

ETR-9100 Series

Auto-Tune PID Temperature Controller

- Easy-to-Use Operator Interface
- Fuzzy Logic PID Heat & Cool Control
- Fast A-D Sampling Rate (5 times/sec.)
- Universal Input PT100, Thermocouple with High Accuracy 18-bit A-D
- Analog Output (Linear Current or voltage) Uses High Accuracy 15-bit D-A
- RS-485 or RS-232 Interface
- Programming Port
- Manual Control & Auto-Tune Functions
- Six Alarm Mode Selections
- Lockout Protection
- Bumpless Transfer During Failure Mode
- Soft-Start Ramp and Dwell Timer
- Bright LED Display Stabilized with Digital Filter
- SEL Function Allows User to Rearrange Menu
- UL Recognized, CSA, IEC1010-1



PDS ETR-9100

Description

The ETR Fuzzy Logic plus PID microprocessor-based controller series incorporates two bright, easy-to-read, 4-digit LED displays, indicating process value and set point value. The Fuzzy Logic technology enables a process to reach a predetermined set-point in the shortest possible time, with minimum overshoot during power-up or external load disturbance.

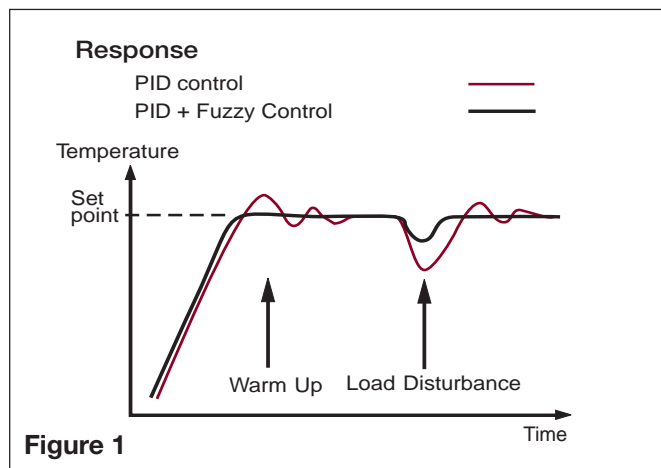
ETR-9100 is a 1/16 DIN size panel mount controller. ETR-8100 is a 1/8 DIN size panel mount controller, and ETR-4100 is a 1/4 DIN size panel mount controller. These units are powered by universal 90-250 VDC/VAC supply. Up to three outputs are available for control and alarm. The second output may be used as cooling control, or an alarm. Output selections are relay, triac, 5 V logic output, linear current, or linear voltage to drive an external device. There are six types of alarms, plus a dwell timer may be configured for the third output.

The units provide universal input selection of RTD's and thermocouple types J, K, T, E, B, R, S, N, L without modification of the unit. The input signal is digitized by using an 18-bit A to D converter. Its fast sampling rate enables the unit to control fast processes.

Digital communications RS-485 or RS-232 are available as an additional option. These options allow the units to be integrated with a supervisory control system and software.

A programming port is available for automatic configuration, calibration and testing without the need to access the keys on front panel.

By using proprietary Fuzzy Logic PID auto tuning technology, temperature overshoot and undershoot is minimized. Figure 1 control diagram is a comparison of a typical system response with and without Fuzzy technology.



ETR-9100 Series Auto-Tune PID Temperature Controller

Specifications

Power

90-250 VAC, 47-63 Hz, 12VA, 5W maximum
11-26 VAC / VDC, 12VA, 5W maximum

Signal Input

Resolution: 18 bits

Sampling Rate: 5 times / second

Maximum Rating: -2 VDC minimum, 12 VDC maximum (1 minute for mA input)

Temperature Effect: ±1.5 uV/°C for all inputs except mA input
±3.0 uV/°C for mA input

Sensor Lead Resistance Effect:

T/C: 0.2uV/ohm

3-wire RTD: 2.6°C/ohm of resistance difference of 2 leads

2-wire RTD: 2.6°C/ohm of resistance sum of 2 leads

Burn-out Current: 200nA

Common Mode Rejection Ratio (CMRR): 120dB

Normal Mode Rejection Ratio (NMRR): 55dB

Sensor Break Detection:

Sensor open for TC, RTD and mV inputs,
Sensor short for RTD input,
below 1 mA for 4-20 mA input,
below 0.25V for 1 - 5 V input,
unavailable for other inputs.

Sensor Break Responding Time:

Within 4 seconds for TC, RTD and mV inputs,
0.1 second for 4-20 mA and 1 - 5 V inputs.

Characteristics

Type	Range	Accuracy @25°C	Input Impedance
J	-120°C-1000°C (-184°F-1832°F)	±2°C	2.2MΩ
K	-200°C-1370°C (-328°F-2498°F)	±2°C	2.2MΩ
T	-250°C-400°C (-418°F-752°F)	±2°C	2.2MΩ
E	-100°C-900°C (-148°F-1652°F)	±2°C	2.2MΩ
B	0°C-1800°C (32°F-3272°F)	±2°C (200°C-1800°C)	2.2MΩ
R	0°C-1767.8°C (32°F-3214°F)	±2°C	2.2MΩ
S	0°C-1767.8°C (32°F-3214°F)	±2°C	2.2MΩ
N	-250°C-1300°C (-418°F-2372°F)	±2°C	2.2MΩ
L	-200°C-900°C (-328°F-1652°F)	±2°C	2.2MΩ
PT100 (DIN)	-210°C-700°C (-346°F-1292°F)	±0.4°C	1.3KΩ
PT100 (JIS)	-200°C-600°C (-328°F-1112°F)	±0.4°C	1.3KΩ
mV	-8mV - 70mV	±0.05%	2.2MΩ
mA	-3mA - 27mA	±0.05%	70.5Ω
V	-1.3V - 11.5V	±0.05%	650KΩ

Output 1 / Output 2

Relay Rating: 2A/240 VAC, life cycles 200,000 for resistive load

Pulsed Voltage: Source Voltage 5V,
current limiting resistance 66Ω.

Linear Output Characteristics

Type	Zero Tolerance	Span Tolerance	Load Capacity
4-20 mA	3.6-4 mA	20-21 mA	500Ωmax.
0-20 mA	0 mA	20-21 mA	500Ωmax.
0-5 V	0 V	5-5.25 V	10 KΩmin.
1-5 V	0.9-1 V	5-5.25 V	10 KΩmin.
0-10 V	0 V	10-10.5 V	10 KΩmin.

Linear Output

Resolution: 15 bits

Output Regulation: 0.02 % for full load change

Output Settling Time: 0.1 sec. (stable to 99.9%)

Isolation Breakdown Voltage: 1000 VAC

Temperature Effect: ±0.01 % of SPAN /°C

Triac (SSR) Output

Rating: 1A / 240 VAC

Inrush Current: 20A for 1 cycle

Min. Load Current: 50 mA rms

Max. Off-state Leakage: 3 mA rms

Max. On-state Voltage: 1.5 V rms

Insulation Resistance: 1000 Mohms min. at 500 VDC

Dielectric Strength: 2500 VAC for 1 minute

Alarm

Alarm Relay: Form C, Max. rating 2A/240VAC,
life cycles 200,000 for resistive load.

Alarm Functions: Dwell timer,
Deviation High/Low Alarm,
Deviation Band High/Low Alarm,
Process High / Low Alarm

Alarm Mode: Normal, Latching, Hold,
Latching/ Hold.

Dwell Timer: 0.1 - 4553.6 minutes

Data Communication

Interface: RS-232 (1 unit), RS-485 (up to 247 units)

Protocol: Modbus Protocol RTU mode

Address: 1 - 247

Baud Rate: 2.4 ~ 38.4 Kbits/sec

Data Bits: 7 or 8 bits

Parity Bit: None, Even or Odd

Stop Bit: 1 or 2 bits

Communication Buffer: 160 bytes

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Specifications (cont'd.)

Analog Retransmission

- Output Signal:** 4-20mA, 0-20mA, 0-5V, 1-5V, 0-10V
- Resolution:** 15 bits
- Accuracy:** $\pm 0.05\%$ of span $\pm 0.0025\%/^{\circ}\text{C}$
- Load Resistance:** 0-500 ohm (for current output)
10K ohm min. (for voltage output)
- Output Regulation:** 0.01% for full load change

User Interface

Dual 4-digit LED Displays:

- ETR-4100
 - Upper 0.55" (14mm)
 - Lower 0.4" (10 mm)
- ETR-8100, ETR-9100
 - Upper 0.4" (10 mm)
 - Lower 0.31" (8 mm)

Keypad: 4 keys

Programming Port: For automatic setup, calibration and testing

Communication Port: Connection to PC for supervisory control

Control Mode

- Output 1:** Reverse (heating) or direct (cooling) action
- Output 2 :** PID cooling control, cooling P band 50~300% of PB, dead band 36.0~36.0% of PB
- ON-OFF:** 0.1-90.0($^{\circ}\text{F}$) hysteresis control (P band = 0)
- P or PD:** 0 - 100.0% offset adjustment
- PI :** Fuzzy logic modified
 - Proportional band 0.1 ~ 900.0 $^{\circ}\text{F}$.
 - Integral time 0 - 1000 seconds
 - Derivative time 0 - 360.0 seconds
- Cycle Time:** 0.1 - 90.0 seconds
- Manual Control:** Heat (MV1) and Cool (MV2)
- Auto-tuning:** Cold start and warm start
- Failure Mode:** Auto-transfer to manual mode while sensor break or A-D converter damage
- Ramping Control:** 0 - 900.0 $^{\circ}\text{F}$ /minute or 0 - 900.0 $^{\circ}\text{F}$ /hour ramp rate

Digital Filter

- Function:** First order
- Time Constant:** 0, 0.2, 0.5, 1, 2, 5, 10, 20, 30, 60 seconds programmable

Environmental & Physical

- Operating Temperature:** -10 $^{\circ}\text{C}$ to 50 $^{\circ}\text{C}$
- Storage Temperature:** -40 $^{\circ}\text{C}$ to 60 $^{\circ}\text{C}$
- Humidity:** 0 to 90% RH (non-condensing)
- Altitude:** 2000m maximum
- Pollution:** Degree 2
- Insulation Resistance:** 20 Mohms min. (at 500 VDC)
- Dielectric Strength:** 2000 VAC, 50/60 Hz for 1 min.
- Vibration Resistance:** 10-55Hz, 10m/s² for 2 hours
- Shock Resistance:** 200 m/s² (20 g)
- Moldings:** Flame retardant polycarbonate

Dimensions:

- ETR-4100 96mm(W) X 96mm(H) X 65mm(D), 53 mm depth behind panel
- ETR-8100 48mm(W) X 96mm(H) X 80mm(D), 65 mm depth behind panel
- ETR-9100 48mm(W) X 48mm(H) X 116mm(D), 105 mm depth behind panel

Mounting:

- ETR-4100 panel mount, cutout 92 X 92 (mm)
- ETR-8100 panel mount, cutout 45 X 92 (mm)
- ETR-9100 panel mount, cutout 45 X 45 (mm)

Weight :

- ETR-4100 250 grams
- ETR-8100 210 grams
- ETR-9100 150 grams

Third Party Approvals

- Safety :** UL61010C-1
CSA C22.2 No. 24-93
EN61010-1 (IEC1010-1)

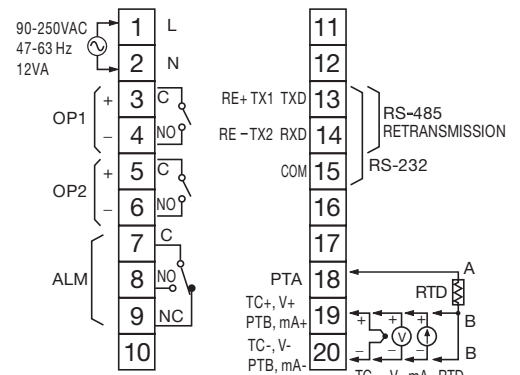
Protective Class:

- IP65 front panel with additional option,
- IP50 front panel without additional option,
- all indoor use,
- IP 20 housing and terminals with protective cover.

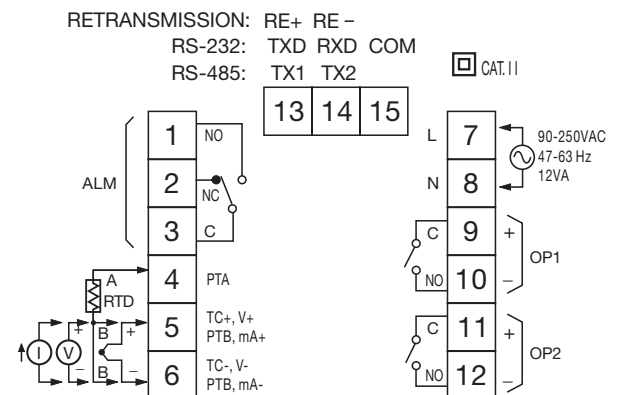
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Connection Diagrams

ETR-4100, 8100



ETR-9100



ETR-9100 Series Auto-Tune PID Temperature Controller

Ordering Information

Model Dual Display Microprocessor Based Temperature Controller with Smarter Logic®

ETR-9100 1/16 DIN Temperature Controller

ETR-8100 1/8 DIN Temperature Controller

ETR-4100 1/4 DIN Temperature Controller

Code Power Input

- 4** 90 - 250 VAC, 50/60 HZ
- 5** 11 - 26 VAC or VDC
- 9** Special Order

Code Signal Input

- | | | | |
|----------|---|----------|---------------|
| 1 | Standard Input Thermocouple: J, K, T, E, B, R, S, N, L
RTD: PT100 DIN, PT100 JIS | 5 | 1 - 5 V |
| 2 | 0 - 60 mV | 6 | 4 - 20 mA |
| 3 | 0 - 1 V | 7 | 0 - 20 mA |
| 4 | 0 - 5 V | 8 | 0 - 10 V |
| | | 9 | Special Order |

Code Output 1

- | | | | |
|----------|--|----------|---|
| 0 | None | 5 | Isolated 0 - 10 V* |
| 1 | Relay rated 2 A/240 VAC | 6 | Triac output 1 A / 240 VAC, SSR |
| 2 | Pulsed voltage to drive SSR, 5 V/30 mA | C | Pulsed voltage to drive SSR, 14 V/40 mA |
| 3 | Isolated 4 - 20 mA / 0 - 20 mA* | 9 | Special order |
| 4 | Isolated 1 - 5 V / 0 - 5 V* | | |

Code Output 2

- | | | | |
|----------|--|----------|---|
| 0 | None | 6 | Triac output, 1 A / 240 VAC, SSR |
| 1 | Form A relay 2 A/240 VAC | 7 | Isolated 20 V/25 mA transducer power supply |
| 2 | Pulsed voltage to drive SSR, 5 V / 30 mA | 8 | Isolated 12 V/40 mA transducer power supply |
| 3 | Isolated 4 - 20 mA / 0 - 20 mA | 9 | Isolated 5 V/80 mA transducer power supply |
| 4 | Isolated 1 - 5 V / 0 - 5 V | C | Pulsed voltage to drive SSR, 14 V/40 mA |
| 5 | Isolated 0 - 10 V | A | Special order |

Code Alarm 1

- 0** None
- 1** Form C Relay 2A/240 Vac
- 9** Special Order

Code Communications

- | | | | |
|----------|------------------------------|----------|--------------------------|
| 0 | None | 4 | Retransmit 1-5 V / 0-5 V |
| 1 | RS-485 interface | 5 | Retransmit 0-10 V |
| 2 | RS-232 interface** | 9 | Special order |
| 3 | Retransmit 4-20 mA / 0-20 mA | | |

Code Options

- 0** Panel mount
- 1** Panel mount NEMA 4X / IP65
- 2** DIN Rail mount (ETR-9100 only)

ETR-9100 - 4 1 1 0 0 0 0 Typical Model Number

Accessories

CC94-1 = RS-232 Interface Cable (2M)

CC91-1 = Programming Port Cable

RK91-1 = Rail Mount kit for ETR-9100

*Range set by front keyboard

**Option includes CC-94-1 communication cable

Related Products

SNA10A = Smart Network Adaptor for third party software, which converts 255 channels of RS-485 or RS-422 to RS-232 Network.

SNA10B = Smart Network Adaptor for ETR-Net software, which converts 255 channels of RS-485 or RS-422 to RS-232 network.

SNA12A = Smart Network Adaptor for programming port to RS-232 interface.

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