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This manual was written by

Patrick KRENCKER

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Wissembourg, France

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Description

Introduction 1.1

The BTO2000 is a high performance cold junction compensation which improves the long term stability of the sample temperature in a NMR spectrometer when controlling the temperature with a thermocouple.

It is composed by a small housing that is mounted on the base plate of the probe head. Inside there is a small oven for junction temperature control and a circuit for cold junction compensation. The thermocouple is attached to the case and its wires are soldered inside on a small printed circuit.

Main components 1.2

All types of BTO2000, except the BTO for SB750MHz, are composed as follows:

Table 1.1. BTO2000 Part Number list

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>housing</td>
</tr>
<tr>
<td>3</td>
<td>mounting brackets (2 standard + 1 Z gradient)</td>
</tr>
<tr>
<td>2</td>
<td>spacer wedges</td>
</tr>
<tr>
<td>2</td>
<td>knurled screws</td>
</tr>
<tr>
<td>4</td>
<td>screws M2.5 X20</td>
</tr>
<tr>
<td>1</td>
<td>supply cable</td>
</tr>
<tr>
<td>1</td>
<td>signal cable</td>
</tr>
</tbody>
</table>
Installation on probe head

The BTO2000 is delivered with the thermocouple mounted. The BTO2000 is installed on the base plate of the probe head. It is installed with the probe head removed from the magnet. In order to install it correctly you have to follow all the steps of the installation procedure (see "Probe SB Z gradient" on page 22).

1. Remove carefully the probe head from the magnet.

2. For the GRADIENT probe only:
   - Unscrew the round connector (Burndy 12 pins) from his support.
   - Remove the support from the probe.
   - Fix the new support (13) on probe base plate with two screws (M2.5x8).
   - Insert the connector on this support and fix it with four screws.

3. Screw the two mounting brackets (2) on both sides of the probe with the four screws (4) (for the gradient probe use the special bracket (15) for the right side).

4. Place one or two spacer wedge(s) (5) for standard, (10) and (11) for wide bore probe) on the side(s) of the BTO2000's main body and screw loosely the knurled screws (see corresponding figure for your probe type).

5. Insert carefully the thermocouple in the hole at the bottom of the probe head. Push until interlocking of the connectors (the end of the thermocouple must be very close to the bottom of the sample tube).

6. Tighten the knurled screws and control that you have no spinning perturbations.
**Temperature controller configuration**

**Using a BTO2000 with a BVT2000**

**Electrical connections**
- Plug the signal cable (8) from the BTO2000 in the plug (35) PT100 on the rear panel of the BVT2000.
- Connect the power supply cable (9) in the plug marked «DRIVE AIR» on the rear side of the BVT2000.

*Figure 1.1. BVT2000 Rear panel*
**Description**

*Eurotherm 818 configuration*

You have to configure the controller to select an external cold junction compensation for the thermocouple. To do this, the BVT2000 controller must be in the configuration mode.

To enter the configuration mode, proceed as follows:

1. Switch off the power (button 20).

2. Press and hold the configuration button (19) down and switch then the power button (20) on. The upper display will now read "CONF " and the lower " C1 ."

3. By pressing the ▼ (4) button, the current value of C1 appears on the lower display. It represents the type of sensor for which the controller is currently programmed (ex: "0203" for internal compensation 273K type T).

4. Press and hold the configuration button (19) down and change the previous value to "5203" by using the ▼ (4) and ▲ (9) buttons.

To save the new configuration, proceed as follows:

5. Press two times the "RUN/HOLD " button (5). The mnemonic " CLR " will appear on the lower display (3).

6. Press the ▼ and ▲ buttons simultaneously and observe that the "CLR" message blinks one time.

To leave the configuration mode, proceed as follows:

- Switch off the power (20) (see "BVT2000 Front panel view" on page 11)
- Switch on the power.

Refer to the BVT2000 "Operating manual" for more information (section: Changing the temperature sensor)

When your configuration and the BTO2000’s connection (power and signal cable) are correct, the controller display indicates the probe temperature.

NB. As the power supply for the BTO2000 is delivered by the BVT2000 unit, you have to turn the power on (button 20) at least 10 minutes before starting sample temperature regulation.

*Warning*: When the following message appears on the upper display " C En "; you must restart the complete operation (switch off the power ... ).
Temperature controller configuration

Figure 1.2. BVT2000 Front panel view

1) CONTROLLER
2) MEASURED TEMPERATURE
3) SECONDARY DISPLAY
4) CONTROLLER DOWN BUTTON
5) RUN/HOLD BUTTON
6) LOCAL/REMOTE BUTTON
7) AUTO/MANUAL BUTTON
8) SCROLL BUTTON
9) CONTROLLER UP BUTTON
10) REGULATION HEATER ON LED
11) ON/OFF REGULATION HEATER
12) GAS FLOW FAILURE LED
13) N2 EMPTY LED
14) DECREASE LN2 POWER
15) ON/OFF LN2 HEATER
16) INCREASE LN2 POWER
17) LN2 HEATER ON LED
18) AIR FLOW CONTROL
19) CONFIGURATION BUTTON
20) POWER ON/OFF
21) GAS FLOW METER
22) LN2 HEATER CURRENT
23) N2 REFILL LED
24) PROBEHEAD OVERHEATING LED
25) REGULATION HEATER CURRENT
**Description**

**Using a BTO2000 with a BVT3000**

1.4.2

---

**Electrical connections**

- Connect the signal cable to the PT100 plug
- Connect the power supply cable to the PS/BVT3500 plug

---

**Figure 1.3. BVT3000 Front panel**

---

The EUROTHERM 902 controller must be configured to work with the correct sensor type.

**Manual Eurotherm 902 configuration**

Proceed as follows:

1. Switch off the main power.

2. Press the two most left keys at same time while turning the power on.

3. The message CONF and UCONF appears on the display.

4. Press the scroll button until ICONF is displayed.

5. Press the left button until C1 appears.

6. Press now the increment button or decrement : the 4 digits code is displayed. It must be changed to select the new sensor.
Table 1.2.  Eurotherm 902 sensor code

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Code C1</th>
</tr>
</thead>
<tbody>
<tr>
<td>T thermocouple internal CJC</td>
<td>0004</td>
</tr>
<tr>
<td>PT100</td>
<td>0024</td>
</tr>
<tr>
<td>BTO2000 (external CJC)</td>
<td>1004</td>
</tr>
</tbody>
</table>

7. With left selection button select the blinking digit to be modified and change the value with the increment or decrement button. When the code is correct press the scroll button. C2 will be displayed.

8. Press now selection button ICONF appears. Press the scroll button until LEAVE appears. Press the left selection button again.

The configuration is completed now and the temperature is displayed.

**Eurotherm 902 configuration by software**

In the EDTE program, select sensors and BTO2000 in the Setup menu.
**Description**

*Using a BTO2000 with a BVT3300*

### Electrical connections
- Connect the signal cable to the PT100 plug
- Connect the power supply cable to the PS/BVT3500 plug

*Figure 1.4. BVT3300 Front panel*

The EUROTHERM 847 controller must be configured to work with the correct sensor type.

**Manual Eurotherm 847 configuration**
To access the configuration mode, a switch located inside the 847 controller must be closed.

**The switch must be closed only during the configuration mode.**
Proceed as follows:
- Switch off the main power.
- Unscrew the EUROTHERM controller front plate.
- Remove the module out of its cabinet.
- The switch **WB1** is located on the left side at the rear of the module.
- Close the switch.
- Insert the controller module and screw the front panel.
- Switch on the main power.
- Press the button **PAR** until «Sn» appears. («Sn» is the mnemonic for sensor). Then select the sensor type: press the up ▲ or down ▼ key until the correct sensor appears.
Temperature controller configuration

Table 1.3. Eurotherm 847 sensor selection

<table>
<thead>
<tr>
<th>sensor type</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>T thermocouple internal CJC</td>
<td>t tc</td>
</tr>
<tr>
<td>BTO2000</td>
<td>t tc</td>
</tr>
<tr>
<td>Pt100</td>
<td>rtd3</td>
</tr>
</tbody>
</table>

If the sensor is a thermocouple or a BTO2000 you must select also the type of (Cold Junction Compensation). Press the PAR key until CJC appears and select with the up and down key.

Table 1.4. CJC selection

<table>
<thead>
<tr>
<th>sensor type</th>
<th>Cjc</th>
</tr>
</thead>
<tbody>
<tr>
<td>T thermocouple</td>
<td>int (internal)</td>
</tr>
<tr>
<td>BTO2000</td>
<td>0 °C (external at 0 °C)</td>
</tr>
<tr>
<td>Pt100</td>
<td>X (don’t care)</td>
</tr>
</tbody>
</table>

- When the configuration is finished, switch off the main power, remove again the controller and open the switch.

- finely close the controller and switch on the power supply.

**Eurotherm 847 configuration by software**

In the EDTE program, select sensors and BTO2000 in the Setup menu.
**Electrical Connections**

- Connect the signal cable to the Pt100 plug.
- Connect the power supply cable to the PS/BVTB3500 plug.

*Figure 1.5. BVT3200 Front panel view*

2416 Temperature Controller configuration

- The controller must be configured to use the BT02000 sensor.
- In the EDTE program select the menu SETUP → SENSORS → BTO2000
Figure 1.6. Menu : Setup → Sensors → BTO2000
### Technical specifications 1.5

The specified temperature coefficient can be reached under the following experimental conditions:

- use a 5 mm dual flow probe.
- PID values of temperature controller correctly adjusted according to our standard procedure.
- room temperature is within the regulation range of a normal operating air conditioning system (i.e. ± 1 to 2 °C, 1 to 5 min. time cycle).
- PMMA (plastic spinner).
- no spinning sample or temperature of spinning air stabilized.
- thermocouple located at 1 mm maximum from the sample.

<table>
<thead>
<tr>
<th>Table 1.5. Technical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INPUT</strong></td>
</tr>
<tr>
<td><strong>OUTPUT</strong></td>
</tr>
<tr>
<td><strong>SUPPLY VOLTAGE</strong></td>
</tr>
<tr>
<td><strong>POWER CONSUMPTION</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>WARM UP TIME</strong></td>
</tr>
<tr>
<td><strong>TEMPERATURE COEFFICIENT</strong></td>
</tr>
<tr>
<td><strong>OPERATING TEMPERATURE</strong></td>
</tr>
<tr>
<td><strong>STORAGE TEMPERATURE</strong></td>
</tr>
<tr>
<td><strong>WEIGHT</strong></td>
</tr>
<tr>
<td><strong>CASE SIZE</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Drawings
Figure 2.1. Probe head SB-DUL SB-SEL SB-SEI

<table>
<thead>
<tr>
<th>LOC</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>PART</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>1</td>
<td>POWER CABLE</td>
<td>W1100164</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>SIGNAL CABLE</td>
<td>W1100644</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>KNURLED SCREW M3X11</td>
<td>W1500141</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>KNURLED SCREW M3X6</td>
<td>W1500140</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>SPACER WEDGE</td>
<td>W1500134</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>SCREW M2.5X20</td>
<td>Z9568</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>HOUSING</td>
<td>W1500139</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>MOUNTING BRACKET</td>
<td>W1500136</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>PROBE</td>
<td></td>
</tr>
</tbody>
</table>

B-TO 2000 Mounting on probe
type: SB-DUL SB-SEL SB-SEI
B-TO 2000 Mounting on probe

type: SB-BBI  SB-BBO  SB-QNP

Figure 2.2. Probe head SB-BBI-SB-BBO SB-QNB
Figure 2.3. Probe SB Z gradient

<table>
<thead>
<tr>
<th>LOC</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>PART</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1</td>
<td>RIGHT MOUNTING BRACKET</td>
<td>W1500155</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>BURNDY CONNECTOR FEMALE 12 P.</td>
<td>4413</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>BURNDY CONNECTOR FIXATION</td>
<td>W1500146</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>POWER CABLE</td>
<td>W1100664</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>SIGNAL CABLE</td>
<td>W1100644</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>KNURLED SCREW M3X11</td>
<td>W1500141</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>KNURLED SCREW M3X6</td>
<td>W1500140</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>SPACER WEDGE</td>
<td>W1500134</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>SCREW M2.5X20</td>
<td>Z9586</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>HOUSING</td>
<td>W1500139</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>LEFT MOUNTING BRACKET</td>
<td>W1500136</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>PROBE</td>
<td></td>
</tr>
</tbody>
</table>

ECHELLE: ~1/2

B-TO 2000 type: SB Z-GRADIENT
MOUNTING ON PROBE
Figure 2.5. Probe wide bore 360-400-500 MHz

<table>
<thead>
<tr>
<th>LOC</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>PART</th>
<th>DRAWING</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>KNURLED SCREW M3X15.5</td>
<td>W1500153</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>RIGHT SPACER WEDGE</td>
<td>W1500152</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>LEFT SPACER WEDGE</td>
<td>W1500149</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>POWER CABLE</td>
<td>W1100864</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>SIGNAL CABLE</td>
<td>W1100864</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>KNURLED SCREW M3X11</td>
<td>W1500141</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>SCREW M2.5X20</td>
<td>Z9566</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>HOUSING</td>
<td>W1500139</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>MOUNTING BRACKET</td>
<td>W1500136</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>PROBE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B-TO 2000 Mounting on probe

type: Wide Bore 360-400-500 MHz
# Figures

## 1 Description

<table>
<thead>
<tr>
<th>Figure 1.1</th>
<th>BVT2000 Rear panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.2</td>
<td>BVT2000 Front panel view</td>
</tr>
<tr>
<td>Figure 1.3</td>
<td>BVT3000 Front panel</td>
</tr>
<tr>
<td>Figure 1.4</td>
<td>BVT3300 Front panel</td>
</tr>
<tr>
<td>Figure 1.5</td>
<td>BVT3200 Front panel view</td>
</tr>
<tr>
<td>Figure 1.6</td>
<td>Menu : Setup → Sensors → BTO2000</td>
</tr>
</tbody>
</table>

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