

Bruker BioSpin

BCU05

Cooling Unit
Technical Manual

Version 008

think forward

NMR Spectroscopy

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This manual describes the units as they are at the date of printing. On request, the manufacturer shall supply circuit diagrams, lists of components, descriptions, calibrating instructions and any other information for use by qualified personnel of the user, in charge of repairing the parts of the unit which have been stated by the manufacturer to be "repairable". Such supply shall in no event constitute permission to modify or repair the units or approval of the same.

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This unit is not designed for any type of use which is not specifically described in this manual. Such use may be hazardous.

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Description

1

Introduction

1.1

The BCU05 is a gas cooler designed to carry out experiments at low temperature. It is connected to a power supply and needs dry air or gaseous nitrogen. It is designed to function with a BVT or a MAS remote Unit.

Main components and part location

1.2

The BCU05 integrates a refrigerating unit, an external heat exchanger and an electronic unit in a 550 x 500 x 490mm metal cabinet.

The refrigerating unit and electronics are located inside the cabinet, while the external exchanger is located inside the insulated line.



Figure 1.1. BCU05 Cooling Unit closed

Description

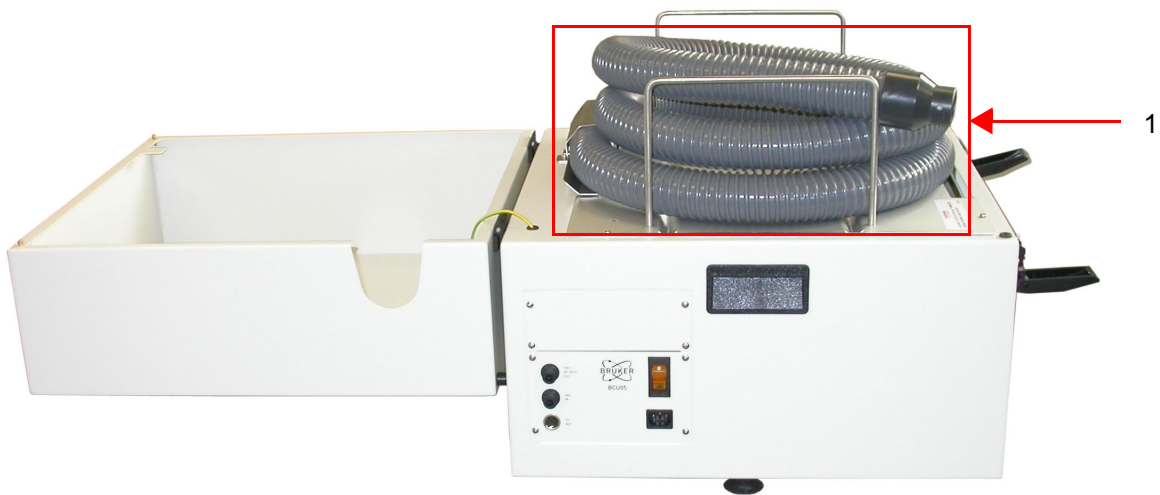


Figure 1.2. BCU05 open lid

1. Insulated transfer line and heat exchanger

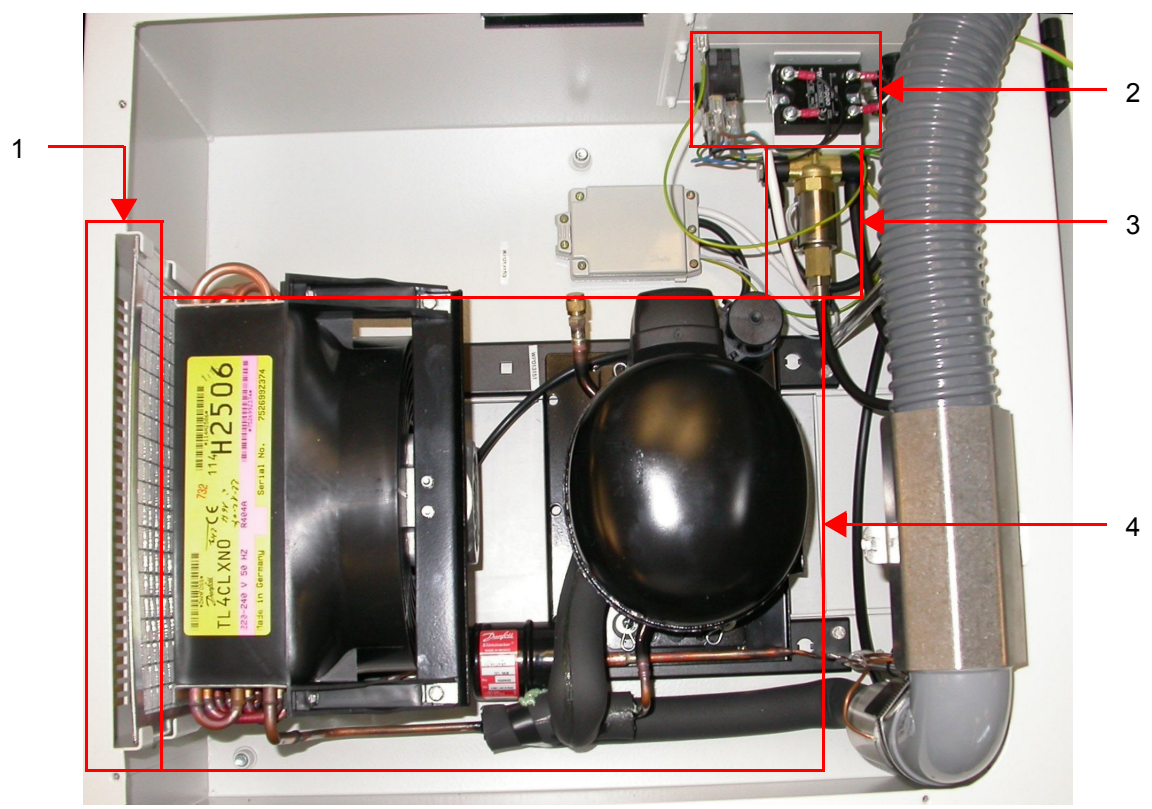


Figure 1.3. BCU05 Cooling Unit inside view

- 1. Filter
- 2. Electronics
- 3. By-pass valve
- 4. Refrigerating unit

Principle of operation**1.3**

The BCU05 must be fed with dry gas or nitrogen from either the BVT or the MAS Unit. The gas is cooled in the external heat exchanger.

The BCU05 heat exchanger has been built for efficient heat transfer from dry gas to frigorific fluid circulating in the refrigerating unit.

Refrigerating unit principles are not explained in this manuel.

Front Panel**1.4****HR-MAS Front panel****1.4.1**

This option is not mounted on the standard BCU05.

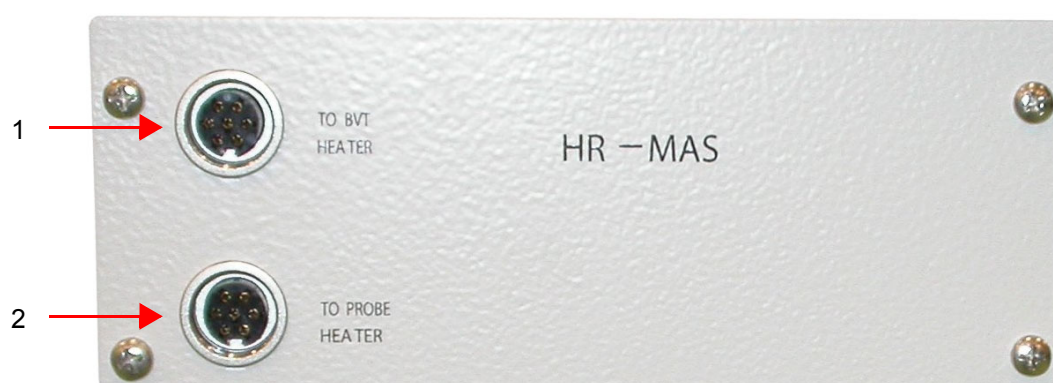


Figure 1.4. HR-MAS Front view

1. Connect to heater connector on host BVT
2. Connect to probe heater



Figure 1.5. BCU05 Front view

1. By-pass out
2. Gas inlet
3. Connect to BCU05 connector on host BVT
4. Power switch
5. Main power supply plug

Installation

2

Preliminary

2.1

To install the system, proceed as follows:

- Place the cooling unit at approximately 2m from the magnet. Open the lid and carefully unroll the heat exchanger.
- Put some vacuum grease on the glass ball-joint before clamping the heat exchanger. Take care to keep the right distance between the probe glass ball joint and the support clamp.
- Take the heat exchanger support stand and position it between the magnet and the unit. Adjust the height.
- Position the cooling unit as far as possible from the magnet to minimize the effect of the magnet stray field.

Electrical wiring

2.2

Before connecting, please verify that all the elements are switched off. Disconnect the main power cord.

- Connect the "TO BVT" BCU05 connector to "BCU05" plug on host BVT. Use the W1212078 remote cable.
- If BCU05 HR-MAS is used, connect the probe heater to "TO PROBE HEATER" connector on BCU05. Also connect the "TO BVT HEATER" connector to "Heater" connector on host BVT. Both connection are done with a W1100117 cables.
- If the standard BCU05 is used, connect the probe heater to "Heater" connector on host BVT with the W1100117 cable.

Connection of air

2.3

Special care must be taken while connecting the BCU05 to the other devices. Please always verify the gas flow circuitry before power up the system.

Heat exchanger by pass function explanation

2.3.1

Goal: It avoids the sample freezing when the probe heater is switched off.

The BCU05 cools the gas flowing through the heat exchanger when the probe heater is ON. As soon as the probe heater is switched off, gas present on the BCU05 inlet connector flows through an external plastic hose, directly to the end of the trunk just after the heat exchanger without been cooled, avoiding the sample freezing.

Internal pneumatic circuitry

2.3.2

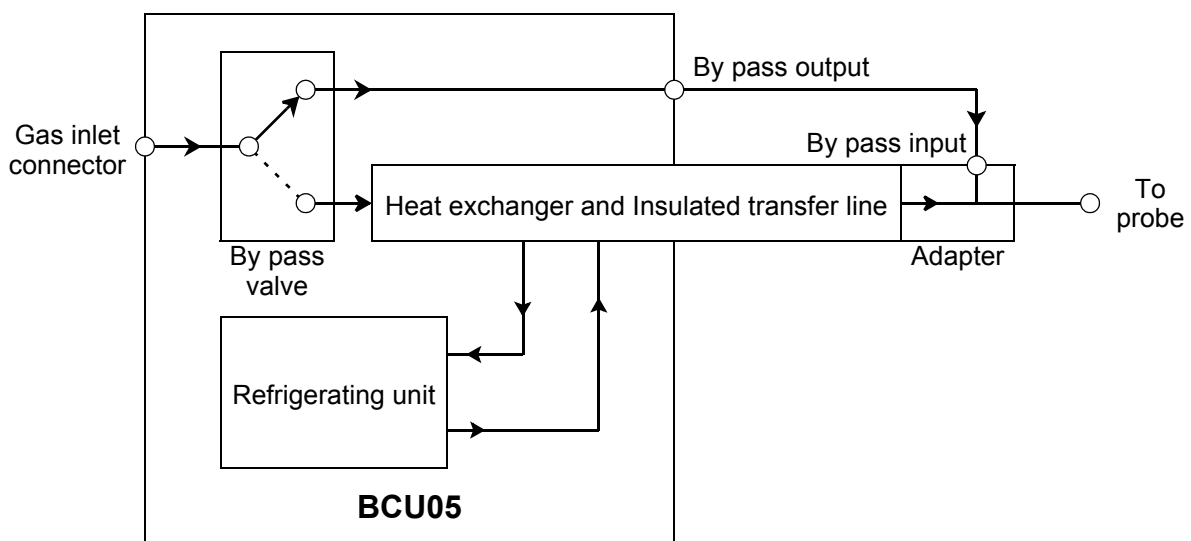


Figure 2.1. Pneumatic circuitry

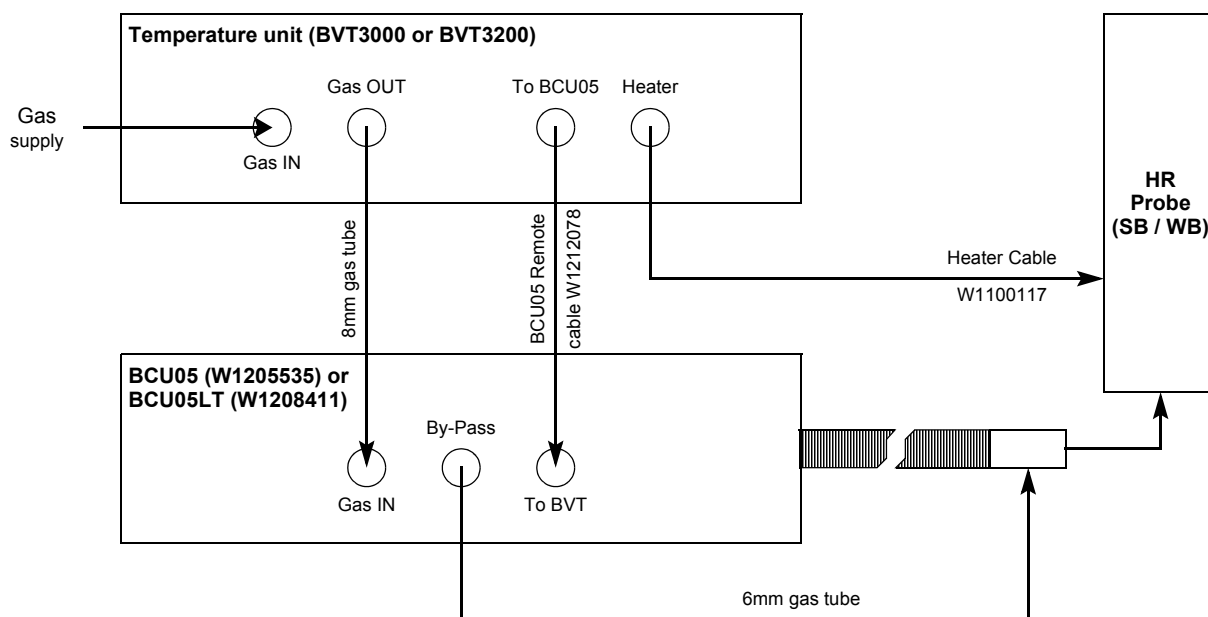


Figure 2.2. Case 1

BCU05 is BVT controlled, BVT gas output is connected to BCU05 gas input. HR probe needs no special attention.

The operation of the BCU05 is enabled by the BVT when the probe heater is "ON".

Installation

BCU05 HR-MAS, BVT, Probe (HR,VTN or WVT) and MAS remote unit connection 2.3.4

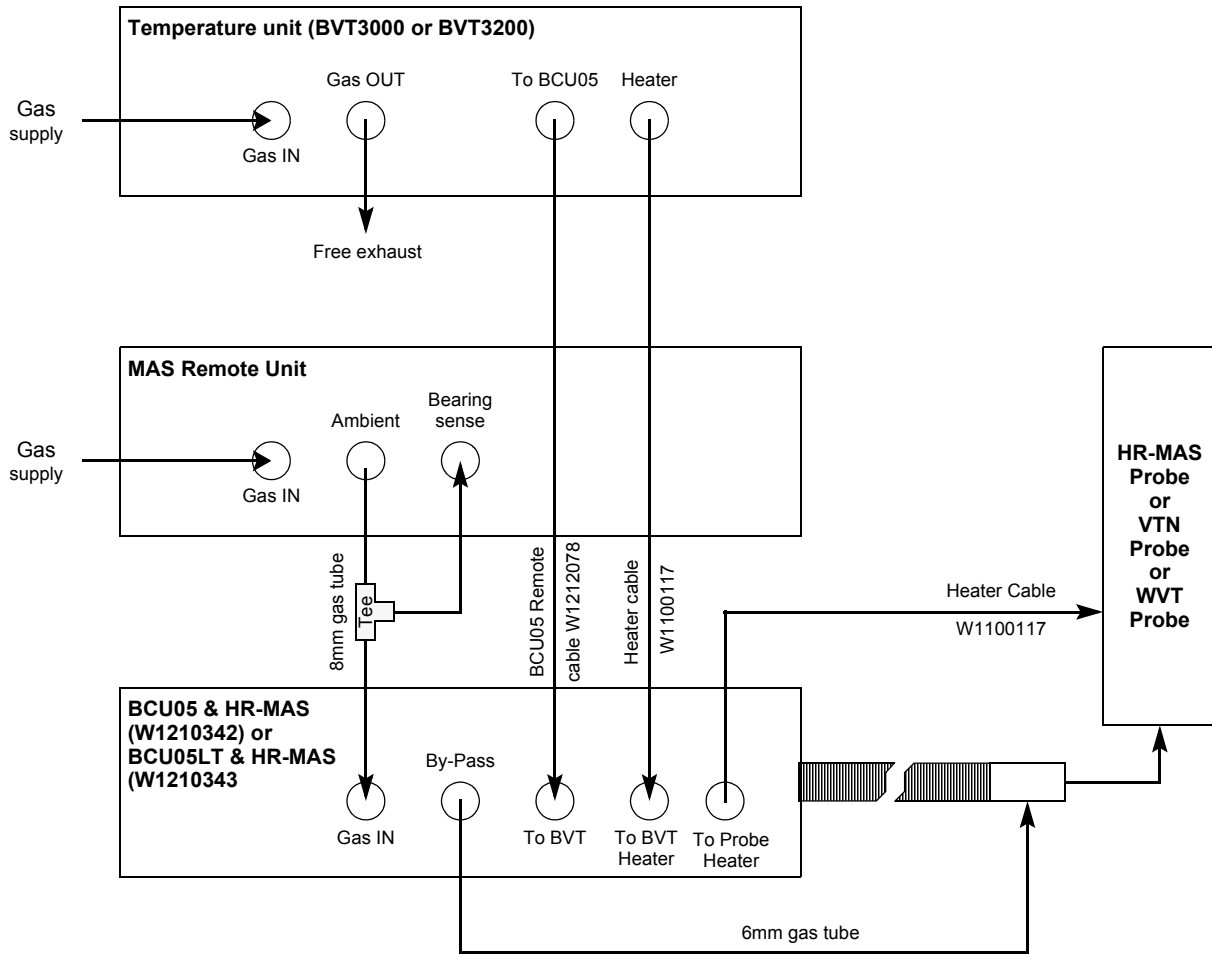


Figure 2.3. Case 2

DVT probe has been designed to be used with the MAS remote unit. The probe has special gas connections for each gas circuit.

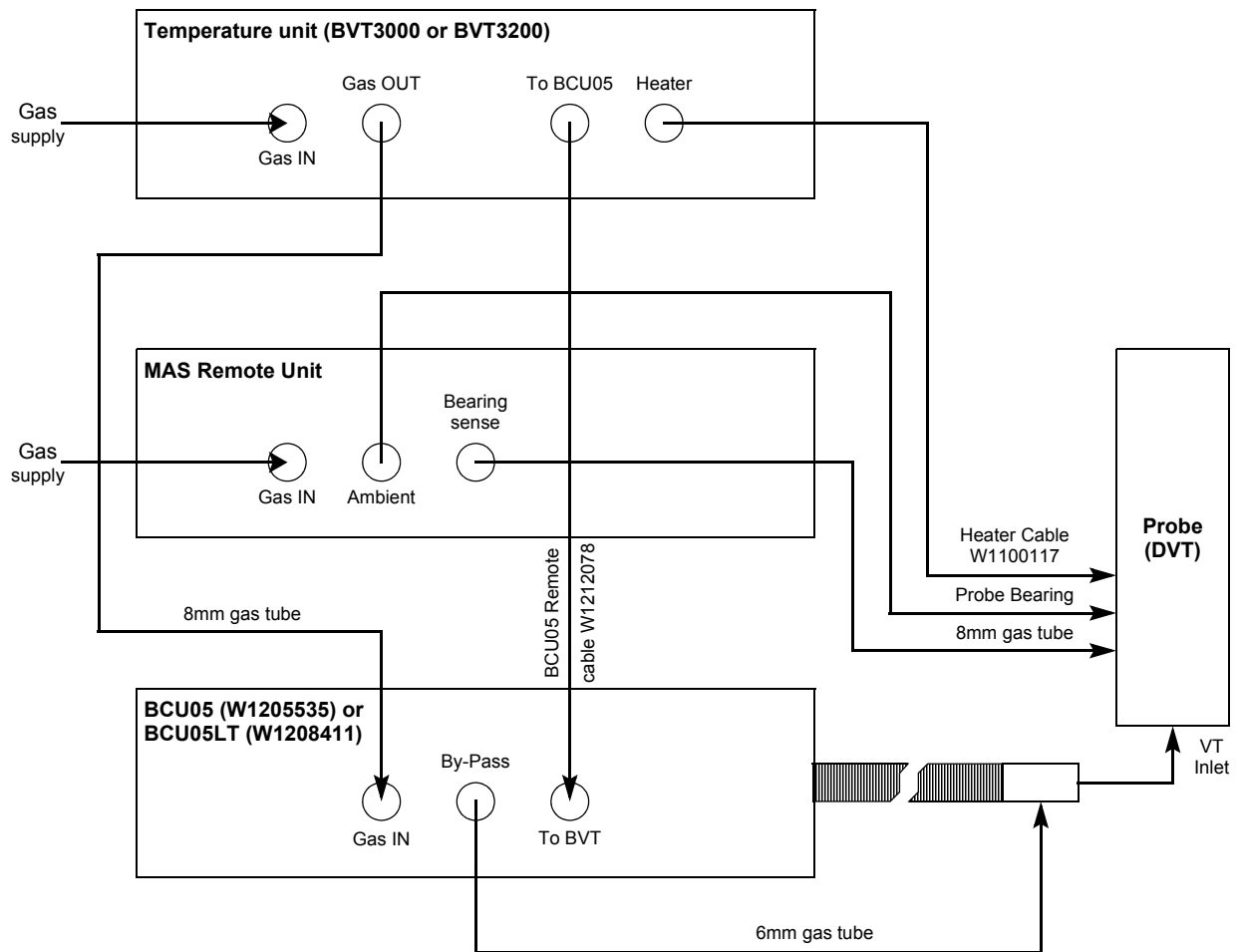


Figure 2.4. Case 3



Note: Same diagram for BCU05-HR unit.

BCU05 stand alone mode

3

The BCU05 operation is controlled by the Variable Temperature Unit. However, it is possible to modify the internal wiring to manually control the BCU05 with the main front panel power switch. Modifications are explained below.

Remote to Stand alone BCU05 modification

3.1

Follow the instructions below to make the transformation to the stand alone mode.

- Disconnect the main power cord.
- Unscrew the top cover (4 screws) and remove it.

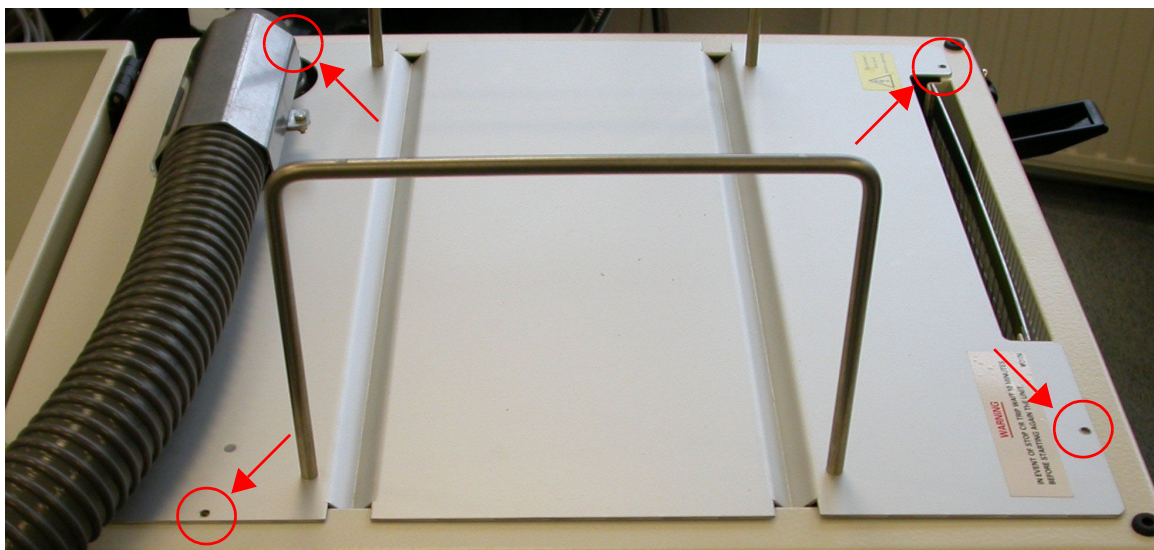


Figure 3.1. Location of screws

BCU05 stand alone mode

- Unscrew and unplug the wires connected on solid state relay terminal 1 and 2.



Figure 3.2. Two wires to be disconnect

- Replace one screw on terminal 2.
- Place both wires on terminal 1 and fasten the screw.

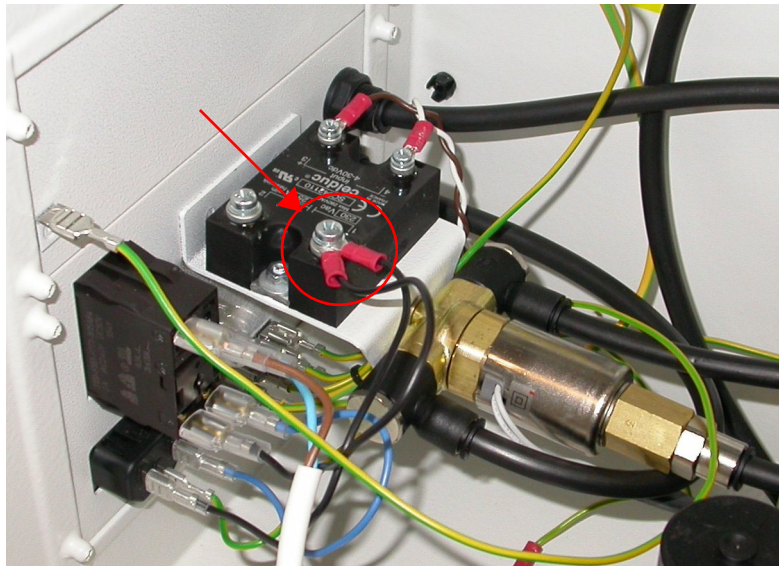


Figure 3.3. Two wires reconnected

- Replace the top cover. Fasten the 4 screws.

The access to the solid state relay is not possible without dismantling the HR-MAS panel.

- Unscrew the 4 screws on the front panel.

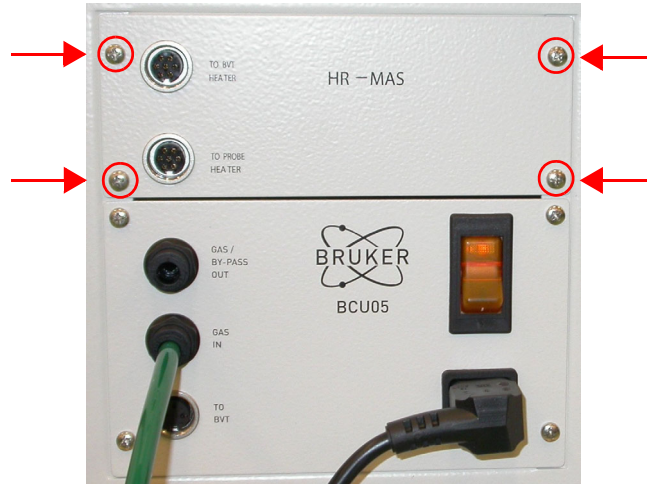


Figure 3.4. HR-Mas front panel screws

- Slightly pull out the panel to access to terminal 1 and 2.

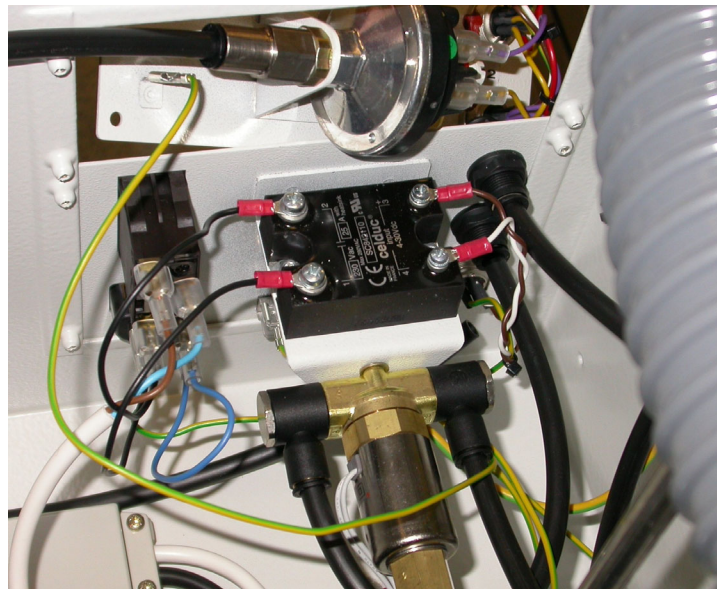


Figure 3.5. HR-Mas front panel removed

- Next modification steps are the same as for standard BCU05 see **"Remote to Stand alone BCU05 modification" on page 15.**
- Mount the HR-MAS front panel. Fasten the 4 screws.

Operating notes

4

Some tips and tricks to avoid problems:

- The BCU05 is BVT controlled and is designed for 24 hours a day operation as long as the probe is not exchanged. If the probe must be exchanged, switch off the BCU and wait for 10 minutes before handling. The exchanger tip must not be frozen when it has to be disconnected from the probe.
- Never operate the unit without gas flowing through the heat exchanger first. Otherwise ice may clog the heat exchanger. The inlet gas should be dry, oil and dust free. Serious damage to the probe and the BCU may result if gas is not clean.
- The outlet gas temperature is not directly controllable. Its temperature will depend on input gas temperature, ambient room temperature, flow rate, etc.
- The minimal sample temperature reached with the BCU05 is at least -5°C with 25°C room temperature. Slightly lower temperatures may be reached depending on the probe, input air temperature, room temperature.
- The BCU05 is designed to be positioned at approximately 2m from the magnet.
- The inlet gas dew point should be below -50°C . The low dew point is needed to avoid the blocking of the exchanger by frost.

Service information and maintenance

5

Service information

5.1

The BCU05 is not designed to be user serviced.

Maintenance

5.2

Maintenance must be done every 6 month.

Air filter

5.2.1

The air filter must be cleaned every 6 month. The filter is accessible on the top of the BCU05. Remove it and clean it with compressed air or with a vacuum cleaner. Install the filter in the BCU05.

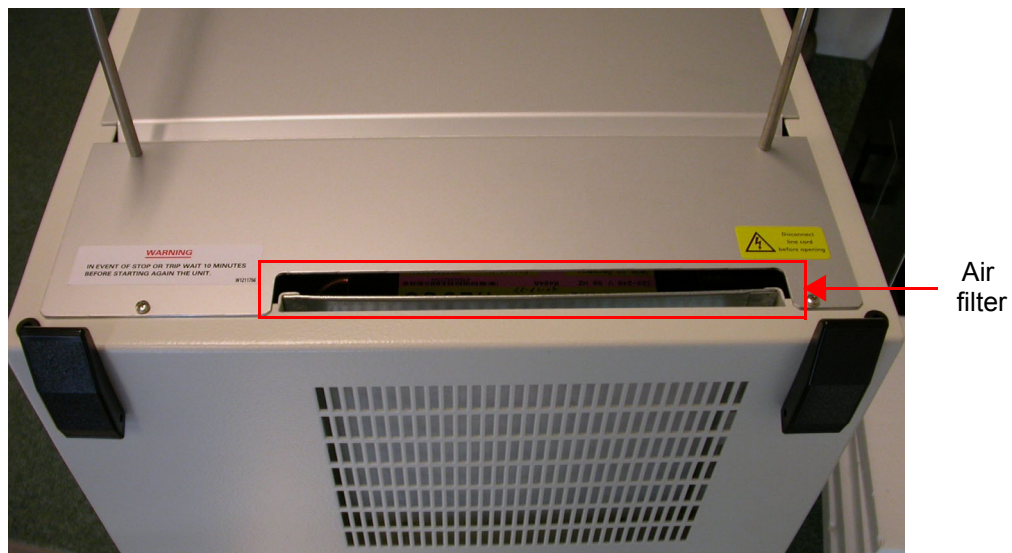


Figure 5.1. Filter access

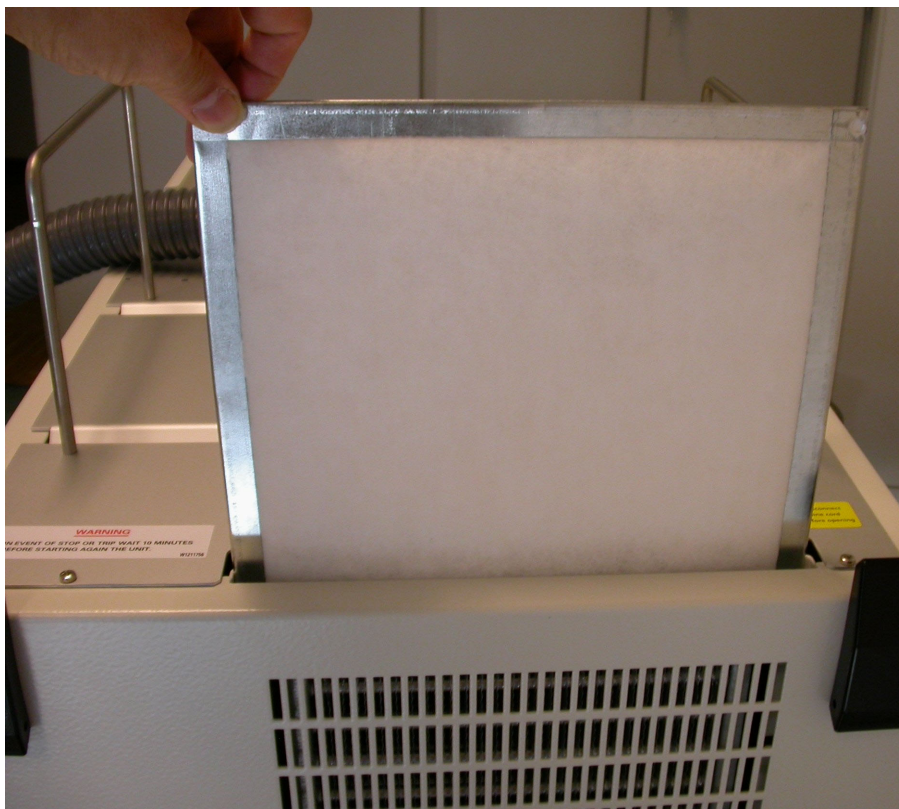


Figure 5.2. Removing the filter (W3004035)

Trouble shooting guide

5.3

BCU05 deicing

5.3.1

The heat exchanger may be clogged with frost:

- Switch off the BCU05 unit and wait for a period of 12 hours.
- Disconnect the exchanger from the probe.
- Place the heat exchanger on the floor.
- Make sure that the gas is present at the inlet.
- Start the Cooling Unit for 2 or 3 minutes only, not longer(heater must be "ON" in EDTE) .
- Stop then the BCU05 (heater "OFF") before the gaz cooling begins.
- Wait 10 minutes and repeat the same operation again.
- Reconnect the BCU05 on the probe.

Modification**5.4**

Heat exchanger adapter can be easily exchanged allowing the cooler to be used with HR or HR-MAS probes.

BCU05 HR Adapter**5.4.1**

Figure 5.3. HR Adapter W1212096



Figure 5.4. HR Adapter mounted



Figure 5.5. HR-MAS Adapter W1212504



Figure 5.6. HR-MAS End Adapter mounted

BCU05 HR to BCU05 HR-MAS**5.5**

- Unscrew the HR adapter.
- Screw the HR-MAS adapter.

BCU05 HR-MAS to BCU05 HR**5.5.1**

- Unscrew the HR-MAS adapter.
- Screw the HR adapter.

Schematics

6

Common electrical circuitry

6.1

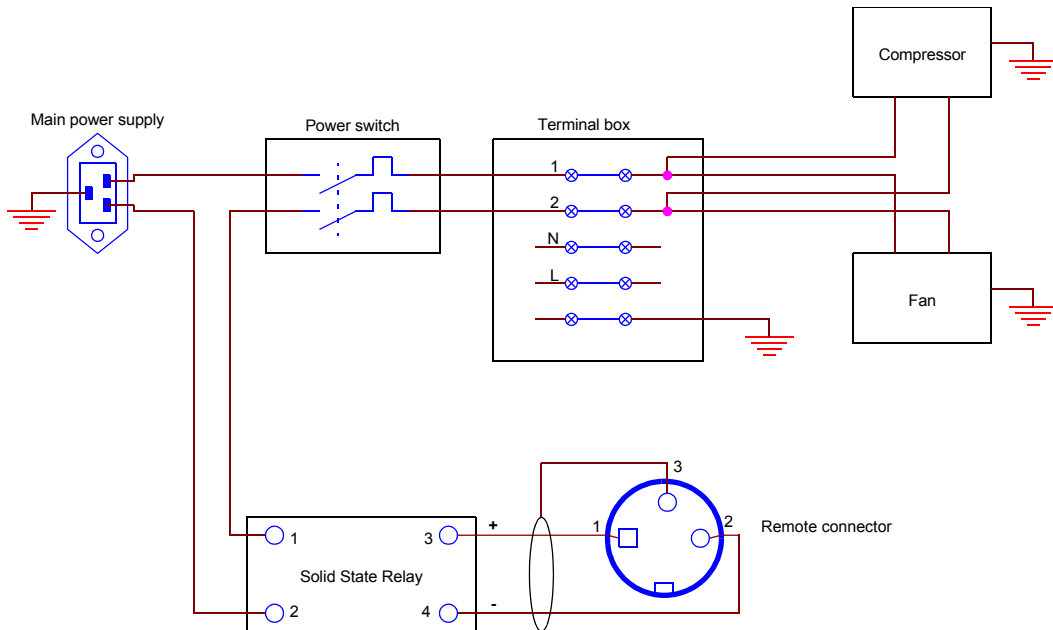


Figure 6.1. Common electrical circuitry

- Remote control voltage 4-30Vdc.

BCU05 HR-MAS pressure switch module

6.2

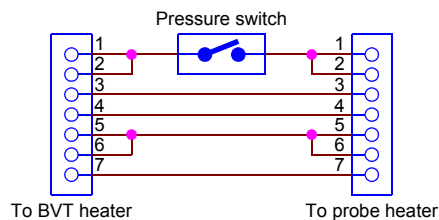


Figure 6.2. HR-MAS add-on circuit W1211938

These 2 connectors and the pressure switch are mounted on the BCU05 HR-MAS front panel rear side.

The pressure switch interrupts the heater line when the pressure is below a predefined pressure.



Note: The status of the pressure switch is not shown in "EDTE".

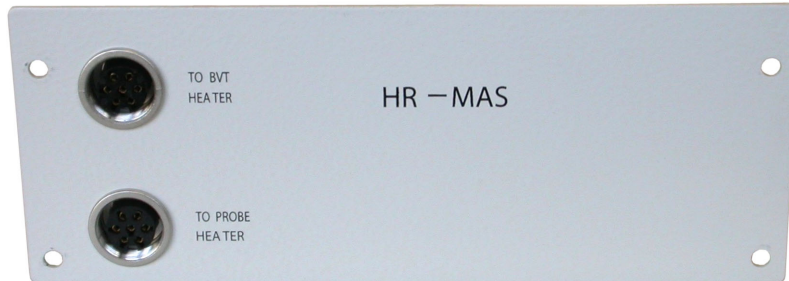


Figure 6.3. HR-MAS option front view

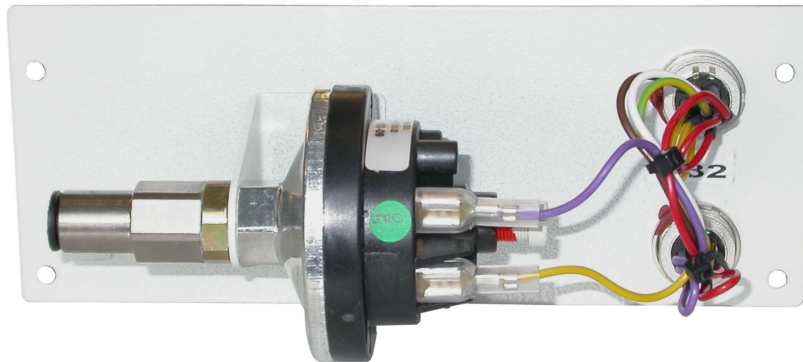


Figure 6.4. HR-MAS option rear view

Technical specifications

7

Common specifications

7.1

Table 7.1. Common specifications

Power supply	1 x 230V ($\pm 10\%$) 50/60Hz - 450VA
Cool down time	30mn
Sample temperature range	-15°C to +50°C (depending on probe)
Ambient operating temperature range	+20°C to +32°C
Gas dew point	< -50°C
Flow rate	Up to 2000l/h (probe dependant)
BCU05 exchanger length	3m
BCU05 LT exchanger length	4m
Gas content	0,275kg Refrigerant R404A
Case dimensions	550 x 500 x 490mm

Special specifications

7.2

Gas flow input pressure

- BCU HR: 0.3bar max.
- BCU HR-MAS: 5bar max.

Exchanger length

- BCU05 HR and BCU05 HR-MAS: 3 meters
- BCU05 LT HR and BCU05 LT HR-MAS: 4 meters

Weight

- BCU05 HR: 35kg
- BCU05 HR-MAS: 40kg
- BCU05 LT HR: 46kg
- BCU05 LT HR-MAS: 46kg

Part numbers list

8

Table 8.1. Part list

P/N	Description
W1205535	BCU05 HR cooling unit
W1208411	BCU05 LT HR cooling unit
W1210342	BCU05 HR-MAS cooling unit
W1210343	BCU05 LT HR-MAS cooling unit
W1212096	BCU05 Probe coupling with bypass
W1212504	BCU05 HR-MAS Probe coupling with bypass
W3200336	BCU05 sliding tripod
W3202026	BCU05 slide for crutch with adjustable diameter
W1208508	BCU05 column for Y crutch
W3202318	BCU05 slide extension bar
W1208415	BCU05 LT Crutch assembly
W1212078	Remote cable
33003	Main power cord
W1206511	Ball joint clip with air input
2166	Ball joint clip
W3004035	Air filter BCU05

Part numbers list

Part presentation

8.2

Sliding tripod

8.2.1

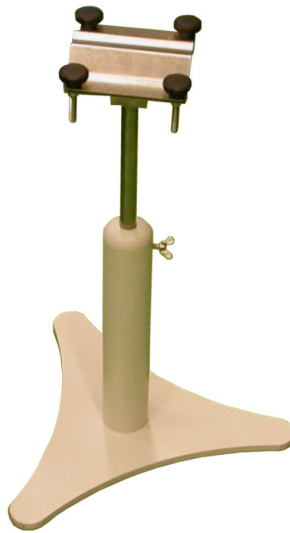


Figure 8.1. Sliding tripod W3200336

BCU05 LT Crutch

8.2.2



Figure 8.2. LT Crutch W1208415



Figure 8.3. Clip W1206511 and 2166

The clip W1206511, with a connection for dry air nitrogen, helps prevent the formation of an ice block on the coupling.

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