

USER MANUAL



BCU14

BAKEOUT CONTROLLER



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1 INTRODUCTION

Please read this manual carefully to ensure optimum operating conditions right from the start. This user manual handbook contains important information about functionality, installation, start-up and operation of the BCU14 device.

1.1 RELEASE NOTE

Information about BCU14 device version can be found at www.prevac.pl, in the tab: *DOWNLOAD*. On this page you can find information about possible changes between successive versions of the device, or changes between successive versions of the software.

1.2 INTENDED TO USE

BCU14 Bakeout Controller is a compact, standalone microprocessor controlled device which is capable of independent control of 2 heating zones. It can control up to 5 heaters (3 regulated and 2 non-regulated) and 2 fans. Its main role is to regulate, control and stabilize the power delivered to the bakeout heaters in order to achieve the required bakeout temperature in the given zone(s).

The BCU14 is capable of controlling the bakeout process of an entire vacuum system (chamber, manipulators etc.) when used with a bakeout tent arrangement. In the alternative configuration it can also be used to control heaters that are mounted internally in the vacuum system.

The BCU14 function depends upon external protection signals; INTERLOCK 1, INTERLOCK 2 and MASTER INTERLOCK. If these signals are missing, it is not possible to initialise or to continue the bakeout process. The controller automatically turns off the heaters, and keeps them off, until the appropriate INTERLOCK signal is received. The re-start condition is configured by the additional INTERLOCK AUTO START setting, see section 3.5.1.8.

If the thermocouple connection (or the sensor itself) is lost, the BCU14 immediately terminates or prevents heating of that particular zone, depending on whether the regulator is ON or OFF.

1.3 OPERATING DESCRIPTION

The main task of the BCU14 is regulation and stabilization of the power supplied to the heaters in order to achieve the required bakeout temperature in the given zone.

The temperature set-point (destination temperature) and time to reach temperature stabilization are all user-defined. A typical plot of the heating process (temperature vs. time) is shown in Fig. 1.1.

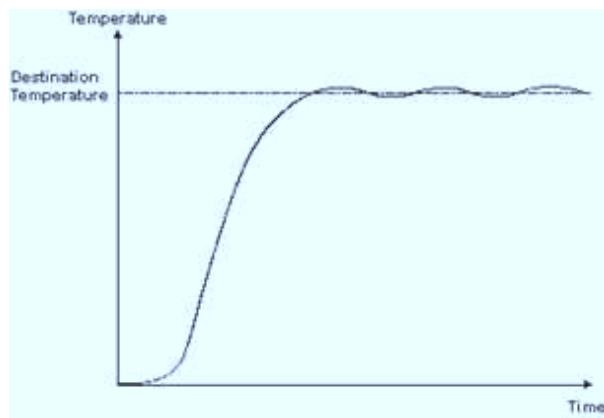


Figure 1.1: Heating process

The time to reach the destination temperature and the magnitude of oscillations around the destination temperature depend upon the thermal properties of the heated object as well as the heating parameters set in the controller.

Usually, since increasing the temperature ramp rate causes larger temperature oscillations, the defined parameters of the heating process are always a compromise between the temperature ramp rate and the desired accuracy. The frequency of temperature oscillations depends only on the thermal properties of the heated object.

One of the main parameters that determines the course of the heating process is the „Ramp Rate”. This parameter determines the rate of the temperature increase from the starting (initial) temperature to the destination temperature. The „Ramp Rate” parameter does not guarantee the required rate of the temperature increase but ensures rather that it will not be larger than that defined by the user since it depends on the supplied power as well as on the heat capacity of the object.

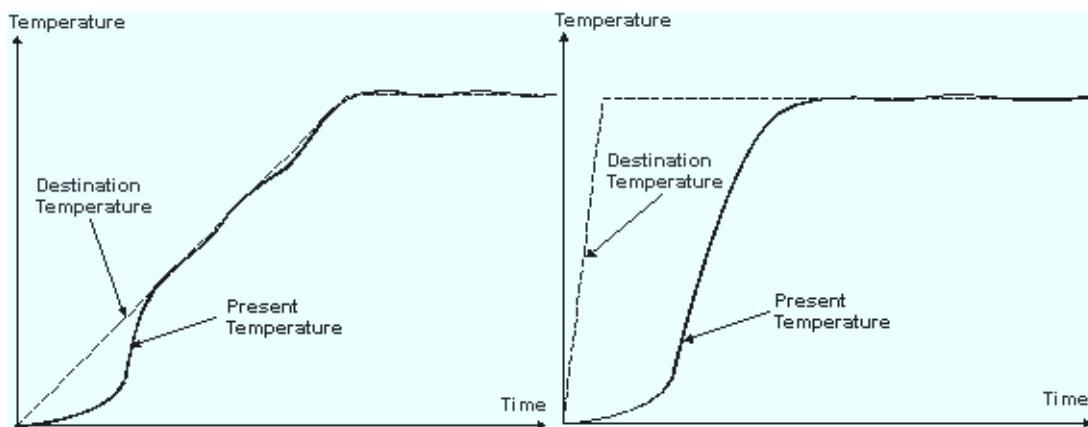


Figure 1.2: Linear destination temperature – „Ramp Rate”

An example of heating an object, for which the temperature growth rate is larger than the one determined by the „Ramp Rate” parameter, is shown in Fig. 1.2a. In this case the “Ramp Rate” directly influences the heating process.

However, if the temperature growth rate of the object is lower than the one determined by the “Ramp Rate”, it does not influence the heating process in any way. This case is shown in Fig. 1.2b. The BCU14 controller is suitable for controlling the power of the heaters as well as switching on and off any auxiliary heaters e.g. for baking out ion pumps and controlling any heat circulation fans. The auxilliary functions are not used if the BCU14 is only utilized for sample heating and not bakeout control.

BCU14 operation depends upon the presence or absence of certain Interlock signals. In the absence of appropriate Interlock signals the heating process will either not start or will be interrupted if already in progress. Usually, signals are provided by the vacuum sensor associated with a given zone. If the user-defined pressure threshold is exceeded for example then the heating process will be interrupted.

1.4 SAFETY

The owner of the equipment must ensure that all users are aware of the Health and Safety information contained in this manual. If the equipment is sold or passed to another owner, this manual must be included with the equipment.

1.4.1 PERSONNEL QUALIFICATIONS

All the work described in this document should only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end user of the product.

1.4.2 ILLUSTRATION OF RESIDUAL DANGERS

This Operating Manual illustrates safety notes concerning residual dangers as follows:

1. Information on preventing any kind of physical injury



2. Information on preventing extensive equipment and environmental damage



3. Information on correct handling or use. Disregarding safety notes can lead to malfunctions.



4. **Note: Indicates particularly important, but not safety-relevant information.**

1.4.3 GENERAL SAFETY INSTRUCTIONS

The BCU14 protects the operator and surrounding area from electric shock or burn, mechanical hazards, excessive temperature, and spread of fire from the instrument. Environmental conditions outside of the conditions below may pose a hazard to the operator and surrounding area.

- Indoor use.
- Altitude to 2000 meters.
- Temperature for safe operation: 5 °C to 40 °C.
- Maximum relative humidity: 80% for temperature up to 31 °C decreasing linearly to 50% at 40 °C.
- Power supply voltage fluctuations not to exceed ±10% of the nominal voltage.
- Safety Class 1.



Figure 1.3: Do not insert objects through louvers and keep device dry

For all work you are going to do, adhere to the applicable safety regulations. Also observe all safety notes given in this document and forward the information to all other users of the product. In particular, pay attention to the following safety notes:

DANGER



Mains voltage.

Contact with live parts is extremely hazardous when any objects are introduced or any liquids penetrate into the device. Make sure that no objects enter through the louvers of the device. Keep the device dry.

WARNING



Improper use.

Improper use can damage the BCU14 . Use the BCU14 only as intended by the manufacturer.

WARNING**Improper installation and operation data.**

Improper installation and operation data may damage the BCU14 . Strictly adhere to the stipulated installation and operation data.

WARNING**Individual configuration of the device.**

Individual configuration of the device by the client via the service application will void the liability of PREVAC.

1.4.4 GROUNDING

This product is a Safety Class 1 instrument. To minimize shock hazard, the instrument chassis must be connected to an electrical ground. Plug the power cable into an approved three-contact electrical outlet or use a three-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. For instruments designed to be hard-wired to the supply mains, the protective earth terminal must be connected to the safety electrical ground before another connection is made. Any interruption of the protective ground conductor, or disconnection of the protective earth terminal will cause a potential shock hazard that might cause personal injury.

1.4.5 LIVE CIRCUIT

Operating personnel must not remove the instrument cover. No internal adjustment or component replacement is allowed by non-PREVAC qualified personnel. Never replace components with power cable connected. To avoid injuries, always disconnect power , discharge circuits and remove external voltage source before touching components.

1.4.6 PARTS SUBSTITUTION AND MODIFICATIONS

Parts substitutions and modifications are allowed by authorized PREVAC service personnel only. For repairs or modifications, the instrument must be returned to PREVAC service facility.

1.4.7 VENTILATION

The instrument has ventilation holes in its side covers. Do not block these holes when the instrument is operating.

1.4.8 EXPLOSIVE ATMOSPHERE

DANGER



Explosive atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

1.4.9 CLEANING

Do not submerge instrument. Clean only with a damp cloth and mild detergent. Exterior only.

1.5 TECHNICAL DATA

1.5.1 MECHANICAL DATA

This section describes mechanical parameters, Figure 1.4 shows the BCU14 rack mounted and stand alone dimensions.

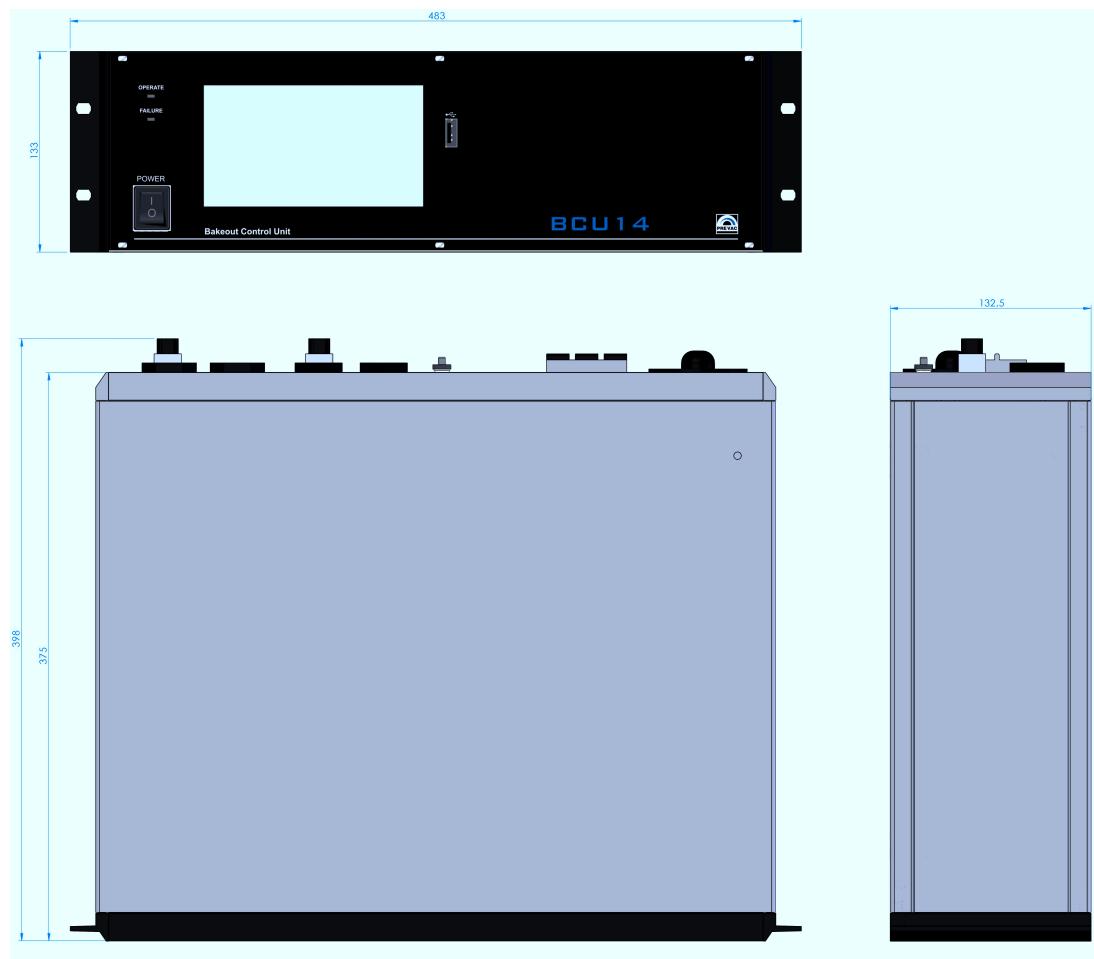


Figure 1.4: Dimensions

1.5.2 SPECIFICATION

PARAMETER	DESCRIPTION
ELECTRICAL PARAMETERS	
Product numbers	02-1512-0000-00212 02-1512-0000-00213
ELECTRICAL PARAMETERS	
Supply voltage	120/240 VAC(2Ph + PE) 230VAC (1Ph + N + PE)
Frequency	50 – 60 Hz
Overtoltage category	II
Protection class	1
Power consumption	up to 11,5kW
Current consumption	max. 50A/phase
Fuse	50A
Supply connector type	RST50I5(male)
UPS INPUT	
Quantity	1
Number of pins	3
Input voltage	110V - 240VAC
Connector type	IEC 60320 C14 10A (male)
MECHANICAL	
Dimensions	Width: 448.8 mm (84HP) Height: 132.5 mm (3HU) Depth: 375 mm
Net weight	9.0 kg
Installation	Rack mounted or Desktop device
Zone 1 Regulated Output	
Number of pins	5
Regulated output pins	1
Fuse	16A
Fuse type	Resettable circuit breaker
continued on next page	

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PARAMETER	DESCRIPTION
Output Voltage	230 VAC
Socket type	RST20I5S (female)
Zone 2 Regulated Output	
Number of pins	5
Regulated output pins	1
Fuse	16A
Fuse type	Resettable circuit breaker
Output Voltage	230 VAC
Socket type	RST20I5S (female)
Zone Continuous Output	
Quantity	1 per zone
Number of pins	3
Regulated output pins	0
Fuse	16A
Fuse type	Resettable circuit breaker
Output Voltage	230 VAC
Socket type	RST20I3S
Fan Outputs	
Quantity	1 per zone
Number of pins	3
Fuse	6A
Fuse type	Resettable circuit breaker
Output voltage	the same as supplied to the Continuous power input
Connector type	STAKEI 2(socket), STAS 2(plug)
Continuous Outputs	
Quantity	1
Number of pins	3
Fuse	10A
Fuse type	Resettable circuit breaker
Output voltage	230VAC
continued on next page	

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PARAMETER	DESCRIPTION
Connector type	IEC 60320 C13 (female)
TEMPERATURE MEASURMENT	
Sensor type	K-type thermocouple
Number of inputs	1 per Zone
Measure Range	20°C - 1200°C
GENERAL SPECYFICATION	
Stabilization of the heating temperature	Temperature stabilized with internal PID controller
Temperature ramp rate	Regulated from 1°/h to 100°/s
Maximum heating time	99d23h59
DIGITAL INPUTS	
Master interlock	1
Remote Control Interlock	1
Zone Interlock	2 (1 per zone)
Triggering	logical high state - 24VDC
RELAY OUTPUTS	
Type	Normal open contact
Number of outputs	6 (3 per zone)
ANALOG OUTPUTS	
Number of outputs	2 (1 per zone)
Type	0 - 10V in reference to GND
COMUNICATION	
Communication Interfaces	RS232, RS485, Ethernet
ENVIRONMENT	
Operation temperature	+15 °C - +45 °C
Storage temperature	0 - 70°C
Relative humidity	Max. 80% (up to 31°C), decreasing to max. 50% (above 30°C)
Allocation	Use indoors only
ADDITIONAL EQUIPMENT	
RST50I5 (female)	1pcs.
continued on next page	

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PARAMETER	DESCRIPTION
RST20I5 (male)	2pcs. (*)
RST20I3 (male)	2pcs. (*)
STAS 2 (male)	2pcs. (*)
EXT1 plug - MC 1,5/ 8-STF-3,81	1pcs.
EXT2 plug - MC 1,5/ 7-STF-3,81	1pcs.
Remote Control plug - MC 1,5/ 2-STF-3,81	1pcs.
Cable IEC C13 female to IEC C14 male, 1.8m	1pcs.
Thermocouple plug wire 7.5m	2pcs. (*)
(*) - depending of zones number.	

Table 1.1: BCU14 230V specification

1.5.3 SPECIFICATION

PARAMETER	DESCRIPTION
Product numbers	02-1512-0000-00210 02-1512-0000-00211
ELECTRICAL PARAMETERS	
Supply voltage	3x400VAC (3Ph + N + PE)
Frequency	50 – 60 Hz
Overtoltage category	II
Protection class	1
Power consumption	up to 19,55kW
Current consumption	max. 50A/phase
Fuse	50A
Supply connector type	RST50I5(male)
UPS INPUT	
Quantity	1
Number of pins	3
Input voltage	110V - 240VAC
Connector type	IEC 60320 C14 10A (male)
Zone 1 Regulated Output	
Number of pins	5
Regulated output pins	2
Fuse quantity	2 (one for each regulated output)
Fuse	20A
Fuse type	tube fuse
Output Voltage	400 VAC
Connector type	RST20I5S
Zone 2 Regulated Output	
Number of pins	5
Regulated output pins	1
Fuse	20A
Fuse type	tube fuse
continued on next page	

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PARAMETER	DESCRIPTION
Output Voltage	400 VAC
Connector type	RST20I5S
Zone Continuous Outputs	
Number of pins	3
Regulated output pins	0
Fuse	20A
Fuse type	tube fuse
Output Voltage	230 VAC
Connector type	RST20I3S
Fan Outputs	
Quantity	1 per zone
Number of pins	3
Fuse	6A
Fuse type	Resettable circuit breaker
Output voltage	the same as supplied to the UPS_IN power input
Connector type	STAKEI 2(socket), STAS 2(plug)
Continuous Outputs	
Quantity	1
Number of pins	3
Fuse	10A
Fuse type	Resettable circuit breaker
Output voltage	230VAC
Connector type	IEC 60320 C13 (female)
TEMPERATURE MEASURMENT	
Sensor type	K-type thermocouple
Number of inputs	1 per Zone
Measure Range	20°C - 1200°C
GENERAL SPECYFICATION	
Stabilization of the heating temperature	Temperature stabilized with internal PID controller
continued on next page	

continued from previous page	
PARAMETER	DESCRIPTION
Temperature ramp rate	Regulated from 1°/h to 100°/s
Maximum heating time	99d23h59
DIGITAL INPUTS	
Master interlock	1
Remote Control Interlock	1
Zone Interlock	2 (1 per zone)
Triggering	logical high state - 24VDC
RELAY OUTPUTS	
Type	Normal open contact
Number of outputs	6 (3 per zone)
ANALOG OUTPUTS	
Number of outputs	2 (1 per zone)
Type	0 - 10V in reference to GND
MECHANICAL	
Dimensions	Width: 448.8 mm (84HP) Height: 132.5 mm (3HU) Depth: 375 mm
Net weight	9.0 kg
Installation	Rack mounted or Desktop device
COMUNICATION	
Communication Interfaces	RS232, RS485, Ethernet
ENVIRONMENT	
Operation temperature	+15 °C - +45 °C
Storage temperature	0 - 70°C
Relative humidity	Max. 80% (up to 31°C), decreasing to max. 50% (above 30°C)
Allocation	Use indoors only
ADDITIONAL EQUIPMENT	
RST50I5 (female)	1pcs.
RST20I5 (male)	2pcs. (*)
RST20I3 (male)	2pcs. (*)
continued on next page	

continued from previous page	
PARAMETER	DESCRIPTION
STAS 2 (male)	2pcs. (*)
EXT1 plug - MC 1,5/ 8-STF-3,81	1pcs.
EXT2 plug - MC 1,5/ 7-STF-3,81	1pcs.
Remote Control plug - MC 1,5/ 2-STF-3,81	1pcs.
Cable IEC C13 female to IEC C14 male, 1.8m	1pcs.
Thermocouple plug wire 7.5m	2pcs. (*)
(*) - depending of zones number.	

Table 1.2: BCU14 230V specification

1.5.4 OPERATION

The device can be controlled in two ways:

- Manually via control panel with integrated touch screen.
- Remote control via RS232, RS485 or Ethernet see chapter 6.

1.5.5 STANDARDS

SAFETY:

- LVD 2006/95/EC Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
- PN-EN 61010-1 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

EMC:

- EMC 2004/108/EC Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
- EN 61326-1:2006 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

2 INSTALLATION

This chapter describes the procedures for unpacking, mechanical installation and electrical installation. Take care when lifting the unit that the weight and position do not exceed comfortable limits.

2.1 UNPACKING

1. Visually inspect the transport packaging for signs of external damage.
 2. Unpack the BCU14 and retain the packaging materials.
- Note: Retain the packaging materials for later use. The BCU14 must be stored and transported in the original packaging material only.**
3. Examine the BCU14 for completeness.
 4. Visually inspect the BCU14 for signs of damage.

DANGER



Damaged product.

Putting a damaged product into operation can be extremely dangerous. Never attempt to put a damaged product into operation. Secure the damaged product from unintended operation. Send a damage report to the haulage company or the insurer.

2.2 MECHANICAL INSTALLATION

The BCU14 is designed for installation into a rack according to DIN 41 494 (19", 3 HU) and occupying the whole width of the cassette. Before taking any actions read the safety notes below.

WARNING



Ambient temperature.

Exceeding the maximum permitted ambient temperature may damage the device. Make sure that the maximum permitted ambient temperature is not exceeded and that the air can flow freely through the louvers. Do not expose the device to direct sunlight.

DANGER



Protection class of the rack.

If the product is installed in a rack, it is likely to lower the protection class of the rack (protection from foreign bodies and water) e.g. according to the EN 60204-1 regulations for switching cabinets. Take appropriate measures to restore the required protection class of the rack.

2.3 COOLING

The BCU14 is equipped with a cooling system . A set of fans is installed inside the power supply. The air is supplied from the power supply housing side panels. Hot air outlet is located on the right panel. A minimum 15mm space for air intake (side panels) and 15 cm for expelling warm air from the back of the power supply should be observed. BCU14 should not be used at temperatures exceeding 40°C.

2.4 ELECTRICAL INSTALLATION

The unit can be supplied in two power versions:

- 3x400VAC Power supply,
- 230VAC(120/240VAC) Power supply,

Depending on the version, the rear panel is different. If there are differences in versions of the device, they were clearly stated in the description.

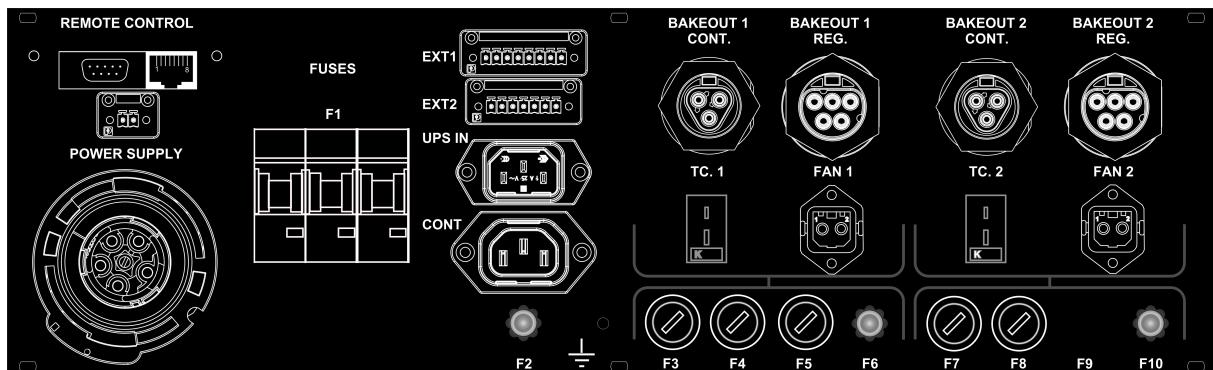


Figure 2.1: Rear panel of device in the 3x400V power supply version

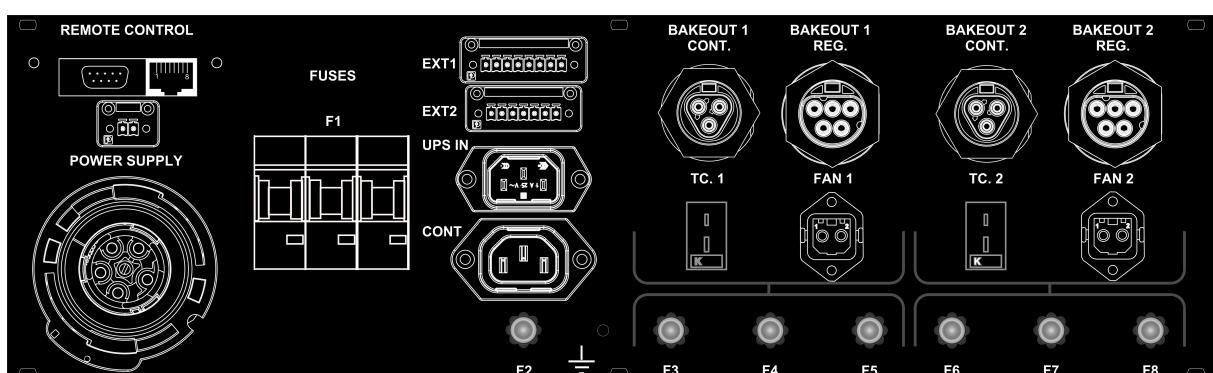


Figure 2.2: Rear panel of device in the 230V(2x110V) power supply version

2.4.1 AC INPUT POWER CONNECTORS

BCU14 has two separate power supplies:

1. High power from RST50I5 connector (50 A). It is used to power the high current outputs CONT and REG in both heating zones and CONT output (230 V).

2. Low power from the UPS IN connector. It is used to power the control device electronics system and fans (FAN1 and FAN2).

2.4.1.1 MAIN POWER SOCKET

The mains connection is an RST50I5 type connector on the rear side of the unit. A mains plug is supplied with the device.

Follow the instructions below for connection of the load wires to the mains plug:

1. Strip approx. 10mm at the end of each of the wires.
2. Loosen the plug terminal screws.
3. Insert the stripped wires into the terminal and tighten the terminal screw securely.

Use cable by fallow specification:

- Five-conductor cable with protective ground
- Conductor cross-section 5x4mm² or larger.

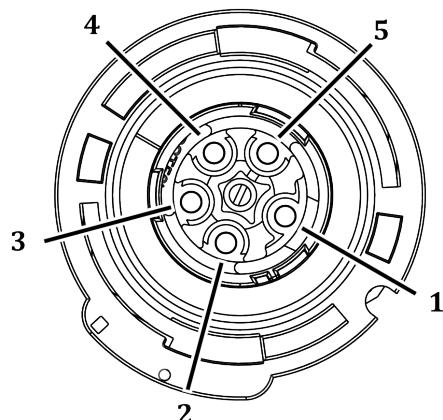


Figure 2.3: Main power supply connector description - outside view

PIN NUMBER	FUNCTION	DESCRIPTION
1	L1	Phase wire L1
2	L2	Phase wire L2
3	L3	Phase wire L3
4	N	Neutral wire
5	PE	Protective earth (Ground)

Table 2.1: Main power supply connector description



Figure 2.4: RST50I5 connector supplied with the device

For proper connect the main power refer to the drawings below.

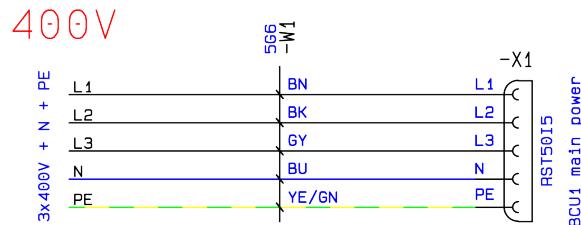


Figure 2.5: Main power supply wiring 3x400VAC

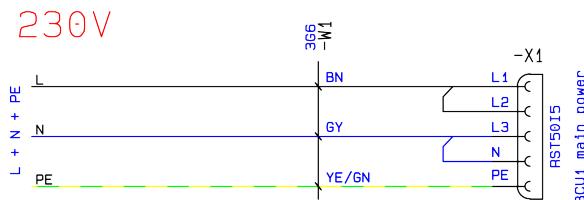


Figure 2.6: Main power supply wiring 230VAC

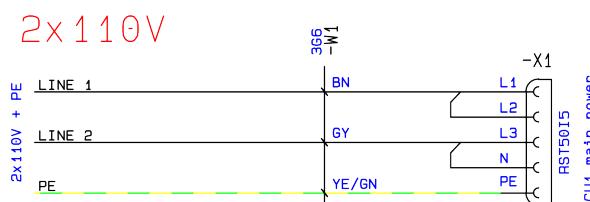


Figure 2.7: Main power supply wiring 2x110VAC(120/240VAC)

2.4.1.2 UPS IN CONNECTOR

Socket for uninterruptible power supply (from UPS). The socket must be accompanied by voltage in range 110 - 240 V. In the case of main power failure, the power outputs is disabled(regulated and continuous outputs in each zone) - runs only the control electronics and the fan outputs.

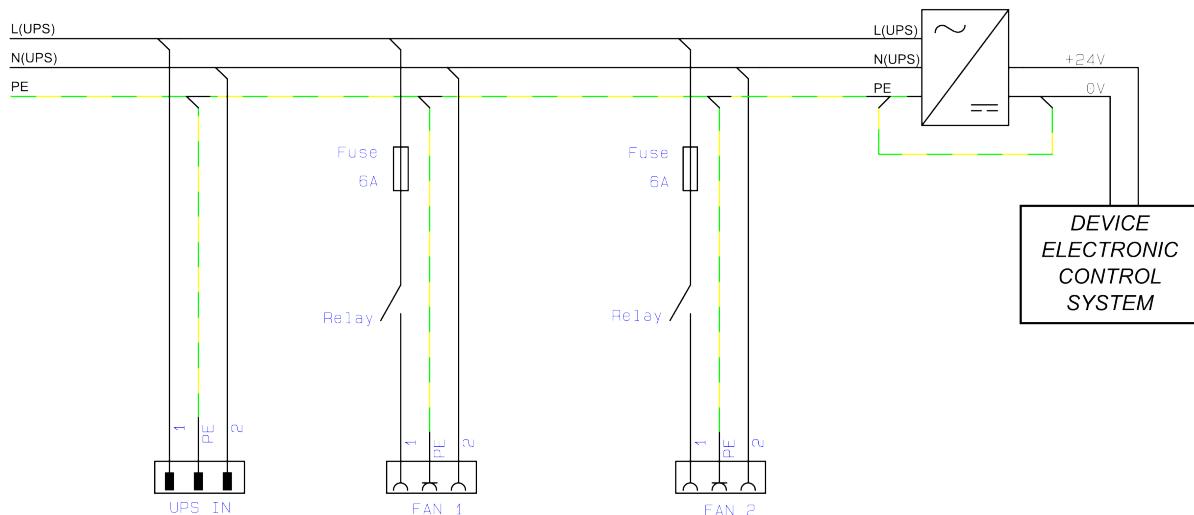


Figure 2.8: UPS IN - internal circuit diagram

CAUTION

No external power supply

If you do not have an available external UPS make jumper from the CONT output to the UPS_IN input, using the cable supplied with the device(2.10). In this way, the UPS circuit is powered from the main power input. This configuration ensures the functioning of the unit with a single power supply. The main power supply failure will disable the BCU14 controller.

CAUTION

External power supply

If you use an external power supply - UPS, connect it to the UPS_IN input. In this way, the main power failure does not disable the entire system, and all the time we have possibility to monitoring individual parameters of the heating process.



WARNING**Start BCU14**

To start the unit, voltage must be given to the **UPS_IN** input. In the absence of an uninterruptible power supply, you can create the bypass connection between the **CONT** output and the **UPS_IN** input. However, in the case of main power failure the entire device is switched off.

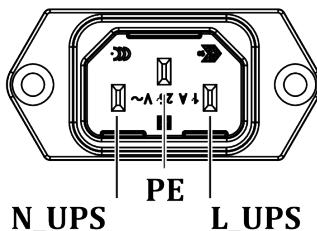


Figure 2.9: UPS IN connector



Figure 2.10: Cable IEC C13 female to IEC C14 male

2.4.2 POWER SWITCH

The power switch is located on the front of the BCU14 . The switch is a toggle type, marked with **I** and **O**. The **I** (on) position applies the power to the instrument. The **O** (off) position cuts off the power to the instrument. However, turning the power switch off does not fully remove the AC power from inside the instrument.

Always disconnect the power cord from the power entry module to fully remove AC power from inside the instrument.

DANGER**Risk Of Electric Shock**

Do NOT use the power switch as a disconnecting device; disconnect the power cord from the power entry module to fully remove hazardous voltage from inside the BCU14 .

2.4.3 GROUNDING BOLD

A grounding lug is located on the rear panel, near the power entry module. Use heavy ground wire, wire braid, or copper strap of 4mm² or larger to connect this grounding lug directly to a facility protective earth ground to provide additional protection against electrical shock. The ground screw can be used to connect the BCU14 with the protective ground of e.g. a pumping station.

DANGER



Screw for internal protective conductor.

The internal protective conductor is connected to the casing with a screw. Do not turn or loosen this screw.

2.4.4 FUSES

The outputs on the rear panel are protected by fuses.

Significance of the individual fuses in the 230 VAC version:

FUSE	FUNCTION
F1	Main fuse 50 A,
F2	CONT connector fuse (10 A - Resettable circuit breaker),
F3	BAKEOUT 1 REG connector fuse (16 A - Resettable circuit breaker),
F4	BAKEOUT 1 CONT connector fuse (16 A - Resettable circuit breaker),
F5	FAN1 connector fuse (6A - Resettable circuit breaker),
F6	BAKEOUT 2 REG connector fuse (16 A - Resettable circuit breaker),
F7	BAKEOUT 2 CONT connector fuse (16 A - Resettable circuit breaker),
F8	FAN2 connector fuse (6A - Resettable circuit breaker),

Table 2.2: Fuses function in 230 VAC (2x110 VAC) version

Significance of the individual fuses in the 3x400 VAC version:

FUSE	FUNCTION
F1	Main fuse 50 A,
F2	CONT connector fuse (10 A - Resettable circuit breaker),
F3	BAKEOUT 1 REG(1) connector fuse (20 A - cartridge fuse 6.3x32 mm/400 VAC),
F4	BAKEOUT 1 REG(2) connector fuse (20 A - cartridge fuse 6.3x32 mm/400 VAC),
F5	BAKEOUT 1 CONT connector fuse (20 A - cartridge fuse 6.3x32 mm/400 VAC),
F6	FAN1 connector fuse (6A - Resettable circuit breaker),
F7	BAKEOUT 2 REG connector fuse (20 A - cartridge fuse 6.3x32 mm/400 VAC),
F8	BAKEOUT 2 CONT connector fuse (20 A - cartridge fuse 6.3x32 mm/400 VAC),
F9	not used,
F10	FAN2 connector fuse (6A - Resettable circuit breaker),

Table 2.3: Fuses function in 3x400 VAC version

2.4.5 ZONE 1 REGULATED OUTPUT

2.4.5.1 BCU14 230 VAC (2x110 VAC)

Power available at the output depends on the difference of the set temperature and current temperature. Power is regulated in such a way as to achieve stable set temperature.

The BCU14 version powered by 230 VAC (2x110 VAC) voltage, has only one regulated output per zone.

Pin description is showed in Fig. 2.11):

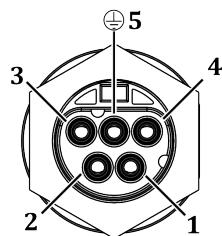


Figure 2.11: Regulated output connector(female) for ZONE 1

PIN NUMBER	FUNCTION	DESCRIPTION
1	NC	Not connected
2	L_REG	Regulated phase wire
3	N	Neutral wire
4	N	Neutral wire
5	PE	Safety wire(Ground)

Table 2.4: Regulated output connector pinout for ZONE 1 - 230 VAC(2x110 VAC)

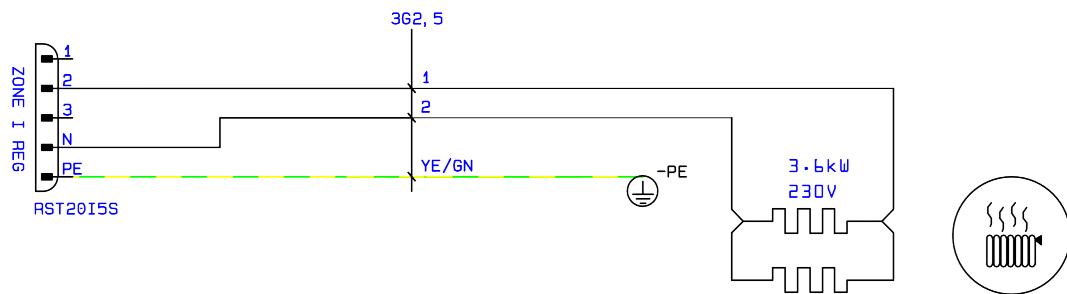


Figure 2.12: Zone 1 (230V) regulated output - wiring example

2.4.5.2 BCU14 3x400 VAC

In BCU14 version powered by a three-phase 3x400 VAC voltage, the controller has two regulated outputs. Both outputs are derived from a single power regulator. Both channels are controlled with the same analog signal, so voltage at the both regulated outputs are the same at any given time.

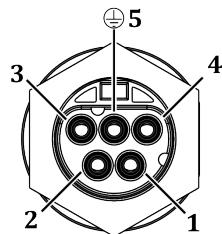


Figure 2.13: Regulated output connector for ZONE 1 (3x400 VAC)

PIN NUMBER	FUNCTION	DESCRIPTION
1	L_REG(1)	Regulated phase wire (regulator output 1)
2	L_REG(2)	Regulated phase wire (regulator output 2)
3	L2	Phase wire L2
4	L1	Phase wire L1
5	PE	Safety wire(Ground)

Table 2.5: Regulated output connector pinout ZONE 1 - 3x400VAC

WARNING



Property wiring .

If you use only one output channel REG 1 - the load should be connected to pin **L1 and L_REG(1)**. Other connections will cause malfunction of the regulator.

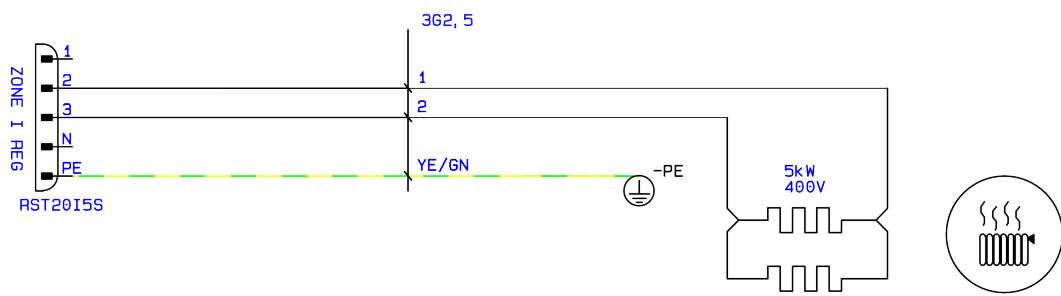


Figure 2.14: Zone 1 (3x400 VAC) regulated output(single) - wiring example

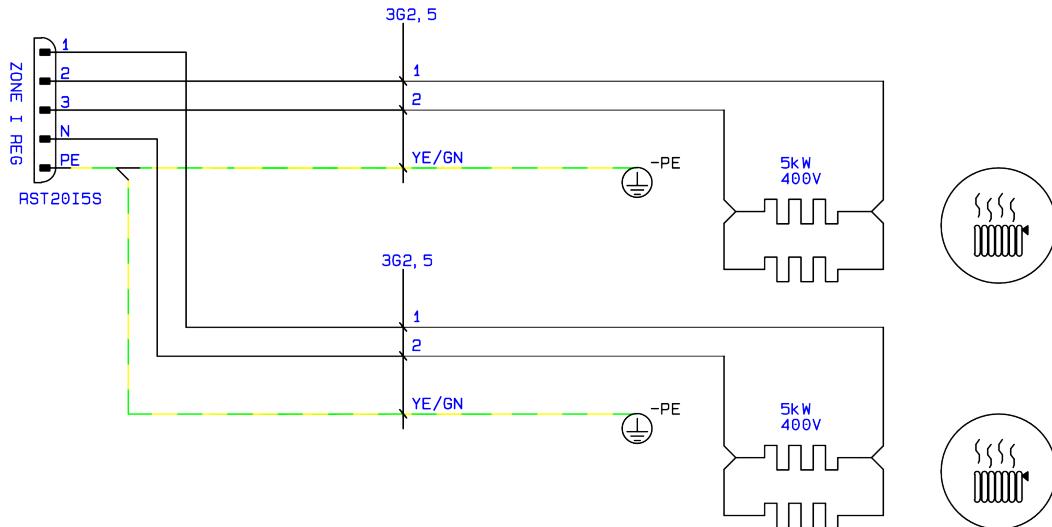


Figure 2.15: Zone 1 (3x400 VAC) regulated output(double) - wiring example

2.4.6 ZONE 2 REGULATED OUTPUT

2.4.6.1 BCU14 230 VAC (2x110 VAC)

Same as *ZONE 1 REGULATED OUTPUT 230V*. See subsection 2.4.5.1 for detail.

2.4.6.2 BCU14 3x400 VAC

In BCU14 version powered by a three-phase 3x400 VAC voltage, the ZONE 2 REGULATED OUTPUT have only one regulated pin(as opposed to ZONE 1 that has two regulated pins.).

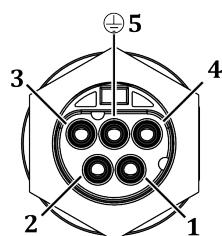


Figure 2.16: Regulated output connector for ZONE 2

PIN NUMBER	FUNCTION	DESCRIPTION
1	L	Phase wire
2	L_REG	Regulated phase wire
3	NC	Not connected
4	N	Neutral wire
5	PE	Safety wire(Ground)

Table 2.6: Regulated output connector pinout for ZONE 2

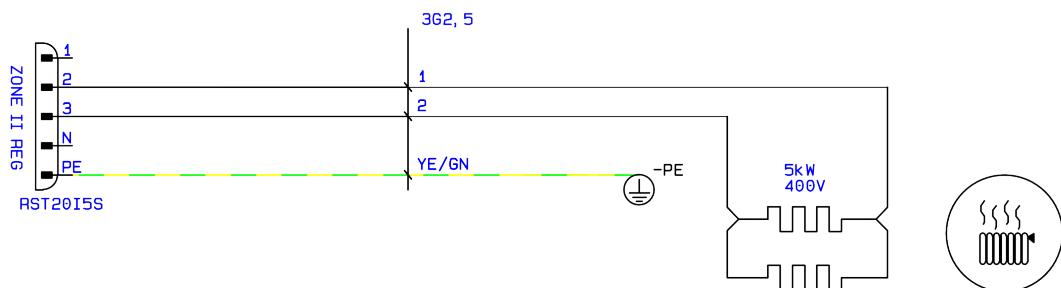


Figure 2.17: Zone 2 regulated output - wiring example

2.4.7 ZONE CONTINUOUS OUTPUTS (BOTH ZONE)

Unregulated output. After turn on the heating, 230 V voltage appears on the connector. Output is used to connect eg. heating tape.

The working time of this output is configurable, depends on the settings in the menu - **Continuous Out Timer** (see chapter 3.5.1.5) - and can not be longer than the Regulated Out Timer.

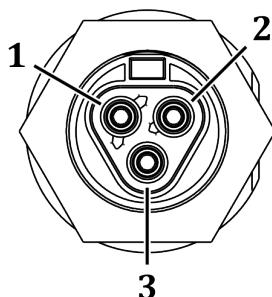


Figure 2.18: Continuous output connector for both zone

WARNING



Continuous output timer.

Before turning on the bakeout process, make sure that continuous output have set the correct time value (see chapter 3.5.1.5).

PIN NUMBER	FUNCTION	DESCRIPTION
1	PE	Safety wire(Ground)
2	N	Neutral wire
3	L	Phase wire

Table 2.7: Continuous output connector for both zone - pin description

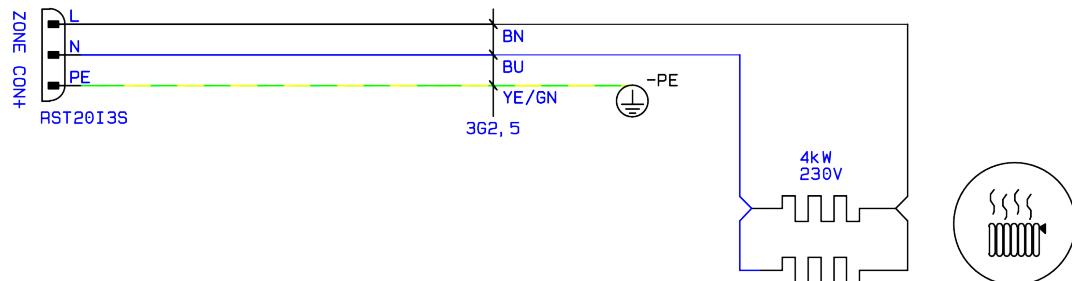


Figure 2.19: Continuous output wiring for both zone

2.4.8 FAN OUTPUTS (BOTH ZONE)

Output (230 V) to connect the fan(s) used to force air circulation in a heater tent. Work function depends on the setting of the Fan Start Temperature. Voltage available at the output is taken from the input **UPS_IN**.

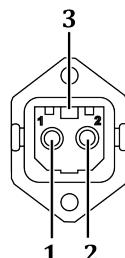


Figure 2.20: FAN 1(2) output connector

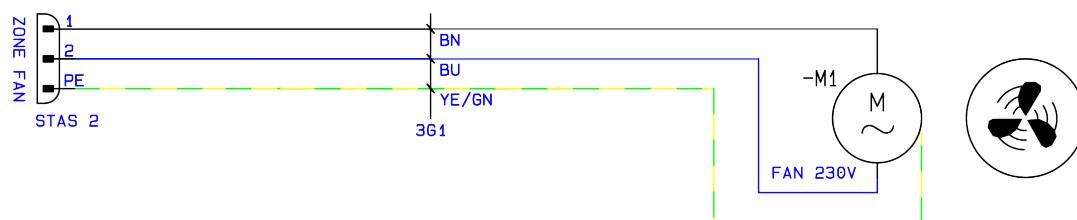


Figure 2.21: Fan output wiring example

PIN NUMBER	FUNCTION	DESCRIPTION
1	N_UPS	Neutral wire
2	L_UPS	Phase wire
3	PE	Safety wire(Ground)

Table 2.8: FAN 1(2) output connector pinout

2.4.9 CONT OUTPUT

230 V Power output. The output voltage is taken from the main power supply input and it is available at all times. Output is powered always while the BCU14 is on.

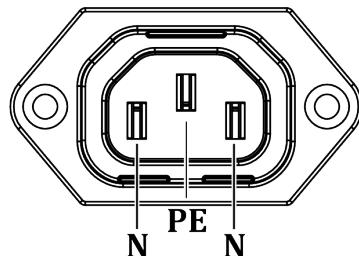


Figure 2.22: CONT 230VAC connector

CAUTION



Run device

Use this output in order to run the unit without additional power supply. Make connection between the CONT output and UPS_IN using supplied cable(*Cable IEC C13 female to IEC C14 male*) with the BCU14 . For detail information see section 2.4.1.2

2.4.10 EXT1 CONNECTOR

EXT1 connector allows you to attach the external heating interface. Data output is Active Low - ground potential (for pins 1-6). Analog outputs (pins 7 and 8) are working in the range of 0-10 V (max 100 mA output current).

Signals available on EXT1 connector are in reference to EXT2-6(GND) and EXT2-7(24 VDC).

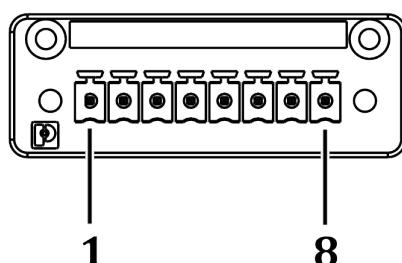


Figure 2.23: EXT1 Connector

PIN NUMBER	FUNCTION	DESCRIPTION
1	Relay 1	Signal to switch on regulated heating for Zone 1
2	Relay 2	Signal to switch on regulated heating for Zone 2
3	Relay 3	Signal to switch on FAN for Zone 1
4	Relay 4	Signal to switch on FAN for Zone 2
5	Relay 5	Signal to switch on nonregulated output for zone 1
6	Relay 6	Signal to switch on nonregulated output for zone 2
7	AO1	Analog output - Zone 1
8	AO2	Analog output - Zone 2

Table 2.9: EXT1 connector pinout

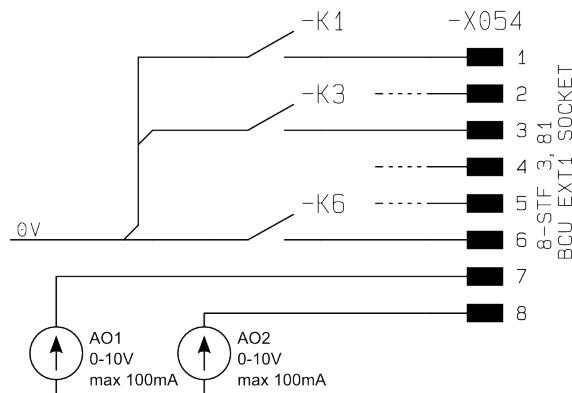


Figure 2.24: EXT1 Connector internal circuit

2.4.11 EXT2 CONNECTOR

EXT2 connector is used to connect the error signals from BCU supervisors devices, eg. vacuum pump group controller. The outputs are physically isolated from the device and active high state. In order to activate the input - put a 24 VDC voltage to pin you want to activate (pins 1 - 4) and GND to the reference input - pin 5.

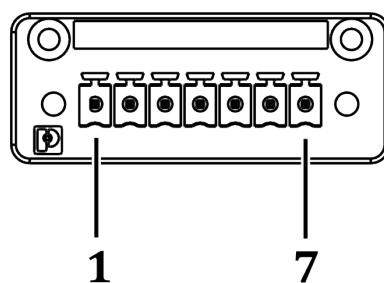


Figure 2.25: EXT2 Connector

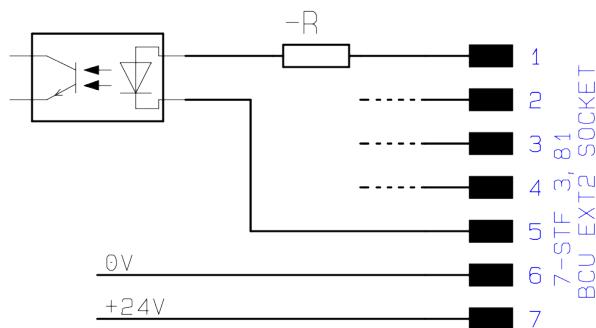


Figure 2.26: Single interlock internal circuit

PIN NUMBER	FUNCTION	DESCRIPTION
1	Interlock 1	Interlock signal for zone 1
2	Interlock 2	Interlock signal for zone 2
3	Master Inter-lock	Master interlock signal to turn off both heating zones. The absence of this signal results in an additional disconnecting the power from all the relays inside the unit.
4	Power Failure	An external power failure signal. Power failure signal selection is made on your device menu, see section 3.5.1.9
5	COMMON	Reference input for signals fed to pins 1-4.
6	GND	Ground
7	24 V (0.5A)	Voltage output

Table 2.10: EXT2 connector pinout

To turn on device without any protection signal, is possible to make short connection for permanent interlock - not recommended wiring.

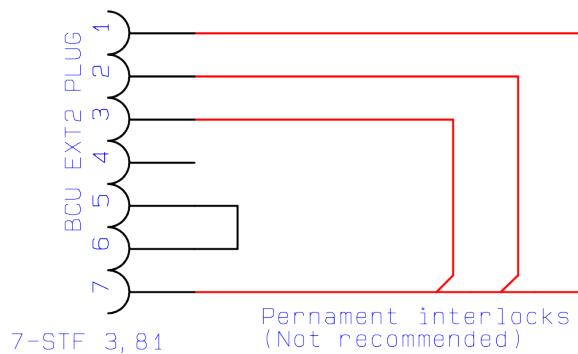


Figure 2.27: Permanent interlock - not recommended

Depending of bakeout system configuration. The interlock driving can be done in several ways. They are shown below.

- Master interlock is driving by circuit with included thermo switch.

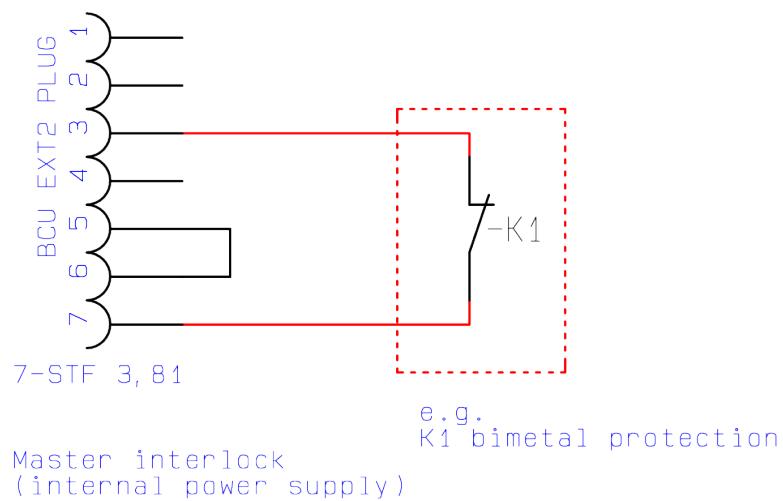


Figure 2.28: Master interlock wiring using internal power supply - thermo switch protection

- Master interlock is driving by thermo switch - supply is applied by external power supply.

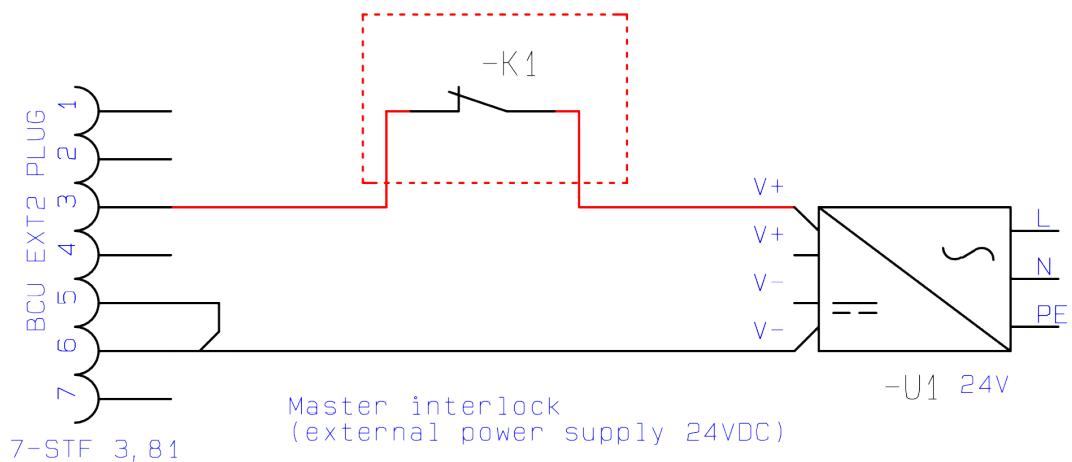


Figure 2.29: Master interlock wiring using external power supply - thermo switch protection

- Master interlock and baking zones interlock protection connected via external supervision device(external power supply 24VDC). K1 - thermo switch protection, K2, K3 high vacuum gauge protection.

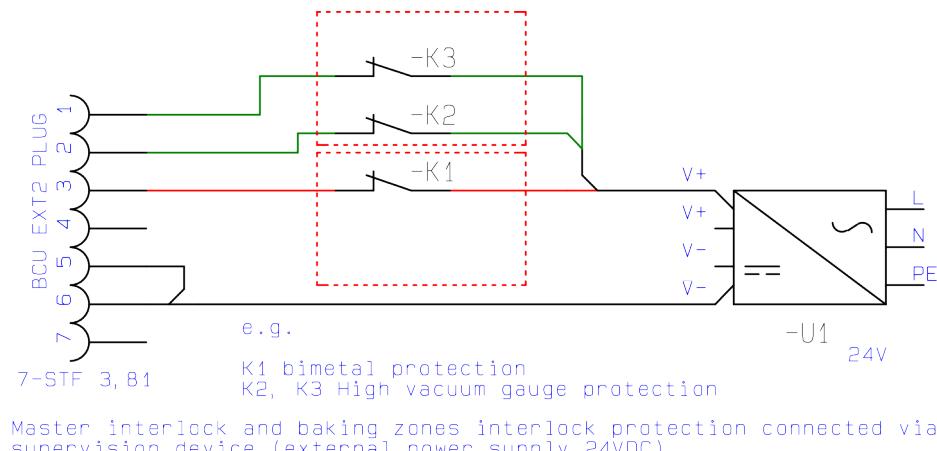


Figure 2.30: Interlock connection - example 1

- Master interlock and baking zones interlock protection connected via external supervision device(internal BCU power supply). K1 - thermo switch protection, K2, K3 high vacuum gauge protection.
- Master interlock and baking zones interlock drive from external device for example: PLC or Digital Card.

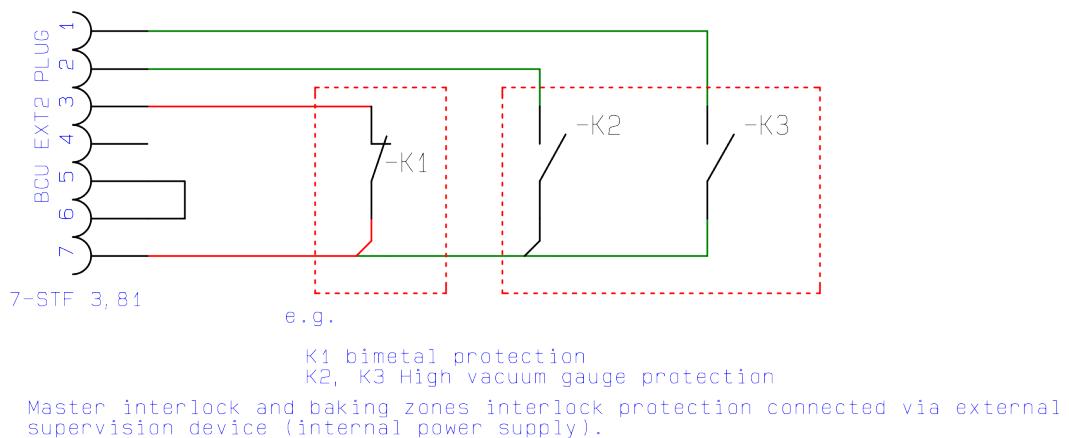


Figure 2.31: Interlock connection - example 2

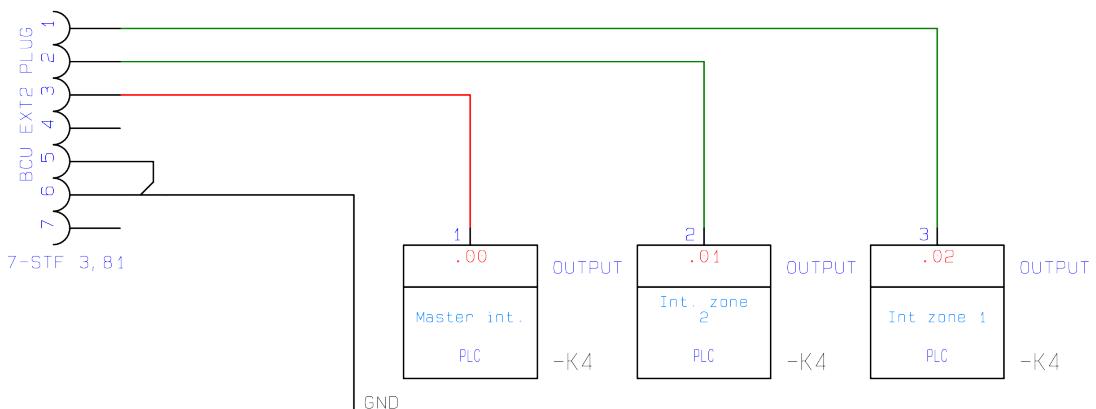


Figure 2.32: Interlock connection - example 3

2.4.12 REMOTE CONTROL

The device comes supplied with the following communication interfaces:

- Serial interface RS232/RS485 (selected from menu),
- Ethernet interface (IEEE 802 standard),

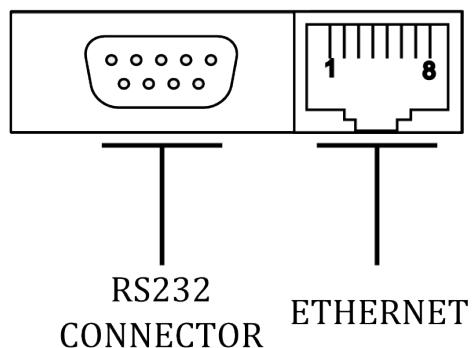


Figure 2.33: Remote control module

The remote interface allows read-back of the device parameters. In order to control and set the device parameters, the device must be switched to the remote control mode.

For a detailed description of the remote interface configuration, please see section ??

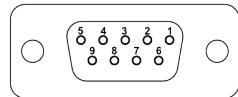


Figure 2.34: Serial interface connector(female 9 pin)

PIN NUMBER	FUNCTION	DESCRIPTION
2	RX	RS232 - Data signal RX
3	TX	RS232 - Data Signal TX
5	GND	Ground
8	D+	RS485 - Data signal positive
9	D-	RS485 - Data signal negative
1,4,6,7	none	not used

Table 2.11: Serial interface connector - pin description

3 OPERATING

Interaction with the BCU14 takes place mainly via the touch panel and encoder. The front panel also contains LED status indicators describing the current state of the Bakeout Controller.

3.1 TURN ON DEVICE

In order to turn on the device make sure that all of the connections on the rear panel are made correctly and that the AC connection meets the criteria provided in the AC source requirements section. If these conditions are met, set **Power Switch** into **ON** position on the front panel.

3.2 FRONT PANEL

There are several principal parts of the BCU14 user interface:

- LED diode indicators
- Touch panel display
- USB port
- Power switch
- Back-light logo

The front panel of the BCU14 is shown in the figure 3.1 below

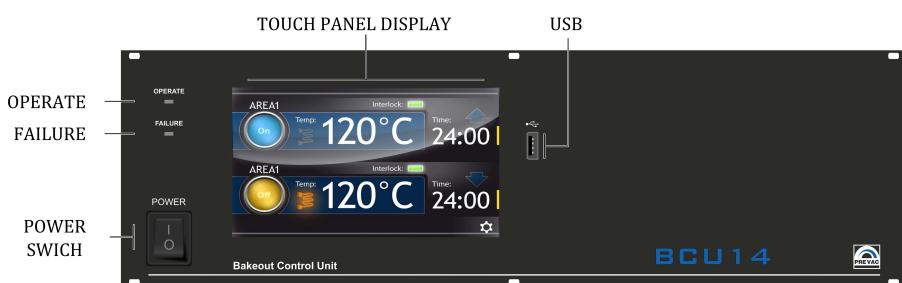


Figure 3.1: Front panel

3.2.1 LED INDICATORS

LED indicators inform about the operating state of the power supply:

- OPERATE – Green diode indicates operate status. Blinking indicates that some of the parameters are still stabilize.
- HV ON – Yellow diode indicates high voltage ($> 48V$) applied to any output pin,
- FAILURE – Blinking red diode indicates failure of the power supply. Additionally a corresponding failure message is displayed on the touch screen display.

3.2.2 TOUCH PANEL DISPLAY

The device has a TFT color display with a resolution of 800x480 pixels and a diagonal of 7" with 16:10 aspect ratio. The display has an integrated touch panel, which provides the user interface.

CAUTION



The touch panel is capable of processing only one input signal at a time. It is not permissible to simultaneously touch the touch panel at several points.

CAUTION



To operate the touch panel, do not use any pointed or sharp items. Such items can damage the foil resulting in input errors.

3.2.3 USB CONNECTOR

Allows removable media to be used for e.g. firmware or software upgrade . It is also possible to play videos on the screen.

3.3 USER INTERFACE

The BCU14 is equipped with a colour display touch screen. All data and functions are accessible via the menus from this touch screen interface. Every operation must be performed by a tap on screen.



Figure 3.2: Main screen view - 2 zones

Main view contains 3 elements:



Figure 3.3: Main screen view - 1 zone

1. Main window - contains the most important parameters controlled by the device,
2. Menu - contains the device menu from where the user may enter the setup menu, upgrade firmware, show contents of the usb stick, playing videos,
3. Setup shortcut - contains list of favourites setup positions (see section 3.3.6).

3.3.1 MAIN PANELS

The device contains one main panel which contains the most important parameters controlled by the device. Additionally, the panel shows information on working time, operating mode and heating status.

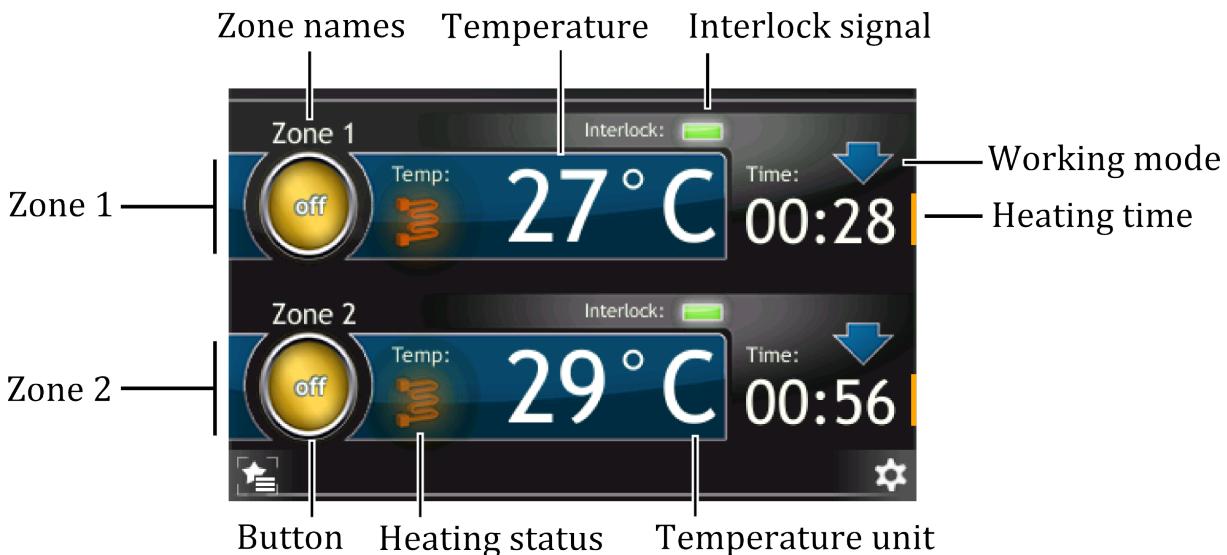


Figure 3.4: Main panel description

- **Button** - allows to switch ON/OFF bakeout process for the zone.
- **Heating status** field - display information about heating status. When the zone heater is ON then field is in orange colour.
- **Heating time** - display time in OPERATE mode, depending on settings in "Regulated Out Timer" configuration menu.
- **Working mode** field - depending on settings in "Control type" configuration menu.
- **Interlock signal** field - display information about Interlock status.
- **Temperature** - display the current temperature for the zone.
- **Zone names** - can be changed according to user preferences.

3.3.2 NUMERIC KEYBOARD

Numeric values can be entered via the numeric keyboard. It consists of the numbers 0 to 9 and additional function keys to facilitate data entry and editing of the current data. The numeric keyboard is shown in Figure 3.5.

It is possible to enter data:

- directly from the numeric keypad by typing a value and confirming the entered value,
- by entering data in the form of the mantissa and exponent,
- by increasing or decreasing the current value step by step.

Increment or decrement current value:

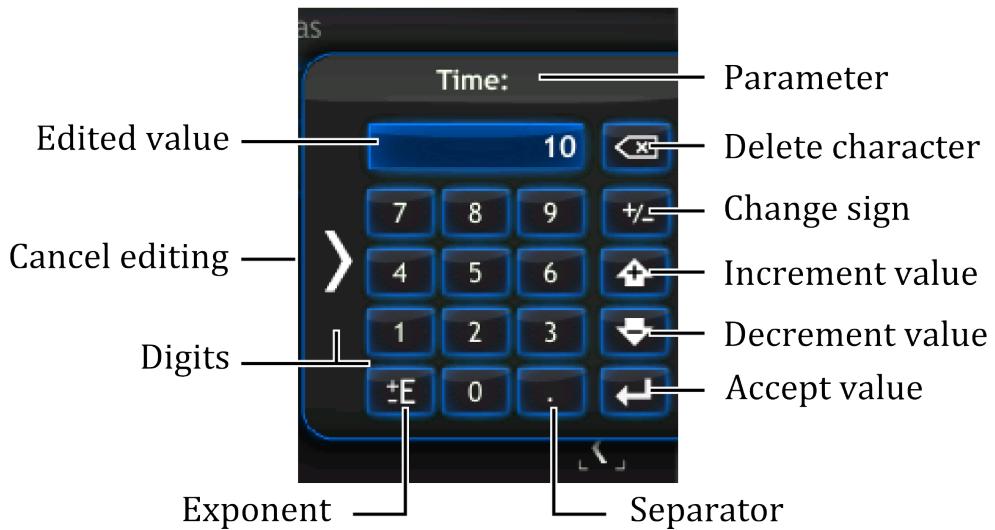


Figure 3.5: Numeric keyboard

1. Select value to edit (e.g. Tooling Sens 2).
2. Tap on **2** and **0** to increment value by 20.
3. Tap on the **Increment value** button (every tap on the button increments the value by 20).
4. To decrement value just tap on the **Decrement value** button (every tap on the button decrements the value by 20).
5. Value is decrement.
6. Confirm value by tapping the **Accept value** button.

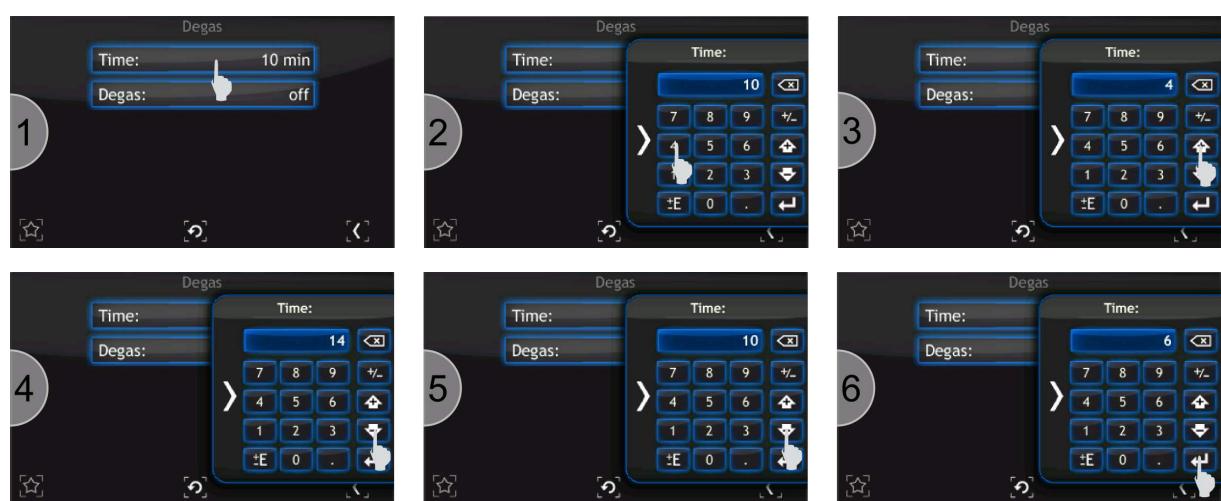


Figure 3.6: Increment/decrement value by numeric keyboard

To enter a number in exponential form:

1. Enter the numeric value of the mantissa number along with a sign (e.g. -12.5).

2. Press the **Exponent** button. To enter a negative exponent symbol, press the **Exponent** button twice.
3. Enter exponent value.
4. After entering the value, it is possible to modify the sign of mantissa and the sign of exponent by using the **Exponent** button or the **Change sign** button (see Figure 3.5).
5. Confirm value by tapping the **Accept value** button.

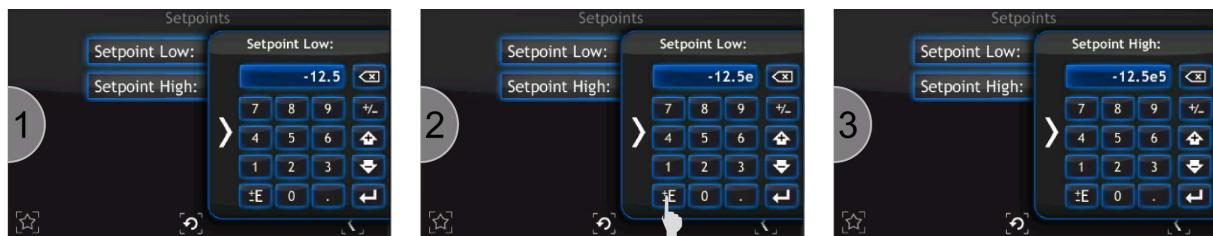


Figure 3.7: Number in exponential form

3.3.3 ALPHANUMERIC KEYBOARD

The on-screen keyboard is used for entering alphanumeric data and also facilitates text entry. Figure 3.8 shows the alphanumeric keyboard with description of main keys.

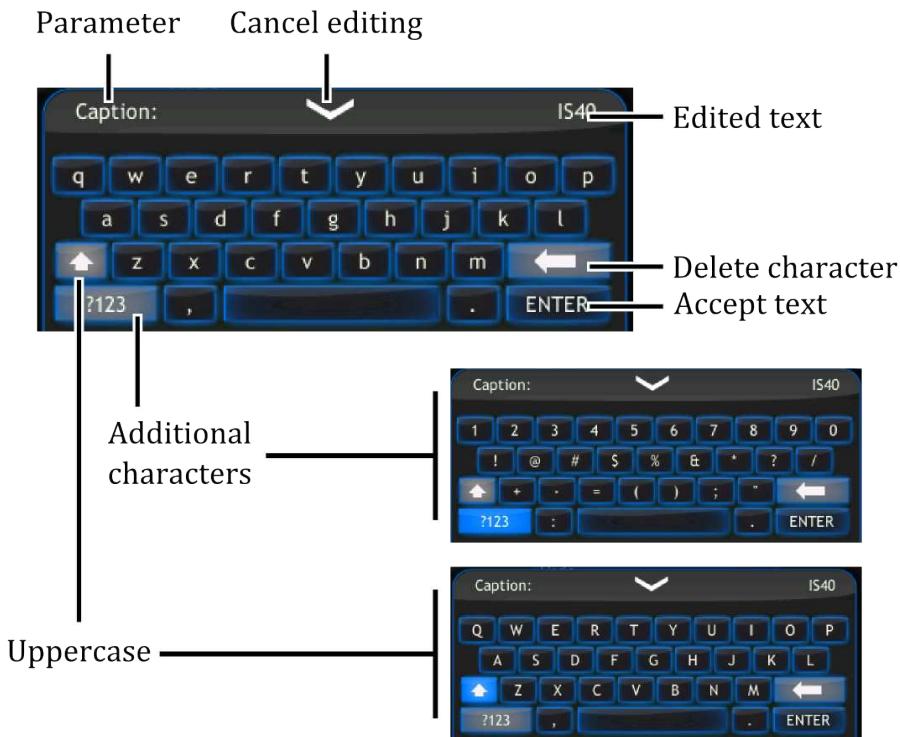


Figure 3.8: Alphanumeric keyboard

3.3.4 DEVICE INTERACTION

To change the displayed temperature unit:

1. Tap on temperature unit to change.
2. Select target units.
3. Value in new units is displayed.



Figure 3.9: Changing displayed measurement unit

The main panel allows quick and easy changes to be made to the displayed parameters. When you click on a given parameter, you will be automatically moved to the position in the configuration menu associated with it. The following figure shows the parameters for the main panel, which can be edited.



Figure 3.10: Editing (clickable) areas on the main panel

3.3.5 SETUP

Advanced configuration of the device parameters is possible via the setup menu. Tap the menu icon to expand the menu and then tap device setup icon (see Figures 3.11 - 3.12).

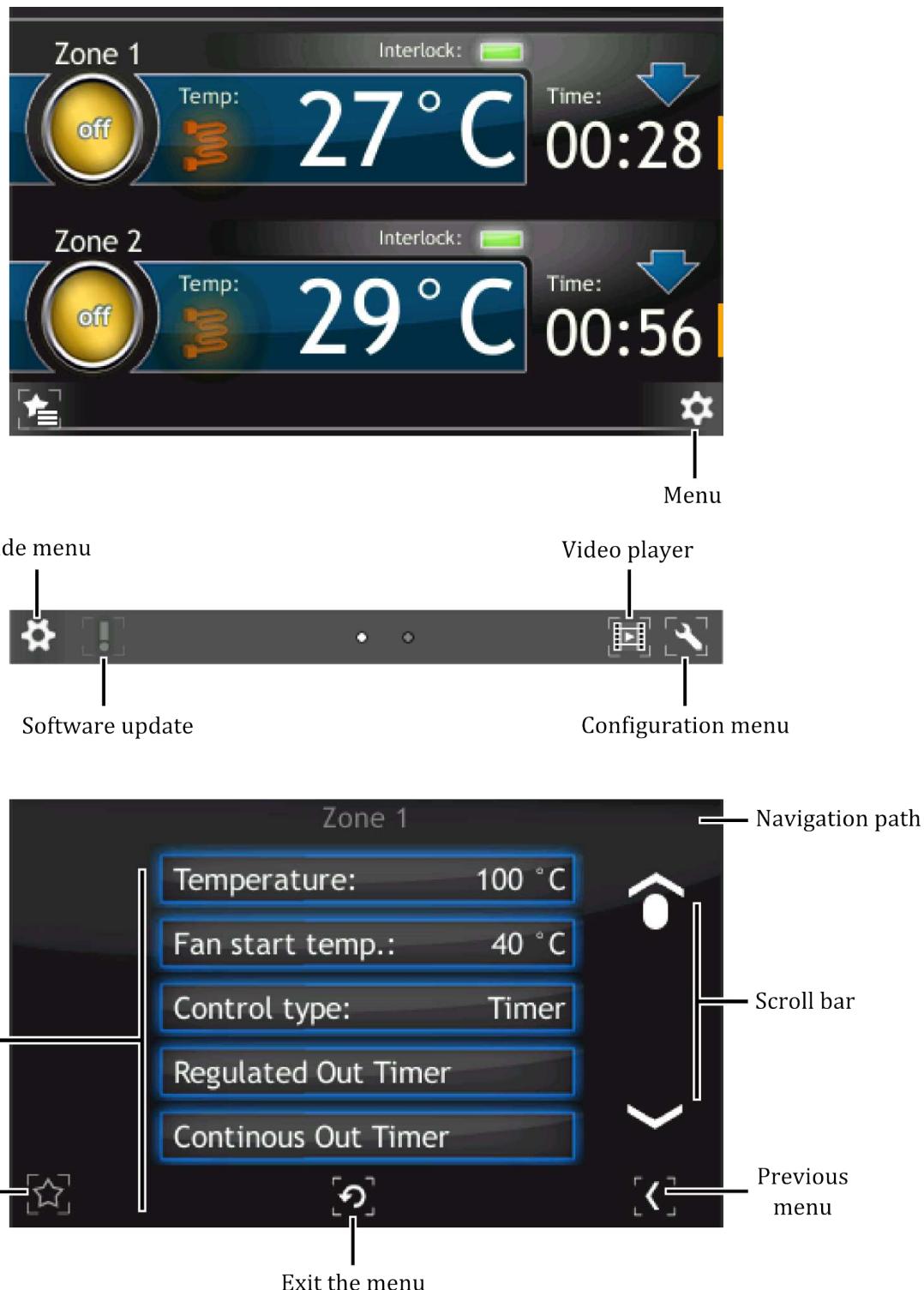


Figure 3.11: Device setup

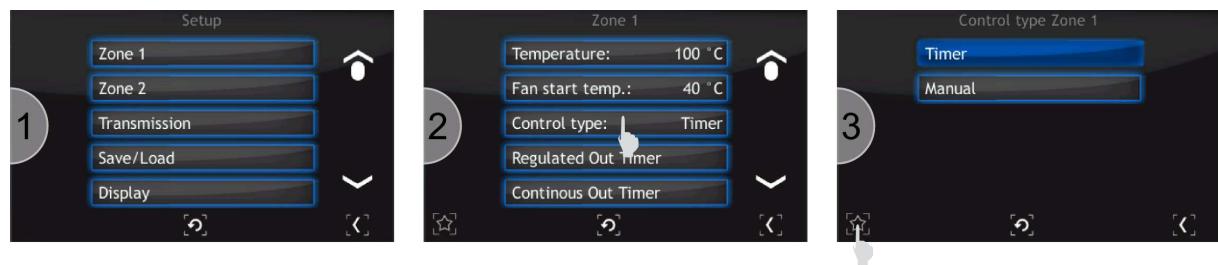


Figure 3.12: Navigating the setup (example)

3.3.6 SETUP SHORTCUTS

Frequently used commands/settings can be conveniently accessed by creating shortcuts.

To create a shortcut:

1. Navigate to the setup position where a shortcut should be created.
2. Tap on **Setup shortcut** to add the position to shortcuts (To remove position from shortcut list tap again on the **Setup shortcut** button).

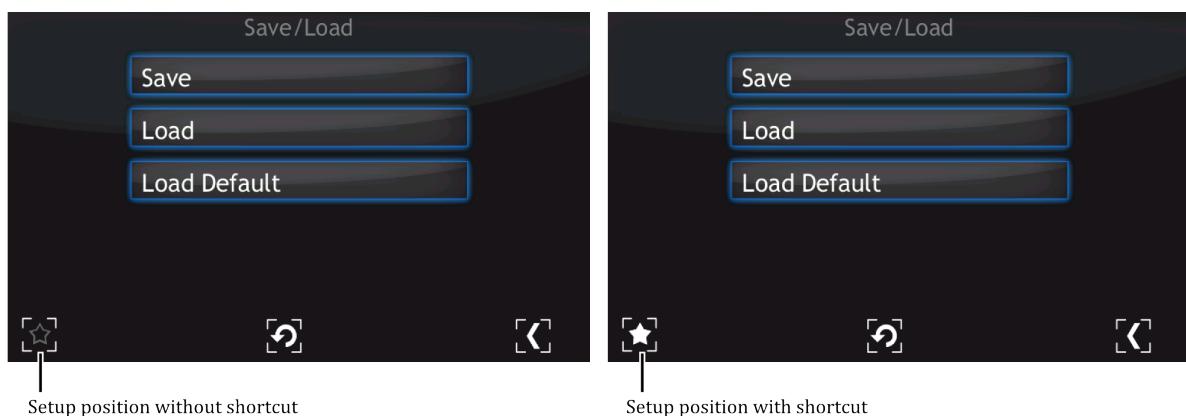


Figure 3.13: Setup shortcut on setup menu

To use shortcut:

1. On main panel tap on **Setup shortcut** button.
2. Select setup shortcut to enter (e.g. Save/Load).
3. Current setup position should be displayed.



Figure 3.14: Using setup shortcut

3.3.7 TIMER PANEL

Additional screen contains countdown timer and information about the current time and date. Elapsed time is paired with a progress bar indicator located around the Start/Stop button. Timer value can be set from 23h:59m:59s to 00h:00m:01s. After pressing the **Start** button the time is counted from set value to zero. An audible beep sounds when the timer has completed and the set value is displayed once again.

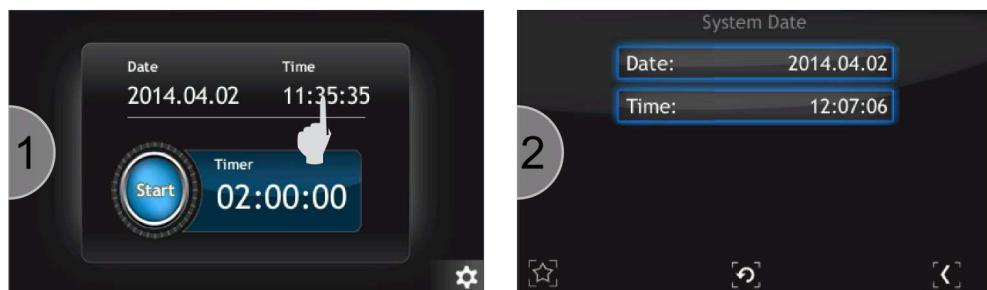


Figure 3.15: Go to system date

3.3.7.1 SETTING TIMER VALUE

In order to set the timer start value:

1. Tap **timer field**.
2. Type a timer initial value using numeric button **from 0 to 9** and ":" symbol as separator. Confirm value by tapping **Enter** button.
3. New value is set and display in **timer field**. Tap **Start** in order to run the timer
4. Timer is counting down,

The time may also be entered in seconds. The entered value is automatically converted to **hh:mm:ss** format

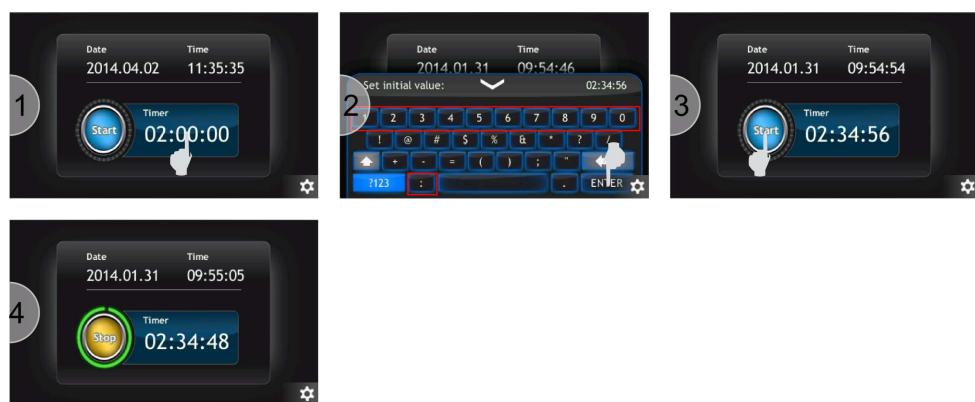


Figure 3.16: Set timer value

3.3.8 MESSAGES

The BCU14 will automatically display both warning and error messages as appropriate.

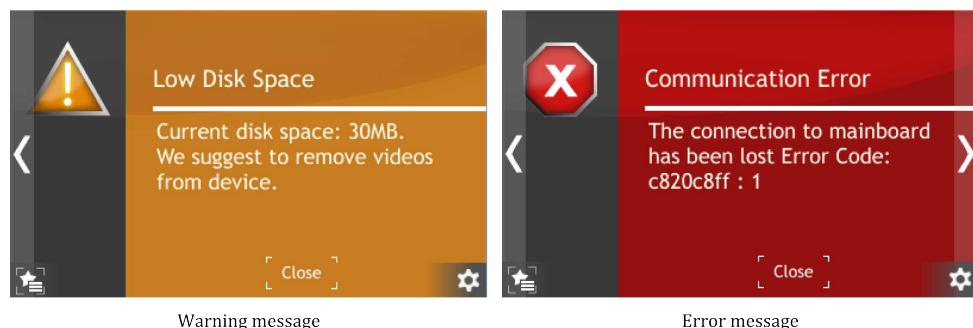


Figure 3.17: Messages

3.3.8.1 WARNING MESSAGE

Warning messages are displayed on the right of the screen. When present, they can be clicked to display the full warning information (see Figure 3.18). Warning messages consist of information together with a description field. When the problem causing the error no longer exists, the message is automatically removed whether or not it has been acknowledged.

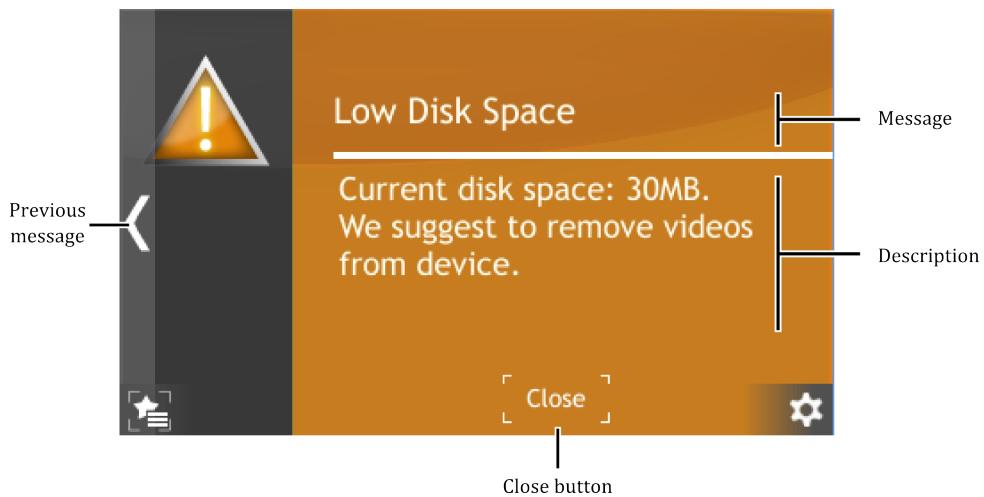


Figure 3.18: Warning message

3.3.8.2 ERROR MESSAGE

Error messages inform about critical issues. The message is displayed in full screen (see Figure 3.19). Error messages consist of an information field together with a description of the error. If the cause of error no longer exists, the error message will disappear after the user clicks OK. When the user clicks OK but the error still exists, then information about the event will continue to be displayed on the right hand side of the screen. If the cause of error still exists, please contact the manufacturer.

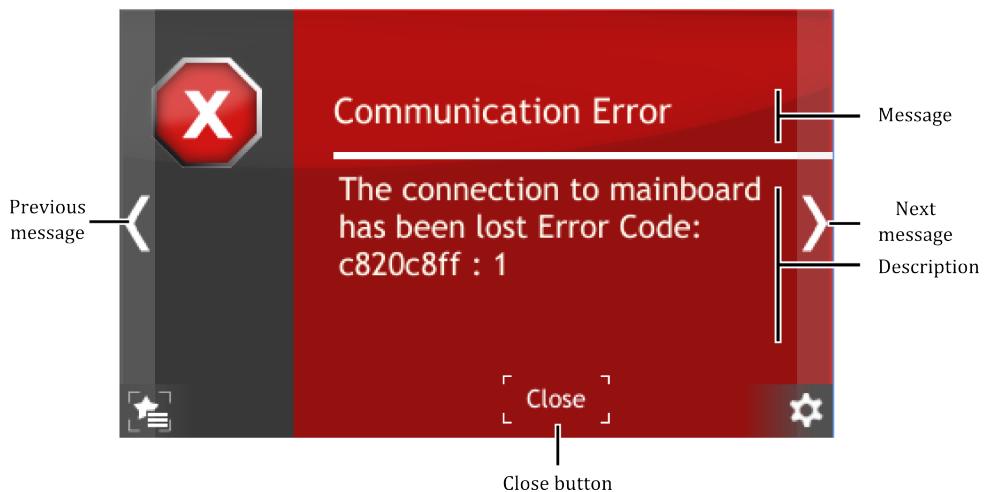


Figure 3.19: Error message

3.3.8.3 MULTIPLE MESSAGES

If several errors or warnings occur simultaneously they are indicated with a counter on the bottom right hand corner of a screen. The first digit (red) indicates the number of errors, the second digit (yellow) indicates the number of warnings. Clicking on this counter will bring up the message list. The list is displayed in date/time order from most recent to oldest. Error messages appear in the list before Warning messages.

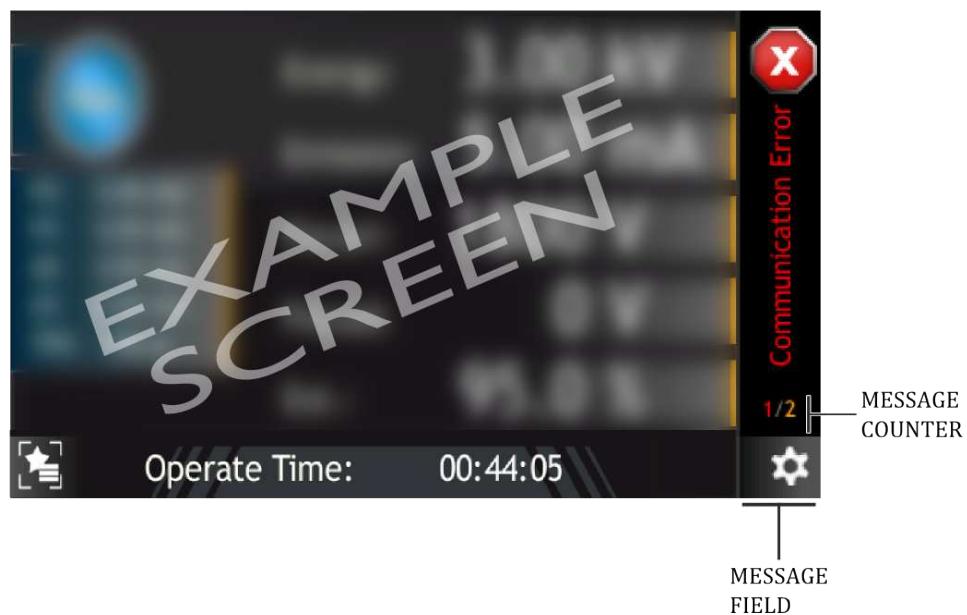


Figure 3.20: Multiple messages

3.3.9 VIDEO PLAYER

The BCU14 device can play video files. Files can be played only from the device. Full instructions on how to copy a video file onto the device is in the subsection ***Copy video file to the device***. A short guide on how to play the video is included in subsection ***Playing Video***.

3.3.9.1 PLAYING VIDEO

In order to play a video go to the main screen and tap the **Menu icon** on the bottom right corner of the screen to display the menu bar. Then tap the **Video player** icon on the bottom right (see Figure 3.21).

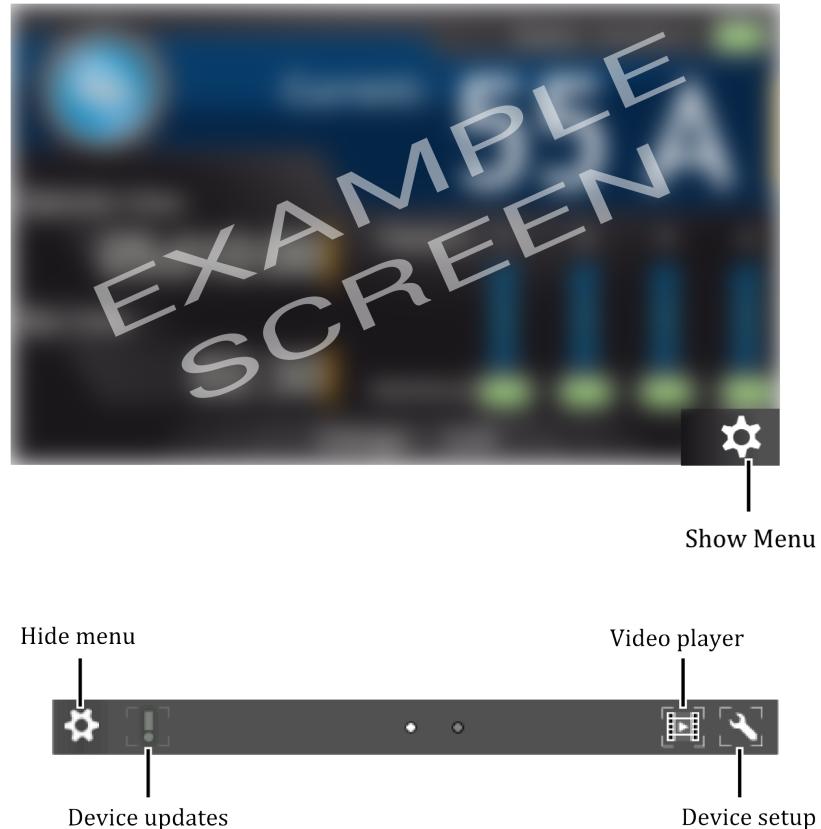


Figure 3.21: Menu bar - video player

1. Tap on the desired file to open video menu.

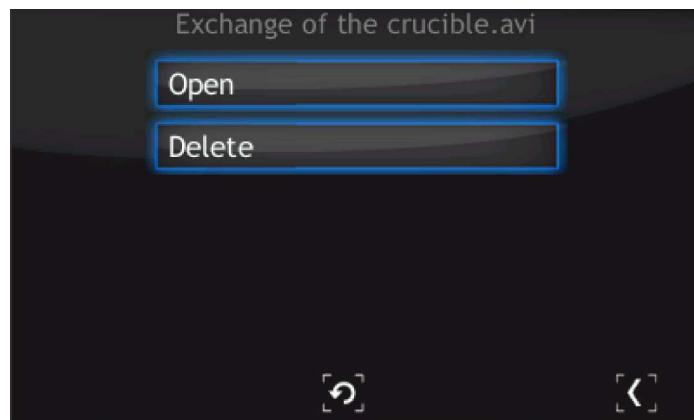


Figure 3.22: Video player - menu

2. From this menu, a video file can be played or deleted. In order to delete the file tap **Delete** and confirm the action by tapping **Yes**.

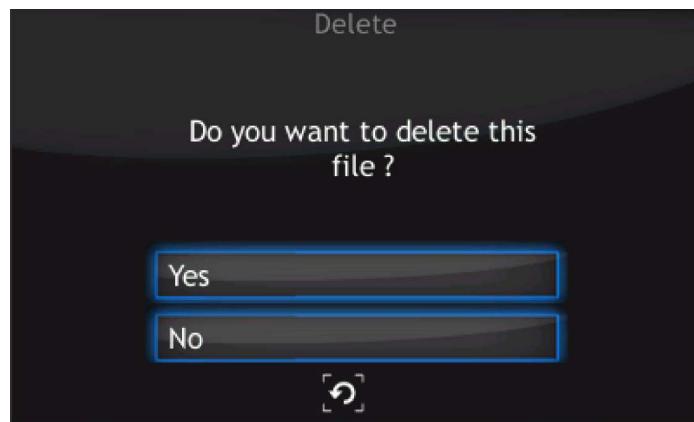


Figure 3.23: Video delete question

3. To open a video, tap ***Open***. The video player is displayed.
4. Tap on the screen to see the video player menu.

From this menu, the following controls are visible:

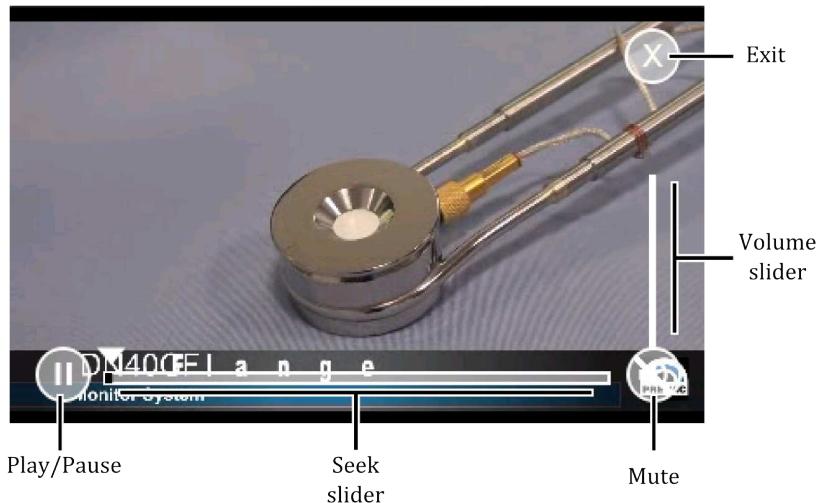


Figure 3.24: Video player

3.3.9.2 COPY VIDEO FILE TO THE DEVICE

In order to copy a video file to the device, connect a USB flash drive which contains the video files. The following hint appears ***New USB device detected***. Tap on the USB menu to show the menu. Tap on the ***List of videos on USB*** button to see all the videos stored on the USB drive with *.avi extension (see Figure 3.26).

1. Choose a desired file from the list.
2. To copy file, tap ***Copy file to the device***.
3. Depending on the file size, the copy operation can take from a few seconds to several minutes. At the end of the copy operation, tap the ***Return*** button.

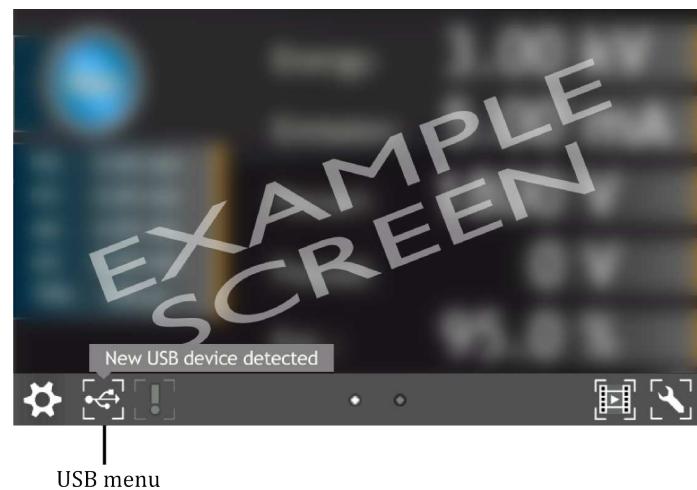


Figure 3.25: USB detected hint

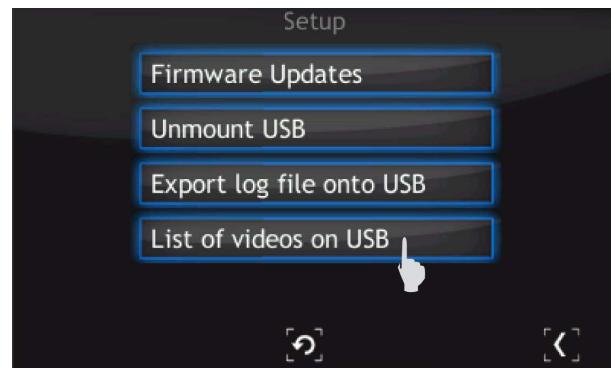


Figure 3.26: USB menu - list of videos on USB

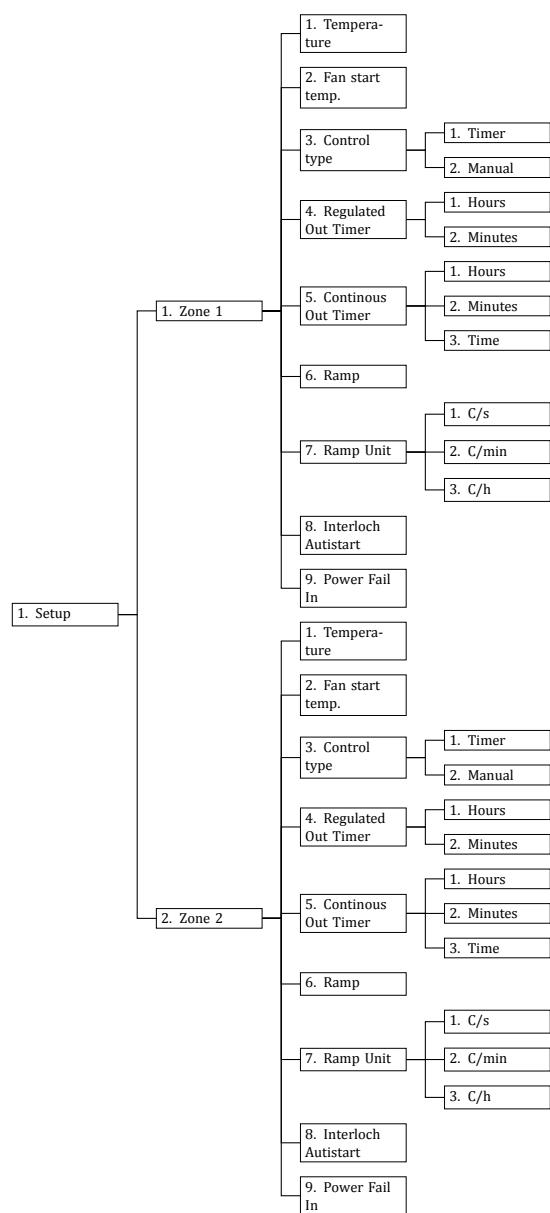


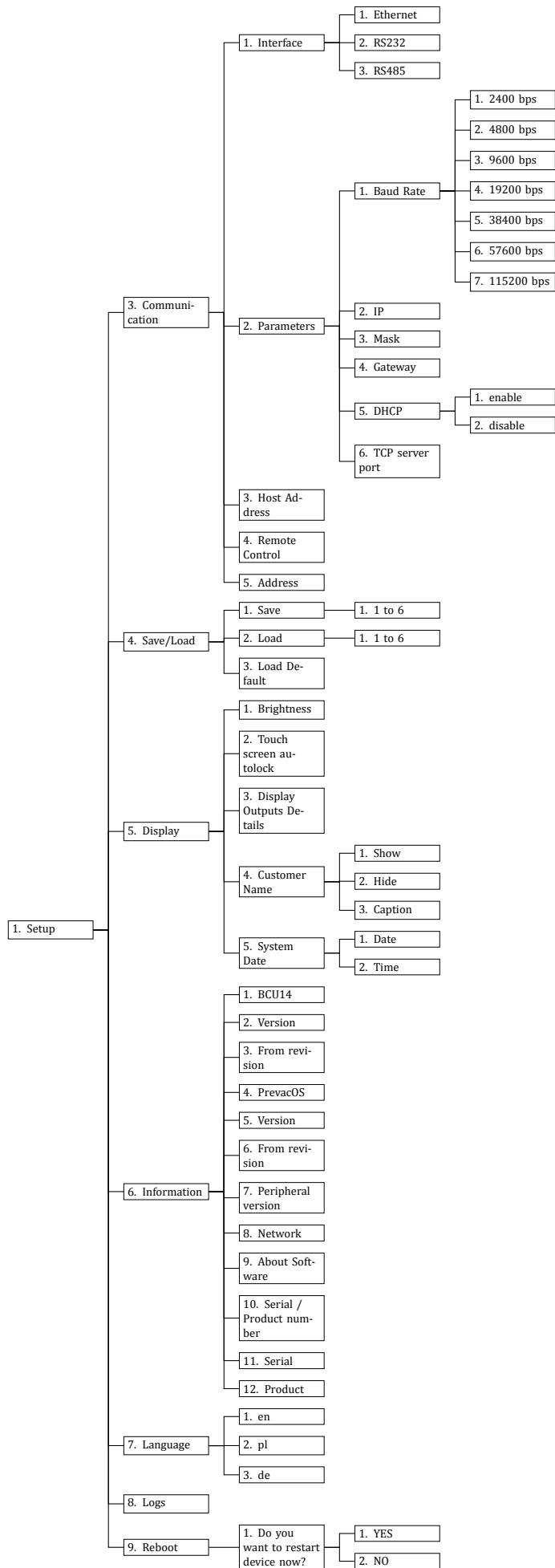
Figure 3.27: Copy *.avi to device

3.4 SETUP MENU

Allows access to the device configuration options such as geometry, communication, etc. To store the changes, save them in accordance with instructions from the section 3.5.3.

3.5 SETUP MENU TREE





3.5.1 ZONE 1 / ZONE 2

Where the parameters relating to each heating zone are set. The sub-menus allow user to set the following parameters:

3.5.1.1 Temperature

This submenu displays an actual target temperature. Temperature adjustment is limited between 0 - 1200°C.

To change actual value:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap **Temperature**.
3. Enter desired value on the numeric keyboard.
4. Confirm by tapping **Enter** button.
5. The new value for the target temperature has been set.

The target temperature can also be modified by clicking on the temperature for the zone on the main screen (see Fig. 3.28):



Figure 3.28: Changing the target temperature

3.5.1.2 Fan start temp

The temperature at which the fans are switched on or off for each channel/zone. Only active when the regulator on a particular zone is OFF. If regulator is ON, FAN is active independently of temperature value.

Temperature adjustment is limited between 0 - 150°C.

To change actual value, proceed in the same way as when changing the target temperature.

CAUTION



The fan is always on during heating. If heating is off, fan is off while actual temperature is lower than adjusted fan temperature, otherwise it remains on.

3.5.1.3 Control type

In this submenu the user can change the operational mode of a particular zone.

If the description is **TIMER**, the time of operation is counted down from the predefined value (Regulated Out Timer) as soon as actual zone temperature reaches **95%** of the target zone temperature. Until this moment is reached, the device operates to heat the zone as normal. After the predefined time has counted down to 00:00, the controller stops heating and goes into standby state.

The time counter works in a similar way when the device is in **MANUAL** mode but does not start to count upwards until the temperature reaches **95%** of the target temperature.

In both modes, either counting up or down, the time separator (colon) blinks during counting and is steady when the timer clock has stopped.

To change actual value:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap **Control type**.
3. Tap on the desired control type: **Timer** or **Manual**.
4. Zone operational mode has now been set.

Control type can also be modified by clicking on the arrow icon on the main screen (see Fig. 3.29):

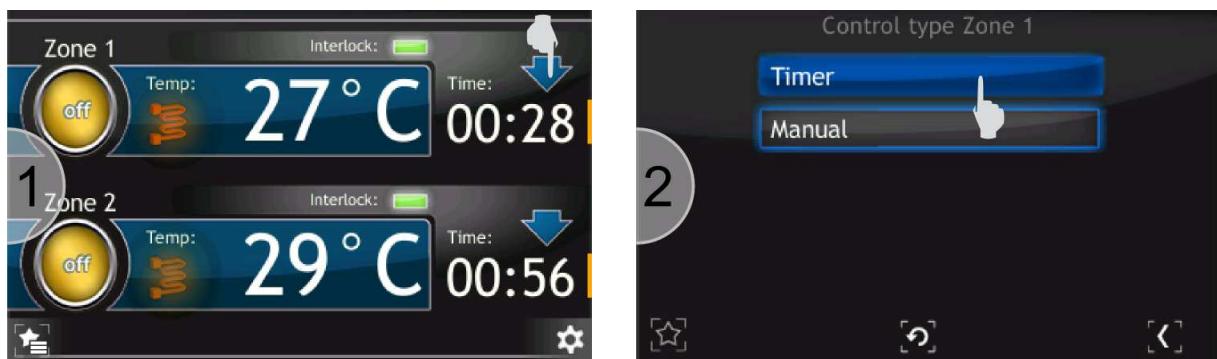


Figure 3.29: Control type change

3.5.1.4 Regulated Out Timer

In this submenu the user can change the Bake Timer value. Bake Timer determines the heating time/duration over which the actual temperature must not differ more than **5%** from the target temperature. Period length is between 00:01 – 99:59 (hh:mm).

To change actual Bake Timer value:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.

2. Tap **Regulated Out Timer**.
3. Tap **Hours** or **Minutes**.
4. Enter desired value on the numeric keyboard.
5. Confirm by tapping **Enter** button.
6. New value for Bake Timer has now been set.

Bake timer value can also be modified by clicking on the clock on the main screen (see Fig. 3.30):

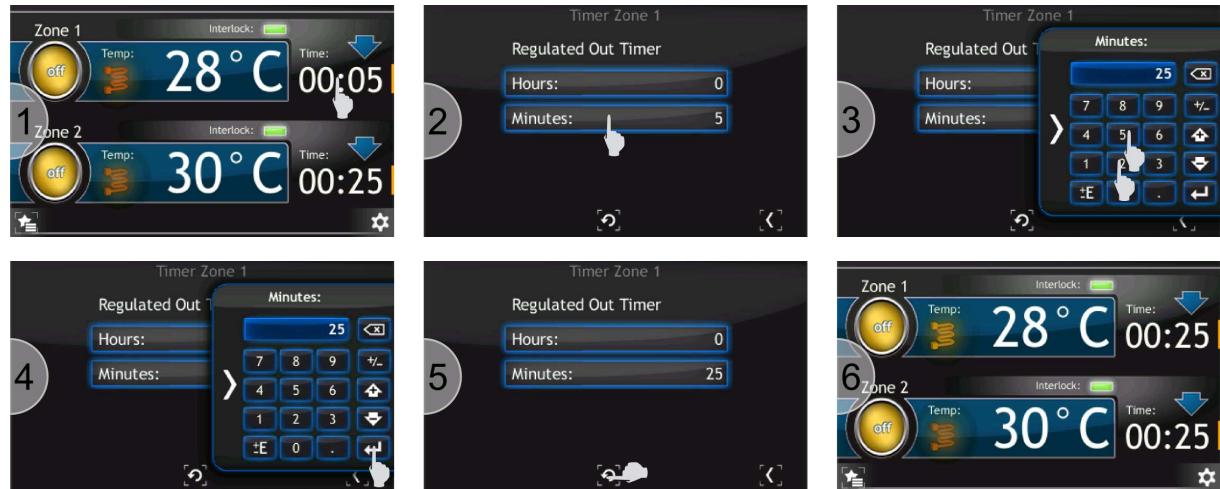


Figure 3.30: Bake timer value



Bake Time value applies in TIMER mode only. It does not apply in MANUAL mode.

3.5.1.5 Continuous Out Timer

In this submenu the user can change and view the current value of the Continuous Timer. This value determines the working time/duration for continuous output. The time is adjustable over the range 00:01 – 99:59 (hh:mm), **but the value cannot be larger than Regulated Out Timer value.**

If the **regulated timer** value change to less than **continuous timer** then **continuous timer** value will be adjusted automatically to value equal **Regulated timer**. For example: Continues timer value is set to 12:00(hh:mm). Regulated timer value is changes to 10:00(hh:mm) then Continues timer value is automatically adjusting to 10:00(hh:mm). Setting a large **regulated timer** value does not affect to the **continuous timer** settings.

CAUTION



Before the start the bakeout process in which **continuous output** is used. Check the **Continuous Out Timer** settings to ensure that the output will work for the required time.

To change actual Continuous Timer value:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap **Continuous Out Timer**.
3. Tap **Hours or Minutes**.
4. Enter desired value on the numeric keyboard.
5. Confirm by tapping **Enter** button.
6. New value for Continuous Timer has now been set.

3.5.1.6 Ramp / Ramp Unit

In this submenu the user can change and view the actual ramp rate value and unit.

This value determines the rate of bakeout temperature rise. The ramp rate temperature growth is limited between 1°C/h - 100°C/s. This setting can vary – the heating rate value will be calculated per hour or minute or second, dependent on user choice. For example, if the user selects 55°C/h, the warm up phase may take a long time, depending on the target temperature.

To change actual Ramp Rate value/unit:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap **Ramp / Ramp Unit**.
3. For **Ramp Unit** tap desired unit.
4. For **Ramp** enter desired value on the numeric keyboard.

5. Confirm by tapping **Enter** button.
6. New value for Ramp Rate/Unit has now been set.



Ramp Rate value means upper limit of ramp rate. The actual heating rate will depend on the thermal characteristics of the system as a whole. See chapter 1.3 for details.

3.5.1.7 Cooling Ramp

Option responsible for the way ending heating process. It allows for a gradual removal of power from the heaters after bakeout procedure.

If **Cooling Ramp** is **OFF** - bakeout procedure is ending normally by immediate shutdown of the regulated output.

If **Cooling Ramp** is **ON** - after heating time a progressive decrease temperature setpoint according **RAMP** value. The process continues until the setpoint value drops to 50°C, then regulated output is shutdown.

Actual Setpoint value is available on main screen if **Display details outputs** is **ON**.

3.5.1.8 Interlock Autostart

If the description is **Interlock Autostart: OFF**, the controller DOES NOT automatically re-start the regulator after loosing the external INTERLOCK signal, therefore BCU14 remains in standby mode.

If **Interlock Autostart: ON** is chosen, the device resumes heating mode (after INTERLOCK loss) as soon as the INTERLOCK signal returns.

To change Interlock Autostart parameter:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap the down arrow.
3. Tap **Interlock Autostart**.
4. The parameter should be changed to the opposite.

3.5.1.9 Power Fail In

If the description is **Power Fail In: Intern**, then the power failure signal is taken from the internal BCU14 power supply watchdog device.

If the description is **Power Fail In: Extern**, then the power failure signal is taken from the EXT2 connector on the rear panel. For a more detailed description about the connection, see chapter 2.4.11.

To change Power Fail Input:

1. Go to menu **Setup Menu -> Zone 1 or Zone 2 ->**.
2. Tap the down arrow.
3. Tap **Power Fail In**.
4. The parameter should be changed to the opposite.

3.5.2 COMMUNICATION SETTINGS

To change communication settings go to: **Setup Menu -> Communication**

The communication setup allow to configure remote control interface. Allow options:

- **Interface** - determines which interface will be used for communication,
- **Parameters** - advanced parameters for selected module,
- **Host Address** - the device ID that have permission to control (save and set parameters),
- **Address** - the current address,

There are three types of communication interfaces available in the BCU14 :

- **Ethernet**
- **RS232**
- **RS485**

For details about pin assignment of RS232/485 see subsection 6

To change communication interface go to: **Setup Menu -> Communication -> Interface**

Each communication interface is configured in **Parameters** submenu (**Setup Menu -> Communication -> Parameters**):

- **Baud Rate** (for interface RS232/RS485 only):
 - available speeds 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps,
 - 8 bits of data, 1 bit stop and no parity parameters are fixed and cannot be changed,
- **IP** - adjusted manually if DHCP is disabled. Automatically set in the opposite case, when the device is powered on,
- **Mask** - subnetwork mask (logically subdivision of an IP network),
- **Gateway** - default gateway on a TCP/IP network,

- **DHCP** - Dynamic Host Configuration:
 - **enable** - automatic configuration on connection (IP address, gateway, subnet mask),
 - **disable** - IP protocol parameters must be set manually,
- **TCP server port** - specifies the port number used in network socket created by TCP server,

3.5.3 SAVING AND LOADING SETTINGS

To save or load parameters go to: **Setup Menu -> Save/Load**

When the BCU14 is powered off, the current device settings are lost. However, there are up to six different parameters slots which can be used to store current device parameters. Each can have an individual name and parameter set. The current status of the device (parameter values) can also be stored in memory.

In order to save the device configuration:

1. Go to menu **Setup Menu -> Save/Load -> Save**.
2. Choose one of the sockets where settings will be stored (previous parameters will be erased) and tap it.
3. Enter desired name using keyboard.
4. Tap **Enter** button in order to accept given name.
5. Current parameters will be saved in the selected slot with a given name.

Restoring the saved settings is also achieved via the configuration menu. In order to load previously saved settings:

1. Go to menu **Setup Menu -> Save/Load -> Load**.
2. Choose one of the slots from which device settings will be loaded and tap it.
3. Selected device settings will be loaded.

Default factory settings may also be loaded as follows:

1. Go to menu **Setup Menu -> Save/Load**.
2. Tap **Load Default** in order to load factory settings.

3.5.4 DISPLAY SETTINGS

To change display settings go to: **Setup Menu -> Display**

In **Display** submenu it is possible to change the following settings:

Brightness - display brightness value. Value can be in range 10-100

Touch Screen Autolock - When the value is set to ON the autolock function is active. If the touch panel is not used for longer than 3 min then the screen is locked. Unlock the device by pressing the "Yes" in the displayed message.

Display Outputs Details - When the value is set to ON then on main screen is show additional information like: Output status(Regulated, Continuous and Fan), Setpoint value and Actual Setpoint value(controlled by RAMP parameter).

Customer Name - The device can be assigned individual name that appears on the top of main screen. This allows to distinguish between several devices of the same type.

System Date - The device has a built-in **real time clock** (RTC). The menu allows you to set the current date and time.

Setting a date should be the individual parts separated using the sign "-". For example: **21-03-2014**

Setting a time should be the individual parts separated using the sign ":". For example: **13:20:22**.

Alternate form of save time that are accepted: **3:4:5 -> 03:04:05, 12:8:1 -> 12:08:01**

3.5.5 INFORMATION MENU

To display menu information go to:

Setup Menu -> Information.

This menu contains information about the device name and version, the current software version, serial and product number as well as the network parameters such as IP address, netmask and gateway.

Service Maintenance - Display actual regulator output value(range 0-100%) for each zone.

3.5.6 LANGUAGE MENU

This submenu allows to change the device language.

In order to select the language go to **Setup menu -> Language.**

To finish change the language the device must be reset.

3.5.7 LOGS MENU

To display logs menu go to **Setup Menu -> Logs.**

This submenu displays the error history log. Displayed list of errors includes a description and the date of its occurrence

3.5.8 REBOOT

Restart the application running on the device. To restart device go to **Setup Menu -> Reboot.**

4 STEP BY STEP

The following section provides an example of the steps required to perform a typical bakeout procedure.

4.1 START HEATING IN THE TIMER MODE

1. Install the BCU14 in a vacuum system, see section 2.4 - *Installation*.
2. Make sure that all the cables are attached to the device (power to the regulated heaters, power to the heating elements do not require regulation, power supply to the fan, thermocouple wires).
3. Turn on the device, see section 3.1 - *Turn on device*.
4. Check and confirm that the thermocouple cable does not have any signs of damage.
5. Check that all enable signals are available (interlocks, master interlock, power failure). If a signal is not controlled by an external device, simulate the presence of a signal with a simple jumper connection.
6. Set the target temperature.
7. Set the maximum temperature ramp rate value and unit.
8. Set the control mode: Timer.
9. Set the time that will operate regulated output.
10. Set the time that will operate non-regulated output.
11. Turn on the heating for the selected area.
12. The BCU14 output voltage is applied (regulated, non-regulated output and fan output).
13. After some time the object's temperature begins to rise (temperature ramp rate depends primarily on the size of the facility and its heat capacity).
14. After the object reached the $\pm 5\%$ of target temperature the timer counting down is activated.
15. The object temperature is kept at a set level for a specified time.
16. If during temperature stabilization, the difference between the temperature set point and the actually read value is more than 5%, then time will stop counting. Resume counting occurs when the temperature of the object will be in the range $\pm 5\%$ of the target.
17. If, in the course of stabilization, the temperature rises above 20 degrees of the set temperature, the heating in the zone will be turned off immediately.
18. If the time for non-regulated output was set less than the master clock time, the unregulated output will be turned off before.
19. After a preset time reaches 00:00, regulated output will be turned off.

4.2 START HEATING IN THE MANUAL MODE

1. Install the BCU14 in a vacuum system, see section 2.4 - ***Installation***.
2. Make sure that all the cables are attached to the device (power to the regulated heaters, power to the heating elements do not require regulation, power supply to the fan, thermocouple wires).
3. Turn on the device, see section 3.1 - ***Turn on device***.
4. Check and confirm that the thermocouple cable does not have any signs of damage.
5. Check that all enable signals are available (interlocks, master interlock, power failure). If a signal is not controlled by an external device, simulate the presence of a signal with a simple jumper connection.
6. Set the target temperature.
7. Set the maximum temperature ramp rate value and unit.
8. Set the control mode: Manual.
9. Turn on the heating for the selected area.
10. The BCU14 output voltage is applied (regulated, non-regulated output and fan output).
11. After some time the object's temperature begins to rise (temperature ramp rate depends primarily on the size of the facility and its heat capacity).
12. After the object reached the $\pm 5\%$ of target temperature the timer counting up is activated.
13. The object temperature is kept at a set level.
14. If during temperature stabilization, the difference between the temperature set point and the actually read value is more than 5%, then time will stop counting. Resume counting occurs when the temperature of the object will be in the range $\pm 5\%$ of the target.
15. If, in the course of stabilization, the temperature rises above 20 degrees of the set temperature, the heating in the zone will be turned off immediately.
16. Work in this mode continues until it is interrupted by the user or the heating time reached 99h: 59min.

4.3 CONFIGURATION COMMUNICATION INTERFACE

The following procedure to configure the module RS232 to work at a rate of 19200 bps:

1. Tap Menu Bar
2. Tap Setup Menu
3. In the configuration menu select the Communication -> Module.
4. From the list select the module RS232.
5. Tap Parameters option.
6. The list describes highlighted display parameters that can be configured in the module, other options are grayed.
7. Tap Baud Rate.
8. In the displayed list, select the appropriate baud rate 19200 bps.

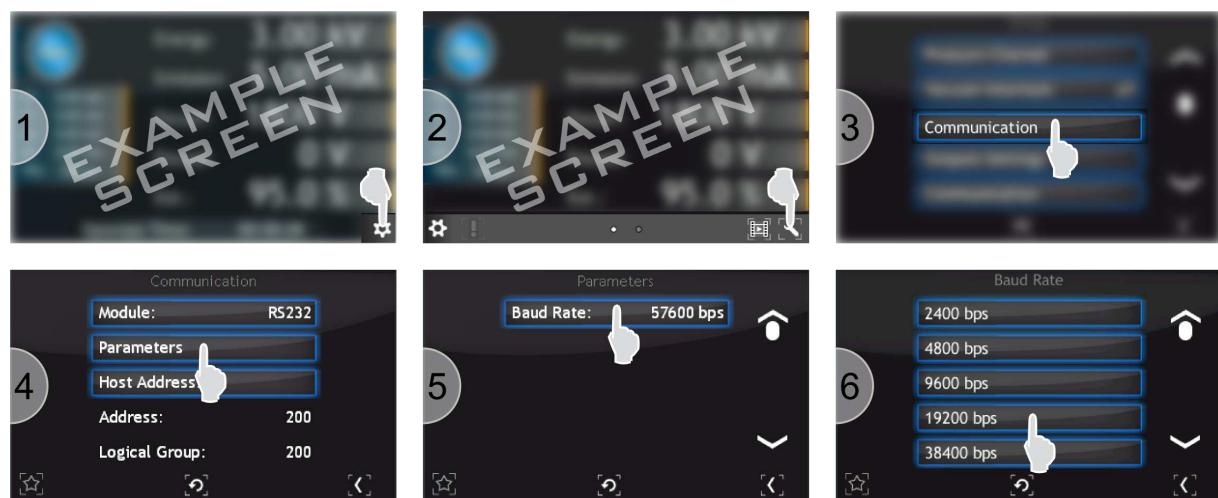


Figure 4.1: Configuration communication interface

4.4 LANGUAGE SELECTION

In order to select the language:

1. Tap Menu Bar
2. Tap Setup Menu
3. Tap Language
4. Enter desired language
5. Tap Yes to reboot the device

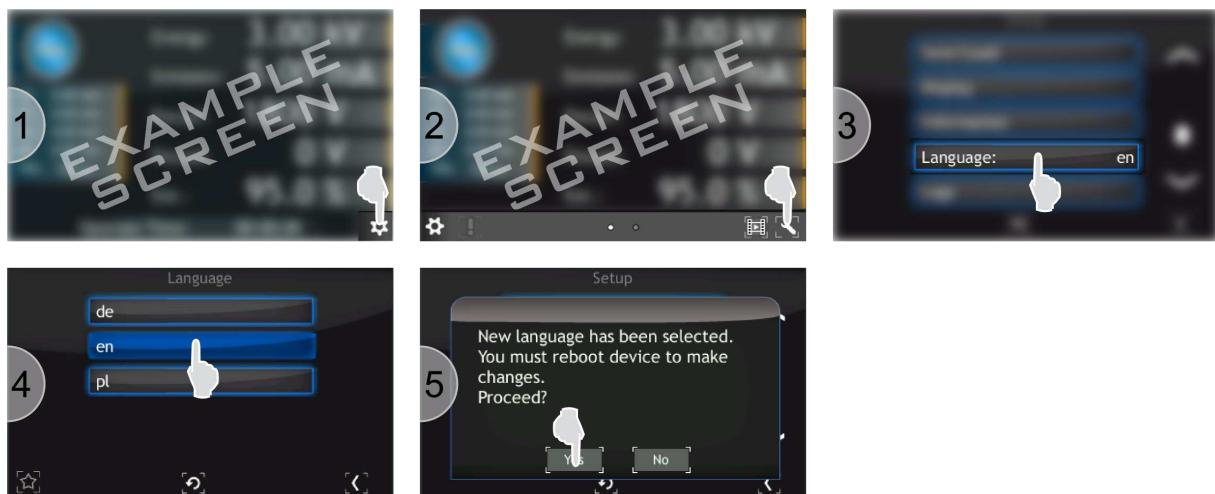


Figure 4.2: Selecting language

4.5 INFORMATION

This menu contains information about the device name and version, the current software version as well as the network parameters such as IP address, netmask and gateway.

In order to view this information:

1. Tap Menu Bar
2. Tap Setup Menu
3. Tap Information
4. Information about the device are displayed

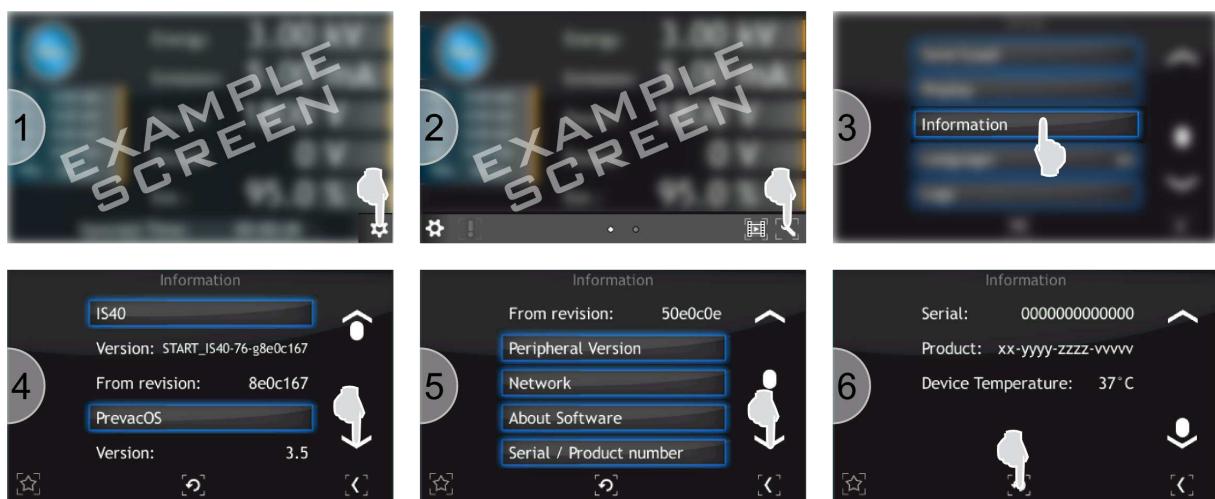


Figure 4.3: Device Information

5 TROUBLESHOOTING

This section describes the errors, warnings and notifications appearing in BCU14 . All information displayed on the screen is divided into two groups:

- Errors and warnings which relate primarily to the device hardware are displayed in the message bar on the right side of the screen. They are identified by the colours red and yellow (for more information about them can be found in the chapter on user interface). Error disappears from the bar when it will be physically eliminated. This information is stored in 5.1 section.
- All information that is not directly related to operation of the device is displayed as a message box. This information presents notifications after user interaction. More information can be found in section 5.2.

5.1 MESSAGE BAR NOTIFICATIONS

5.1.1 ERRORS

- **E01: The connection to mainboard has been lost. Error Code: <number>** Connection to the mainboard has been lost. Error code is displayed in order to find the source of the problem.
- **E02: We hightly recomend to remove videos from device.** Error resulting from the insufficient space on the SDHC card. In order to free up some space, delete some videos.
- **E03: Not enough space on the disk.** The amount of space on the USB drive is less than 2 megabytes. Please remove videos from your device.
- **E04: Stopped heating. Power Failure.** The heating was interrupted because of failure of the main power supply.

Possible causes:

- The main power cord was disconnected,
- No power is supplied power cord,
- Incorrect supply voltage,
- There was a short circuit in the load circuit. Fuse is off.

Activities:

- Check the condition of fuse F1 on the rear panel,
- Make sure that the power is supplied to the device,
- Check that the electrical parameters correspond to the information on the nameplate,
- Check for power load has been not exceeded.

- **E05: Stopped heating. Zone <zone number>. No sensor!** The heating was interrupted because there is no temperature reading from the thermocouple.

Possible causes:

- Not connected thermocouple wire,
- Defective thermocouple wire.

Activities:

- Check the appropriate thermocouple is connected (Type K),
- Check that the plug is properly inserted into the socket on the rear panel (polarity),
- Replace the sensor.

- **E06: Stopped heating. No Master Interlock!!**

During the heating process Master Interlock signal disappeared. (Pin 3 on EXT2 connector).
Possible causes:

- No signal permitting to heating (EXT2 connector pin 3),
- Master Interlock signal cable is damaged.

Activities:

- Check master Interlock signal cable,
- Master Interlock signal is not available (for administration interlock signal from another device).

- **E07: Heating interrupted. Error controller.**

The heating was discontinued due to lack of temperature reading.

Possible causes:

- Heating was discontinued due to physical damage to the power regulator inside the unit.
This message is displayed if during the bakeout process the temperature setpoint is exceeded by more than 20 degrees Celsius.

Activities:

- Turn off the power, check the power heaters, if the cables are not reversed or shorted,
- Check the temperature setting, if all is correct, contact the manufacturer.

5.1.2 WARNINGS

- **W01: Low Disk Space: We suggest to remove videos from device.** Warning resulting from insufficient space on the SDHC card. In order to free up some space, delete some videos.

- **W02: Heating unable. Zone <zone number>. No 'Interlock'!!** You can not turn on the heat because Interlock signal is missing in selected zone. (Pin 1 or 2 on EXT2 connector).

Possible causes:

- Interlock signal cable is damaged,
- Interlock signal is not available (for administration interlock signal from another device),

- **W03: Heating unable. Power Failure.** You can not turn on the heat because of failure of the main power supply.

Possible causes:

- The main power cord was disconnected,
- No power is supplied power cord,

- Incorrect supply voltage,
- There was a short circuit in the load circuit. Fuse is off.

Activities:

- Check the condition of fuse F1 on the rear panel,
- Make sure that the power is supplied to the device,
- Check that the electrical parameters correspond to the information on the nameplate,
- Check for power load has been not exceeded.

- **W04: Heating unable. Zone <zone number>. No sensor!** You can not turn on the heat because there is no temperature reading from the thermocouple.

Possible causes:

- Not connected thermocouple wire,
- Defective thermocouple wire.

Activities:

- Check the appropriate thermocouple is connected (Type K),
- Check that the plug is properly inserted into the socket on the rear panel (polarity),
- Replace the sensor.

- **W05: Heating unable. No Master Interlock!!**

You can not turn on the heat because Master Interlock signal disappeared. (Pin 3 on EXT2 connector).

Possible causes:

- No signal permitting to heating (EXT2 connector pin 3),
- Damaged signal cable.

Activities:

- Master Interlock signal cable is damaged,
- Master Interlock signal is not available (for administration interlock signal from another device).

5.2 MESSAGE BOX NOTIFICATIONS

- **M01: Copy summary: Error when copying a log file.**

Copying Log file failed.

- **M02: Copy summary: Error when copying a translation file.**

Copying the translation file failed.

- **M03: Copy summary: Error: Copying log file timeout.**

Copying the log file took too long, the copying process was interrupted.

- **M04: Copy summary: Error: Copying translation file timeout.**

Copying the translation file took too long, the copying process was interrupted.

- **M05: Copy summary: Error: No space left on USB.**

Copying Log file failed due to lack of sufficient space on the USB. Free some space and then copy Log file again.

- **M06: Copy Summary: Error: No space left on device.**

Disk space on the SDHC reached a critical level. In order to free space remove videos.

- **M07: Copy summary: File successfully copied.**

Copying process was performed successfully.

- **M08: Copy summary: Log file has been copied.**

Copying Log file completed successfully.

- **M09: Copy summary: No usb found.**

Message informing about absence of USB, which could occur for example when someone pull it while copying.

- **M10: Translation file has been copied.**

Translation file copy process ran correctly.

- **M11: DHCP client couldn't obtain ip address.**

Attempt to obtain an IP address from the DHCP server failed. Check the device connection to the network and the status of DHCP server.

- **M12: New language has been selected. You must reboot device to make changes. Proceed?**

After selecting one of the available languages, you must reboot the device to apply the changes.

- **M13: Parameters has been loaded.**

Process of reading the stored device settings ran correctly.

- **M14: Copy summary: <Summary> Click OK to reset the device.**

After reading summary informations tap "OK" button in order to reboot device.

- **M15: Copy summary: Mainboard: Everything is up to date. Click OK.**

Message informing that following elements (mainboard, bus etc) are up to date.

- **M16: Proceed ?**

The message a confirmation before turning on heating.

6 REMOTE CONTROL

This chapter describes how to communicate with the device BCU14 with the selected interface. Control BCU14 is possible via one of three interfaces installed on your device RS232, RS485, Ethernet. Only one of these interfaces can be used at the same time. Selection and configuration of the communication interface is done as described in subsection 3.5.2.

6.1 CONNECTION PARAMETERS

PARAMETER	VALUE
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Baud rate	57600 (default value)

Table 6.1: Connection parameters

6.2 DATA FRAME

DATA FRAME	
Byte	Description
1 - HEADER	First byte is responsible for identifying the serial protocol. Header in hexadecimal is 0xBB
2 - DATA LENGTH	Length of the data field. Maximum data file length is 0xFF (256 bytes). Prevac Serial Protocol
3 - DEVICE ADDRESS	Identification of hardware device address. Default value is 0xC8
4 - HOST ADDRESS	Host identification address. Assigned to host during the registration process (using a unique ID).
5 - FUNCTION CODE - MSB	First procedure function code byte 8th (MSB) bit is the read(0)/write(1) select bit
6 - FUNCTION CODE - LSB	Second procedure function code byte

continued on next page

continued from previous page	
Byte	Description
7 .. [7 + DATA LENGTH] - DATA FIELD	Data capture needed to realize defined functions.
[7 + DATA LENGTH] + 1(last frame position) - CRC	CRC is simple module 256 calculated without protocol header byte(see section 6.2.4)

Table 6.2: Data frame

6.2.1 ORDER TYPES

There are two types of commands:

- write orders,
- read orders.

Type the command defines the most significant bit of command code (see 6.2). If the bit is a logical "1", then the function code is interpreted as a command Save/Set. Otherwise, the order read. For example: order 0x7F06(set customer Name) allow read customer Name, and order 0xFF06(MSB set to "1") allow set customer Name.

Command structure

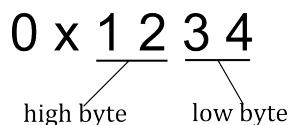


Figure 6.1: Command structure

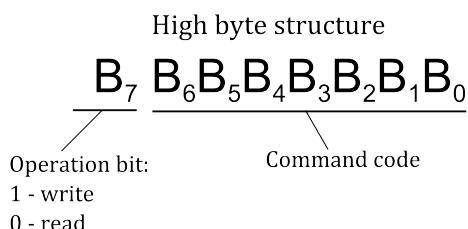


Figure 6.2: High byte command structure

For a read command, the device returns the value in a specific data type assigned to the command (see tables of orders).

For orders write the answers may be as follows:

- write command is correct (proper type, has the appropriate length and value), the device responds 0x00 value in the last byte in the data field.
- write order is incorrect, the device return error code in the last data field byte as shown in Table ref Global communication status codes.

WARNING**Read/Write Parameters.**

Reading the parameters of the device is always allowed (even if the device is not in REMOTE CONTROL mode).

Writing parameters to the device requires:



- switching device in REMOTE CONTROL mode,
- registration using a unique ID
- receive permission to control as *Master*.

The registration procedure host is described in subsection 6.3

6.2.2 APPLIED DATA TYPES

DATA TYPE	DESCRIPTION	EXAMPLE
ASCII	The text value of the length specified in the <i>DATA LENGTH</i>	"CUSTOMER"
Long	4 bytes integer value in <i>Big endian</i> format(The most significant byte is placed first in data field)	0x000082AC
Byte	1 byte integer value, used for enumerate type and control command(ON/OFF)	0x05
Bool	true/false value (0 = false, 1 = true)	0x01, 0x00
Double	8 bytes value in IEEE 754 double-precision binary floating-point in <i>Big endian</i> format(The most significant byte is placed first in data field)	0x4028 A4DD 2F1A 9FBE

Table 6.3: Data types

6.2.3 INDEXING

There are 3 types of orders because of the type of indexing:

- indexed - require an index on first byte of data fields in order to appeal to a particular object (module) on the device. On the following bytes to put the data in a format compatible with the type of order.
- indexed (no matter) - the index does not matter, but it is necessary to provide an index (eg. 1) on first byte data field. On the following bytes to put the data in a format compatible with the type of order
- without an index - only orders from the global group (see global commands table). The value we put from the first byte of the data field.

For example, reading the vacuum level from device that has 2 vacuum channels, needs to be sent command 0x0101 with the index 0x01 to read the value of the first channel:

TX: BB 01 C8 01 01 01 01 CD

Index and 0x02 to read the value of the second channel:

TX: BB 01 C8 01 01 01 01 02 CE.

WARNING



Index out of range.

If the index value is outside the range defined for a given command, the device returns the error code 0x93 in the last position of the data field.

If the order requires indexing, the table specified item *index* with the scope of change. If the order does not apply to index this field *Index* is not specified in the table.

6.2.4 CRC

CRC is simple modulo 256 calculate without protocol header byte. Below is a sample code for the enumerator checksum value.

```
1 || quint8 mod256_CRC = 0;
2 || for(i= 1; i <= InputFrame->size; i++) mod256_CRC += InputFrame(i);
```

6.3 EXAMPLES

6.3.1 READ PARAMETERS FROM DEVICES

Read FG pressure value (Function code 0x0101, data field: 0x01 (index): **Request:**

TX: BB 01 C8 01 01 01 01 CD

Answer (CH1=6.25 E-2):

RX: BB 09 C8 01 01 01 01 3F B0 00 00 00 00 00 00 C4

6.3.2 SETUP PARAMETERS

Shutter control (Function code 0x8207, data field: 0x01 (index), 0x01 (1-ON / 0-OFF)

Request:

TX: BB 02 C8 01 82 07 01 01 56

Answer:

RX: BB 02 C8 01 82 07 01 00 55

Command executed correctly: last byte in data field equal 0.

Setting the target temperature out of range(Function code 0x8706, data field: 0x01[index], 1500.0 [target temperature])

Request:

TX: BB 09 C8 01 87 06 01 40 97 70 00 00 00 00 00 A7

Answer:

RX: BB 02 C8 01 87 06 01 91 EA

The order not executed: returned error code 0x91 in last byte data field (value too high - see ??).

6.3.3 TAKING OVER CONTROL AS MASTER

Request:

TX: BB 01 C8 01 FF F1 01 BB

Answer:

RX: BB 01 C8 01 FF F1 00 BA

The data field equal to 0 - to take control goes correctly.

6.4 UNIQUE ID

For proper operation of mechanism for the allocation numbers of hosts is necessary to ensure that each computer using the unique ID during the registration process host(command 0x7FF0). A unique string of characters can be extracted from the operating system using the codes explained the program.

6.4.1 WINDOWS OPERATING SYSTEM

```

1 #define _WIN32_DCOM
2 #include <comdef.h>
3 #include <comutil.h>
4 #include <Wbemidl.h>
5 #pragma comment(lib, "wbemuuid.lib")
6
7 long get_uuid(char** uuid, int* size)
8 {
9     HRESULT hr = CoInitializeEx(0, COINIT_MULTITHREADED);
10    if (FAILED(hr))
11        return 1;
12
13    hr = CoInitializeSecurity(
14        NULL,
15        -1,                               // COM authentication
16        NULL,                             // Authentication services
17        NULL,                             // Reserved
18        RPC_C_AUTHN_LEVEL_DEFAULT,       // Default authentication
19        RPC_C_IMP_LEVEL_IMPERSONATE,   // Default Impersonation
20        NULL,                             // Authentication info
21        EOAC_NONE,                        // Additional capabilities
22        NULL                              // Reserved
23    );
24

```

```

25     if (FAILED(hr)) {
26         CoUninitialize();
27         return 1;
28     }
29
30     IWbemLocator *pLoc = NULL;
31
32     hr = CoCreateInstance(
33         CLSID_WbemLocator,
34         0,
35         CLSCTX_INPROC_SERVER,
36         IID_IWbemLocator, (LPVOID *)&pLoc);
37
38     if (FAILED(hr)) {
39         CoUninitialize();
40         return 1;
41     }
42
43     IWbemServices *pSvc = NULL;
44
45     hr = pLoc->ConnectServer(
46         _bstr_t(L"ROOT\\CIMV2"), // Object path of WMI namespace
47         NULL, // User name. NULL = current user
48         NULL, // User password. NULL = current
49         0, // Locale. NULL indicates current
50         NULL, // Security flags.
51         0, // Authority (for example, Kerberos)
52         0, // Context object
53         &pSvc // pointer to IWbemServices proxy
54     );
55
56     if (FAILED(hr)) {
57         pLoc->Release();
58         CoUninitialize();
59         return 1;
60     }
61
62     hr = CoSetProxyBlanket(
63         pSvc, // Indicates the proxy to set
64         RPC_C_AUTHN_WINNT, // RPC_C_AUTHN_xxx
65         RPC_C_AUTHZ_NONE, // RPC_C_AUTHZ_xxx
66         NULL, // Server principal name
67         RPC_C_AUTHN_LEVEL_CALL, // RPC_C_AUTHN_LEVEL_xxx
68         RPC_C_IMP_LEVEL_IMPERSONATE, // RPC_C_IMP_LEVEL_xxx
69         NULL, // client identity
70         EOAC_NONE // proxy capabilities
71     );
72
73     if (FAILED(hr)) {
74         pSvc->Release();
75         pLoc->Release();
76         CoUninitialize();
77         return 1;
78     }
79
80     IEnumWbemClassObject* pEnumerator = NULL;
81     hr = pSvc->ExecQuery(
82         bstr_t("WQL"),
83         bstr_t("SELECT * FROM Win32_ComputerSystemProduct"),
84         WBEM_FLAG_FORWARD_ONLY | WBEM_FLAG_RETURN_IMMEDIATELY,
85         NULL,
86         &pEnumerator);
87

```

```
88     if (FAILED(hr)) {
89         pSvc->Release();
90         pLoc->Release();
91         CoUninitialize();
92         return 1;
93     }
94
95     IWbemClassObject *pclsObj = NULL;
96     ULONG uReturn = 0;
97
98     while (pEnumerator)
99     {
100         HRESULT hr = pEnumerator->Next(WBEM_INFINITE, 1, &pclsObj, &
101                                         uReturn);
102
103         if (uReturn == 0)
104             break;
105
106         VARIANT vtProp;
107
108         hr = pclsObj->Get(L"UUID", 0, &vtProp, 0, 0);
109         *size = SysStringLen(vtProp.bstrVal);
110         *uuid = _com_util::ConvertBSTRToString(vtProp.bstrVal);
111         // ConvertBSTRToString allocates a string you must delete!
112         VariantClear(&vtProp);
113
114         pclsObj->Release();
115     }
116
117     pSvc->Release();
118     pLoc->Release();
119     pEnumerator->Release();
120     CoUninitialize();
121
122     return 0;
123 }
124 // Usage example:
125 //     char* uuid;
126 //     int size;
127 //     get_uuid(&uuid, &size);
128 //     // do sth with uuid
129 //     delete[] uuid;
```

6.4.2 LINUX - OPERATING SYSTEM

```
1 #include <stdio.h>
2 #include <stdlib.h>
3
4 // First make a copy of /sys/class/dmi/id/product_uuid to your source directory.
5 // Type: sudo cp /sys/class/dmi/id/product_uuid ./product_uuid
6 // Then change file attributes of the file you've copied.
7 // Type: sudo chmod 777 ./product_uuid
8
9 long get_uuid(char** uuid, int* size)
10 {
11     long error = -1;
12     FILE *file = popen("cat ./product_uuid | egrep '[A-Fa-f0-9]{8}-[A-Fa-f0-9]{4}-[A-Fa-f0-9]{4}-[A-Fa-f0-9]{4}-[A-Fa-f0-9]{12}'", "r");
13     if (file != NULL) {
14         *size = 36;
15         *uuid = (char*)malloc(*size+1);
16         // Allocated buffer you must free!
17         if (*uuid != NULL) {
18             fread(*uuid, 1, *size, file);
19             (*uuid)[*size] = 0;
20             error = 0;
21         }
22     }
23     pclose(file);
24 }
25 return error;
26 }
27 }
28
29 // Usage example:
30 //     char* uuid;
31 //     int size;
32 //     get_uuid(&uuid, &size);
33 //     // do sth with uuid
34 //     free(uuid);
```

6.4.3 ORDERS TYPES

There are two types of commands:

- Read/Write orders,
- Read only orders,

For read commands, the device returns the requested value in the specified data format.

For write commands, the depends on the send value:

- When send value is correct(correct type, has the correct length and value), then device sends 0x00 value into data field. The answer is located in last byte of the data field,
- When send value is incorrect, an appropriate error code is sent in the last byte of the data field.

6.4.4 REGISTER NEW HOST

If the remote controller connects to the device first time, follow the procedure for obtaining a host address according to the diagram below.

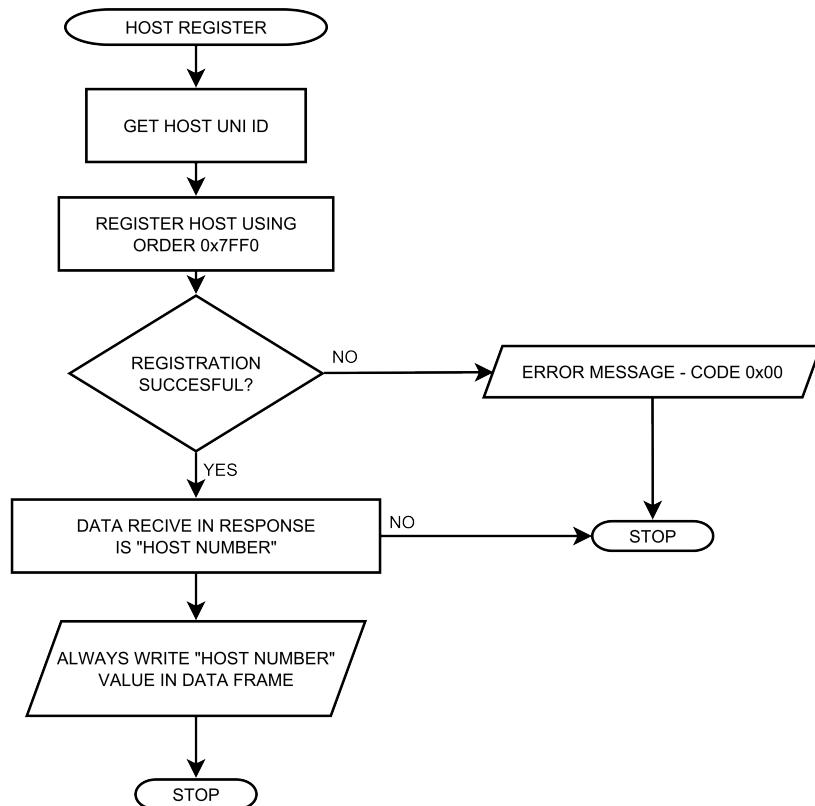


Figure 6.3: Host assign - diagram

Description of the allocation host number order is contained in the table 6.29.

Below is an example procedure for the preparation of a new host address. And then send a command set to Setpoint Low value.

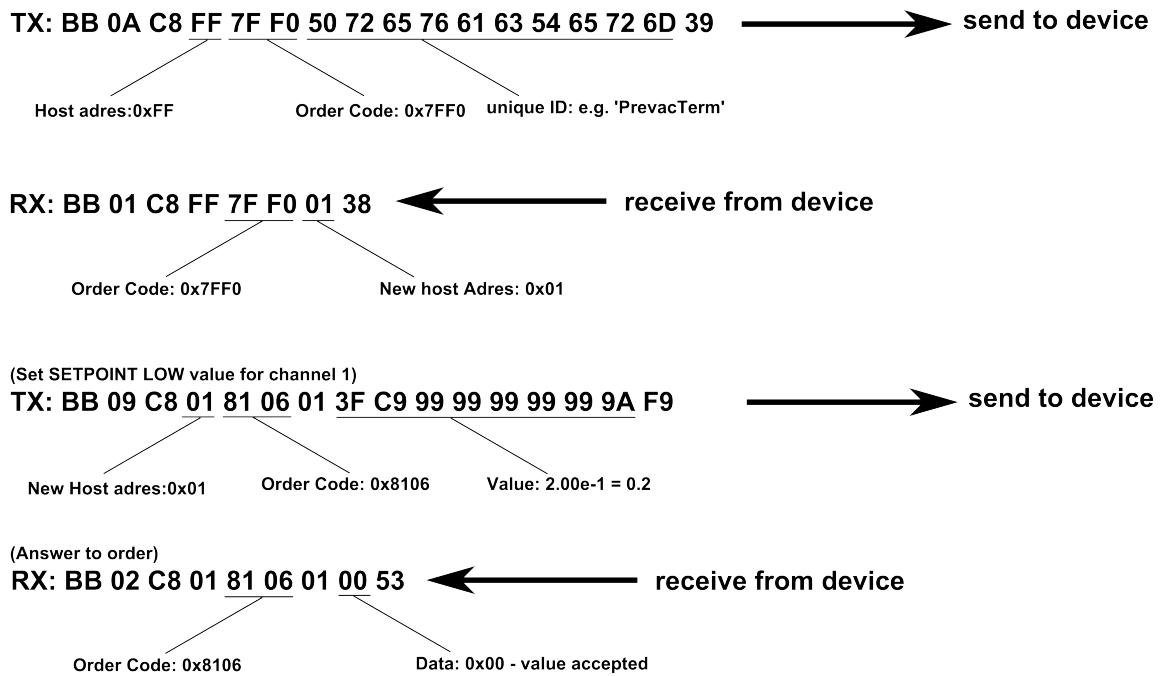


Figure 6.4: Host assign example

6.5 REMOTE CONTROL MODE

REMOTE CONTROL mode operations change the parameters from the touch panel are locked. You can monitor only the parameters on the screen and the settings in the configuration menu of the device. Device in *REMOTE CONTROL* mode display at the top of the main screen information banner with the inscription "*BCU14 - REMOTE CONTROL*"

The device can be entered in remote control mode in two ways: hardware and software.

6.5.1 HARDWARE

Switching to *Remote Control* mode is done by activating the remote interlock input. Located on the rear panel (see section [ref logicInputs](#)). The input can be activated permanently by making a short connection between the activating input and pin 24V or activated from the outside (eg.: switch, PLC). Example plug configuration is shown in Figure 6.5. Exit *Remote Control* mode is possible only by deactivating the input *REMOTE INTERLOCK*.

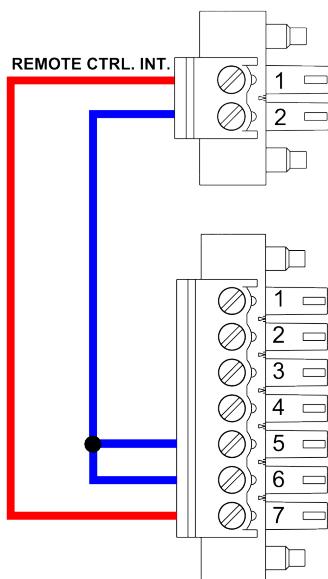


Figure 6.5: Activation *Remote Control Interlock*

6.5.2 SOFTWARE

Software switch to Remote Control mode is provided selecting **COMMUNICATION -> REMOTE CONTROL -> ON**. Then device switches to Remote Control mode and remains in it until switched again to local mode by selecting **COMMUNICATION -> REMOTE CONTROL -> OFF**.

Communication in software Remote Control mode is done according following principles:

- At a time control device it is only possible from one place (panel of the unit or remote computer with *MASTER* permissions). item Permissions to control in RC mode has a host that is in the *MASTER*. On the *Communications* submenu can check which host (of which number) currently has *Master* permissions.
- After the takeover of control by the remote *MASTER* device is locked to return to local control mode from the device menu (item **COMMUNICATION -> REMOTE CONTROL** is grayed out).

- Host have *MASTER* permissions until kept communication with the device (the interval between frames will not be longer than 10 seconds) or release rights master (using order 0xFFFF1; data field = 0).
- In case of loss of communication between the host and the device for longer than 10 seconds the item **COMMUNICATION -> REMOTE CONTROL** is active and is possible return to local control by setting item **COMMUNICATION -> REMOTE CONTROL -> OFF**
- In case of loss of communication between the host and the device for longer than 60 seconds, it becomes possible take over control by another remote host.

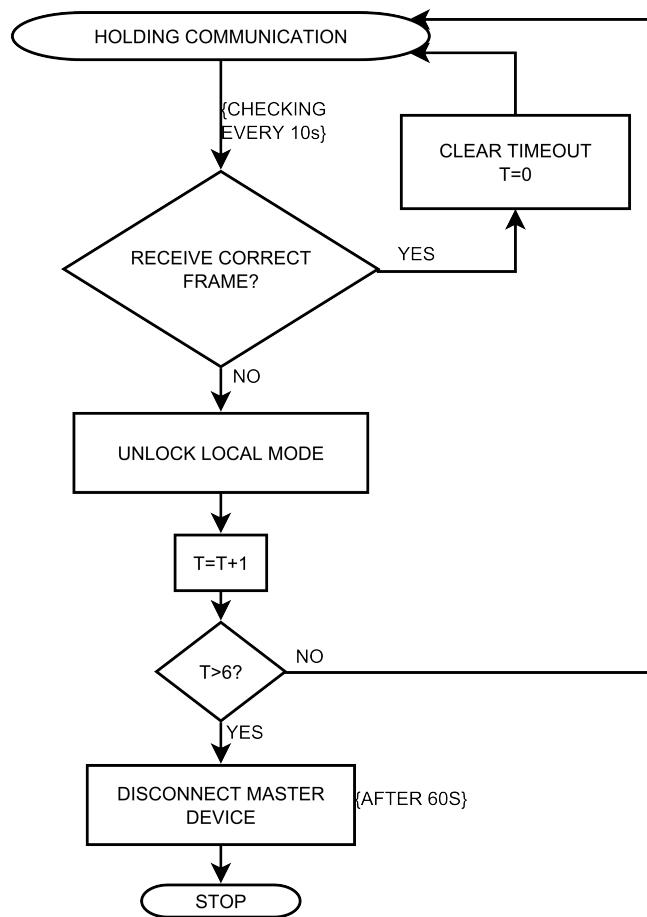


Figure 6.6: Keeping communication- diagram

Properly registered device will appear in the menu **Communication -> Host address** and will be able to control the device. If the list contains more than one device, you must choose which is to have permissions to write (control). Other devices in the list will be able to read only parameters.



Figure 6.7: Preview of registered host addresses

6.6 GLOBAL DEVICE STATUS

There are two types of device status: errors and warnings. Status appear in the bar at the right of the main screen of the device. To read the error status, use the command 0x7F51, for warning status use command 0x7F52. In response we receive a code whose meaning is contained in the tables below.

Error code	Description
7F01	Internal communication error
7F02	Communication with Anybus module error
7F03	Communication with Bluetooth Anybus module error
7F04	Critically low disk space

Table 6.4: Global error status

Warning code	Description
7F80	Low disk space.
7F06	Invalid read the internal temperature of the device.
7F07	The internal temperature of the device is above safe level.
7F08	The internal temperature of the unit is too high. Switching to standby mode.

Table 6.5: Global warning status

6.7 GLOBAL ERROR CODES

In response to the write command, it is possible to obtain the specifying error status code, which makes impossible execution of the order. The table below lists the global error codes (apply to all orders). Additionally, the device can return specific error codes, depending on the module in which it is equipped.

Status code	Description
0x00	No errors, order executed correctly
0x91	Value is too large
0x92	Value is too small
0x93	Wrong parameter (probably wrong data format or index out of range)
0x95	Read only parameter, write prohibited
0x96	Host not know and not registered
0x97	Host know but not selected to remote control
0x98	Device configured to work in local mode
0x99	Operation or parameter is not available

Table 6.6: Global status codes

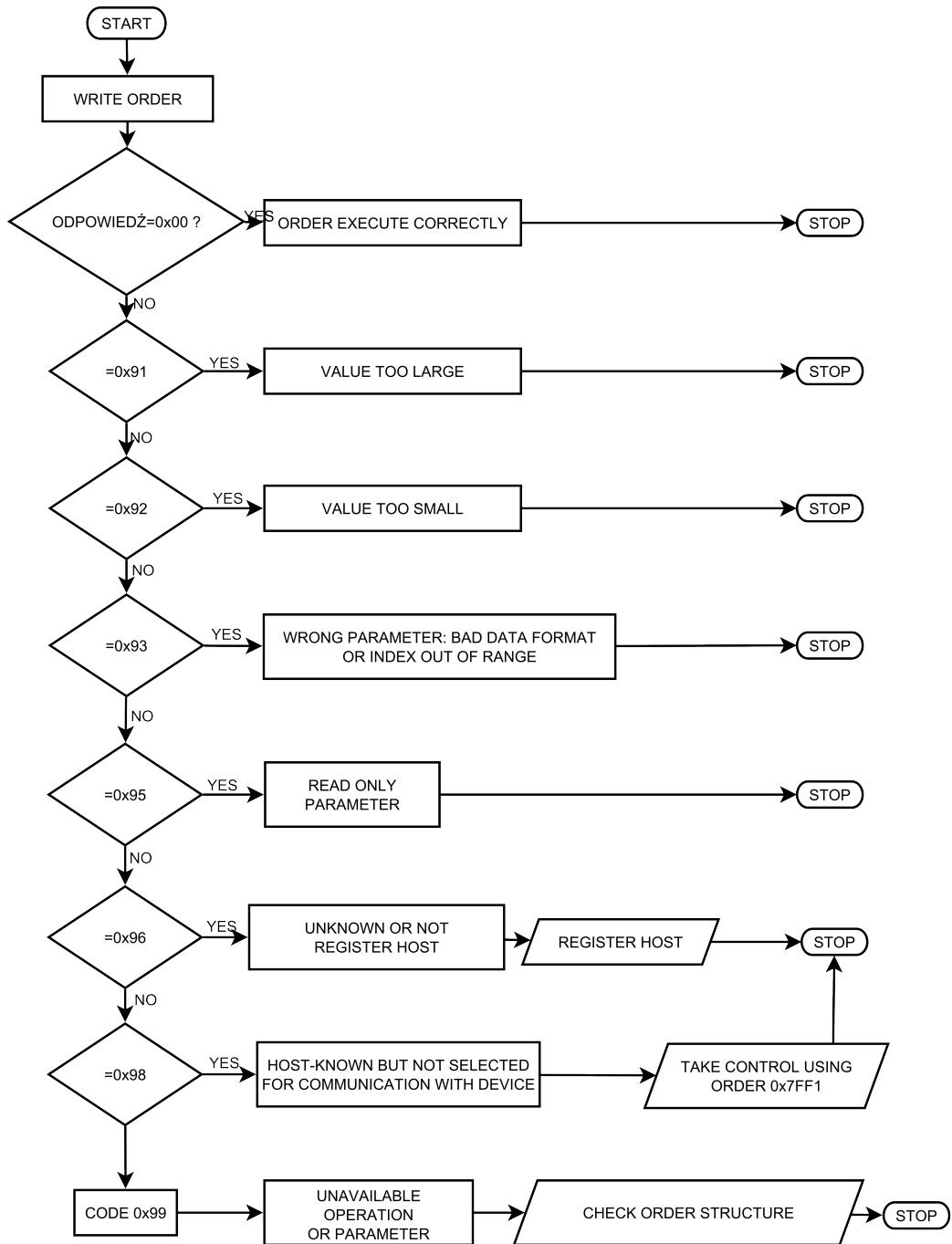


Figure 6.8: Write order example- diagram

6.8 BCU14 STATUS CODE

Error code	Description
4C01	Regulator Error. Zone 1
4C02	Regulator Error. Zone 2

Table 6.7: BCU14 error status

Warning code	Description
4C80	No interlock. Zone1
4C81	No interlock. Zone2
4C82	Sensor Break! Zone1
4C83	Sensor Break! Zone2
4C84	Bakeout power failure. Zone1
4C85	Bakeout power failure. Zone2
4C86	No Master Interlock. Zone1
4C87	No Master Interlock. Zone2

Table 6.8: BCU14 warning status

6.8.1 BCU14 ERROR ORDER CODES

Status code	Description
0xB0	Internal communication error
0xB1	Unable heating. No interlock. Zone1
0xB2	Unable heating. No interlock. Zone2
0xB3	Unable heating. Sensor Break! Zone1
0xB4	Unable heating. Sensor Break! Zone2
0xB5	Unable heating. Bakeout power failure. Zone1
0xB6	Unable heating. Bakeout power failure. Zone2
0xB7	Unable heating. No Master Interlock. Zone1
0xB8	Unable heating. No Master Interlock. Zone2
0xB9	Timer mode can not be changed. BCU14 during operation.

Table 6.9: BCU14 order error codes

6.9 ORDERS LIST

6.9.1 GLOBAL ORDERS - FUNCTION CODE 0x7F..

ORDER NUMBER 0x7F01 READ PRODUCT NUMBER					R
Byte	Description	Type	Unit	Min value	Max value
1-15	Product number	ASCII			

Table 6.10: Read product number

ORDER NUMBER 0x7F02 READ SERIAL NUMBER					R
Byte	Description	Type	Unit	Min value	Max value
1-13	Serial number	ASCII			

Table 6.11: Read serial number

ORDER NUMBER 0x7F03 READ DEVICE VERSION					R
Byte	Description	Type	Unit	Min value	Max value
1 - [DATA LENGTH]	Device version	ASCII			

Table 6.12: Read device version

ORDER NUMBER 0x7F04 READ HASH CODE VERSION					R
Byte	Description	Type	Unit	Min value	Max value
1 - [DATA LENGTH]	Hash code	ASCII			

Table 6.13: Read hash code version

ORDER NUMBER 0x7F05 READ DEVICE NAME					R
Byte	Description	Type	Unit	Min value	Max value
1 - [DATA LENGTH]	Device name	ASCII			

Table 6.14: Read device name

ORDER NUMBER 0x7F06 CUSTOMER NAME					R/W
Byte	Description	Type	Unit	Min value	Max value
1 - [DATA LENGTH]	Customer name (max 17 characters)	ASCII			

Table 6.15: Customer name

ORDER NUMBER 0x7F50 DEVICE STATUS					R
Byte	Description	Type	Unit	Min value	Max value
1	Number of device errors 0 - no errors			0	255
2	Number of device warnings 0 - no warnings			0	255

Table 6.16: Read device status

ORDER NUMBER 0x7F51 ERROR CODES					R
Byte	Description	Type	Unit	Min value	Max value
1	Index of device error	INT		0	255
2 - 5	Device error code				

Table 6.17: Read error status code

ORDER NUMBER 0x7F52 WARNING CODES					R
Byte	Description	Type	Unit	Min value	Max value
1	Index of device warning			0	255
2 - 5	Device warning code				

Table 6.18: Read warning status code

ORDER NUMBER 0x7F60 VOLTAGE VALUE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: 1 - U_c 2 - U_e 3 - U_{f1} 4 - U_{f2} 6 - U_{ext} 7 - U_{erg} 8 - U_{wehn} 9 - U_x 10 - U_y	INT			
2-9	Value	Double	V		

Table 6.19: Voltage value

ORDER NUMBER 0x7F61 ACTUAL VOLTAGE VALUE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index: 1 - U_c 2 - U_e 3 - U_{f1} 4 - U_{f2} 6 - U_{ext} 7 - U_{erg} 8 - U_{wehn} 9 - U_x 10 - U_y	INT			
2-9	Value	Double	V		

Table 6.20: Actual voltage value

ORDER NUMBER 0x7F62 CURRENT VALUE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: 1 - I_c 2 - I_e 3 - I_{flux} 4 - I_{fil1} 5 - I_{fil2} 6 - I_{fil3} 7 - I_{fil4}	INT			
2-9	Value	Double	V		

Table 6.21: Current value

ORDER NUMBER 0x7F63 ACTUAL CURRENT VALUE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index: 1 - I_c 2 - I_e 3 - I_{flux} 4 - I_{fil1} 5 - I_{fil2} 6 - I_{fil3} 7 - I_{fil4}	INT			
2-9	Value	Double	V		

Table 6.22: Actual current value

ORDER NUMBER 0x7F70 RTC DATA SETTINGS					R/W
Byte	Description	Type	Unit	Min value	Max value
1-10	Data value in format $yyyy.mm.dd$	ASCII			

Table 6.23: RTC data settings

ORDER NUMBER 0x7F71 RTC TIME SETTINGS					R/W
Byte	Description	Type	Unit	Min value	Max value
1-8	Time value in format <i>hh:mm:ss</i>	ASCII			

Table 6.24: RTC time settings

ORDER NUMBER 0x7F72 PANEL TIMER TIME SETTINGS					R/W
Byte	Description	Type	Unit	Min value	Max value
1-8	Set panel timer value in format <i>hh:mm:ss</i>	ASCII			

Table 6.25: Panel Timer time settings

ORDER NUMBER 0x7F73 PANEL TIMER ACTUAL TIME					R
Byte	Description	Type	Unit	Min value	Max value
1-8	Actual panel timer value in format <i>hh:mm:ss</i>	ASCII			

Table 6.26: Actual panel timer value

ORDER NUMBER 0x7F74 PANEL TIMER START/STOP					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Panel Timer Start/Stop (Start=1, Stop=0)	INT			

Table 6.27: Panel timer start/stop

ORDER NUMBER 0x7F0C TOUCH SCREEN AUTOLOCK					R/W
Byte	Description	Type	Unit	Min value	Max value
1	0 - Touch screen autolock OFF 1 - Touch screen autolock ON				

Table 6.28: Touch screen autolock

ORDER NUMBER 0x7FF0 HOST NUMBER ASSIGN					R/W
Byte	Description	Type	Unit	Min value	Max value
QUERY:					
1 - [DATA LENGTH]	Unique ID	ASCII			
RESPONSE:					
1	Assigned host address	INT		1	255

Table 6.29: Host address assign

ORDER NUMBER 0x7FF1 MASTER MODE					R/W
Byte	Description	Type	Unit	Min value	Max value
FOR WRITE ORDER:					
1	Assignment/release <i>MASTER</i> mode control 1 - Assignment control, 0 - Release control,	Byte		0	1
FOR READ ORDER:					
1	<i>MASTER</i> control status (bit field) - status zwracany na poszczególnych bitach od B0(LSB) do B7(MSB). B0: Working as <i>MASTER</i> (0 - no, 1 - yes) B1: Take control as <i>MASTER</i> (0 - forbidden, 1 - permitted). Bit B1=1 if and only if B2=1, B3=1 i B4=0. B2: Device <i>REMOTE CONTROL</i> mode(0 - inactive, 1 - activate) B3: Host registration status(0 - not registered, 1 - registered) B4: Other <i>MASTER</i> host device in system (0 - no, 1- yes)	Byte			

Table 6.30: Assignment/release of Master mode

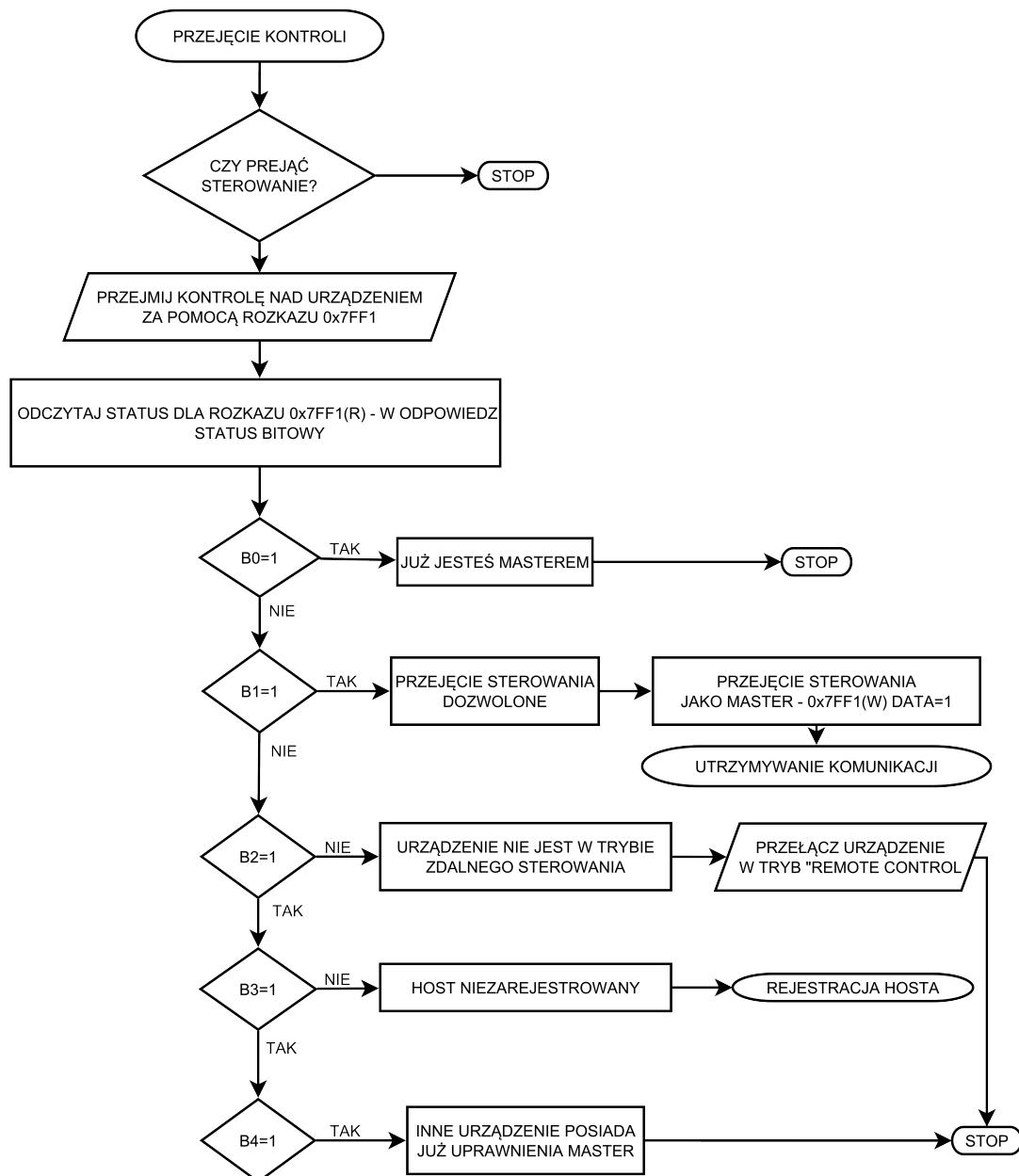


Figure 6.9: Assignment/release of Master mode - sequence diagram

ORDER NUMBER 0x7FAA SEND COMMAND TO DEVICE						R/W
Byte	Description	Type	Unit	Min value	Max value	
1-5	Command (5 characters)	ASCII				
6 - [DATA LENGTH]	Command data (max 32 characters)	ASCII				

Table 6.31: Send command

6.9.2 BCU14 ORDERS - FUNCTION CODE 0x44..

Index value is without function.

ORDER NUMBER 0x4C01 OPERATE STATE						R/W
Byte	Description	Type	Unit	Min value	Max value	
1	Index	INT				
2	Operate On/Off 0 - Operate Off 1 - Operate On	INT				

Table 6.32: Operate State On/Off

ORDER NUMBER 0x4C02 BCU-REG BAKEOUT TIME						R/W
Byte	Description	Type	Unit	Min value	Max value	
1	Index	INT				
2-5	Bakeout time for regulated output	Long	s			

Table 6.33: Bakeout time for regulated output Read/Write

ORDER NUMBER 0x4C03 READ REMAINING BCU-REG BAKEOUT TIME						R
Byte	Description	Type	Unit	Min value	Max value	
1	Index	INT				
2-5	Read remaining bakeout time for regulated output	Long	s			

Table 6.34: Read remaining bakeout time for regulated output Read

ORDER NUMBER 0x4C04 BCU-CONT BAKEOUT TIME						R/W
Byte	Description	Type	Unit	Min value	Max value	
1	Index	INT				
2-5	Bakeout time for continuous output	Long	s			

Table 6.35: Bakeout time for continuous output Read/Write

ORDER NUMBER 0x4C05 READ REMAINING BCU-CONT BAKEOUT TIME					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-5	Read remaining bakeout time for continuous output	Long	s		

Table 6.36: Read remaining bakeout time for continuous output Read

ORDER NUMBER 0x4C06 ACTUAL TEMPERATURE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-9	Read actual temperature	Double	K		

Table 6.37: Actual temperature Read

ORDER NUMBER 0x4C07 TEMPERATURE UNIT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-9	Temperature unit	INT	K		

Table 6.38: Temperature unit Read/Write

ORDER NUMBER 0x4C08 TARGET TEMPERATURE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-9	Target temperature	Double	K		

Table 6.39: Target temperature Read/Write

ORDER NUMBER 0x4C09 FAN TEMPERATURE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-9	Fan temperature	Double	K		

Table 6.40: Fan temperature Read/Write

ORDER NUMBER 0x4C0A RAMP					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2-9	Ramp	Double	K		

Table 6.41: Ramp Read/Write

ORDER NUMBER 0x4C0B RAMP UNIT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Ramp unit	INT			

Table 6.42: Ramp unit Read/Write

ORDER NUMBER 0x4C0C SENSOR BREAK STATUS					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Sensor Break status	INT			

Table 6.43: Sensor Break status Read

ORDER NUMBER 0x4C0D INTERLOCK AUTOSTART					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Interlock Autostart	INT			

Table 6.44: Interlock Autostart Read/Write

ORDER NUMBER 0x4C0E POWER FAILER SIGNAL					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Power failure signal (external/internal)	INT			

Table 6.45: Power failure signal(exrternal/internal) Read/Write

ORDER NUMBER 0x4C0F TIMER WORKING MODE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Timer working mode	INT			

Table 6.46: Timer working mode Read/Write

ORDER NUMBER 0x4C0G MANUAL WORKING MODE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Manual working mode	INT			

Table 6.47: Manual working mode Read/Write

ORDER NUMBER 0x4C10 INTERLOCK FAILURE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Interlock failure	INT			

Table 6.48: Interlock failure Read

ORDER NUMBER 0x4C11 MASTER INTERLOCK FAILURE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Master Interlock failure	INT			

Table 6.49: Master Interlock failure Read

ORDER NUMBER 0x4C12 REGULATOR FAILURE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Regulator failure	INT			

Table 6.50: Regulator failure Read

ORDER NUMBER 0x4C13 POWER FAILURE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
2	Power failure	INT			

Table 6.51: Power failure Read

ORDER NUMBER 0x4C14 ZONE NAME READ					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT			
	Zone Name Read	ASCII			

Table 6.52: Zone Name Read

6.9.3 VACUUM GAUGE ORDERS - FUNCTION CODE 0x01..

ORDER NUMBER 0x0101 ACTUAL VACUUM GAUGE VALUE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Value	Double	mbar		

Table 6.53: Read actual vacuum gauge value

ORDER NUMBER 0x0102 ACTUAL VACUUM GAUGE ANALOG VALUE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Value	Double	V		

Table 6.54: Read actual vacuum gauge analog value

ORDER NUMBER 0x0103 VACUUM GAUGE UNIT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Unit: 0 - mbar 1 - Torr 2 - Pa 3 - psia				

Table 6.55: Vacuum gauge unit

ORDER NUMBER 0x0104 NO SENSOR IN THE VACUUM GAUGE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	State: 0 - False, 1 - True	Bool		0	1

Table 6.56: Read no sensor state

ORDER NUMBER 0x0105 VACUUM GAUGE STATUS					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Status: -1 - "Sensor Break!" 0 - Vacuum 1 - "Wait for emission" 2 - "No Emission" 3 - "Wait for ignition" 4 - "Not Calibrated" 5 - Voltage 6 - "Degassing " + time 7 - "Exter. Setpoint" 8 - "Low Pressure" 9 - "High Pressure" 10 - "0.00e+00"	INT			

Table 6.57: Read vacuum gauge status

ORDER NUMBER 0x0106 LOW SETPOINT IN MBAR					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Setpoint value	Double	mbar		

Table 6.58: Set/Read LOW Setpoint in mbar

ORDER NUMBER 0x0107 HIGH SETPOINT IN MBAR					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Setpoint value	Double	mbar		

Table 6.59: Set/Read HIGH Setpoint in mbar

ORDER NUMBER 0x0108 LOW SETPOINT IN VOLTS					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Setpoint value	Double	V		

Table 6.60: Set/Read LOW Setpoint in volts

ORDER NUMBER 0x0109 HIGH SETPOINT IN VOLTS					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Setpoint value	Double	V		

Table 6.61: Set/Read HIGH Setpoint in volts

ORDER NUMBER 0x010A TRIGGER STATE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	State: 0 - Off, 1 -	Bool		0	1

Table 6.62: Read trigger state

ORDER NUMBER 0x010B GAUGE TYPE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Type:	INT			
	0 - CTR90				
	1 - TTR90				
	2 - TTR211				
	3 - PTR225				
	4 - PTR90				
	5 - ITR90				
	6 - ITR100				
	7 - Baratron				
	8 - ANALOG IN				
	9 - MKS 937A				
	10 - PG105				
	11 - MG13/14				
	12 - PKR 251				
	13 - PCR 280				
	14 - ATMION				

Table 6.63: Set/Read gauge type

ORDER NUMBER 0x010C CTR90/91 FULL SCALE PARAMETER					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	FS:	INT			
	0 - 0.1 Torr				
	1 - 1 Torr				
	2 - 10 Torr				
	3 - 100 Torr				
	4 - 1000 Torr				

Table 6.64: Set/Read full scale parameter for CTR90/91 gauge unit

ORDER NUMBER 0x010D Baratron FULL SCALE PARAMETER					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	FS: 0 - 10 Torr 1 - 50 Torr 2 - 100 Torr 3 - 500 Torr 4 - 1000 Torr 5 - 20 psia 6 - 30 psia 7 - 50 psia 8 - 60 psia 9 - 100 psia 10 - 250 psia 11 - 500 psia 12 - 725 psia 13 - 1000 psia 14 - 2000 psia 15 - 3000 psia	INT			

Table 6.65: Set/Read full scale parameter for Baratron gauge unit

ORDER NUMBER 0x010E TYPE OF GAS					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Typ of gas: 0 - Air 1 - He 2 - Ne 3 - Ar 4 - Kr 5 - Xe 6 - H2 7 - CO 8 - define	INT			

Table 6.66: Set/Read type of gas

ORDER NUMBER 0x010F DEFINED GAS FACTOR					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-9	Gas factor value	Double			

Table 6.67: Set/Read defined gas factor

ORDER NUMBER 0x0110 DEGASS POSSIBILITY					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Possibility: 0 - degas possible 1 - vacuum gauge damaged 2 - meter does not support degas 3 - too low vacuum in chamber, to start the degassing	INT		0	3

Table 6.68: Read degas possibility

ORDER NUMBER 0x0111 DEGAS STATE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	0 - OFF, 1 - ON	INT		0	3

Table 6.69: Set/Read degas state

ORDER NUMBER 0x0112 DEGAS TIME					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-5	Time	LONG	Seconds		

Table 6.70: Set/Read degas time

ORDER NUMBER 0x0113 READ REMAINING DEGAS TIME					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2-5	Time	LONG	Seconds		

Table 6.71: Read remaining degas time

ORDER NUMBER 0x0114 EMISSION STATE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Emission: 0 - OFF, 1 - ON	INT			

Table 6.72: Set/Read emission state

ORDER NUMBER 0x0115 READ EMISSION STATE FROM VACUUM GAUGE					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Emission: 0 - OFF, 1 - ON	INT			

Table 6.73: Read emission state from vacuum gauge

ORDER NUMBER 0x0116 FILTRATION LEVEL OF VACUUM MEASUREMENT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT		1	2
2	Filtration level: 0 - low 1 - medium 2 - high	INT			

Table 6.74: Set/Read filtration level of vacuum measurement

6.9.4 DIGITAL OUTPUTS ORDERS - FUNCTION CODE 0x03..

ORDER NUMBER 0x0301 ASSIGNMENT OF RELAYS FUNCTION					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Relay (Out) number. From 1 to number of all relays	INT			
2	Assigned function code: Code corresponds to the position of function in the menu "Relay Outputs/Out x". For example, if the menu looks as below: <i>Relay Outputs</i> <i>Out 1</i> <i>Setpoint 1</i> <i>Setpoint 2</i> <i>Still OFF</i> <i>Still ON</i> <i>None</i> Code of function <i>Still OFF</i> is 3	INT			

Table 6.75: Assigning of relays function

6.9.5 DIGITAL INPUTS ORDERS - FUNCTION CODE 0x04..

ORDER NUMBER 0x0401 ASSIGNMENT OF FUNCTION TO THE INPUT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index 1: Channel number	INT	1		
2	Index 2: Function code. 1 - Interlock 2 - Operate On 3 - Operate Off 4 - Pressure Emiss ON 5 - Pressure Emiss OFF 6 - Open Shutter 7 - Close Shutter 8 - Zero Thickness 9 - Zero Time 9 - Remote Control Availability of functions is device dependent.	INT			
3	Digital Input number. From 1 to number of all inputs	INT		1	

Table 6.76: Assignment of functions to the input

ORDER NUMBER 0x0402 DIGITAL INPUTS SENSE CONTROL					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Digital Input number. From 1 to number of all inputs	INT		1	
2	Sense: 1 - Low level 2 - High level 3 - Falling edge 4 - Rising edge			1	4

Table 6.77: Digital inputs sense control

6.9.6 ANALOG OUTPUTS ORDERS - FUNCTION CODE 0x05..

ORDER NUMBER 0x0501 SIGNAL SOURCE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2	Assigned signal source: Corresponds to the position of signal source in the menu "Source" of Analog out channel. For example, if the menu looks as below: <i>Source</i> <i>Pressure 1</i> <i>Pressure 2</i> <i>Usource</i> <i>Iemis</i> <i>None</i> Code of signal source <i>Iemi</i> is 4	INT		1	

Table 6.78: Set/Read signal source

ORDER NUMBER 0x0502 RETRANSMISSION MODE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2	Retransmission mode: 1 - range 2 - 1 to 1 3 - exponent	INT		1	3

Table 6.79: Set/Read work mode

ORDER NUMBER 0x0503 RETRANSMISSION SCALE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2	Retransmission scale: 1 - linear 2 - logarithmic	INT		1	2

Table 6.80: Set/Read retransmission scale

ORDER NUMBER 0x0504 MINIMUM VALUE OF RETRANSMITTED PARAMETER					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2-9	Minimum value Unit and min/max is signal source dependent	Double			

Table 6.81: Set/Read minimum value of the retransmitted parameter.

ORDER NUMBER 0x0505 MAXIMUM VALUE OF RETRANSMITTED PARAMETER					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2-9	Maximum value Unit and min/max is signal source dependent	Double			

Table 6.82: Set/Read maximum value of the retransmitted parameter.

ORDER NUMBER 0x0506 MINIMUM VALUE OF THE OUTPUT VOLTAGE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2-9	Output voltage	Double	V	0	10

Table 6.83: Set/Read minimum value of the output voltage.

ORDER NUMBER 0x0507 MAXIMUM VALUE OF THE OUTPUT VOLTAGE					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index: Out number. From 1 to number of all analog outs	INT		1	
2-9	Output voltage	Double	V	0	10

Table 6.84: Set/Read maximum value of the output voltage.

6.9.7 OPERATE TIMER ORDERS - FUNCTION CODE 0x11..

ORDER NUMBER 0x1101 TIMER COUNTING DIRECTION					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT	1		
2	Counting direction 0 - down 1 - up	INT		0	1

Table 6.85: Timer counting direction

ORDER NUMBER 0x1102 OPERATE TIME					R
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT	1		
2-5	Operate time	LONG	sec		

Table 6.86: Operate time

ORDER NUMBER 0x1103 OPERATE TIME SETPOINT					R/W
Byte	Description	Type	Unit	Min value	Max value
1	Index	INT	1		
2-5	Operate time setpoint	LONG	sec		

Table 6.87: Operate time setpoint

7 MAINTANCE AND SERVICE

7.1 MAINTANCE

The BCU14 does not require any special maintenance work.

7.2 CLEANING

For cleaning of the outside of the device, a slightly moistened cloth will usually do. Do not use any aggressive or abrasive cleaning agents.

DANGER



Mains voltage.

Components inside of the BCU14 are components at mains voltage. Do not insert any objects through the louvers of the device. Protect the device from liquids. Do not open the device.

7.3 FIRMWARE UPGRADE

On the pictures below we will use the names of {device_name} and {version}:

- {device_name} in this case means BCU14 .
- {version} is in numerical form and contains 3 digits separated by a dots. E.g: 1.0.0 or 3.1.5

WARNING



Firmware upgrade

During the upgrade, do not turn off the BCU14 or disconnect it from the wall outlet. Failure to do so may cause damage to the BCU14 , with the result that the unit is not unfit for use and will require repair.

In order to update the software/firmware via USB the USB memory stick must be formatted as FAT / FAT32. Then simply copy the update file received from us to the memory stick and insert into the USB slot on the front of the BCU14 . The “New USB Device Detected” hint will appear on the bottom of the screen.

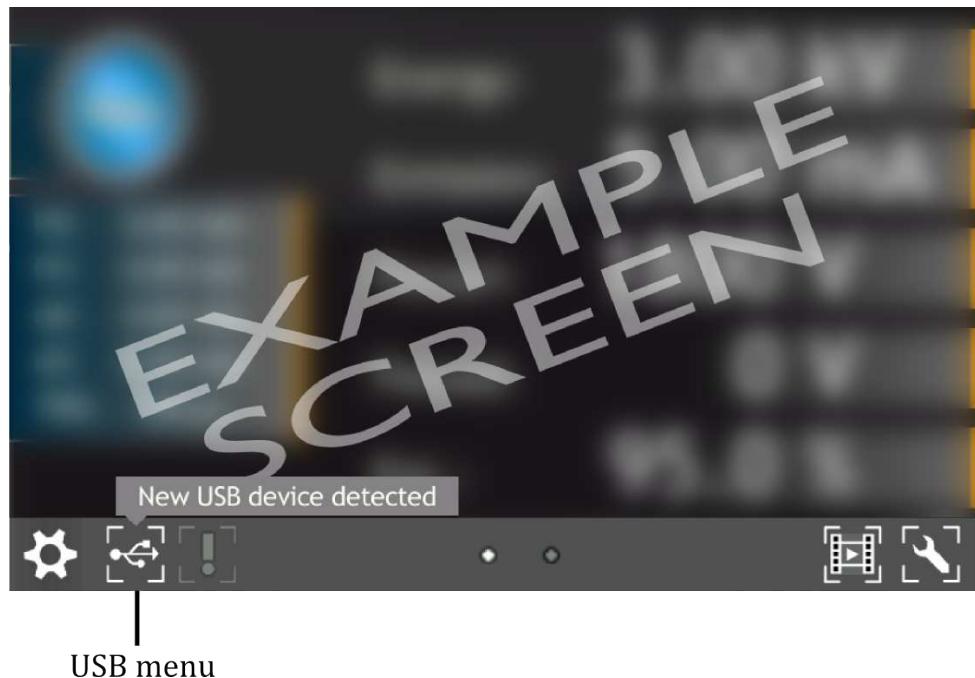


Figure 7.1: USB detected hint

The USB menu is accessed by clicking the USB icon on the bottom of the screen. This displays several options:

- see list of found firmware,
- copy user manual to USB,
- un-mount USB drive,
- export log file onto USB,
- see list of videos on USB,
- copy new language to device,



Figure 7.2: USB menu

To update the current version to a newer version, select the Firmware Updates option. To accelerate the search for updates on the USB drive, delete all files except the updates.



Figure 7.3: Firmware list

In order to choose one of the updates simply click on the name. The “Do you want to update firmware to selected version? After whole procedure device will be rebooted” phrase will appear. Selecting No returns the user to the main menu of Firmware Updates. It is highly recommended to finish all the work on the device and save your data before pressing the “Yes” button.

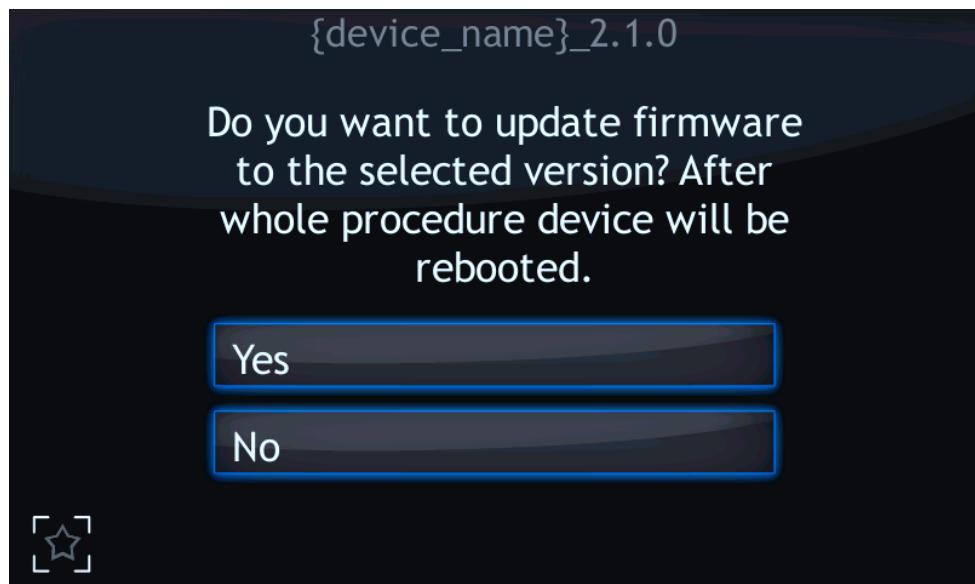


Figure 7.4: Restart message

After selecting to proceed with the update, the device will stop and the updating procedure will be initiated. The update process takes a few minutes during which time the screen below is displayed.



Figure 7.5: Updating firmware

Upon successful installation, the message with "updated" statuses should be displayed.



Figure 7.6: Update summary example

Select "OK" to reboot the device and finish the upgrade.

7.3.1 AUTO UPDATE

The auto-update feature compares the current version of main-board and bus firmware with software. In case of any mismatch (for example if the micro SDHC card was swapped) the user will be informed with a blinking exclamation icon.

- To synchronize the firmware, select the exclamation icon.
- The screen below is displayed. If the “Recommended Updates” message is visible, tap the “Auto Update” button in order to synchronize firmware and software. Then follow the procedure from the previous section Upgrading firmware via USB.

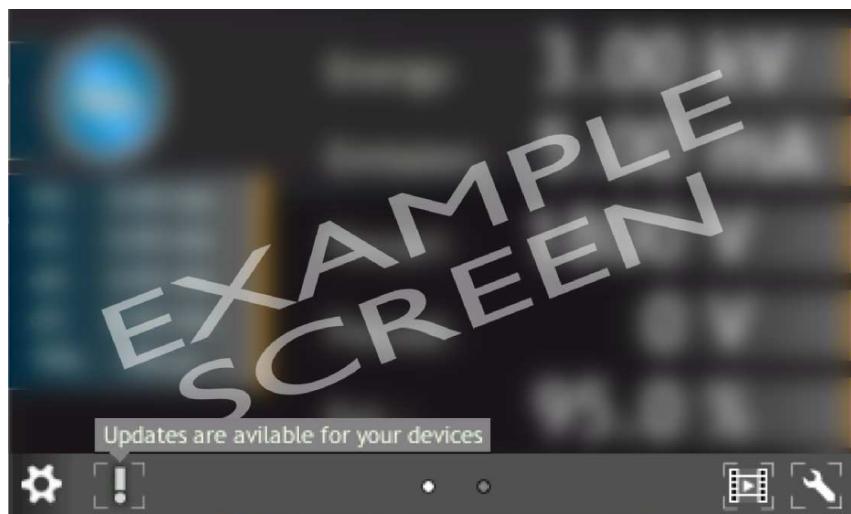


Figure 7.7: Auto update 1

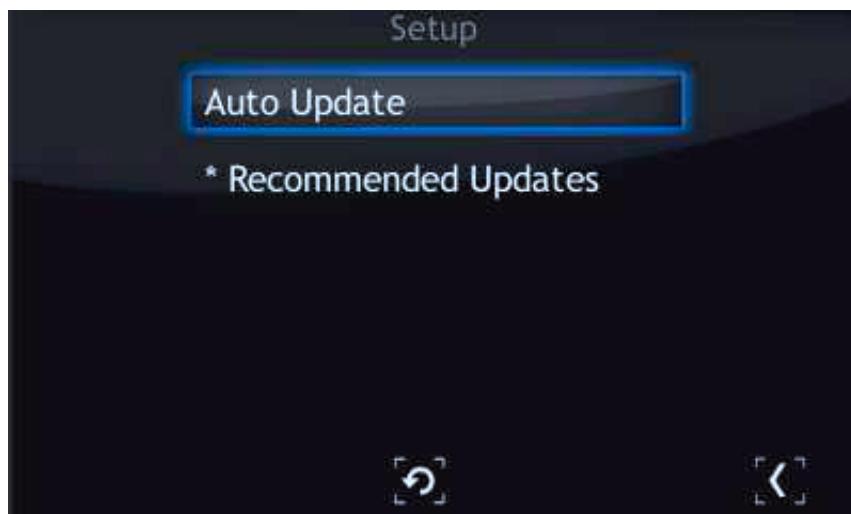


Figure 7.8: Auto update 2

7.4 PREBOOT ENVIRONMENT

To run the Preboot application press on the logo at BCU14 startup (7.9).



Figure 7.9: Enter into preboot environment

The Preboot Environment is an application to boot the BCU14 . Its main task is to launch the device in the version selected by the user. It can also be used to run other tools, such as the gauge calibration application.

The main menu consist three options:

- Reboot – rebooting BCU14 .
- Continue booting – close Preboot Environment and continue starting BCU14 .
- Continue booting (photo mode) – allow to run device with screenshot function.

7.4.1 BOOT MENU

Boot menu allows the user set which version of the BCU14 and Preboot Environment will be run after the start of device. In order to switch software version, click on “Software boot version” combo box.

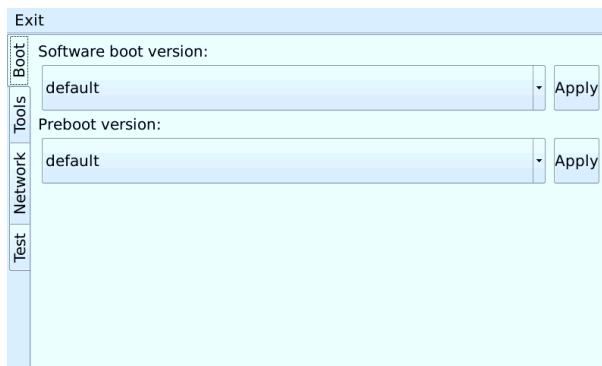


Figure 7.10: Boot menu

Then select one of the available versions, for example default.

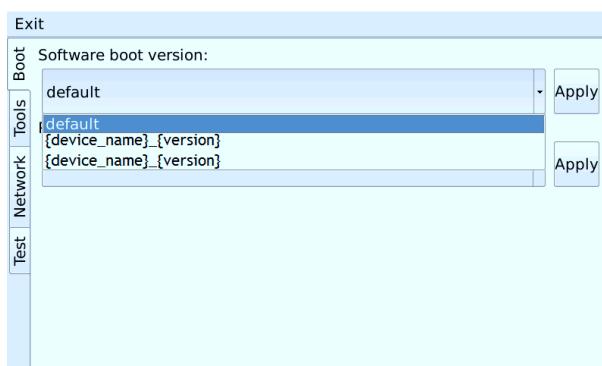


Figure 7.11: Switch software version

To apply changes press Apply button. From now the default version will be automatically run after restarting BCU14 .

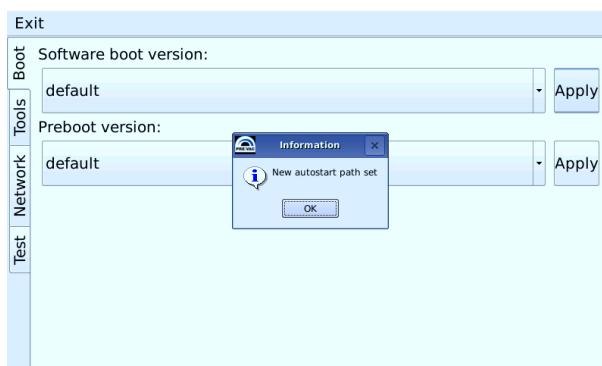


Figure 7.12: Message box confirming the changed settings

7.4.2 TOOLS MENU

The Tools menu allows the user to run applications such as touch screen or power supply calibration.



Figure 7.13: Tools menu

In order to select one of the applications, tap the desired application from the tools combo box and tap the Run button.



Figure 7.14: Selecting additional tool

7.4.3 NETWORK TAB

From this tab the user can configure the IP address, netmask and enable / disable DHCP.

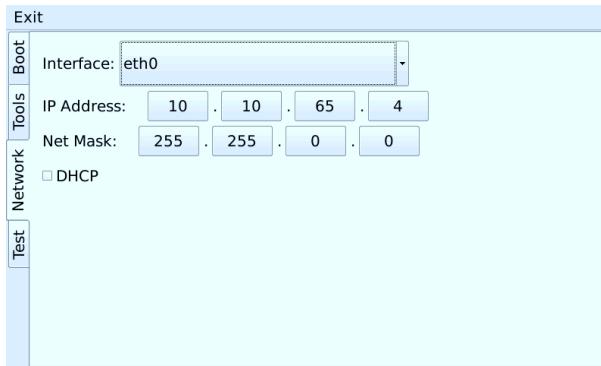


Figure 7.15: Network tab

After tapping on one of the editable fields, the numeric panel for editing values will appear . Input values can be completed by tapping X button in the upper-left corner of the screen.

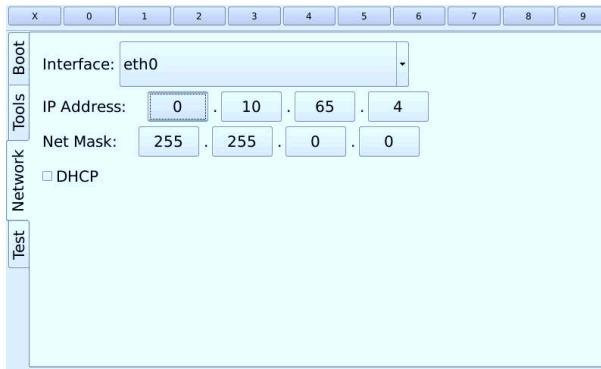


Figure 7.16: Numeric panel

7.4.4 TEST TAB

From this tab the user can test the speaker.



Figure 7.17: Test tab

8 STORAGE AND DISPOSAL

8.1 PACKING

Please retain the original packaging. The packaging is required for storing the BCU14 and for shipping it to an authorized PREVAC service center.

8.2 STORAGE

The BCU14 should only be stored in a dry room. The following requirements must be met:

PARAMETER	VALUE
Ambient temperature	-20...50°C
Humidity	as low as possible; preferably in an air-tight plastic bag with a desiccant

Table 8.1: Storage parameters

8.3 DISPOSAL

The product must be disposed of in accordance with the relevant local regulations for the environmentally safe disposal of systems and electronic components.