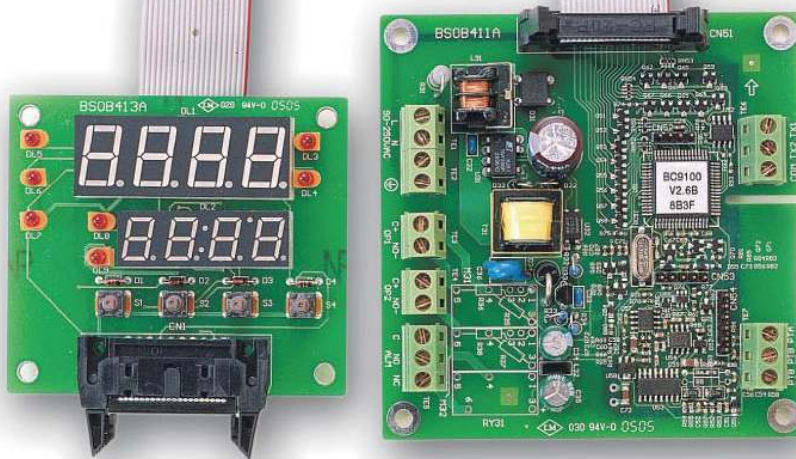


B41 BOARD PID TEMPERATURE CONTROLLER



Features

- Easy-to-use
- Fuzzy modified PID heat & cool control
- Fast A-D sampling rate (5 times/s)
- 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, RS-232 interface
- Programming port provided on board
- Support manual control & auto-tune function
- Wide variety of alarm mode selection
- Lockout protection control
- Bumpless transfer during failure mode
- Soft-start ramp and dwell timer
- Bright display stabilized with digital filter
- SEL function allows to rearrange user menu
- Meets UL/CSA/CE standards
- High performance at low cost



BrainChild



Overview

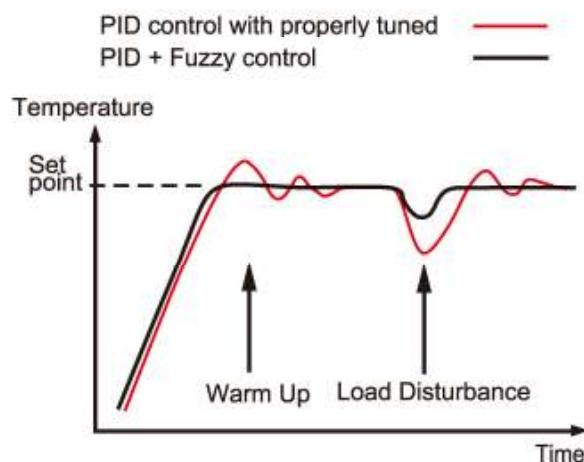
The Fuzzy Logic plus PID microprocessor-based controller series, incorporates a bright, easy to read 4-digit LED display, indicating process value and set point value. The Fuzzy Logic technology enables a process to reach a predetermined set point in the shortest time, with the minimum of overshoot during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

This unit is powered by 11-26 or 90-250 VDC/VAC supply, incorporating a 2 amp. control relay output as standard. The second output can be used as cooling control, an alarm or dwell timer. Both outputs can select triac, 5V logic output, linear current or linear voltage to drive external device. The units are fully programmable for PT100 and thermocouple types J, K, T, E, B, R, S, N, L and no need to modify the unit. The input signal is digitized by using a 18-bit A to D converter. Its fast sampling rate allows 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 supervisory control system and software.

A programming port is available for automatic Configuration, calibration and testing without pressing the keys on front panel.

By using proprietary Fuzzy modified PID technology, the control loop will minimize the overshoot and undershoot in a shortest time. The following diagram is a comparison of results with and without Fuzzy technology.



High Accuracy

This unit is manufactured with custom designed ASIC (Application Specific Integrated Circuit) technology which contains a 18-bit A to D converter for high resolution measurement (true 0.1 BF resolution for thermocouple and PT100) and a 15-bit D to A converter for linear current or voltage control output. The ASIC technology provides improved operating performance, low cost, enhanced reliability and higher density.

Fast Sampling Rate

The sampling rate of the input A to D converter reaches 5 times/second. The fast sampling rate allows this series to control fast processes.

Fuzzy Control

The function of Fuzzy control is to adjust PID parameters from time to time in order to make manipulation output value more flexible and adaptive to various processes. The results is to enable a process to reach a predetermined set point in the shortest time, with the minimum of overshoot and undershoot during power-up or external load disturbance.

Digital Communication

The units are equipped with RS-485 or RS-232 interface card to provide digital communication. By using the twisted pair wires there are at most 247 units can be connected together via RS-485 interface to a host computer.

Programming Port

A programming port is used to connect the unit to a smart network adaptor and PC for quick configuration, also can be connected to an ATE system for automatic testing & calibration.

Auto-tune

The auto-tune function allows the user to simplify initial setup for a new system. A clever algorithm is provided to obtain an optimal set of control parameters for the process, and it can be applied either as the process is warming up (cold start) or as the process has been in steady state (warm start).

Lockout Protection

According to actual security requirement, one of four lockout levels can be selected to prevent the unit from being changed abnormally.

Bumpless Transfer

Bumpless transfer allows the controller to continue to control by using its previous value as the sensor breaks. Hence, the process can be well controlled temporarily as if the sensor is normal.

Soft-start Ramp

The ramping function is performed during power up as well as any time the set point is changed. It can be ramping up or ramping down. The process value will reach the set point with a predetermined constant rate.

Digital Filter

A first order low pass filter with a programmable time constant is used to improve the stability of process value. This is particularly useful in certain application where the process value is too unstable to be read.

SEL Function

The units have the flexibility for user to select those parameters which is most significant to him and put these parameters in the front of display sequence. There are at most 8 parameters can be selected to allow the user to build his own display sequence.

Specifications

Power

90-250 VAC, 47-63 Hz, 10VA, 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 : $\pm 1.5 \mu\text{V}/^\circ\text{C}$ for all inputs except
mA input
 $\pm 3.0 \mu\text{V}/^\circ\text{C}$ for mA input

Sensor Lead Resistance Effect :

T/C: $0.2 \mu\text{V}/\text{ohm}$

3-wire RTD: $2.6 ^\circ\text{C}/\text{ohm}$ of resistance difference of two
leads

2-wire RTD: $2.6 ^\circ\text{C}/\text{ohm}$ of resistance sum of two leads

Burn-out Current : 200 nA

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)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
K	-200 °C-1370 °C (-328 °F-2498 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
T	-250 °C-400 °C (-418 °F-752 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
E	-100 °C-900 °C (-148 °F-1652 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
B	0 °C-1820 °C (32 °F-3308 °F)	$\pm 2 ^\circ\text{C}$ (200 °C - 1820 °C)	2.2 M Ω
R	0 °C-1767.8 °C (32 °F-3214 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
S	0 °C-1767.8 °C (32 °F-3214 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
N	-250 °C-1300 °C (-418 °F-2372 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
L	-200 °C-900 °C (-328 °F-1652 °F)	$\pm 2 ^\circ\text{C}$	2.2 M Ω
PT100 (DIN)	-210 °C-700 °C (-346 °F-1292 °F)	$\pm 0.4 ^\circ\text{C}$	1.3 K Ω
PT100 (JIS)	-200 °C-600 °C (-328 °F-1112 °F)	$\pm 0.4 ^\circ\text{C}$	1.3 K Ω
mV	-8mV - 70mV	$\pm 0.05 \%$	2.2 M Ω
mA	-3mA - 27mA	$\pm 0.05 \%$	70.5 Ω
V	-1.3V - 11.5V	$\pm 0.05 \%$	302 K Ω

Output 1 / Output 2

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

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

Linear Output Characteristics

Input	Output	Input	Output
4-20 mA	3.6-4 mA	20-21 mA	500 Ω max.
0-20 mA	0 mA	20-21 mA	500 Ω max.
0-5 V	0 V	5 - 5.25 V	10 K Ω min.
1-5 V	0.9 - 1 V	5 - 5.25 V	10 K Ω min.
0 - 10 V	0 V	10 - 10.5 V	10 K Ω min.

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 : $\pm 0.01 \%$ of SPAN / LC

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

Analog Retransmission

Output Signal: 4-20 mA, 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 minimum (for voltage output)

Output Regulation: 0.01% for full load change

Connection Diagrams

Output Settling Time : 0.1 sec. (stable to 99.9 %)
Isolation Breakdown Voltage : 1000 VAC min.
Integral Linearity Error : ± 0.005 % of span
Temperature Effect : ± 0.0025 % of span/ LC
Saturation Low : 0 mA (or 0V)
Saturation High : 22.2 mA (or 5.55V, 11.1V min.)
Linear Output Range : 0-22.2mA(0-20mA or 4-20mA)
 0-5.55V (0 - 5V, 1 - 5V)
 0 - 11.1 V (0 - 10V)

Dual 4-digit LED Displays :

Upper 0.55" (14mm)
 Lower 0.4" (10mm)

Keypad : 4 keys

Programming Port : For automatic setup, calibration and testing

Communication Port : Connection to PC for supervisory control

User Interface

Control Mode

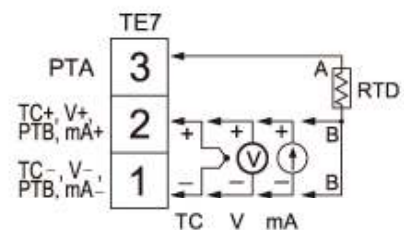
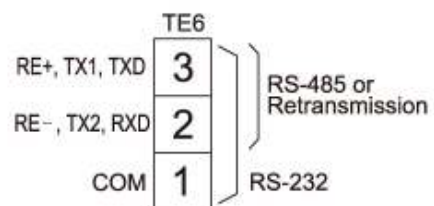
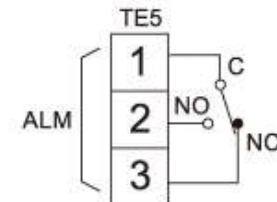
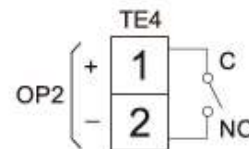
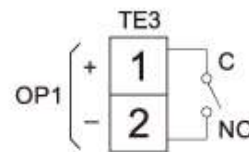
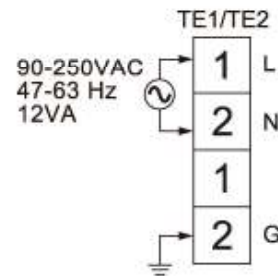
Output 1 : Reverse (heating) or direct (cooling) action
Output 2 : PID cooling control, cooling P band 50~300% of PB, dead band -36.0~36.0% of PB
ON-OFF : 0.1 - 90.0 (°F) hysteresis control (P band = 0)
P or PD : 0 - 100.0 % offset adjustment
PID : Fuzzy logic modified
 Proportional band 0.1 ~ 900.0 °F.
 Integral time 0 - 3600 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 °F/minute or 0 - 900.0 °F/hour ramp rate

Digital Filter

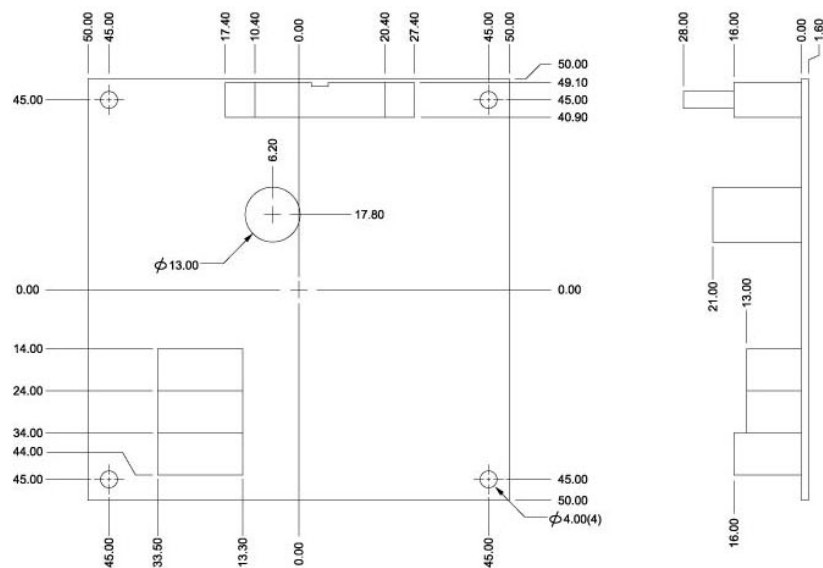
Function : First order
Time Constant : 0, 0.2, 0.5, 1, 2, 5, 10, 20, 30, 60 seconds programmable

Environmental & Physical

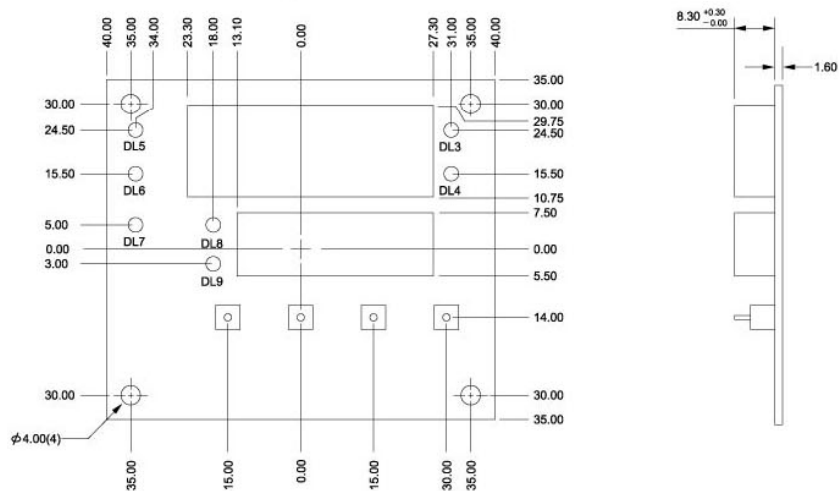
Operating Temperature : -10 °C to 50 °C
Storage Temperature : -40 °C to 60 °C
Humidity : 0 to 90 % RH (non-condensing)
Altitude : 2000m maximum
Pollution : Degree 2
Insulation Resistance : 20 Mohms min. (at 500 VDC)
Dielectric Strength : 2000 VAC, 50/60 Hz for 1 minute
Vibration Resistance : 10 - 55 Hz, 10 m/s for 2 hours
Shock Resistance : 200 m/s² (20 g)
Safety : UL61010C-1
 CSA C22.2 No.24-93
 EN61010-1 (IEC1010-1)
EMC : EN61326



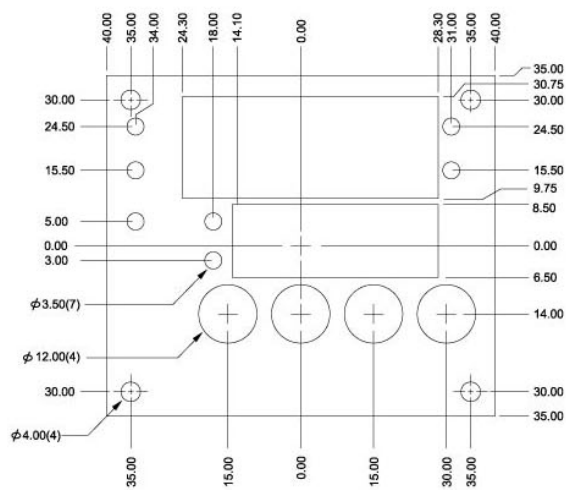
Dimension of Control Board



Dimension of Display Board



Dimension of Mounting Plate for Display Board



Accessories

OM94-6 = Isolated 1A / 240VAC Triac Output Module (SSR)
 OM94-7 = 14V / 40 mA SSR Drive Module
 OM95-3 = Isolated 4 - 20 mA / 0 - 20 mA Analog Output Module
 OM95-4 = Isolated 1 - 5V / 0 - 5V Analog Output Module
 OM95-5 = Isolated 0 - 10V Analog Output Module
 CM94-1 = Isolated RS-485 Interface Module
 CM94-2 = Isolated RS-232 Interface Module
 CM94-3 = Isolated 4 - 20 mA / 0 - 20 mA Retrains Module
 CM94-4 = Isolated 1 - 5V / 0 - 5V Retrains Module
 CM94-5 = Isolated 0 - 10V Retrains Module
 DC94-1 = Isolated 20V/25mA DC Output Power Supply
 DC94-2 = Isolated 12V/40mA DC Output Power Supply
 DC94-3 = Isolated 5V/80mA DC Output Power Supply
 CC94-1 = RS-232 Interface Cable (2M)
 CC91-2 = Programming Port Cable

Related Products

SNA10A = Smart network adaptor for Brainchild software
DAQ Studio or third party software,
 which converts 255 channels of
 RS-485 or RS-422 to RS-232 network.
 SNA12A = Smart network adapter for programming port to RS-232
 interface
 BC-Set = Configuration software
DAQ Studio software = PC software for data logging
 PC-E = RS-232/485 to Ethernet converter
 PC-W = RS-232/422/485 x 2 + Ethernet x 1 converted to Ethernet wireless

Ordering Code

B41 -							
Power Input							
4: 90 - 250 VAC, 50/60 HZ							
5: 11 - 26 VAC or VDC							
Signal Input							
1: Standard Input Thermocouple: J, K, T, E, B, R, S, N, L RTD: PT100 DIN, PT100 JIS							
2: 0 - 60 mV							
3: 0 - 1 V							
4: 0 - 5 V							
5: 1 - 5 V							
6: 4 - 20 mA							
7: 0 - 20 mA							
8: 0 - 10 V							
Output 1							
0: None							
1: Relay rated 2A/240VAC							
2: Pulsed voltage to drive SSR, 5V/30mA							
3: Isolated 4 - 20mA / 0 - 20mA							
4: Isolated 1 - 5V / 0 - 5V							
5: Isolated 0 - 10V							
6: Triac output 1A / 240VAC, SSR							
C: Pulsed voltage to drive SSR, 14V/40mA							
Output 2							
0: None							
1: Form A relay 2A/240VAC							
2: Pulsed voltage to drive SSR, 5V / 30mA							
3: Isolated 4 - 20mA / 0 - 20mA							
4: Isolated 1 - 5V / 0 - 5V							
5: Isolated 0 - 10V							
6: Triac output, 1A / 240VAC, SSR							
7: Isolated 20V/25mA transducer power supply							
8: Isolated 12V/40mA transducer power supply							
9: Isolated 5V/80mA transducer power supply							
C: Pulsed voltage to drive SSR, 14V/40mA							
Alarm							
0: None							
1: Form C relay 2A/240VAC							
Communications							
0: None							
1: RS-485 interface							
2: RS-232 interface							
3: Retransmit 4-20mA / 0-20mA							
4: Retransmit 1-5 V / 0-5V							
5: Retransmit 0-10V							
Display board and Cable							
0: Without display board and without cable							
3: With display board and with 300 mm cable							
4: With display board and with 1000 mm cable							

* Standard model without option
 B41-4110003: Power 90-250 VAC, standard input thermocouple + Pt100,
 output 1- relay, output 2 - none, alarm - none, communication - none,
 with display board and with 300 mm cable