Embracing Challenge

Combustion Air Conditioning Unit Series BA

BA, BA-P4

Instruction Manual
Version 1.02.00

Dear customer,

Thank you for buying our product. In this manual you will find all necessary information about this M&C product. The information in the manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. You will find all the addresses in the appendix of this instruction manual.

For additional information about our products, please go to M&C's website www.mc-techgroup.com. There you can find the data sheets and manuals of our products in German and English.

This Operating Manual does not claim completeness and may be subject to technical modifications.

With the release of this version all older manual versions will no longer be valid. The German instruction manual is the original instruction manual. In case of arbitration only the German wording shall be valid and binding.

Version: 1.02.00

Content

List of Illustrations

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1 GENERAL INFORMATION

The product described in this instruction manual has been built and tested in our production facility.

All M&C products are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this instruction manual need to be followed. This instruction manual includes all information regarding proper transportation, storage, installation, operation and maintenance of this product by qualified personnel.

Follow all instructions and warnings closely.

Read this manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor.

2 DECLARATION OF CONFORMITY

CE - Certification

The product described in this operating manual complies with the following EU directives:

EMV-Instruction

The requirements of the EU directive 2014/30/EU "Electromagnetic compatibility" are met.

Low Voltage Directive

The requirement of the EU directive 2014/35/EU "Low Voltage Directive" are met.
The compliance with this EU directive has been examined according to DIN EN 61010.

Declaration of conformity

The EU Declaration of conformity can be downloaded from the **M&C** homepage or directly requested from **M&C**.

3 SAFETY INSTRUCTIONS

Please take care of the following basic safety procedures when mounting, starting up or operating this equipment:

Read this operating manual before starting up and use of the equipment. The information and warnings given in this operating manual must be heeded.

Any work on electrical equipment is only to be carried out by trained specialists as per the regulations currently in force.

Attention must be paid to the requirements of VDE 0100 (IEC 364) when setting high-power electrical units with nominal voltages of up to 1000 V, together with the associated standards and stipulations.

Check the details on the type plate to ensure that the equipment is connected to the correct mains voltage.

Protection against touching dangerously high electrical voltages:
Before opening the equipment, it must be switched off and hold no voltages. This also applies to any external control circuits that are connected.

The device is only to be used within the permitted range of temperatures and pressures.

Check that the location is weather-protected. It should not be subject to either direct rain or moisture.

The device must not be used in hazardous areas.

Installation, maintenance, monitoring and any repairs may only be done by authorized personnel with respect to the relevant stipulations.

4 WARRANTY

In case of a device failure, please contact immediately M&C or your M&C authorized distributor.

We have a warranty period of 12 months from the delivery date. The warranty covers only appropriately used products and does not cover the consumable parts. Please find the complete warranty conditions in our terms and conditions.

The warranty includes a free-of-charge repair in our production facility or the free replacement of the device. If you return a device to M&C, please be sure that it is properly packaged and shipped with protective packaging. The repaired or replaced device will be shipped free of delivery charges to the point of use.

5 USED TERMS AND SIGNAL INDICATIONS

Danger

The 'Danger' warning sign indicates that death, serious injury and/or significant material damage will be the consequence, if the appropriate precautions should not be taken.

Warning

The 'Warning' warning sign indicates that death, serious injury or damage to property may occur if the relevant precautionary measures are not observed.

Caution

The 'Caution' warning sign indicates that slight personal injury can occur if the appropriate safety precautions are not observed.

Corrosive!
These substances destroy living tissue and equipment upon contact.
Do not breathe vapors; avoid contact with skin and eyes.

Caution

'Caution' indicates that damage to property can occur if the appropriate safety precautions are not observed.

Note

'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.

Qualified personnel

'Qualified personnel' are experts who are familiar with the installation, mounting, commissioning and operation of these types of products.

Hot surface!
Contact may cause burn! Do not touch!

High voltages!
Protect yourself and others against damage which might be caused by high voltages.

Wear protective gloves!
Working with chemicals, sharp objects or extremely high temperatures requires wearing protective gloves.

Use foot protection

Use safety helmet and full protective goggles

6 INTRODUCTION

The **M&C BA.**... combustion air conditioning unit has been specially designed for applications where dry, cleaned and hydrocarbon-free air is required, independent of gas cylinders.

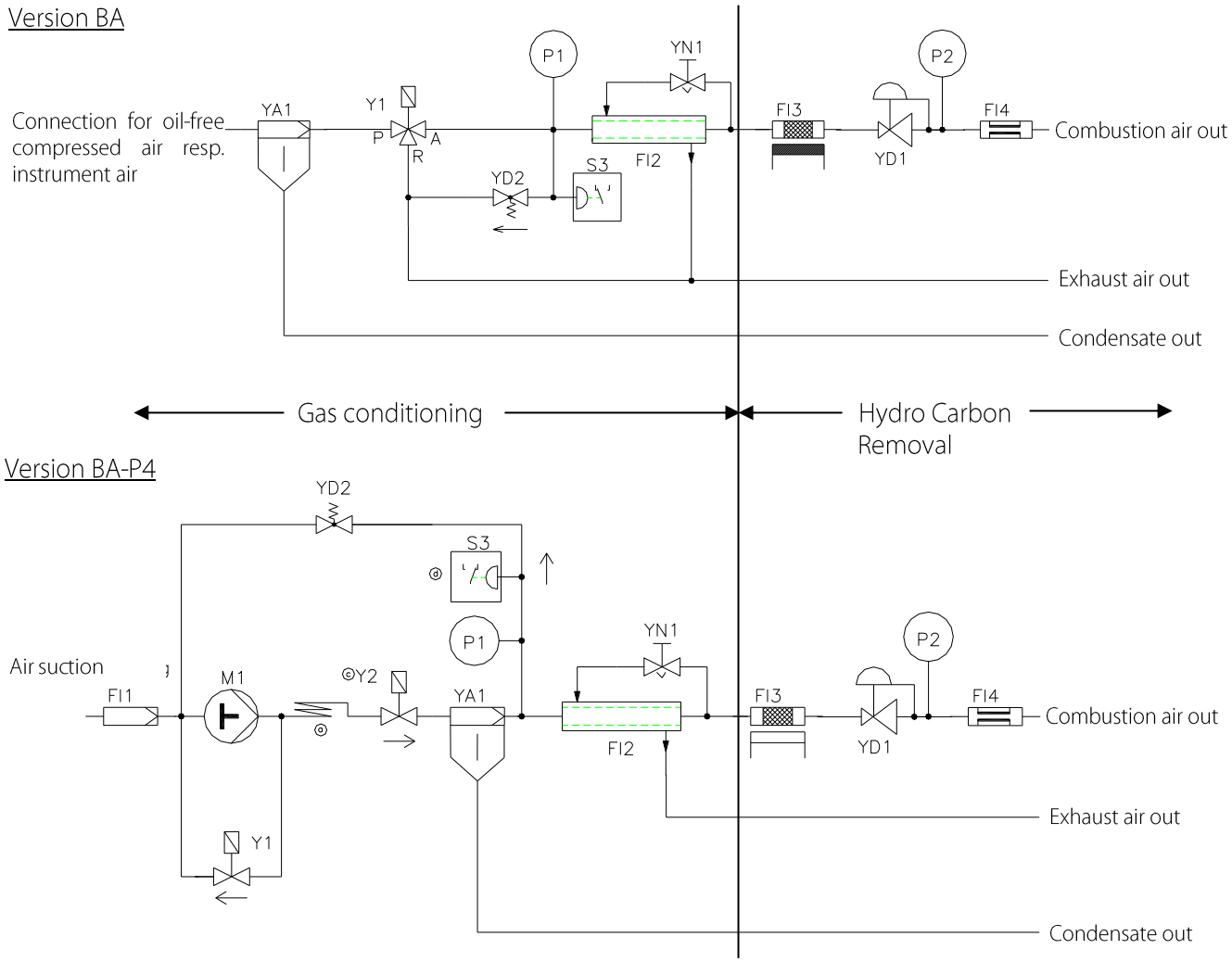
Typical applications are hydrocarbon measurements with flame ionisation detectors (FID) and use as a zero gas for the calibration of infrared (IR) analyzers.

The **M&C BA** and **BA-P4** combustion air conditioning units are compact, operator and service-friendly 19" plug-in units.

BA and **BA-P4** versions provide a controllable outlet pressure of maximum 4 bar.

7 FUNCTION

Figure 1 shows the function diagram of **M&C** combustion air conditioning units.



FI1 = Air filter	P 1 = Manometer inlet	YD1 = Pressure controller
FI2 = Membrane dryer	P 2 = Manometer outlet	YD2 = Relief valve
FI3 = Catalyst	S 3 = Pressure switch	YN1 = Needle valve
FI4 = Adsorber	Y1,2 = Solenoid valve	
M 1 = Compressor	YA1 = Condensate separator	

Figure 1 Function diagram of BA and BA-P4 combustion air conditioning units

Y2 added starting from 10.05

The functional principle of the **M&C** combustion air conditioning unit is divided into two sections (see Figure 1):

- Gas conditioning section
- Hydrocarbon elimination section

The maximum inlet pressure is 5.8 bar and is limited by the **YD2** pressure relief valve (set at the factory). A pressure regulator **YD1** is connected downstream of the catalyst **FI3**. Here, the outlet pressure can be controlled by the customer via a control knob on the front panel of the combustion air conditioning unit in a range from 0 bar to a maximum of 4 bar. The pressure gauges **P1** and **P2** on the front panel of the **BA...** allow visualization and control of the inlet and outlet pressure, respectively.

In the event of a power failure or interruption of the gas flow ("Air/On" switch in bottom position), solenoid valve **Y1** is automatically opened and the pressure in the combustion air conditioning unit is relieved.

If the inlet pressure drops to a value below 4 bar, pressure switch **S3** opens; the gas flow is interrupted automatically, the pressure in the combustion air conditioning unit is relieved via solenoid valve **Y1** and the alarm is applied as a status signal to the 9-pole connector at the rear of the combustion air conditioning unit.

Depending on the combustion air supply, distinction is made between the **BA** and **BA-P4** versions.

BA-P4 version:

- Ambient air is drawn in by suction via the ambient air suction filter **FI1** (filter fineness 0.1 µm) located at the rear by means of the integrated swing piston compressor **M1**.

- The swing piston compressor **M1** compresses the ambient air to about 5.8 bar. If the pressure is exceeded, relief valve **YD2** opens, and the excess gas is fed in the suction pipe between the ambient air filter and pump.

- Compression of the ambient air causes the dew-point of the gas to increase. The condensate occurring in the pipe (as a cooling section) is previously separated in a combined high-efficiency particle-condensate filter YA1 (0.01 µm filter fineness). The integrated automatic float-condensate drain with G 1/8" i connection thread ensures automatic condensate removal. An appropriate hose coupler must be provided by the customer.

BA version:

- With the **BA** version, the swing piston compressor for transport and compression of the gas is omitted. Oil-free compressed or instrument air can be connected directly to the rear panel 5 (G 1/4" i) of the combustion air conditioning unit. It should be noted here that the available inlet pressure must be greater than 4 bar. When the pressure exceeds approx. 5.8 bar, the **YD2** pressure relief valve (see above) opens. The excess gas is led with the exhaust air of the **FI2** membrane dryer to the exhaust air outlet **2**.

- Before entering the diaphragm drier **FI2**, the gas is passed through the high-efficiency particle-condensate filter **YA1** (see above), where any fine particles are separated.

In both versions, the downstream arranged diaphragm drier **FI2** dries the combustion air to a dew point less than -10 °C.

A partial flow of the dried combustion air is used as waste air for the diaphragm drier. The needle valve **YN1** regulates the volume flow depending on the inlet pressure between 20 l/h and 60 l/h (works setting). Air discharge takes place via the waste air outlet **2** on the rear panel of the combustion air conditioning unit; a hose DN 4/6 can be connected by the customer.

Hydrocarbon elimination takes place stepwise in two stages:

- Catalytic oxidation **FI3** of the hydrocarbons at a temperature of 500 °C on the surface of the platinum/palladium filling. The optimal catalyst temperature is preset at the works at temperature controller **B1** on the front panel of the combustion air conditioning unit. In the event of deviation of the temperature within a temperature range of ±10 °C, the gas flow is automatically interrupted and the solenoid valve **Y1** for pressure relief in the combustion air conditioning unit is opened.

- Pressure reducing **YD1** at the outlet of the catalyst cartridge to a maximum outlet pressure of 4 bar.

- Residual cleaning in the adsorber cartridge **FI4** filled with molecular sieve and activated charcoal.

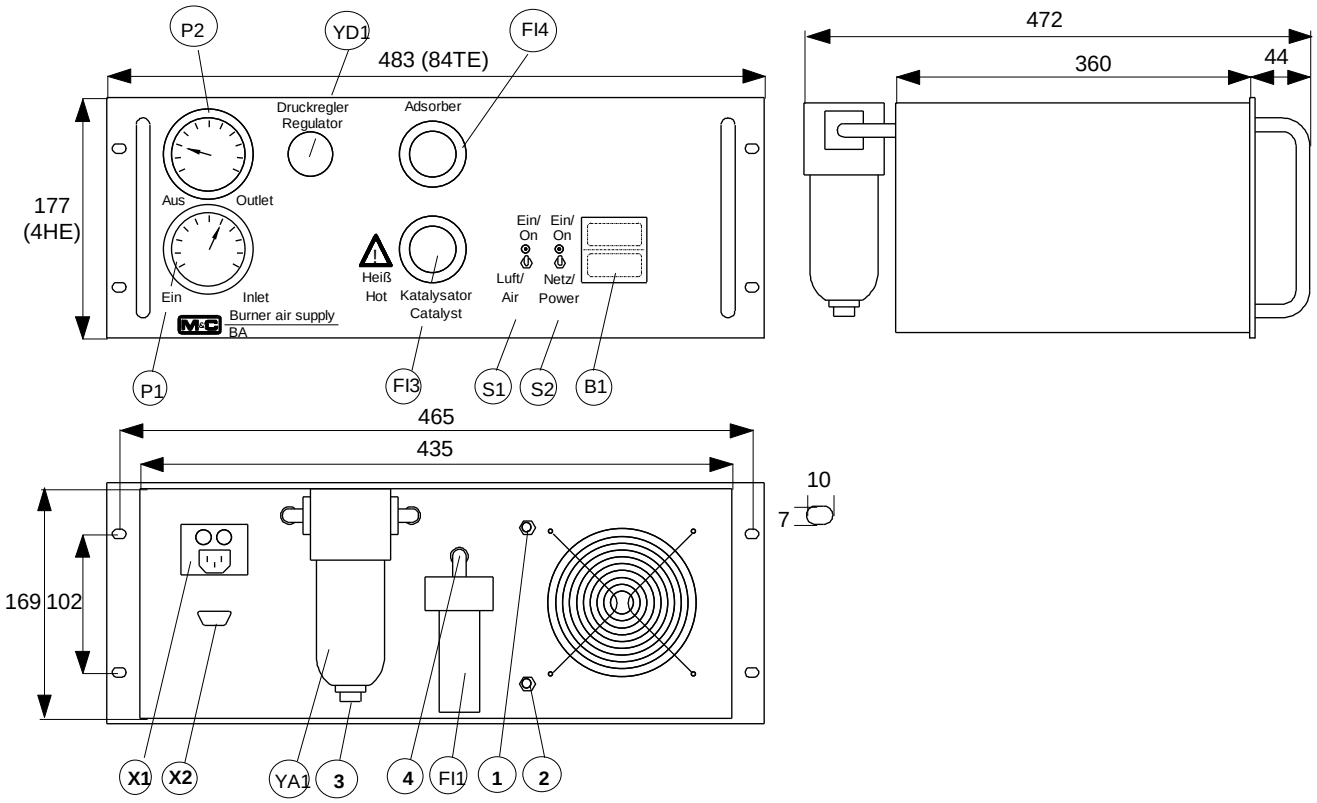
The conditioned combustion air is available at combustion air outlet **1**. A hose of dimension DN 4/6 can be connected here by the customer.

8 TECHNICAL DATA

Combustion Air Conditioning Unit	**Type BA**	**Type BA-P4**
Part No.:	**60A2000**	**60A2200**
Outlet pressure	0 - 4 bar adjustable	
Inlet pressure	Instr. air 4 bar up to 5.8 bar	Internal pump
Flow rate combustion air	Maximum 3 Nl/min	
Ambient temperature	+5 °C to +40 °C	
Ready for operation	Approx. 45 min.	
Catalyst	Platinum/Palladium on Al_2O_3-Support	
Temperature of catalyst	500 °C	
Contamination of catalyst	Halogene, silicon, lead, phosphoric substances	
Adsorber	Molecularsiev/active carbon	
Purity of combustion air	< 10 ppb C_n H_m, H_2O-dew point < -10 °C	
Storage temperature	-25 °C to +65 °C	
Relative humidity	< 75 % avoid condensation	
Gas connection 'Inlet'	G1/4" i	Air filter, 0.1 µm
Gas connection 'Outlet'	Tube connection DN 4/6 mm *Standard	
Condensate connection	G1/8 i DIN ISO 228/1	
Power supply / Power consumption	230 V 48-62 Hz 480 VA	230 V 48-62 Hz 560 VA
Electrical connection	Main power plug connector incl. 2 m cable and shock-proof plug. Alarm-/control signals 9-pin Sub-D plug	
Electrical protection	2 x 4 A_T (time-delayed fuse)	
Status contact output for pressure and temperature	1 NO contact - potential free, max . 24 V, 1 A	
Protection	IP20 **(EN 60529)**	
Dimensions	19" rack mounting 4 U (HE), depth 430 mm	
Weight	14.5 kg	16 kg
Electrical equipment standard	EN 60204-1, EN 57721	

9 DESCRIPTION

Figure 2 shows the **BA-P4** combustion air conditioning unit.



X1	= Power connection	B 1	= Temperature controller	S 1	= Switch 'Air/On'
X2	= Status contact output	FI1	= Air filter	S 2	= Switch 'Power/On'
1	= Combustion air out	FI3	= Catalyst	YA1	= Condensate separator
2	= Exhaust air out	FI4	= Adsorber	YD1	= Pressure controller
3	= Condensate out	P 1	= Manometer 'Inlet'		
4	= Air suction	P 2	= Manometer 'Outlet'		

Figure 2 BA-P4 combustion air conditioning unit

M&C BA and **BA-P4** combustion air conditioning units are available as compact, operator and service-friendly 19" plug-in units.

All controls and indicating elements are arranged easily accessible on the front panel of the combustion air conditioning unit. These are:

- Inlet and outlet pressure gauges **P1** and **P2**
- Control for outlet pressure **YD1** (maximum 4 bar)
- Connections for adsorber cartridge **FI4** and catalyst cartridge **FI3**
- "Air/On" switch **S1**, main switch **S2** (operation is indicated by two green LEDs) and
- Temperature controller with digital temperature display **B1.**

The catalyst cartridge is installed in a heat-insulated tube furnace. A special screw-type adapter enables removal of the hot catalyst cartridge without the aid of tools (see chapter 16.4).

Warning
Excess pressure

The combustion air unit is operated with maximum 5.8 bar.
Before removing the catalyst cartridge, the system must be relieved of pressure by moving the "Air/ON" switch into the lower position!

In the event of incorrect operation, i.e. prior to removal of the catalyst or adsorber cartridge, the combustion air conditioning unit is not relieved by moving the **"Air/On"** switch into the lower position, the compressed air discharges via specific bores when the screw caps are unscrewed.

The furnace temperature is electronically controlled and is preset at the works at temperature controller **B1** on the front panel of the combustion air conditioning unit to +500 °C.

If the catalyst temperature is not reached, the gas flow is automatically interrupted. The status signal is applied as a group alarm to the nine-pole subminiature connector (terminal point, see chapter 12.2) on the rear panel of the combustion air conditioning unit.

The adsorber cartridge is locked by means of a screw cap and can be removed without the aid of tools (see chapter 16.5).

Warning
Excess pressure

The BA.. combustion air unit is operated with maximum 4 bar.
Before removing the catalyst cartridge, the system must be relieved of pressure by moving the "Air/ON" switch into the lower position!

The supply connections are located at the rear of the **BA** housing. These are:

- Supply socket for inlet connector for non-heating apparatus **X1**,
- Nine-pole subminiature connector **X2** for status contact output,
- Combustion air inlet via: Ambient air suction filter **F11** for **BA-P4** version,
  solenoid valve with **G 1/4" i** for **BA** version,
- Combustion air outlet 1, hose connection **DN 4/6**,
- Waste air outlet 2, hose connection **DN 4/6**
- Condensate connection **G 1/8"i 3** at drain **YA1**

For the **BA-P4** version, a built-in fan provides the necessary cooling of the swing piston compressor **M1**. The cooling air discharges via ventilation slots in the **BA** housing.

10 RECEIPT AND STORAGE

The **BA**... combustion air conditioning unit is a complete, pre-installed unit. The standard catalyst and adsorber cartridge supplied is already fitted.

- Immediately remove the combustion air conditioning unit and any special accessories carefully from the packaging and check the contents against the delivery note.
- Inspect the unit for possible transport damage and inform the transport insurer concerned immediately if any damage is noticed.

Note

The combustion air conditioning unit should be stored protected from frost!

11 INSTALLATION NOTES

The combustion air conditioning unit is a **19"** plug-in unit.

Note

The combustion air conditioning unit must only be used in the conditions specified in the technical data.

The combustion air conditioning unit should be installed away from heat sources and freely ventilated to prevent any accumulation of heat.

For outdoor installation, the combustion air conditioning unit must be installed in a housing protected from frost in the winter and sufficiently ventilated in summer. Exposure to direct sunlight must be avoided.

12 SUPPLY CONNECTIONS

12.1 HOSE CONNECTIONS

Connection to the combustion and waste air outlet takes place at the rear of the combustion air conditioning unit. Provided for this purpose are standard **DN 4/6** hose couplers.

Note

Do not confuse the hose connections for the combustion and waste air outlet; the connections are marked appropriately.

When all lines have been connected, they must be checked for leaks (see chapter 16.7).

When connecting the hoses to the appropriate hose couplers, the following must be observed:

Note

Tightness of the connection can only be ensured when the connecting hose has a straight terminating edge (use a hose cutter).

- Loosen the sleeve nut of the clamping ring fitting by turning counter-clockwise; the nut must be removed carefully from the screw fitting to prevent the clamping ring, which is arranged loosely in the nut, from being lost.
- Slip the sleeve nut over the connecting hose.
- Slip the clamping ring on to the connecting hose with the thicker flange facing towards the nut.
- Fit the hose to the nipple in the screw fitting.
- Tighten the sleeve nut hand-tight.

The hose is now fitted non-slip and pressure-proof.

For connection to the condensate pipe, a **G 1/8" i** thread is provided on the underside of the automatic float condensate drain. An appropriate connection fitting must be provided by the customer. In order to prevent return flow of the condensate, the condensate pipe should be installed with a gradient.

For connection of the compressed-air/instrument-air line for the **BA** version, a **G 1/4"** connection thread is provided on the rear panel of the combustion air conditioning unit; an appropriate connection fitting must be provided by the customer.
Appropriate connection fittings are optionally available by M&C.

12.2 ELECTRICAL CONNECTIONS

Warning

Incorrect system voltage can damage the unit. When establishing connections, check that the system voltage corresponds with the voltage shown on the type plate!

Note

For the erection of power installations with rated voltages up to 1000 V, the requirements of VDE 0100 and relevant standards and specifications must be observed!
The main circuit is equipped with a fuse corresponding to the nominal current (over current protection); for electrical details see technical data.

Connection to the supply takes place via the inlet connector for non-heating apparatus with 2 meters connecting cable at the rear of the combustion air conditioning unit (**X1**, see circuit diagram in annex).

In the nine-pole subminiature connector at the rear of the combustion air conditioning unit, the following options are available:

- Under/Overtemperature alarm and pressure drop alarm (common alarm)
- External control

Note

The function of the combustion air conditioning unit is only ensured when the Sub-D-Plug X2 is fitted!

Figure 3 shows the pin assignment in the Sub-D-Plug **X2**.

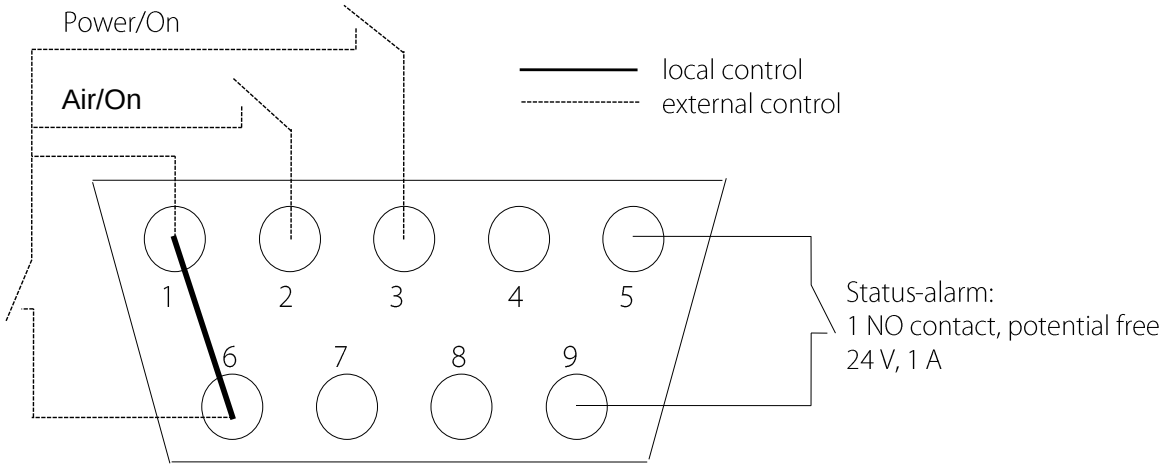


Figure 3 Pin assignment in Sub-D-Plug X2

For signalling the group alarm, the contacts **5** and **9** are available in the Sub-D-Plug (see Figure 3). This is a floating **NO** contact with a switching capacity of maximum 24 V, 1 A. Alarm takes place within a temperature range of ±10 °C for the nominal temperature and if the inlet pressure falls below a value of 4 bar.

Control of the **"Power/On"** and **"Air/On"** functions (switches on front panel, see Figure 2) can takes place either internally or externally by the customer (see Figure 3).

Note

For internal control, a jumper must be provided between contacts 1 and 6 in the Sub-D-Plug !

External control takes place by the customer by means of floating contacts (see Figure 3).

Note

For external control, the jumper between contacts 1 and 6 in the Sub-D-Plug must be removed !

With external control, the selector switch on the front panel of the combustion air conditioning unit is without function. The operating status is still displayed by the two green **LED** indicators.

The two fuses **F1** and **F2 (2A)** are located below the inlet connector for non-heating apparatus **X1** at the rear of the **BA** housing.

13 PREPARATIONS FOR COMMISSIONING

Before initial startup, all plant- and process-specific safety measures must be observed. It is mandatory for the operator to complete the enclosed risk assessment of the product.
The gas exposure risk must be assessed by the operator with regard to the hazards posed by process and calibration gas and the setup at the installation site (e.g. tubing, system cabinet/container/plant). If the risk assessment reveals increased exposure hazards, further measures are required.
A visible label must be attached to the installation site in accordance with the risk assessment provided by the operator.

14 INITIAL OPERATION

Prior to initial operation, the system and process-specific safety measures must be observed!

The following steps must be carried out prior to initial operation:

- Connect the combustion air conditioning unit to the supply system; prior to initial operation, compare the system voltage with the voltage shown on the rating plate.
- If necessary, route the group alarm contact output to the instrument board.
- Move the **"Power/On"** switch into the upper position (green LED lights).
- Check the nominal temperature of 500 °C at the temperature controller (see 16.).

Note

The maximum operating temperature must not exceed 700 °C!

- When operational readiness has been reached (about 45 minutes), move the **"Air/On"** switch into the upper position (green LED lights).

Note

The maximum flow rate is 3 Nl/min!

15 SWITCH OFF

Note

The place of installation of the combustion air conditioning unit must be remain free from frost also during time when the unit is switched off!

No particular measures are required for switch off.

16 MAINTENANCE

Before carrying out maintenance work, the system and process-specific safety measures must be observed!

Warning

High voltage. Disconnect the mains plug before opening the converter housing!

The following components of the **BA**... combustion air conditioning unit must be maintained:

- Swing piston compressor for **BA-P4** version after approximately 2000 operating hours (instructions, see annex).
- Filter element of the ambient air suction filter for **BA-P4** version every six months.
- Filter element of the high-efficiency particle filter after two years or with inadmissible pressure drop.

Our recommendations for spare parts are shown in the spare parts list in chapter 20.

Replacement of the catalyst cartridge (see chapter 16.4) is necessary, when:

- A leak is obvious, caused by defective O-rings of the catalyst cartridge (see chapter 15.7);
- A reduction in the quality of catalysis occurs due to the presence of catalyst poisons.

The lifetime of the adsorber cartridge depends on the quality of the series connected catalysis.
Replacement of the cartridge (15.5) is necessary, when the quality of the combustion air conditioning drops or a leak is obvious, caused by defective O-rings of the adsorber cartridge (see chapter 16.7).

For catalyst or adsorber cartridge replacement, it is recommended also to replace the supplied O-ring seals.

16.1 SWING PISTON COMPRESSOR

The swing piston compressor does not need to be removed for maintenance purposes.

It is recommended to follow the following step by step procedure:

- Disconnect the mains plug of the combustion air conditioning unit.
- Disconnect the connecting hoses to the pump.
- Loosen the four screws in the front panel of the **BA** and remove the **19"** plug-in unit.
- Loosen the cover of the **BA** housing by carefully levering and removing upwards.
- Disconnect the hoses at the pump head; pull back release ring of hose connection fitting (black) and remove hose.

The pump is now freely accessible.

Further maintenance and installation information is provided in the operating instructions in the annex.

Reassembly of the combustion air conditioning unit takes place in reverse order.

16.2 AIR SUCTION FILTER (ONLY BA-P4 VERSION)

The air suction filter is located freely accessible for maintenance purposes at the rear of the combustion air conditioning unit.

Replacement of the 0.1 µm filter element takes place as follows:

- Unscrew the filter element holder; turn counter-clockwise.
- Remove the filter element from the filter element holder.
- Carefully slip the new filter element on to the filter element holder.
- Screw the filter element holder hand-tight into the filter head.

16.3 HIGH-EFFICIENCY PARTICLE-CONDENSATE FILTER

The particle-condensate filter is located freely accessible for maintenance purposes at the rear of the combustion air conditioning unit.

The following must be observed for maintenance of the filter:

- Relieve the pressure in the combustion air conditioning unit by moving the **"Air/On"** switch into the lower off-position.
- Loosen the sleeve nut of the condensate connection fitting and remove the condensate hose.
- Unscrew on the filter glass with seal ring/O-ring and main filter element manually.
- Remove the prefilter element.

The prefilter element can be washed in warm water or a suitable cleaning liquid.

- Place the seal ring/O-ring on the main filter element.
- Fit the main and prefilter element.
- Tighten the filter glass hand-tight.
- Connect the condensate hose.

16.4 CATALYST CARTRIDGE REPLACEMENT

Cartridge replacement can take place without the aid of tools. The following steps must be carried out:

Warning

Hot catalyst cartridges. Contact can result in serious burns. Wear protective gloves and secure cartridge against unauthorised access!

- Relieve the pressure in the combustion air conditioning unit; switch off the **"Air/On"** switch internally or externally (LED goes out).
- Release the catalyst cartridge adapter by turning the screw cap counter-clockwise.
- Remove the catalyst cartridge from the tube furnace by turning the screw cap.
- Remove the catalyst cartridge from the adapter by turning lightly.

When refitting the cartridge, the following must be observed:

- Insert the new catalyst cartridge into the adapter by turning lightly.

Note

In order to ensure the necessary tightness, it is important to ensure that the cartridge is inserted fully into the adapter!

- Place the catalyst cartridge in the tube furnace and lock in place by turning the screw cap clockwise.

Note

The cartridge can be fitted in the furnace more easily by moistening the outer O-rings.

Do not grease the O-rings, since the grease can have a negative effect on the catalyst!

16.5 ADSORBER CARTRIDGE REPLACEMENT

The following steps must be carried out:

- Relieve the pressure in the combustion air conditioning unit; switch off the **"Air/On"** switch internally or externally (LED goes out).
- Remove the screw cap by turning counter-clockwise.
- Remove the adsorber cartridge from the holder by turning the stirrup bolt.

Refitting takes place in reverse order.

Note

In order to ensure the necessary tightness, it is important to ensure that the cartridge is inserted fully into the holder!

16.6 O-RING SEAL REPLACEMENT

With each cartridge replacement, it is recommended to also replace the adapter seals.

Warning

Hot catalyst cartridges. Contact can result in serious burns. Wear protective gloves and secure cartridge against unauthorised access!

Figure 4 shows the position of both inner and both outer O-ring seals.

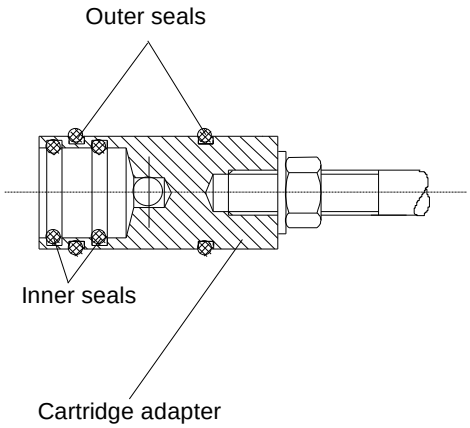


Figure 4 Catalyst cartridge adapter

The inner seals can be removed with a pointed tool (e.g. marking tool).

When refitting, the outer seals must be slipped over the cartridge into the respective seal groove.

The inner seals must be fitted as follows:

- Place the seal in the adapter opening.
- Push the O-ring with a blunt object on to the respective seal groove.

Note

Refit the O-ring seals with care:
Do not damage O-rings and observe correct position of the seals!

The two outer O-ring seals of the adsorber cartridge must be replaced as follows:

- Remove the old seals
- Carefully slip the new seals over the cartridge into the appropriate grooves.

Note

Refit the O-ring seals with care:
Do not damage O-rings and observe correct position of the seals!

16.7 LEAK CHECK

- Tightly close the combustion air outlet.
- Start the combustion air conditioning unit as specified in chapter 14.
- Monitor the inlet and outlet pressure on the pressure gauges on the front panel of the combustion air conditioning unit.

Leaks are indicated when the specified pressures are not reached.

17 USE OF THE TEMPERATURE CONTROLLER

17.1 DISPLAY AND FUNCTION KEYS

① Process value display, red

② Set-point display, green

③ PGM key
- to select the parameters

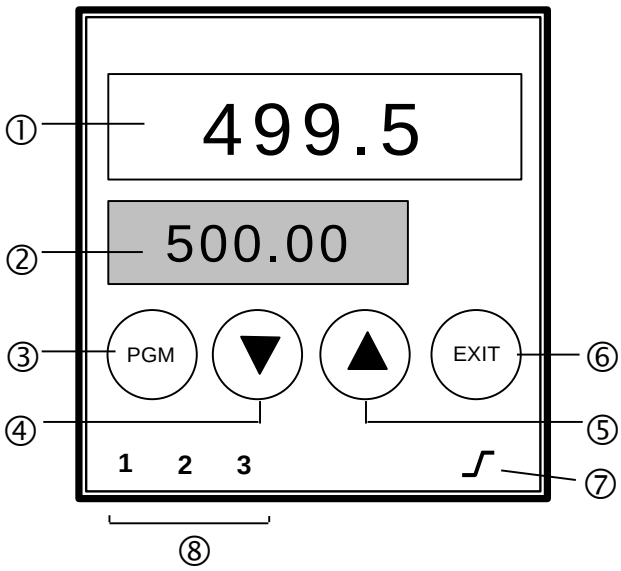
④ Decrement key
- to alter values

⑤ Increment key
- to alter values

⑥ EXIT key
- to quit the levels

⑦ LED for ramp/programme function, green

⑧ LED for status indication, yellow
- outputs 1 to 3



17.2 OPERATING STATE OF THE TEMPERATURE CONTROLLER

The operating state is displayed via the LED's 1 to 3 like:

Operating state		1	2	3
Heating up		off	on	blinking
Normal	heating on	on	on	on
	heating off	on	on	off
Alarm		X	**off**	X

Heating up

Setting value reached

In case of a high or low temperature alarm, the controller passes automatically into the state of self-locking heater switch off.

17.3 CHANGING THE PARAMETERS OF THE TEMPERATURE REGULATOR

The programming of the regulator is made on different levels.
All important adjustments of the converter are listed in the user level and can be modified after removing the key locking.

In order to remove the locking, please proceed as follows:

- Standard indication (setting value below, actual value above (see photo)) must to be seen.
- Press both together, key PGM and ▼ for 5 seconds,

  Indication = **Code 3** (all levels are locked)
- Press PGM
- Change the value from **3** to **2** by using the key ▼
- The display flashes after approx. 2 seconds and the alteration is taken over.
- The user level is now cleared.
- Press EXIT .

In order to go forward to the user level now, press key PGM,
Indication = **User**

- Press the key PGM once again, indication = **SP** (setting value, adjustment at works **350** or **680** depending on converter cartridge)
- Press key ▼ , indication = **ALSE** (temperature range for sensor and heating control, adjustment at works ±**10**)
- Press ▼ , indication = **Lo-t** (relative temperature to temperature setting value for low temperature alarm, adjustment at works -**10**)
- Press ▼ , indication = **rASL** (ramp gradient, temperature increase in °C/min, adjustment at works **30**)

In order to change one of these parameters, you must press the PGM key again after **SP**, **ALSE**,
Lo-t or **rASL** are to be read on the display. The respective value is flashing now on the display and can be modified by using the keys ▼ or ▲ .
The automatic taking over of the setting value is made after approx. 2 seconds; this is indicated by a short flash of the modified value.
If you press the keys ▼ ▲ for a longer time, the speed of changing is increased. The value can only be changed within the admissible range of value.
The abortion of the input is made with EXIT before a new value hasn't been taken over. After an abortion, the standard indication is shown.
In order to switch on again the key locking, change the code to 3 again as described above.

Note

If you reduce the setting value by more than 10°C, the sensor control will be released and the heating circle switched off. For the reset, wait until the value remains under the new setting value, switch off the mains voltage and switch it on again.

17.4 RESET OF THE CONTROLLER

A reset out of the temperature lock happens with connected mains:

- operating simultaneously the keys EXIT and ▼

A reset only happens in case the actual temperature deviates by < +/- 10 °C from the theoretical temperature.

Another method for a reset that functions without problem is to cut the mains voltage for a short moment (remove the mains plug).

Note

Watch carefully the control characteristic after reset. This simplifies the diagnosis of errors when a failure happens again!

18 TROUBLE SHOOTING

The table below is intended to indicate possible causes of faults and the remedial actions to be taken (applies only to operationally ready combustion air conditioning units).

Problem/Indication	Possible cause	Check/Remedial action
LED's do not light, pump does not pump or three-way directional control valves do not switch, temperature controller does not function.	No system voltage. Sub-D-Plug not plugged into socket **X2.** <u>Internal control:</u> Jump not present in Sub-D-Plug. Fuses **F1/F2** blown.	Check mains cable for correct seating **(X1)**; ok? Check whether Sub-D-Plug is present or not properly plugged in; ok? Check Sub-D-Plug; ok? Check fuses and replace if necessary.
Tube furnace does not heat.	Heater faulty. Temperature controller faulty. Solid state relay faulty.	Measure voltage at terminals **X4/2** and **3**; ok? Replace heater; not ok? Measure voltage at terminal **X4/6** and **7**; voltage < 8 V DC? Check controller as specified in operating instructions voltage > 8 V DC? Replace solid state relay.
Pump does not pump or three-way directional control valve does not switch, LED's do not light.	No system voltage. (see above). Sub-D-Plug not plugged into socket **X2** (see above). <u>Internal control:</u> Jumper 1-6 not present in Sub-D-Plug. <u>External control:</u> Fault in external control.	See above Check Sub-D-Plug and solder jumper in place. Check external control.
Pump does not pump or three-way directional control valve does not switch, LED's light.	Pump (**BA-P4** version) faulty, three-way directional control valve faulty, operating temperature not reached.	Check pump for function. Check valve for function. Check temperature controller.
No measuring gas flow.	Pump/valve faulty (see above). Measuring gas lines leaky.	See above Check for leaks (see chapter 16.7) and check measuring gas lines if necessary.

19 PROPER DISPOSAL OF THE DEVICE

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

20 SPARE PART LIST

Wear, tear and replacement part requirements depend on specific operating conditions.
The recommended quantities are based on experience and are not binding.

Combustion Air Conditioning BA ...
(C) Consumable parts, (R) recommended spare parts, (S) spare parts

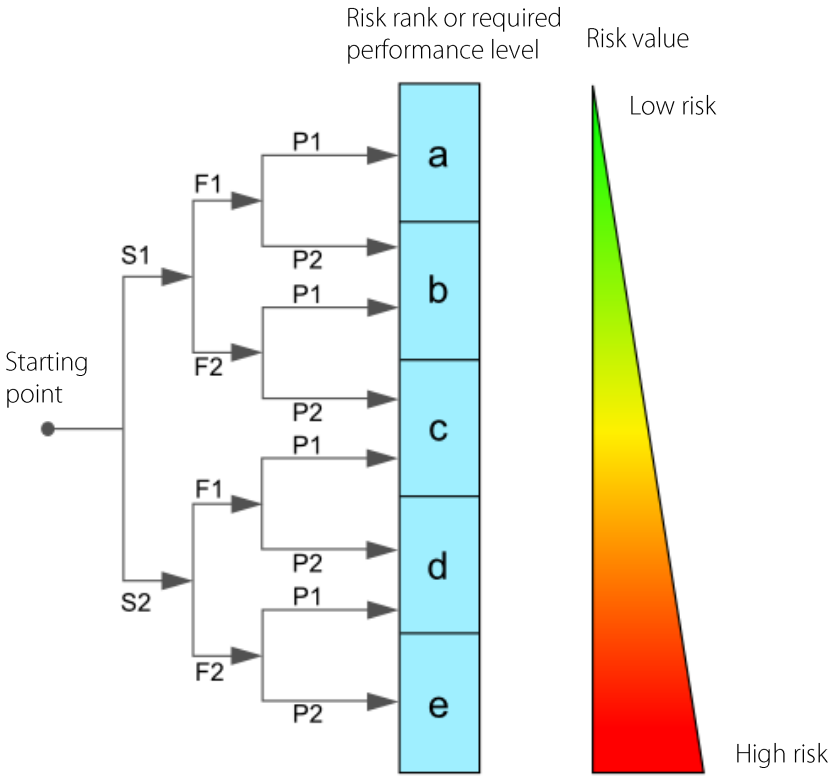
			recommended quantity for **BA...** being in operation [years] (b.d. = by demand)		
		V/E/T	1	2	3
96A0010	Adsorbtion cartridge compl. filled incl. 2 x O-Ring seals **90 F 0050**	C	b.d.	b.d.	b.d.
96A0065	Pt/Pd-Catalyst cartridge BA.. incl. O-Ring seals: 2 x inner seals **90 E 1000** 2 x outer seals **90 S 2040**	C	b.d.	b.d.	b.d.
Swing piston compressor **M1** (version **BA-P4**)					
96A0070	Spare part set consisting of: - 4 x Valve plate for NPK09 - 3 x Seal for NPK09 - 3 x O-ring - 3 x Seal lipp for NPK09 - 1 x Cylinder	C	1	2	3
Air filter **FI1** (version **BA-P4**)					
90F0016	Fine-filter element F-0,1GF, glass fiber 0.1µm	C	1	2	3
Particle condensate filter **YA1**					
	Pre-filter unit	R	-	1	1
	Main-filter unit	R	-	-	1

21 RISK ASSESSMENT

The risk assessment provided in this chapter is intended for all work activities on the product. The hazards can occur in the work steps of assembly, commissioning, maintenance, disassembly and in the event of a product fault. During normal operation, the product is protected by a system cabinet or appropriate covers.
Only qualified personnel is permitted to perform the work. The following minimum knowledge is required for the work:

- Employee instruction provided in process engineering
- Employee instruction provided in electrical engineering
- Detailed knowledge of the instruction manual and the applicable safety regulations

The product complies with the current regulations according to state-of-the-art science and technology. Nevertheless, not all sources of danger can be eliminated while observing technical protective measures. Therefore, the following risk assessment and the description of exposure hazards refer to the work steps mentioned above.



Severity of injury:
S1 = 1 = minor (reversible injury)
S2 = 2 = serious (irreversible injury, death)

Frequency and duration:
F1 = 1 = infrequent or short exposure to hazard
F2 = 2 = frequent (more than once per hour/shift)

Possibility of preventing or limiting the damage
P1 = 1 = possible
P2 = 2 = hardly possible

Figure 5 Overview risk assessment

Aggressive condensate possible

Risk rank - group A
Chemical burns due to aggressive media possible!
This applies to all liquids in vessels and in the product.
In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.

Caution hot surfaces

Risk rank - group A

The temperature inside the product can be higher than > 180 °C.
The hot parts are shielded by mechanical devices. Before opening the products, they must be disconnected from the power supply and a cooling time of more than > 180 minutes must be observed. In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.

Caution electric shock

Risk rank - group C

When installing high-power systems with nominal voltages of up to 1000 V, the requirements of VDE 0100 and their relevant standards and regulations must be observed!
This also applies to any connected alarm and control circuits. Before opening the products, they must always be disconnected from the power supply.

Caution crushing hazard

Risk rank - group A

The work must be performed by trained personnel only.
This applies to products weighing less than < 40 kg [≈ 88.2 lbs]:
The product can be transported by 1 to 2 person(s). The instructions for appropriate personal protective equipment (PPE) must be observed.
The weight specifications are contained in the technical data of this product.
Furthermore, the work safety regulations of the operator must be observed.

22 APPENDIX

- Circuit diagram **BA...** with controller 703/70304
- Circuit diagram **BA...** with controller TM48

More product documentation is available on our Internet catalogue:
www.mc-techgroup.com

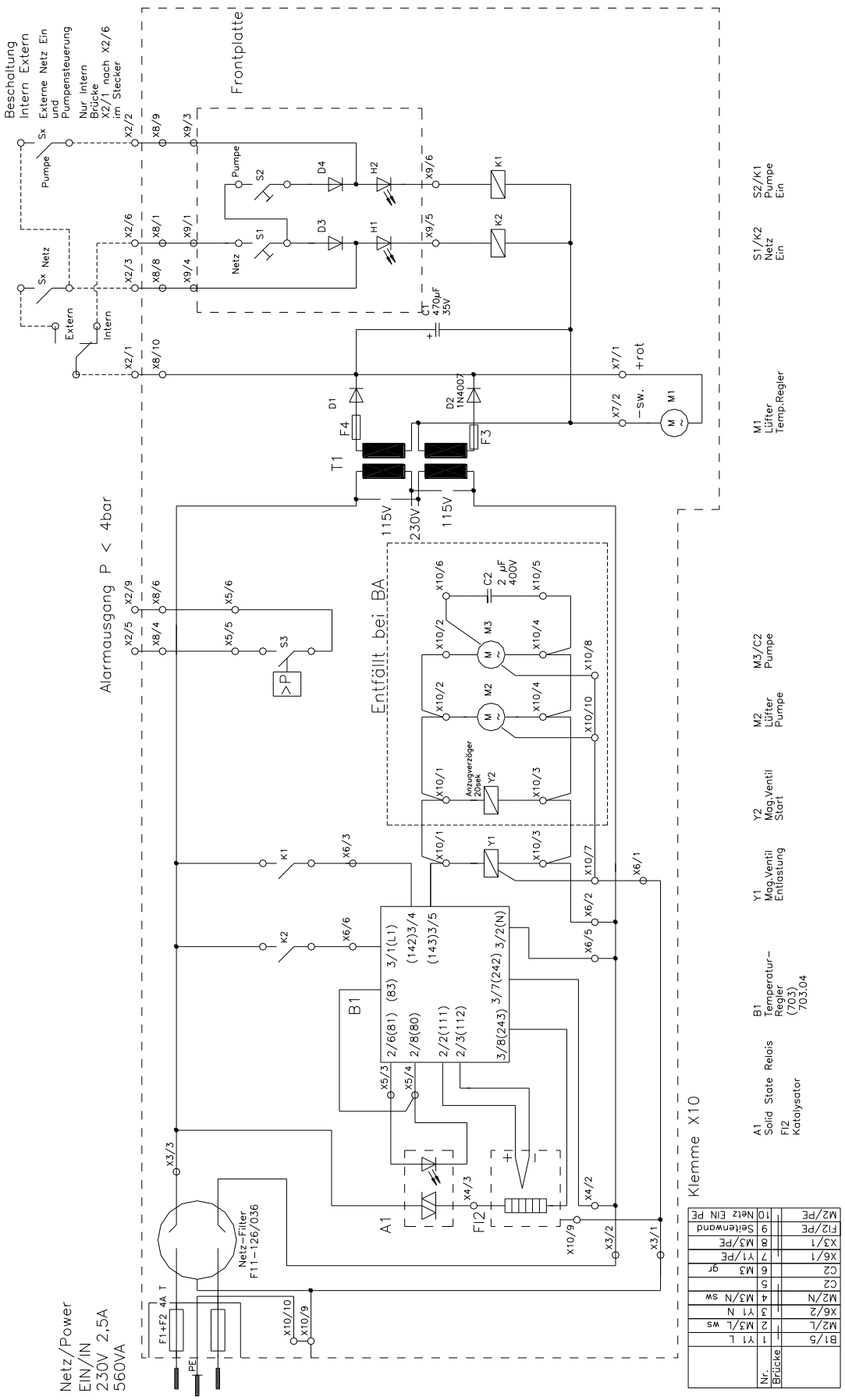


Figure 6 **Circuit diagram BA... with controller 703/70304**

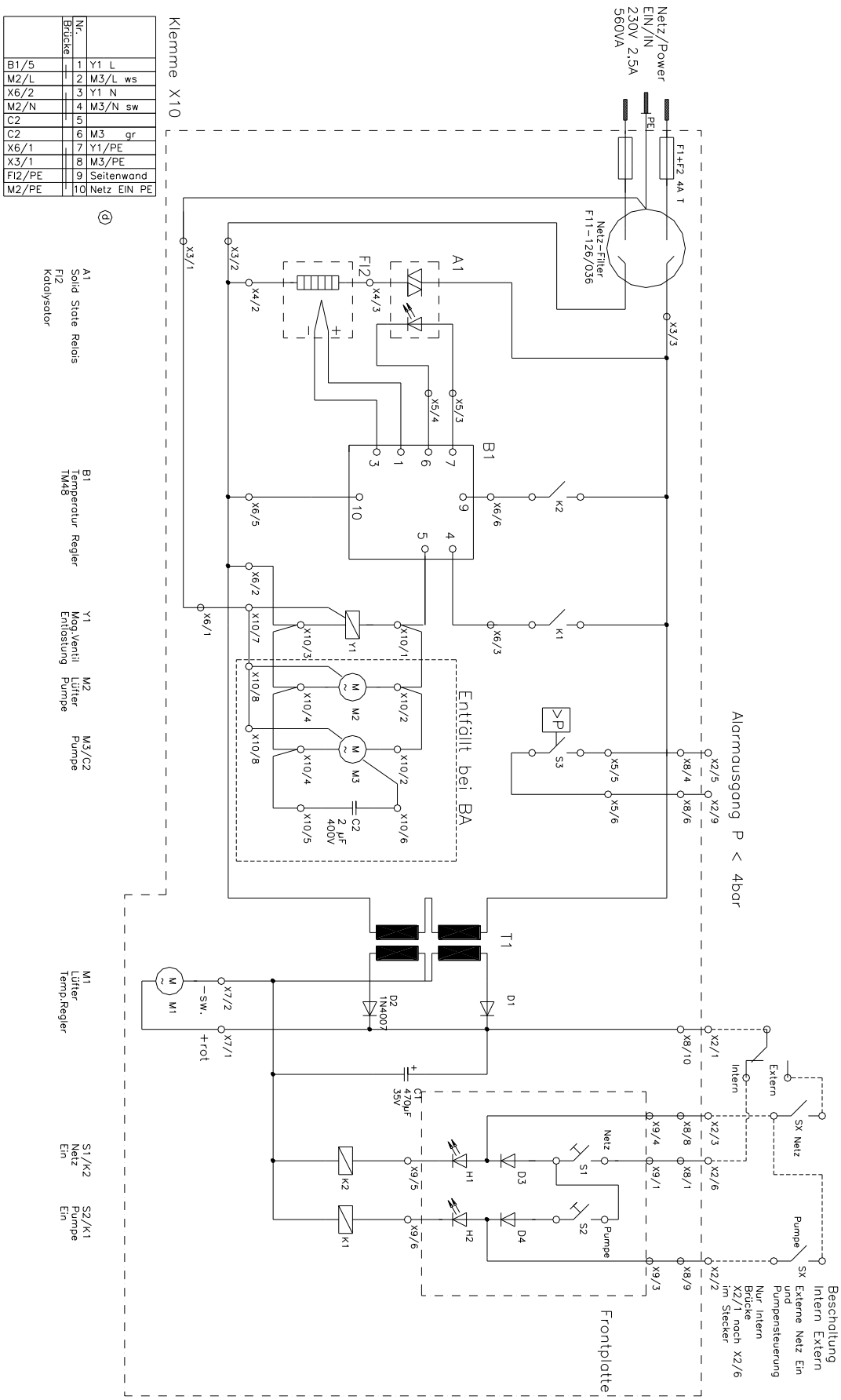


Figure 7 **Circuit diagram BA... with controller TM48**