



## INFORMATION

The Fuzzy Logic plus PID microprocessor-based temperature controllers, incorporate one 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.

## 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
- Front panel sealed to NEMA 4X & IP65(model C21)
- UL/CSA/CE approval
- High performance with low cost

## STANDARD SPECIFICATIONS

## POWER

Power Supply	90 – 250 VAC, 47 – 63 Hz, 12VA, 5W maximum
Power Consumption	11 – 26 VAC / VDC, SELV, Limited Energy, 12VA, 5W maximum

## SIGNAL INPUT

Input 1	Characteristics
Resolution	18 bits
Sampling Rate	5 times / second
Maximum Rating	-2 VDC minimum, 12 VDC maximum( 1 minute for mA input )
Temperature Effect	$\pm 1.5 \text{ uV/ } ^\circ\text{C}$ for all inputs except mA input $\pm 3.0 \text{ uV/ } ^\circ\text{C}$ for mA input
Sensor Lead Resistance Effect	T/C: 0.2uV/ohm 3-wire RTD: 2.6 $^\circ\text{C/ohm}$ of resistance difference of two leads 2-wire RTD: 2.6 $^\circ\text{C/ohm}$ of resistance sum of two 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, 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.

Input 1			
Type	Range	Accuracy @ 25 $^\circ\text{C}$	Input Impedance
J	-120 ~ 1000 $^\circ\text{C}$ (-184 ~ 1832 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
K	-200 ~ 1370 $^\circ\text{C}$ (-328 ~ 2498 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
T	-250 ~ 400 $^\circ\text{C}$ (-418 ~ 752 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
E	-100 ~ 900 $^\circ\text{C}$ (-148 ~ 1652 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
B	0 ~ 1820 $^\circ\text{C}$ (32 ~ 3308 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$ (200 $^\circ\text{C}$ – 1820 $^\circ\text{C}$ )	2.2M $\Omega$
R	0 ~ 1768 $^\circ\text{C}$ (32 ~ 3214 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
S	0 ~ 1768 $^\circ\text{C}$ (32 ~ 3214 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
N	-250 ~ 1300 $^\circ\text{C}$ (-418 ~ 2372 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
L	-200 ~ 900 $^\circ\text{C}$ (-328 ~ 1652 $^\circ\text{F}$ )	$\pm 2 \text{ } ^\circ\text{C}$	2.2M $\Omega$
PT100 (DIN)	-210 ~ 700 $^\circ\text{C}$ (-346 ~ 1292 $^\circ\text{F}$ )	$\pm 0.4 \text{ } ^\circ\text{C}$	1.3K $\Omega$

PT100 (JIS)	-200 ~ 600 °C (-328 ~ 1112 °F)	±0.4°C	1.3KΩ
mV	-8 ~ 70mV	±0.05%	2.2MΩ
mA	-3 ~ 27mA	±0.05%	70.5Ω
V	-1.3 ~ 11.5V	±0.05%	302KΩ

### OUTPUT 1 / OUTPUT 2

<b>Relay Rating</b>	2A/240 VAC, life cycles 200,000 for resistive load
<b>Pulsed Voltage</b>	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	500Ω max.
0-20 mA	0 mA	20-21 mA	500Ω max.
0-5 V	0 V	5-5.25 V	10KΩ min.
1-5 V	0.9-1 V	5-5.25 V	10KΩ min.
0-10 V	0 V	10-10.5 V	10KΩ min.

### LINEAR OUTPUT

<b>Resolution</b>	15 bits
<b>Output Regulation</b>	0.01 % for full load change
<b>Output Settling Time</b>	0.1 sec. ( stable to 99.9 % )
<b>Isolation Breakdown Voltage</b>	1000VAC
<b>Temperature Effect</b>	±0.01 % of SPAN / °C

### TRIAC (SSR) OUTPUT

<b>Rating</b>	1A / 240 VAC
<b>Inrush Current</b>	20A for 1 cycle
<b>Min. Load Current</b>	50 mA rms
<b>Max. Off-state Leakage</b>	3 mA rms
<b>Max. On-state Voltage</b>	1.5V rms
<b>Insulation Resistance</b>	1000 Mohms min. at 500 VDC
<b>Dielectric Strength</b>	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, 0-20 mA, 0-1V, 0-5V, 1-5V, 0-10V
Resolution	15 bits
Accuracy	$\pm 0.05$ % of span $\pm 0.0025$ %/ °C
Load Resistance	0 – 500 ohms ( for current output ), 10 K ohm minimum ( for voltage output )
Output Regulation	0.01 % for full load change
Load Resistance	0 – 500 ohms ( for current output ), 10 K ohm minimum ( for voltage output )
Output Regulation	0.01 % for full load change

## USER INTERFACE

Single 4-digit LED Displays	BTC-4100	Upper 0.55" ( 14mm ), Lower 0.4" ( 10mm )
	BTC-7100, BTC8100, BTC9100	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 ( °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 &amp; PHYSICAL

Operating Temperature	-10°C ~ 50°C
Storage Temperature	-40°C ~ 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 <sup>2</sup> for 2 hours
Shock Resistance	200 m/s <sup>2</sup> ( 20 g )
Moldings	Flame retardant polycarbonate
Dimensions	BTC-4100 —96mm(W) X 96mm(H) X 65mm(D), 53 mm depth behind panel BTC-7100 —72mm(W) X 72mm(H) X 78.2mm(D), 65 mm depth behind panel BTC-8100 —48mm(W) X 96mm(H) X 80mm(D), 65 mm depth behind panel BTC-9100 —48mm(W) X 48mm(H) X 116mm(D), 105 mm depth behind panel

<b>Mounting</b>	BTC-4100 —panel mount, cutout 92 X 92 ( mm ) BTC-7100 —panel mount, cutout 68 X 68 ( mm ) BTC-8100 —panel mount, cutout 45 X 92 ( mm ) BTC-9100 —panel mount, cutout 45 X 45 ( mm )
<b>Weight</b>	BTC-4100 — 250 grams BTC-7100 — 200 grams BTC-8100 — 210 gram BTC-9100 — 150 grams

### APPROVAL STANDARDS

<b>Safety</b>	UL 61010C-1 , CSA C22.2 No. 24-93 , EN61010-1 (IEC1010-1)
<b>Protective Class</b>	IP65 front panel with additional option, IP50 front panel without additional option, all indoor use, IP 20 housing and terminals with protective cover.
<b>EMC</b>	EN61326