

# **Variable Temperature Unit**

**User Manual  
BTO2000**

**Version 002**

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**BRUKER**

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This manual was written by

Patrick KRENCKER

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Wissembourg, France

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# Description

# 1

## 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

Quantity	Item
1	housing
3	mounting brackets (2 standard + 1 Z gradient)
2	spacer wedges
2	knurled screws
4	screws M2.5 X20
1	supply cable
1	signal cable

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

1.4

### Using a BTO2000 with a BVT2000

1.4.1

#### 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





### ***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*)

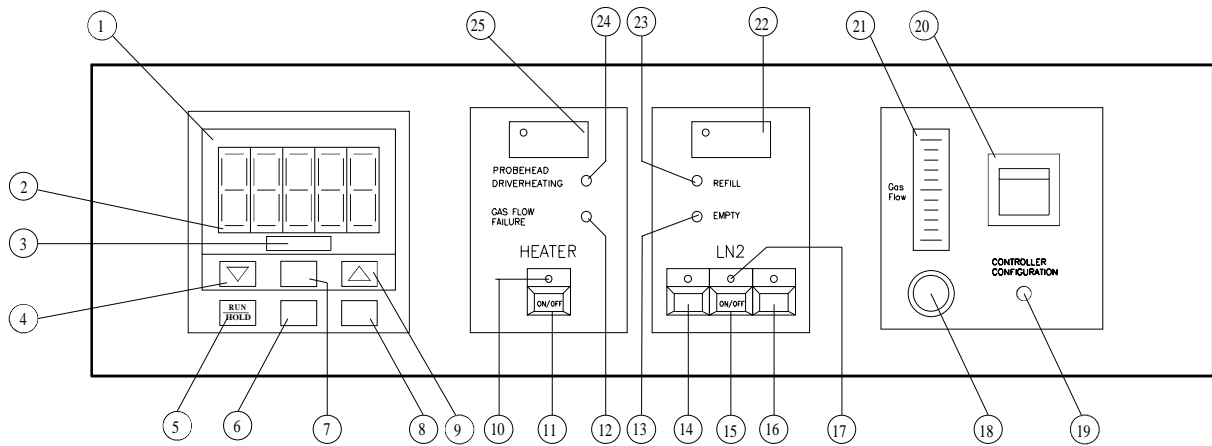
When your configuration and the BTO2000's connection (power and signal cable) are correct, the controller display indicates the probe temperature.

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

### 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 **UNCONF** 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

Sensor	Code C1
T thermocouple internal CJC	0004
PT100	0024
BTO2000 (external CJC)	1004

7. With left selection button  select the blinking digit to be modified and change the value with the increment  or decrement button  ton.

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.

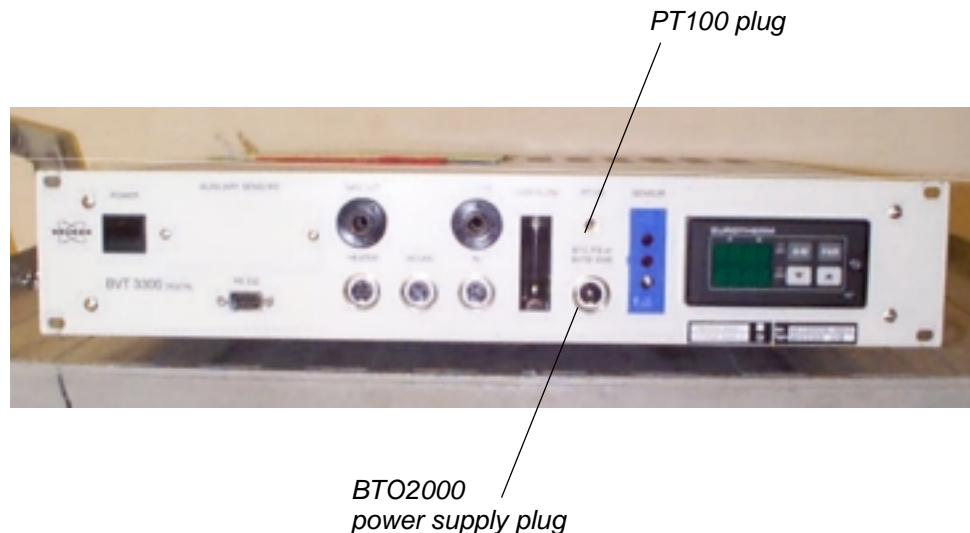
***Eurotherm 902 configuration by software***

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

### **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  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.

*Table 1.3. Eurotherm 847 sensor selection*

sensor type	Sn
T thermocouple internal CJC	t tc
BTO2000	t tc
Pt100	rtd3

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

*Table 1.4. CJC selection*

sensor type	Cjc
T thermocouple	int (internal)
BTO2000	0 °C (external at 0 °C)
Pt100	X (don't care)

- 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.

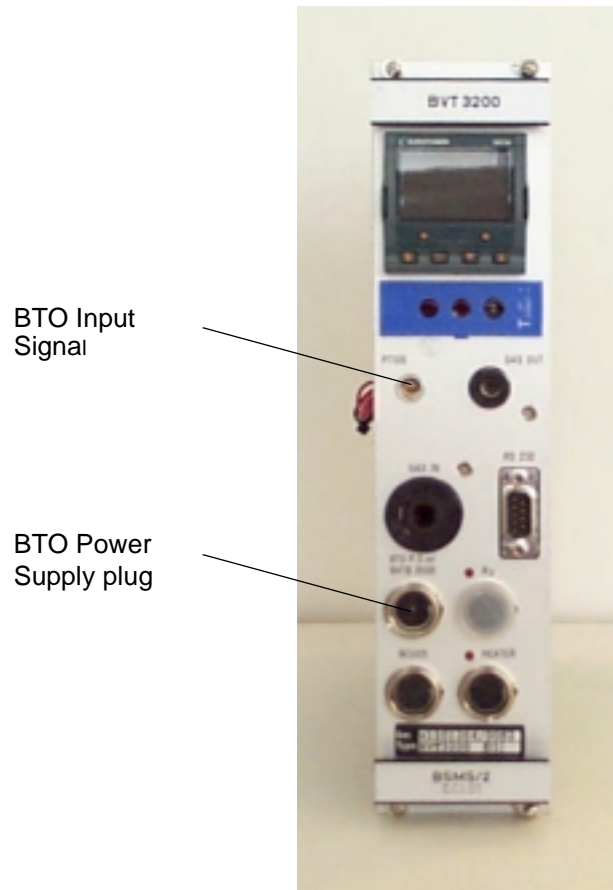
### ***Eurotherm 847 configuration by software***

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



# Temperature controller configuration

Figure 1.6. Menu : Setup → Sensors → BTO2000

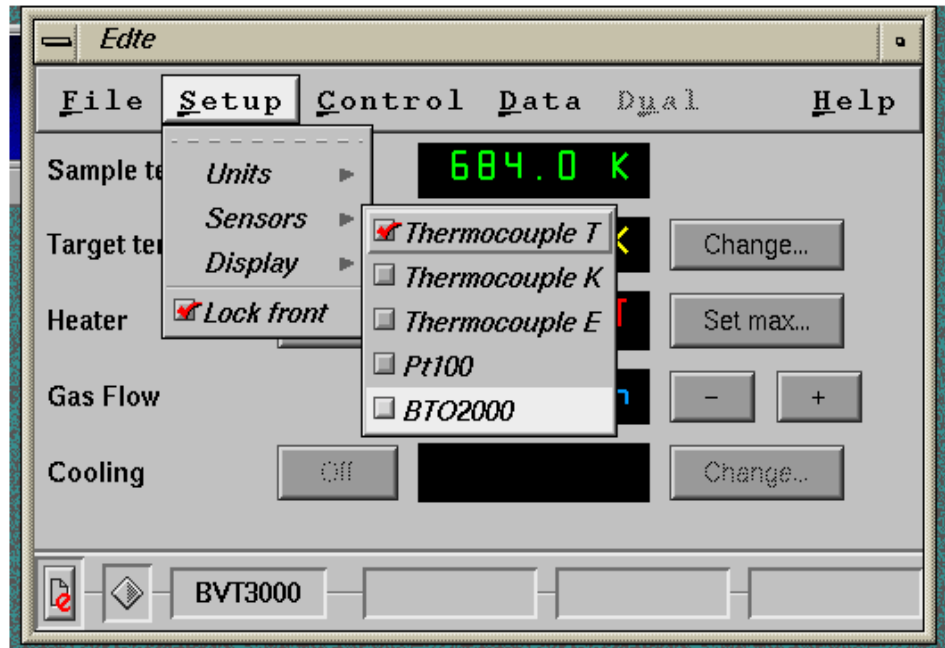


Table 1.5. Technical specifications

INPUT	Thermocouple input Type «T» (Cu-Co)
OUTPUT	42 $\mu$ V/°C About 992 $\mu$ V at 25°C
SUPPLY VOLTAGE	+15V DC
POWER CONSUMPTION	
	• 250 mA max during warm-up time
	• 50 mA typical
WARM UP TIME	10 minutes
TEMPERATURE COEFFICIENT	<0.01°C for room temperature between 15-35°C
OPERATING TEMPERATURE	15 to 35°C
STORAGE TEMPERATURE	-10 to 70°C
WEIGHT	300 grs approx.
CASE SIZE	
• Length	62 mm
• Depth	40 mm
• Height	25 mm

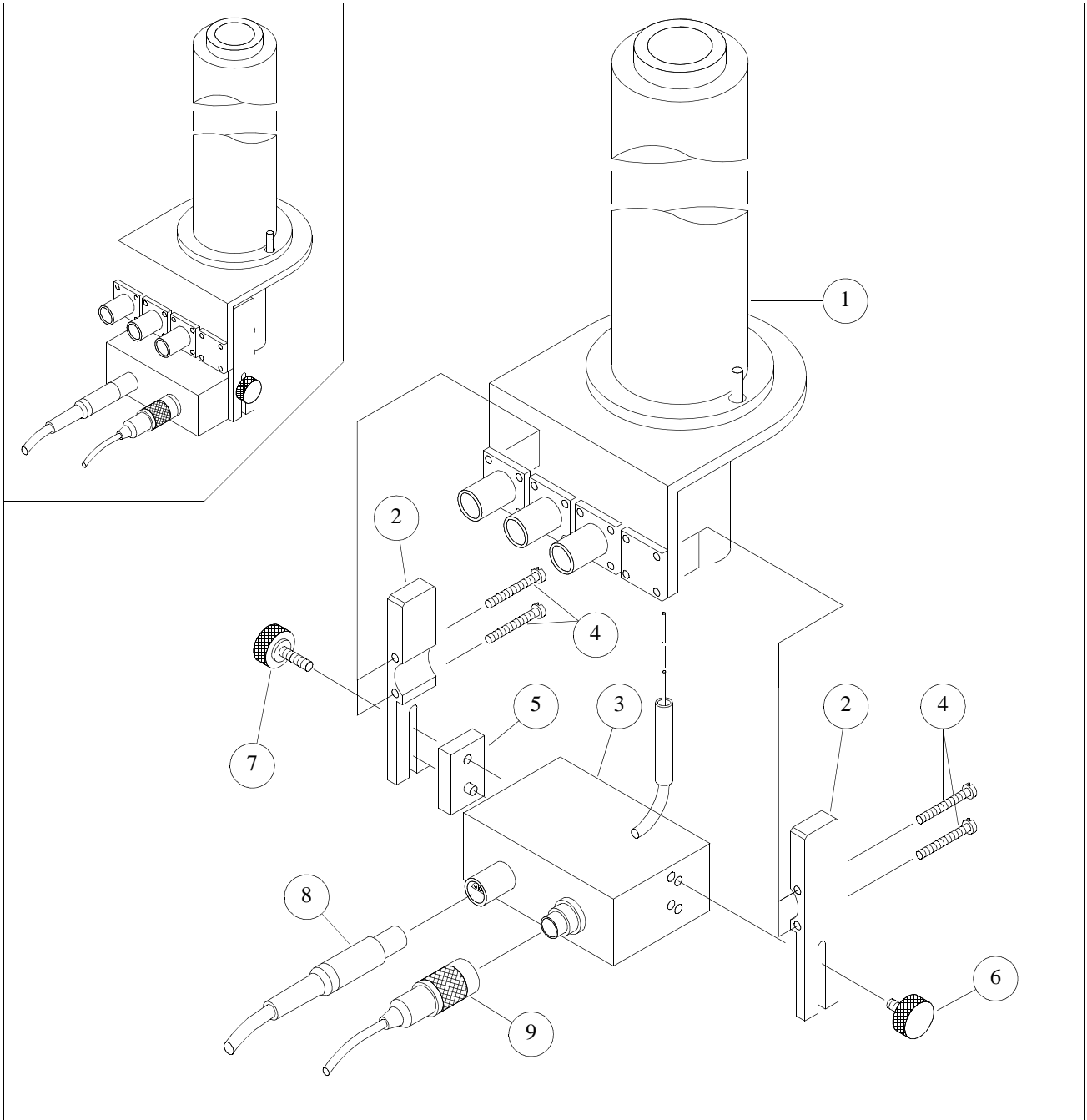
The specified temperature coefficient can be reached under the following experimental conditions :

- 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.  $\pm 1$  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.

# ***Drawings***

# **2**

Figure 2.1. Probe head SB-DUL SB-SEL SB-SEI



9	1	POWER CABLE	W1100864		
8	1	SIGNAL CABLE	W1100644		
7	1	KNURLED SCREW M3X11	W1500141		
6	1	KNURLED SCREW M3X6	W1500140		
5	1	SPACER WEDGE	W1500134		
4	4	SCREW M2.5X20	Z9586		
3	1	HOUSING	W1500139		
2	2	MOUNTING BRACKET	W1500136		
1	1	PROBE			
LOC	QTY	DESCRIPTION	PART	DRAWING	REMARKS

ECHELLE: ~1/2

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

ART:

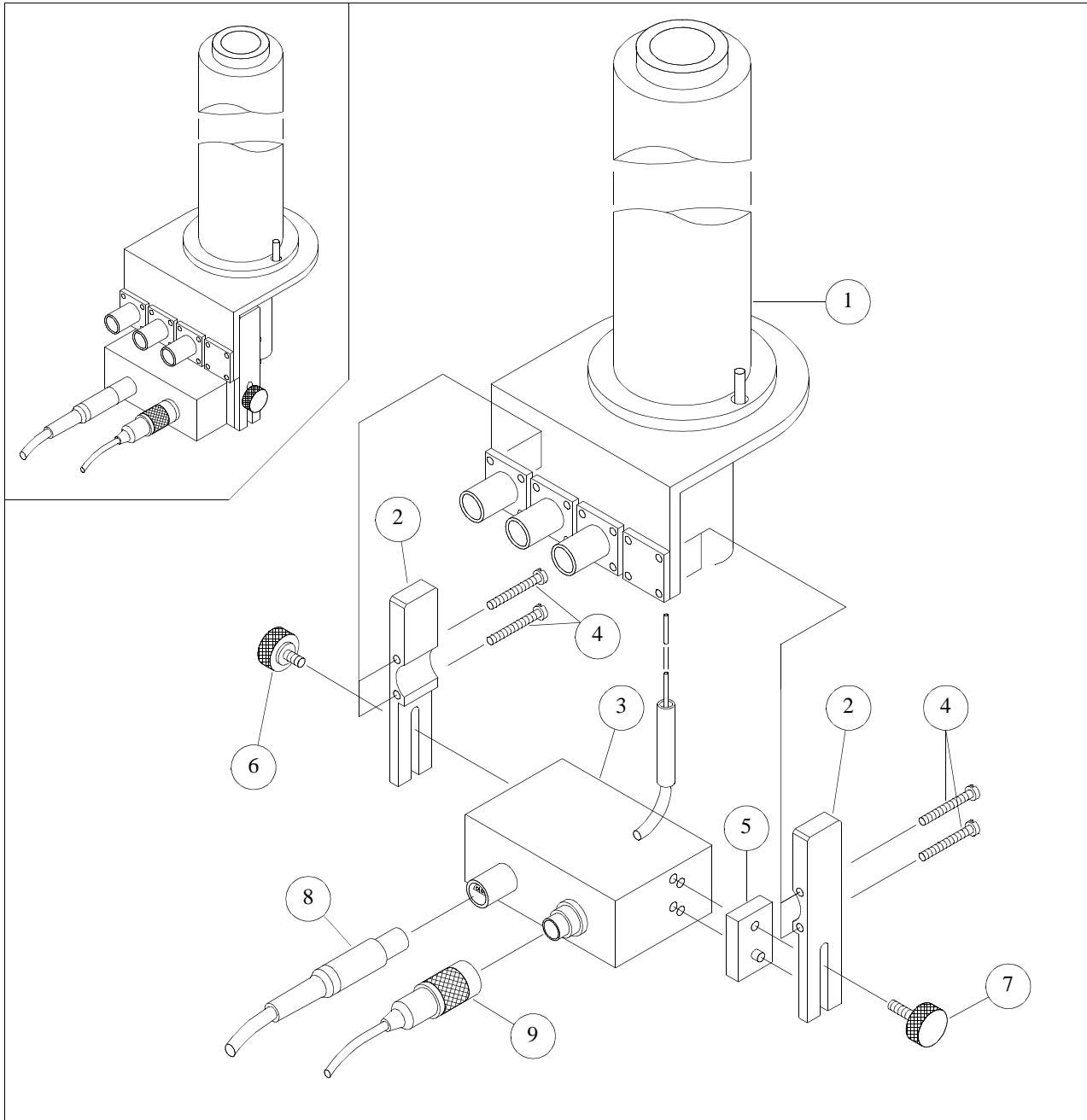
DESS. PAR : RS DATE: 9/92

DSK N : 699

N DE PLAN  
W4M51383B



Figure 2.2. Probe head SB-BBI-SB-BBO SB-QNB



9	1	POWER CABLE	W1100864		
8	1	SIGNAL CABLE	W1100644		
7	1	KNURLED SCREW M3X11	W1500141		
6	1	KNURLED SCREW M3X6	W1500140		
5	1	SPACER WEDGE	W1500134		
4	4	SCREW M2.5X20	Z9586		
3	1	HOUSING	W1500139		
2	2	MOUNTING BRACKET	W1500136		
1	1	PROBE			
LOC	QTY	DESCRIPTION	PART	DRAWING	REMARKS

ECHELLE : ~1/2

B-TO 2000 Mounting on probe  
type: SB-BBI SB-BBO SB-QNP

ART:

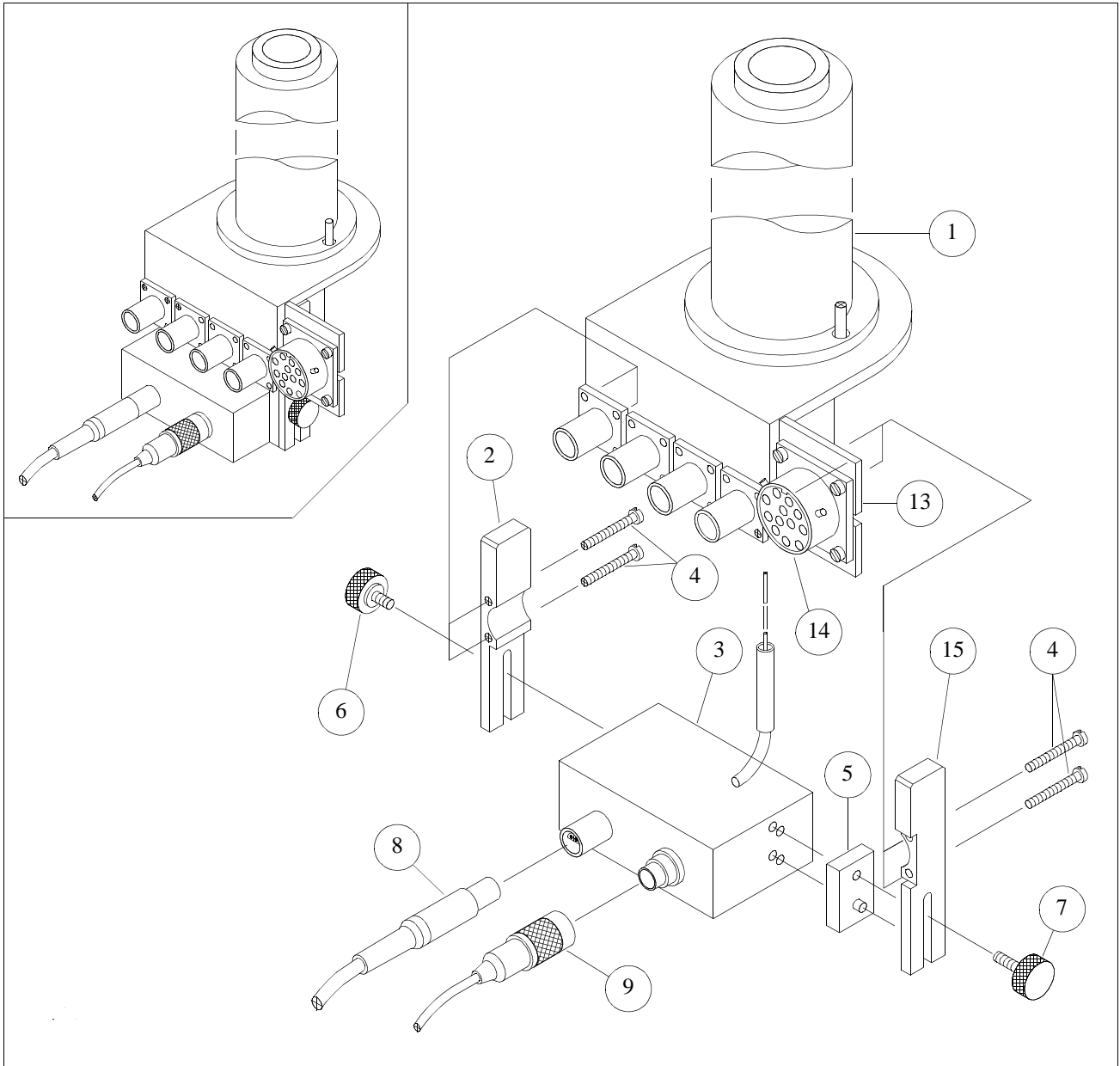
DESS. PAR : RS DATE : 9/92

DSK N : 699

N DE PLAN  
W4M51382B



Figure 2.3. Probe SB Z gradient



15	1	RIGHT MOUNTING BRACKET	W1500155		
14	1	BURNDY CONNECTOR FEMALE 12 P.	4413		
13	1	BURNDY CONNECTOR FIXATION	W1500146		
9	1	POWER CABLE	W1100864		
8	1	SIGNAL CABLE	W1100644		
7	1	KNURLED SCREW M3X11	W1500141		
6	1	KNURLED SCREW M3X6	W1500140		
5	1	SPACER WEDGE	W1500134		
4	4	SCREW M2.5X20	Z9586		
3	1	HOUSING	W1500139		
2	1	LEFT MOUNTING BRACKET	W1500136		
1	1	PROBE			
LOC	QTY	DESCRIPTION	PART	DRAWING	REMARKS

ECHELLE: ~1/2

B-TO 2000 type: SB Z-GRADIENT  
MOUNTING ON PROBE

ART:

DESS. PAR : RS DATE: 10/92

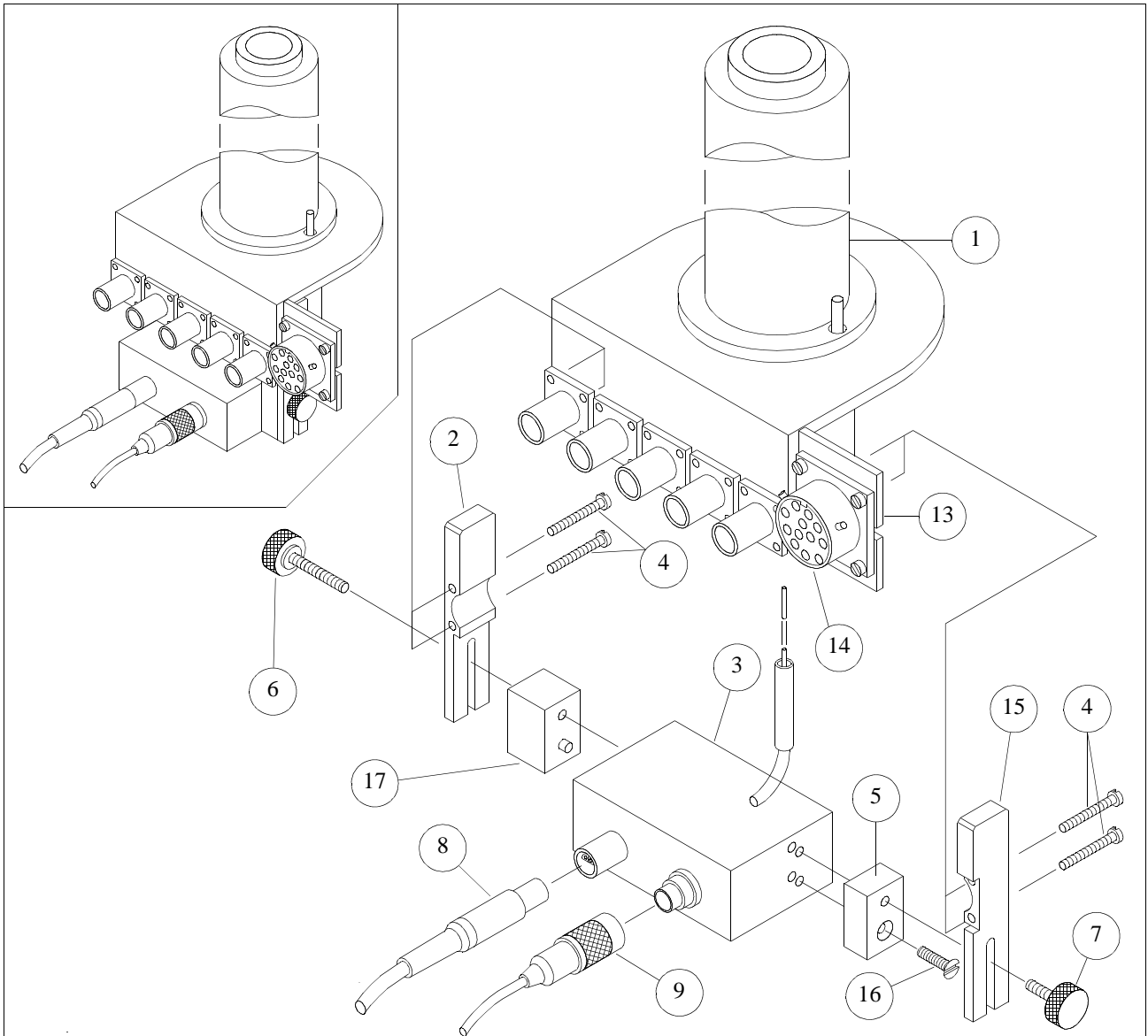
DSK N : 700

N DE PLAN

W4M51445A



Figure 2.4. Probe head QXI



17	1	SPACER WEDGE 14.4mm	W1500115		
16	1	SCREW M3X12	1872		
15	1	RIGHT MOUNTING BRACKET	W1500155		
14	1	BURNDY CONNECTOR FEMALE 12 P.	4413		
13	1	BURNDY CONNECTOR FIXATION	Z9150		
9	1	POWER CABLE	W1100864		
8	1	SIGNAL CABLE	W1100644		
7	1	KNURLED SCREW M3X11	W1500153		
6	1	KNURLED SCREW M3X20.5	W1500112		
5	1	SPACER WEDGE 9mm	W1500111		
4	4	SCREW M2.5X20	Z9586		
3	1	HOUSING	W1500139		
2	1	LEFT MOUNTING BRACKET	W1500136		
1	1	PROBE			
LOC	QTY	DESCRIPTION	PART	DRAWING	REMARKS

ECHELLE : ~1/2

B-TO 2000 type: QXI  
MOUNTING ON PROBE

ART:

DESS. PAR : RST      DATE : 3/95

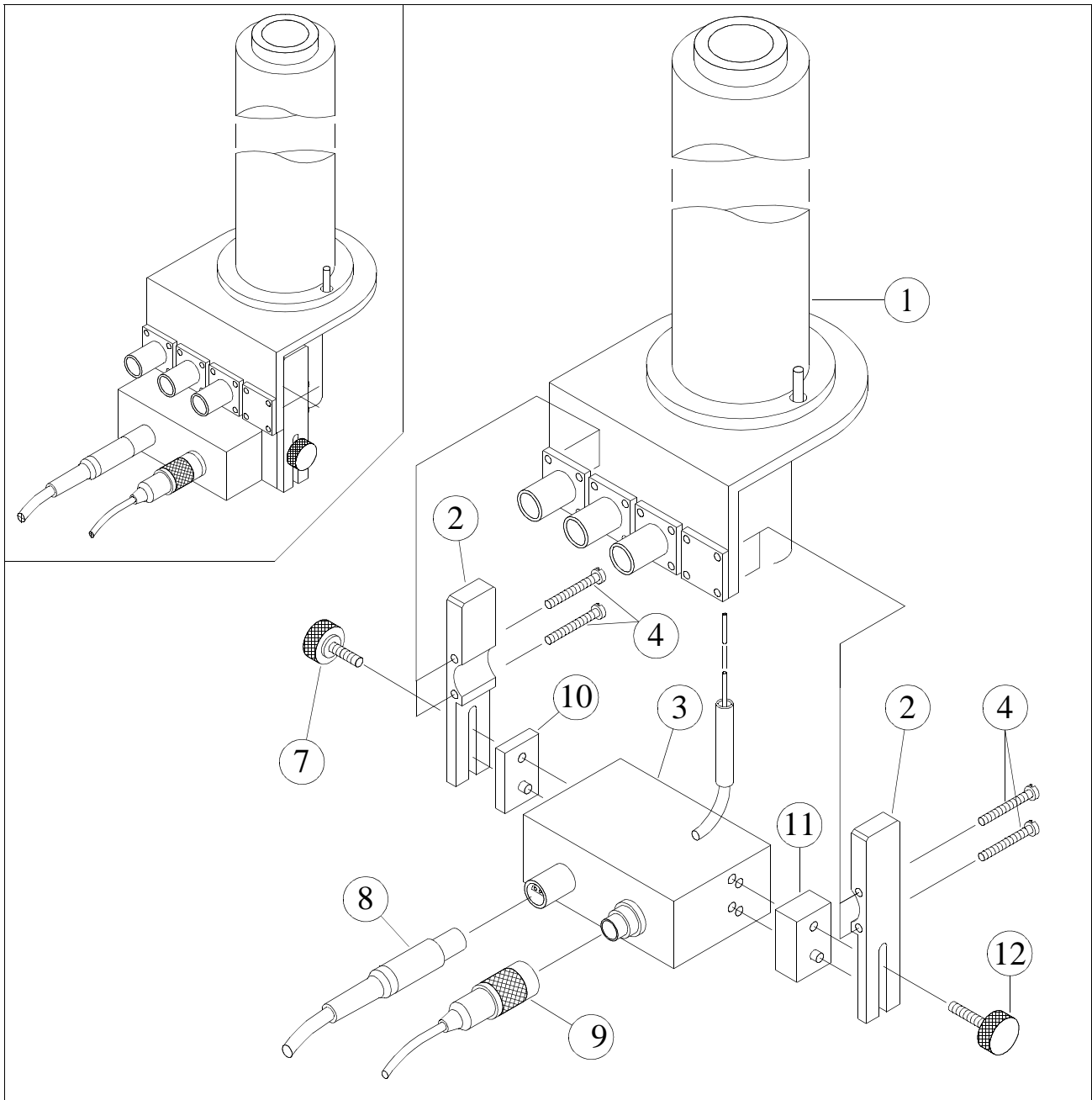
DSK N : ACAD

N DE PLAN

W4M151927



Figure 2.5. Probe wide bore 360-400-500 MHz



12	1	KNURLED SCREW M3X15.5		W1500153	
11	1	RIGHT SPACER WEDGE		W1500152	
10	1	LEFT SPACER WEDGE		W1500149	
9	1	POWER CABLE		W1100864	
8	1	SIGNAL CABLE		W1100644	
7	1	KNURLED SCREW M3X11		W1500141	
4	4	SCREW M2.5X20		Z9586	
3	1	HOUSING		W1500139	
2	2	MOUNTING BRACKET		W1500136	
1	1	PROBE			
LOC	QTY	DESCRIPTION	PART	DRAWING	REMARKS

ECHELLE : ~1/2

B-TO 2000 Mounting on probe

type: Wide Bore 360-400-500 MHz

ART:

DESS. PAR : RS      DATE : 9/92

DSK N : 699

N DE PLAN

W4M51440A



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