ambient temperature

Source impedance effect

< 100 Ω : <0,1% of measurement error (< 1000 Ω : <0,5%)

Resistance thermometer

Sensor: Pt 100

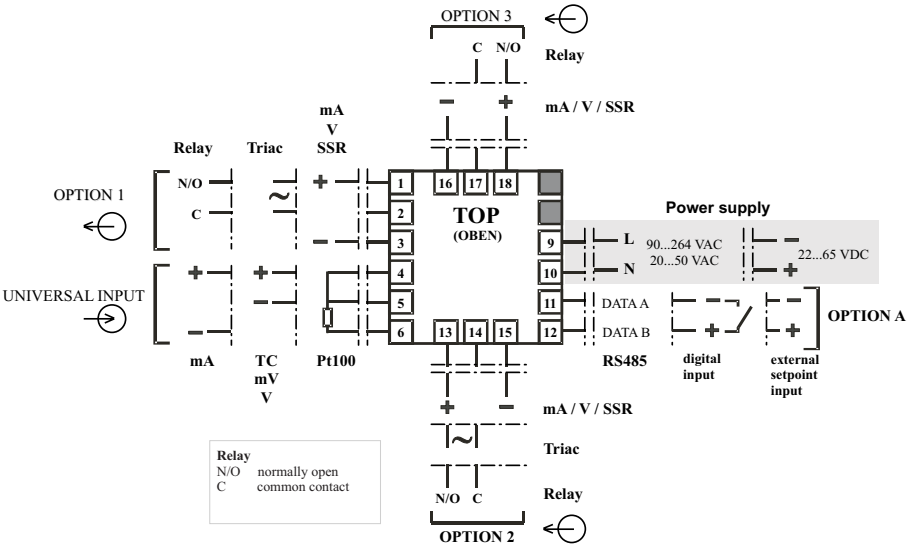
Measuring ranges

-128,8 … 537,7 °C (-199,9 … 999,9 °F)
-199 … 800 °C (-328 … 1472 °F)
Resolution: 0,1 K or 1 K

Characteristic: temperature-linear

Connecting principle: three-wire

Connecting diagram



Thermocouples

Type		Measuring range		Resolution
Fe-CuNi	J	-200...1200 °C	-328...2192 °F	1 K
Fe-CuNi	J	-128,8...537,7 °C	-199,9...999,9 °F	0,1 K
Fe-CuNi	L	0...762 °C	32...1403 °F	1 K
Fe-CuNi	L	0,0...537,7 °C	32,0...999,9 °F	0,1 K
SNiCr-Ni	K	-240...1373 °C	-400...2503 °F	1 K
NiCr-Ni	K	-128,8...537,7 °C	-199,9...999,9 °F	0,1 K
PtRh-Pt 10%	S	0...1762 °C	32...3204 °F	1 K
PtRh-Pt 13%	R	0...1759 °C	32...3198 °F	1 K
PtRh-Pt 6%	B	100...1824 °C	211...3315 °F	1 K
Cu-CuNi	T	-240...400 °C	-400...752 °F	1 K
Cu-CuNi	T	-128,8...400 °C	-199,9...752,0°F	0,1 K
Nicrosil/Nisil	N	0...1399 °C	32...2551 °F	1 K
W5Re/W26Re	C	0...2320 °C	32...4208 °F	1 K
PtRh20% PtRh40%		0...1850 °C	32...3362 °F	1 K

Sensor current: approx. 150 µA

Sensor monitoring

Acts on sensor break and short circuit.
Response time: 2 s
Controller outputs are switched off (output value 0%).

Measurement error

< ±0,1% of measuring range ± 1 digit.

Linearization error

< 0,2°C (typically 0,05 °C)
Without decimals: <±0,5 °C

Temperature stability

0,01% /K change of ambient temperature

Lead resistance effect:

< 0,5% of measurement error with 50Ω /lead

Current and voltage

Measuring ranges:

0...20 mA, 4...20 mA,
0...50 mV, 10...50 mV,
0...5 V, 1...5V, 0...10V, 2...10V

Scaling

-1.999...9.999

Resolution ≥ 1 digit

Characteristic: linear

Measurement error

0,1% of measuring range ± 1 digit

Break monitoring

Only with span start > 0!
Response time: 2 s
Controller outputs are switched off (output value 0%).

Measurement error:

0,1% of measuring range ± 1 digit.

Temperature stability:

< 0,01% / K change of ambient temperature

EXTERNAL SETPOINT (OPTION A)

0-20mA, 4-20mA, 0-50mV, 0-5, 1-5, 0-10, 2-10V. scalable from 1999 to 9999, internal / external Setpoint changeover via front-keys

CONTROL INPUT (OPTION A)

Connection of a potential-free contact or a TTL voltage level

Function

Remote switchover of setpoint or auto/manual operation

Response delay: 0,25 s

TTL voltage level

≤ 0,8 V for setpoint 1 or AUTO
≥ 2...24 V for setpoint 2 or MAN

Contact

≤ 50 Ω: setpoint 2 or MAN
≥ 5 kΩ: setpoint 1 or AUTO

OUTPUTS

Plug-in modules (Options 1, 2, 3)

Quantity: 3

Type (Options 1, 2 and 3)

- Relay
- SSR driver
- Continuous (current / voltage)
- TRIAC

Relays

Contact type:
potential-free, normally open

Contact rating:

Max. 2 A / 240 V AC, resistive load, Min. 100 mA, 5 V AC/DC:

Electrical service life: 500.000 switching cycles at max. contact rating.

- If the relays operate external contactors, these must be fitted with RC snubber circuits to prevent excessive switch-off voltage peaks.

SSR driver (logic output)

Power: >10 V at 20 mA load current

TRIAC

Operating principle:

zero-crossing mode
Load voltage: 20...280 Vrms
Load frequency: 47...63 Hz
Load current: 0,025...1,0 Arms (at 40°C), linear derating to 0,5 Arms at 80 °C

Peak current:

<25 Arms (max. 1 full cycle)
Nominal forward voltage:
< 1,5 V at full load

Critical voltage rise dv/dt:

500 V/ms

Peak reverse voltage:

> 600 Vrms

Leakage current:

<1 mArms

Input/output delay:

1 half cycle

Power factor:

cos φ ≥ 0,5 (full load)

Standard current

Ranges: depending on module type

0...20 mA or 4...20 mA
Signal range: 3,68...20,32 mA (4...20 mA; control output)
Load: = 500 Ω
Load effect: = 0,1%/100 Ω
Resolution: 10 bits
Scanning cycle: 250 ms
Error: ± 0,25 %

Standard voltage

Ranges: depending on module type

0...10 V / 0...5 V / 2...10 V
Signal range: 1,84...10,16 V (2...10 V; control output)
Load: ≥ 500 Ω
Load effect: = 0,25 % (2 kΩ);
= 0,25 % (500 Ω)
Resolution: 10 bits
Scanning cycle: 250 ms
Error: ± 0,25 %

Measuring transducer supply

24V DC supply (nominal), at 910Ω resistive load minimum. For supplying external measuring transducers.

POWER SUPPLY

AC voltage

Voltage: 100...264 V AC
Frequency: 50/60 Hz
Power consumption: 7,5 VA

Universal supply

Voltage: 20...48 VAC, 50/60 Hz and 22...65 VDC
Power consumption: 7,5 VA or 5 W

CONTROL BEHAVIOUR

Proportional band: Pb = 0,5...999,9 % of measuring range; 0 = signaller function
Working point: 0...100 % (2-point and continuous controllers); -100...100 % (3-point and split-range controllers)

Integral action time Tn:

1 s...99 min 59 s...OFF

Derivative action time Tv:

0...99 min 59 s

Switching differential (Pb = 0):

0,1...10% of measuring range

*Neutral zone (*3-point and split-range controllers*):*

-20...+20%, overlap of 'heating/cooling' possible

Switching duty cycle:

0,5; 1, 2, 4, up to 512 s

Operating sense: inverse ('heating') or direct ('cooling')

Output limiting: 0...100 % (only 2-point and continuous controllers)

Output response on sensor break or control loop error: controller outputs switched off.

Manual operation

Selectable via front panel key or control input.
Positioning range: (-100)...0...100 %

Setpoint functions

Second setpoint: selectable (switchover via control input)
Setpoint ramp: 1...9999 units / h or ramp OFF
Setpoint limits: adjustable
External Setpoint: with according analog input.

Self-tuning function

Method: configurable

Manual preconfiguration

Pulse method during start-up with 100 % output signal. If the attempt is successful, the PID parameters become effective automatically.
Condition: (x-w) > 5% of measuring range.

Automatic preconfiguration

Pulse method after power up.
Automatic self-tuning
Tuning attempt at setpoint (1 cycle)
Start condition: (x - w) > 0,15 % of measuring range

Scanning cycle:

250 ms

ALARMS

See text for a description of the functions.
Quantity: 2 (min / max)
Hysteresis: 0...100 % of measuring range

COMMUNICATION (OPTION A)

Interface: RS 485
Protocol: Modbus RTU or ASCII; selectable
Controller addresses: 1...255 (Modbus), or1...99 (ASCII)
Transmission speed: 1200...19.200 bits/s
Galvanic isolation: between inputs/outputs, and power supply

ENVIRONMENTAL CONDITIONS

Operating temperature: 0...55 °C
Relative humidity: 20...95 %, no condensation
Storage temperature: -20...+80 °C

Reference conditions

(for specified accuracy)
Ambient temperature: 20 _ 2 °C
Humidity: 60...70 % rH
Supply voltage: 100...240 VAC, 50 Hz ± 1%
Source impedance (TC): < 10 Ω
Lead resistance (Pt 100): < 0,1 Ω

TESTS

Electrical safety

According to DIN EN 61 010-1
Over-voltage category II
Contamination degree 2
Working voltage range 240 V AC

Electromagnetic compatibility

According to EN 61 326

Certifications

cULus-certification
(Type 1, indoor use)
File: E 208286

GENERAL

Housing

Front dimensions: 48 x 48 mm (1/16 DIN)
Mounting depth: 110 mm
Front panel cutout: 45 x 45 mm

Protection mode

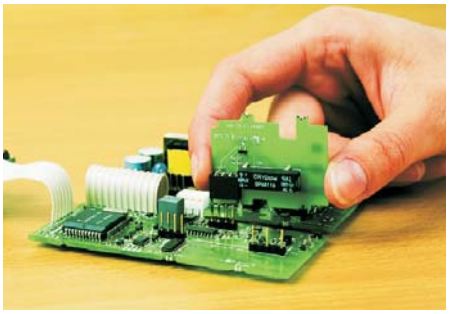
Front: IP 66

Electrical connections

Screw terminals for max. 2,5 mm²

Weight:

approx. 190 g



Options modules

Jumper-free configuration for every type (no other modules required). Ordering data for the Options modules is given under 'Accessories'.

ECO24

Ordering code

ECO24 - □□□ - □□□□ - □□00

Input signal type		
Universal input configured for:	Pt100 or mV	1
	Thermocouple	2
	DC mA	3
	DC Volt	4
Option socket 1 Output module 1		
Not used		0
Relay module		1
SSR-/Logic module		2
Continuous module configured for:	0 - 10 V	3
	0 - 20 mA	4
	0 - 5 V	5
	2 - 10 V	6
	4 - 20 mA	7
Triac		8
Option Socket 2 Output module 2		
Not used		0
Relay module		1
SSR-/Logic module		2
Continuous module configured for:	0 - 10 V	3
	0 - 20 mA	4
	0 - 5 V	5
	2 - 10 V	6
	4 - 20 mA	7
Triac		8
Option Socket 3 Output module 3		
Not used		0
Relay module		1
SSR-/Logic module		2
Continuous module configured for:	0 - 10 V	3
	0 - 20 mA	4
	0 - 5 V	5
	2 - 10 V	6
	4 - 20 mA	7
Measuring transducer supply 24V DC		8
Socket A		
Not used		0
RS485		1
Digital input (W/W2 oder H/A)		3
External setpoint input		4
Supply voltage		
100 - 240 V AC		0
24 - 48 V UC		2
Display colours		
Upper and lower display red		0
Upper and lower display green		1
Upper display red, lower display green		2
Upper display green, lower display red		3
Language of operating manual / operating leaflet		
German operating leaflet		0
German operating manual (D)		3
English operating leaflet		8

ation

For reasons of space, it is not possible to use the following combination:

- Option 1 as continuous module together with
- Option 3 as relay output!

Accessories ECO24

Ordering code

Options module 1 (output module 1)	
Relay module	ECO24 - PO1 - C10
SSR / Logic module	ECO24 - PO1 - C50
Continuous module mA/V/DC	ECO24 - PO1 - C21
Triac	ECO24 - PO1 - C80
Options module 2 (output module 2)	
Relay module	ECO24 - PO2 - C10
SSR / Logic module	ECO24 - PO2 - C50
Continuous module mA/V/DC	ECO24 - PO2 - C21
Triac	ECO24 - PO2 - C80
Options module 3 (output module 3)	
Relay module	ECO24 - PO2 - C10
SSR / Logic module	ECO24 - PO2 - C50
Continuous module mA/V/DC	ECO24 - PO2 - C21
Measuring transducer input	ECO24 - PO2- W08
Options module A (digital input / interface)	
Digital input	ECO24 - PA1 - W03
RS 485 interface	ECO24 - PA1 - W06
External setpoint input	ECO24 - PA1 - W04
Configuration tool	
Configuration tool, consisting of: CD, cable, and adapter	ECO24 - PS1 - CON

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