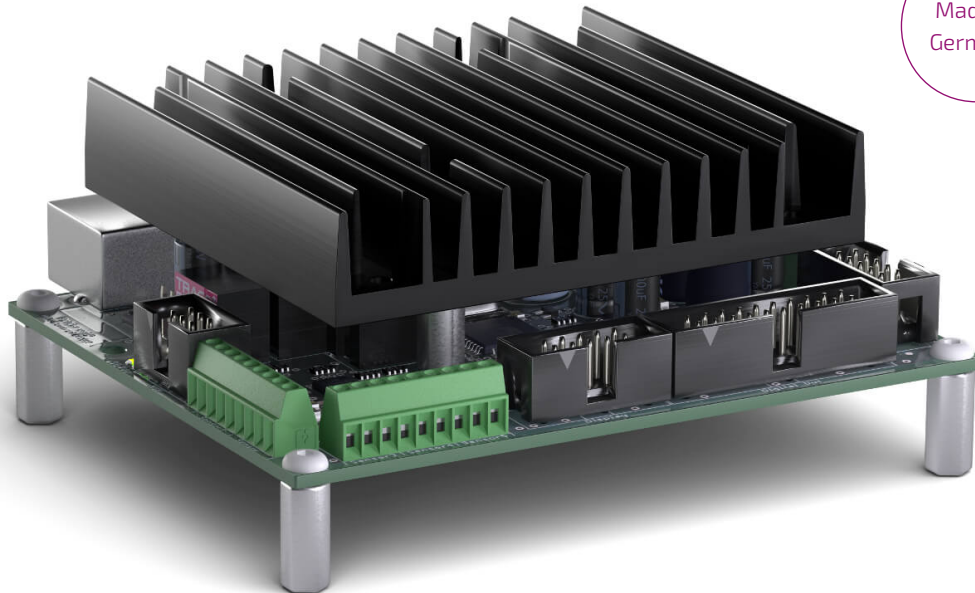


Temperature Controller **BTC-A-Series**

Datasheet



Made in
Germany

Functions

The BELEKTRONIG built-in temperature controller is an integrable controller to control heating and Peltier elements. As an OEM component with a wide range of functionality, it is used in many professional laboratory and analytical instruments. The temperature control is performed by a PID algorithm in combination with a high-precision temperature measurement. The control output generates a PWM signal. An optional output filter to generate a DC output voltage is also available.

Key Features

- ✓ Integrable temperature controller with extended peripherals
- ✓ PWM control output up to 36 V, 10 A
- ✓ Safety functions, short circuit protection
- ✓ Freely usable command set
- ✓ USB interface, serial interface
- ✓ Fan control
- ✓ Additional peripherals: analog inputs; digital IO for LED, TTL-IO, relay; display output
- ✓ Supplied with PC software, USB driver, Labview VIs

Configurations

Name: BTC-OEM-	A10	A20	A100	A200	A1000	A2000
Temperature resolution [°C]	0.1	0.1	0.01	0.01	0.001	0.001
Control accuracy [°C]	±0.1	±0.1	±0.01	±0.01	±0.003	±0.003
Number of temperature sensor inputs	1	2	1	2	1	2
Number of fan outputs	1	2	1	2	1	2
Number of analogue measurement inputs	1	3	1	3	1	3

Connections

USB Interface

Connection for Enclosure Fan

Terminal AUX: UART Interface

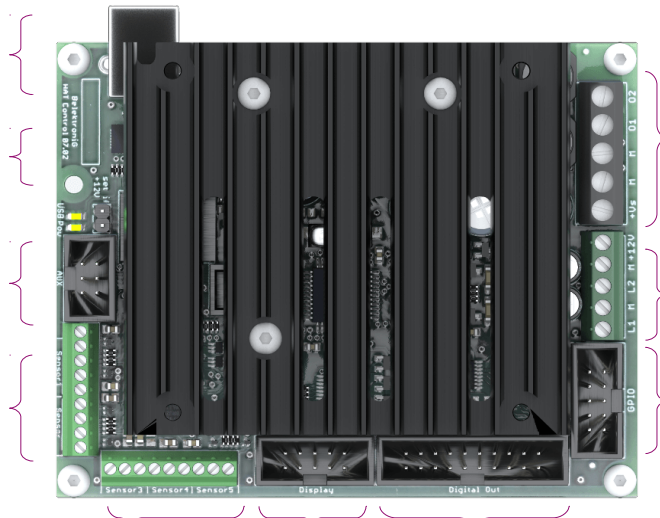
Terminal 4: Connection for Temperature Sensors 1, 2

Terminal 3: Analogue Measurement Inputs, Sensors 3, 4, 5 Display Output Digital Out

Terminal 1: Control Output, Input Power Supply

Terminal 2: Output Fan 1, 2

Terminal GPIO: Digital In and Out



PIN Assignment

Terminal 1

Power Supply and PWM Output

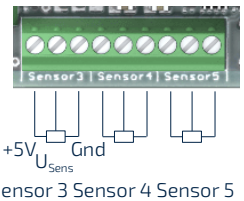
- › Wire gauge up to 2.5 mm²
- › Power supply of board measurement electronics, if voltage of power supply ≥ 12 V
- › **PIN Assignment**

O2	PWM output 2 (Peltier element -)
O1	PWM output 1 (Peltier element +)
M	Gnd
M	Gnd
+Vs	Power supply 12...36 V (maximal 10 A)

Terminal 3

Analogue in (Sensor 3, 4, 5)

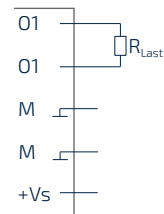
- › Voltage measurement
- › Measurement range adjustable 0.25; 0.5; 1; 2; 4; 5 V
- › E.G. use LM60 temperature sensors
- › Wire gauge up to 0.5 mm²



Wiring Options

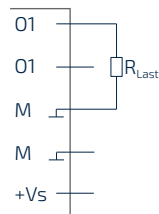
Option 1

Peltier elements
(heating and cooling)



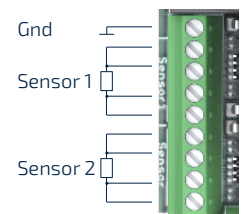
Option 2

Heating resistor
(heating only)



Terminal 4

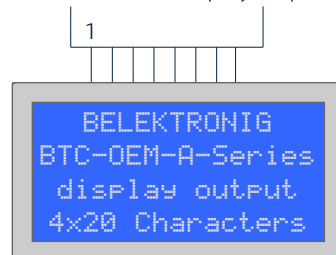
- › Sensor 1, 2
- › PT1000/PT100
- › On request: NTC/PTC
- › 4-wire
- › Wire gauge up to 0.5 mm²



Display Output

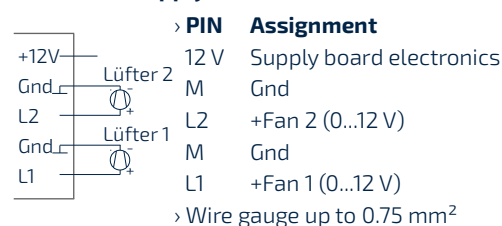
› PIN Assignment

- | | |
|-------|-------------------|
| 1 | +5 V |
| 2 | RS |
| 3 | E |
| 4 | Gnd |
| 5..8 | Data bits D0...D3 |
| 9, 10 | Gnd |
- › Display: KS0073 compatible controller, 4 bit BUS
 - › On request: individual display outputs



Terminal 2

Fan Outputs and Power Supply



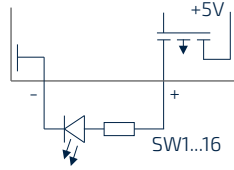
PIN Assignment (continuation)

Terminal Digital out

16x Digital out

PIN	Assignment
1...4	Digital out 1...4
6...9	Digital out 6...9
11...14	Digital out 11...14
16...19	Digital out 16...19
5, 10, 15, 20	Gnd

- > TTL level 5 V, maximal current load: max. 150 mA each, summarized max. 300 mA (see table)



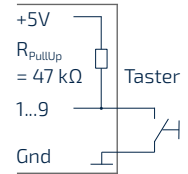
Number of Used Outputs	Max. Current Load for Each single Output [mA]	Summarized Current [mA]
1	150	150
2	150	300
3	100	300
10	30	300

Terminal GPIO:

9x Digital in or out (GPIO)

PIN	Assignment
1...9	Digital in / out
10	Gnd

- > Switchable, use as input or output
- > Input: buttons directly connectable
- > Output: TTL level 5 V, maximal 1 mA



Terminal AUX:

UART Interface

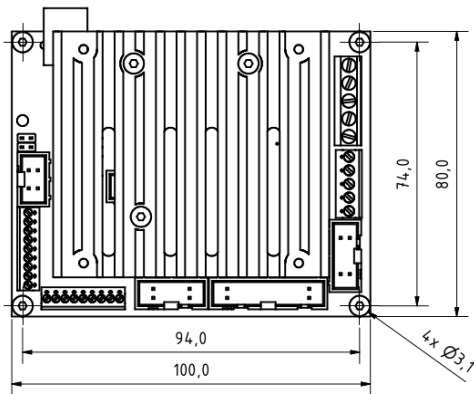
> PIN Assignment

1	TxD
2	+5 V
3	DIO3
4	RxD
5	NC (not connected)
6	Gnd

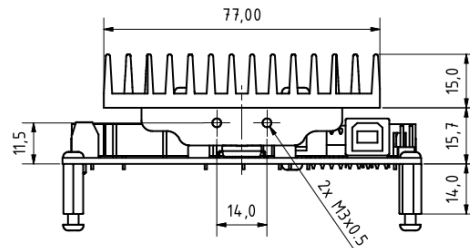
- > Output: TTL level 5 V, maximal 1 mA

Dimensions

Top View

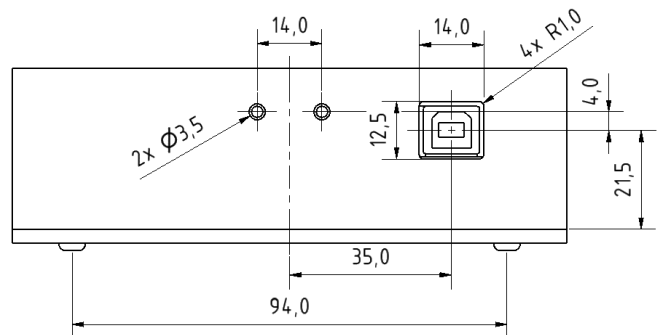
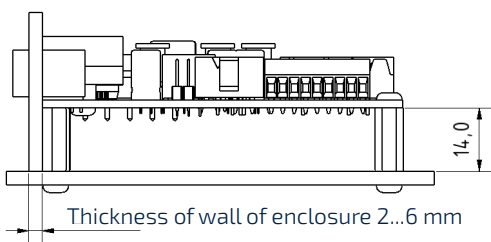


Back View



Note: You can get the 3D model data as stp-file on request.

Installation Drawing for Mounting on Enclosure Wall (mm)



- > Cooling of output stage over wall of enclosure
- > Additional cooling effort may be needed (e.g. heat sink outside of the enclosure, fan)
- > On request: spacers with other length (minimum distance of built-in controller board to bottom: 5 mm)

Power Supply - Wiring Examples

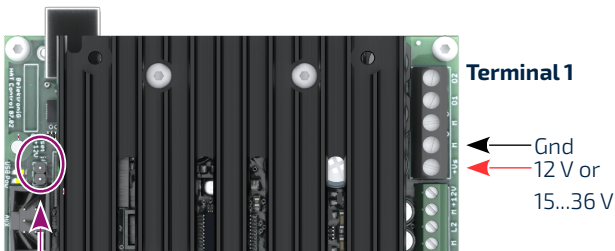
Note: This BELEKTRONIG built-in temperature controller board has separate voltage supplies for:

- > Control output: 0...36 V
- > Board electronics: 12 V

This leads to two different options for connecting power supplies.

Option A: 1 Power Supply with 12 V or 15...36 V

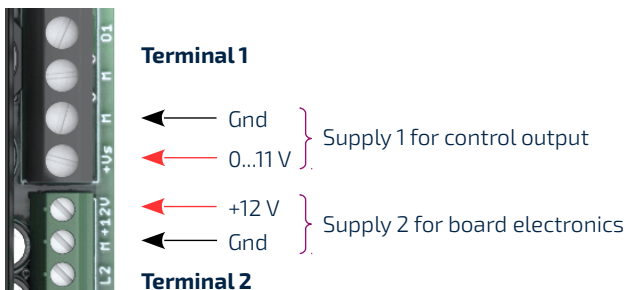
Use if power supplies have output voltages ≥ 12 V. Operating the built-in controller board using voltages ranging from 13.2 to 14.8 V is not possible.



Hinweis: Connect these two pins named "Set if 12 V" with a jumper when operating the controller with a 12 V power supply on "+Vs" and "M" of terminal 1.

Option B (2 Separate Power Supplies)

This option is used if the PWM output voltage is supposed to be < 12 V.



Note: A jumper as described in option A is not needed when operating the controller board using one single power supply with 12 V on "+12 V" and "M" of terminal 2!

Voltage Ranges, Maximum Permissible Values

Note: Exceeding the stated limits might cause a serious damage and destroying of the controller board leading to the loss of warranty!

Recommended Voltage Ranges

Connection	Minimum	Rated Value	Maximum
> +Vs zu M	0	0...36 V	42.0 V
> 12 V zu M	11.4 V	12 V	13.2 V

Note: The stage will be switched off while undershooting the minimal permissible values (error message: "Error stage").

Maximum Values

Connection to M/Gnd	Maximum Value [V]
> +Vs	-0.3...42
> 12 V	-0.3...13.2
> O1, O2	-0.3...65
> L1, L2	-0.3...13.2
> Sensor 1, 2, 3, 4, 5	-0.3...5.5
> Digital In/Out	-0.3...5.5
> USB D+, D-, VBUS	-0.3...5.8

ESD Protection

Connection	Norm
Sensor 1...5	IEC61000-4-2, MIL-STD-3015.7
Digital In	IEC61000-4-2
USB	IEC61000-4-2

Upgrade to Higher Configurations

Upgrading the BELEKTRONIG built-in temperature controllers to higher configurations is possible using a special upgrade code which is transferred to the controller by the PC software BTC Soft. The following upgrade options are available:

From	To	A20	A100	A200	A1000	A2000
A10		✓	✓	✓	✓	✓
A20		-	✓	✓	✓	✓
A100		-	-	✓	✓	✓
A200		-	-	-	✓	✓
A1000		-	-	-	-	✓

Notes

- > The maximum allowed continuous output current without active cooling is 5 A.
- > Without active cooling, the maximum peak current of 10 A can only be applied up to 15 min.
- > For a continuous current between 5 ... 10 A, an active cooling of the controller board is mandatory (e.g. use fans). Exceeding the board's temperature limits causes a thermally induced shutdown of the power output stage.
- > It is not allowed to operate the built-in temperature controller without suitable cooling!

Technical Data

Temperature Measurement

- › Measurement range: -200...+800°C
- › Resolution: 0.1°C, 0.01°C, 0.001°C
- › Sampling rate: 10 Hz
- › Inputs for resistive temperature sensors or thermocouples: PT100, PT1000, (NTC, PTC on request) or type K, type J
- › Accuracy of measurement: ±0.05°C
- › Temperature coefficient: 0.05 mK/K
- › Calibration possibility for sensors

Temperature Control

- › Digital PID control algorithm
- › Adjustable PID parameter
- › Adjustable temperature ramps and limits
- › Automated switch off in case of errors

Modes of Operation for Peltier elements for heating elements

- › (1) Manual control only (1) Manual control
- › (2) Heating operation only (2) Heating operation
- › (3) Cooling operation only
- › (4) Heating and cooling operation

Control Output

- › PWM with 20 kHz output with adjustable voltage up to 36 V, maximal 10 A (depending on power supply)
- › Adjustable duty cycle limits
- › Adjustable current limits in combination with BELEKTRONIG Output Filter

Current Measurement on Control Output

- › Resolution: 0.3 A (active with 3.4 V of output voltage)

Fan Control Output

- › DC Output: 0...12 V DC, maximal 300 mA
- › Modes: (1) Manual control
(2) Associated with temperature control output

Digital IO

- › 9 digital inputs or outputs, adjustable data direction
- › TTL level: 0...5 V
- › Realization of customer-specific logical functions on request

Digital Out

- › 16 digital outputs to connect LED, relays, signal wires, etc.
- › TTL level: 0...5 V, maximal 150 mA
- › Notification of status messages
- › On request: additional logic functions

Interfaces

- › USB 2.0, UART 0...5 V (level converter for RS232 optional)

Software Control

- › PC software, › LabView VIs
- › ASCII command set

Dimensions and Conditions of Operation

- › Dimensions (L x W x H): 100 x 80 x 50 mm³
- › Weight: ~250 g
- › Operating temperature: 10...45°C
- › Relative humidity: 0...80%, not condensating

Scope of Delivery

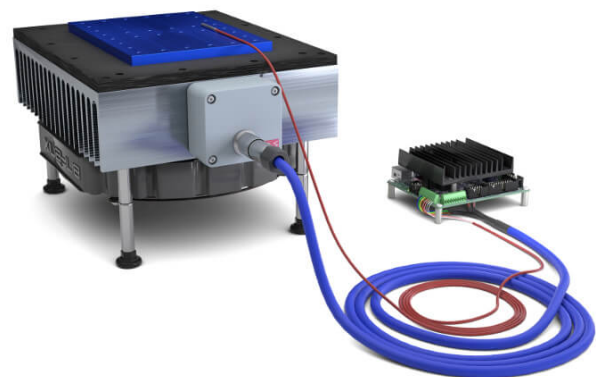
- › Built-in temperature controller module
- › Assembly material (4 spacers M3x14, 8 screws M3x8)
- › PC software (download link)

BTC Soft: Measuring, Monitoring and Recording Temperature Curves



- › Reading and setting of device settings and conditions via USB interface (set-point, PID parameter, limits, ...)
- › Continuous display of temperature and output power
- › Dialogue for data recording
- › Dialogue for controller upgrades and updates

Matching Equipment to Complete your Experimental Setup



- › Peltier modules: Air cooler/heater, Plate cooler/heater
- › Heating and Peltier elements, Temperature Sensors, Cables
- › Customization of controller firmware

Learn more about the quality standards of BELEKTRONIG and easily request a quote for your individual experimental setups.

Dr.-Ing. Glen Guhr and Dr.-Ing. Raimund Bruenig

