

ARITERM OY

Arimatic 1002

User manual



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1. General information

Arimatic 1002 is a versatile control automation centre for bioheating systems. It can be flexibly customised according to your specific needs. The control centre is suitable for controlling a one-burner system of up to 200–1,500 kW (BioJet, BioJet Multi, HakeJet and MultiJet burners).

The system is controlled with programmable logic Siemens ET200SP with fail-safe I/O modules. The interface is a graphic 9" touchscreen display (12" as an optional accessory). The flue gas fan and the combustion air fans are controlled by I/O-controlled frequency converters (Siemens V20).

The Arimatic 1002 control centre is manufactured specifically for each project. The basic programme frame remains standard and the project-specific functions are added to it. Delivery-specific electric diagrams are provided with the control centre.

The Arimatic 1002 control centre is assembled in a floor cabinet which is 1,600 mm wide, 2,100 mm high and 400 mm deep. If required, the centre can be provided as 1,800 mm wide.

This user manual is a general guide for the AM1002 control centre, thus the images of the screens and menus can partially differ from the existing centre due to the centre's project-specific properties.

2. Transport, storage and package opening

The centre is delivered on a platform. The package should be opened as close to the installation site as possible. The centre must be stored indoors. It is important that the recipient checks the condition of the centre before accepting it. In case of damage, the dealer must be contacted without delay.

It is important to inspect the contents of the centre after opening the package. Sensors included in the centre are delivered in a separate package with other equipment. Inspect the sensors by consulting the parts list included in the package.

3. Warranty

Ariterm provides a one-year warranty for its equipment. The warranty is valid for one year starting from the date of implementation or for maximum of 18 months from the date of delivery.

The warranty covers craftsmanship and material defects. Ariterm Oy will deliver new replacement parts for defective parts free of charge.

Spare parts are provided with a 12-month warranty.

The warranty does not cover damages resulting from incorrect installation or electrical storms.

4. Installation and commissioning

1. Install the centre in a place where the system is easy to use and cables are easy to install. The centre should have 1 m of space in front of it. Fasten cabinet securely to wall.
2. Electrical connections should be done according to the wiring diagrams. Safety switches are not included in the delivery. Safety switch feedback must be short circuited if safety switch is not installed or feedback is not wired. Install UPS battery wires.
3. Set the power on to cabinet. Switch on all the circuit breaker and motor protectors which are in use. Current limits for the motor protectors (3RM1) must be set based on the motor's nominal current. The current values are indicated on the type plate of the motor.
4. Run motor identification cycle for inverter controlled devices.
5. Check all the alarm/warnings. Check the system for any alarms caused by, for example, uninstalled or incorrectly connected sensors. Functionality of all safety devices, such as emergency stop buttons, thermostats and hatch switches must be tested/checked.
6. Check the rotation directions of screws and test all functions (fans, fluegas fan). Test can be done from mainpage.
7. Define settings (burner screw, fans).

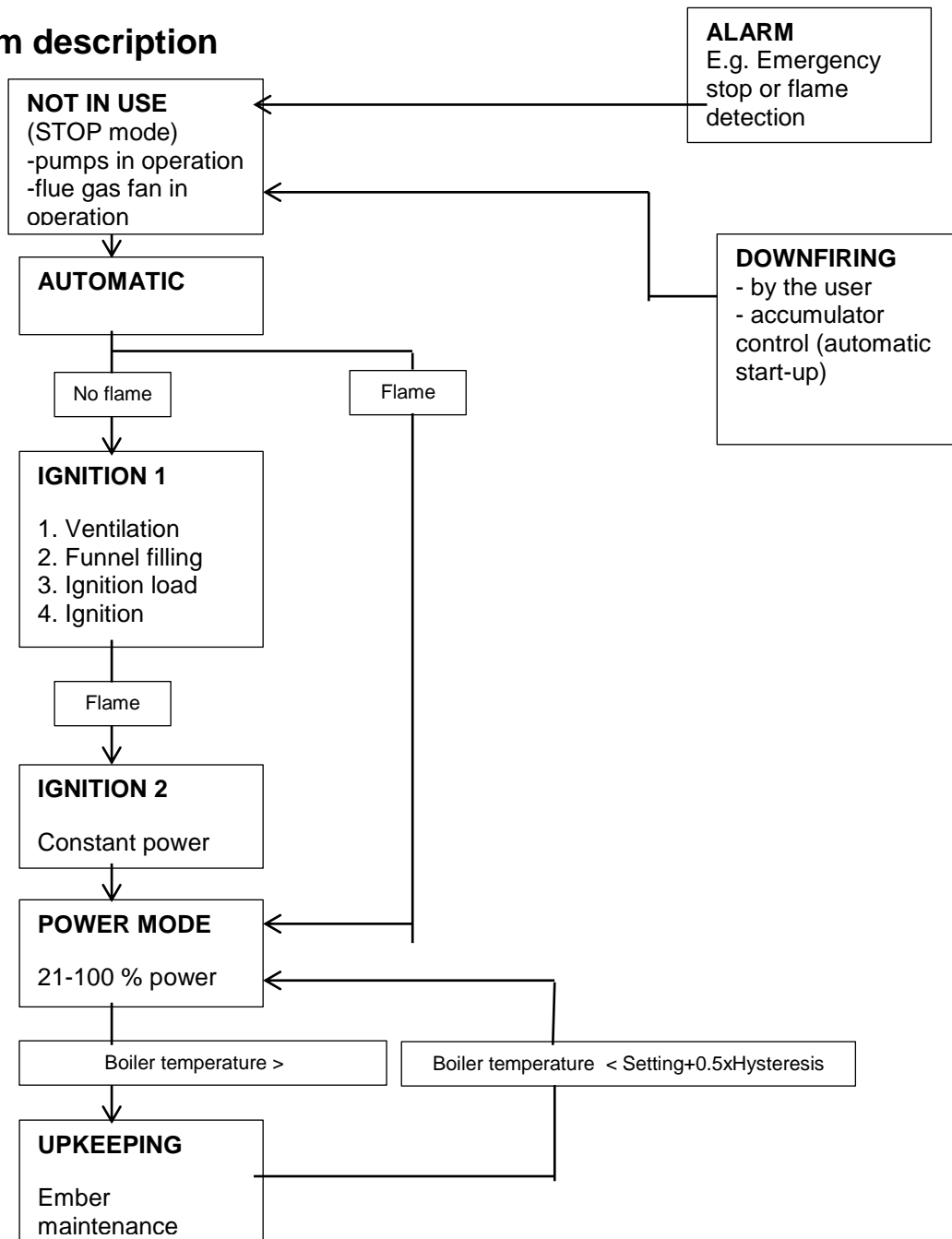
The system has factory default settings, but certain settings, such as the *EFFECT*-settings must be adjusted according to the fuel. Adjustments should be made by using a flue gas analyser in order to ensure clean combustion. Additionally, the *STORAGE SCREW*-settings must be adjusted as they depend on the size of the funnel between the burner screw and the storage screw.

NOTE! If the system is equipped with automatic ignition, the *AUTOMATIC IGNITION*-settings must always be defined on a case-by-case basis. The settings must be configured by an authorised maintenance professional during commissioning. Incorrect ignition times and settings may result in a failed ignition and halt the system.

NOTE! There is a main switch on the centre door for switching the centre's power supply off before opening the door. The main switch does NOT cut off

the voltage supplied by the UPS device (battery backup device for, among others, the control logic and the GSM modem).

5. System description



The system is started with the AUTOMATIC-button, after which the ignition page opens. If the flame detection thermostat detects a flame in the burner head, the burner switches to power mode. After the ignition phase, the burner switches to power mode, during which the power of the burner is adjusted according to the boiler water temperature (according to the required heating power). The automatic system attempts to maintain the boiler water temperature at the set level. If a high level of heating is not required, but the

boiler water temperature increases excessively, the burner will activate the upkeeping mode.

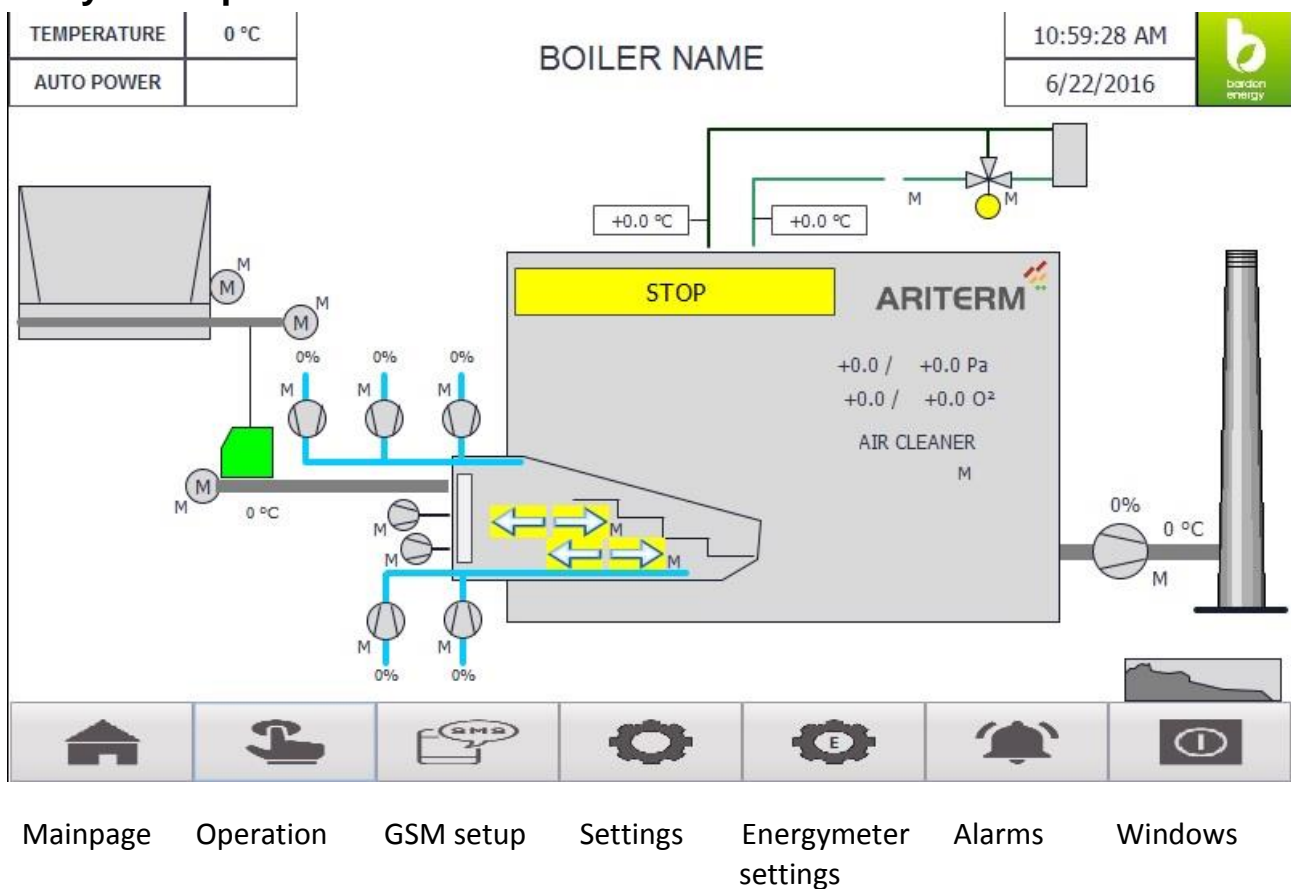
The burner uses the upkeeping mode to maintain ember in the burner head. When the boiler water temperature decreases, the burner returns to the power mode. The user can stop storage operation and empty the feeding screw by pressing the DOWNFIRING-button. This function is used, for example, during maintenance.

The STOP-button stops the system immediately. Only the pumps and the flue gas fan remain in operation. These operations must be stopped manually.

In accumulator use, the shutdown function is activated automatically, when the lower temperature of the accumulator exceeds its setting (e.g., 80 °C). Automatic ignition starts when the accumulator temperature falls below its setting (e.g., 60 °C).

Alarms are indicated with a yellow triangle appearing on the display. The **ALARMS**-page indicates the reason for the alarm and its time. You can reset the alarms and review the alarm history there.

6. System operation



MAINPAGE

- system monitoring
- manual control of devices

OPERATION

- Burner start/stop

GSM SETUP

- phonenumber
- GSM signal strength

SETTINGS

- power adjustment
- function settings
- sensor scalings
- options

ENERGYMETER SETTINGS

- Energymeters values and trends
- Works only if selected in options and Kamstrup Multical 801 is used

ALARMS

- Alarms messages and alarm history

WINDOWS

- IP-settings

7. Main screens and usage

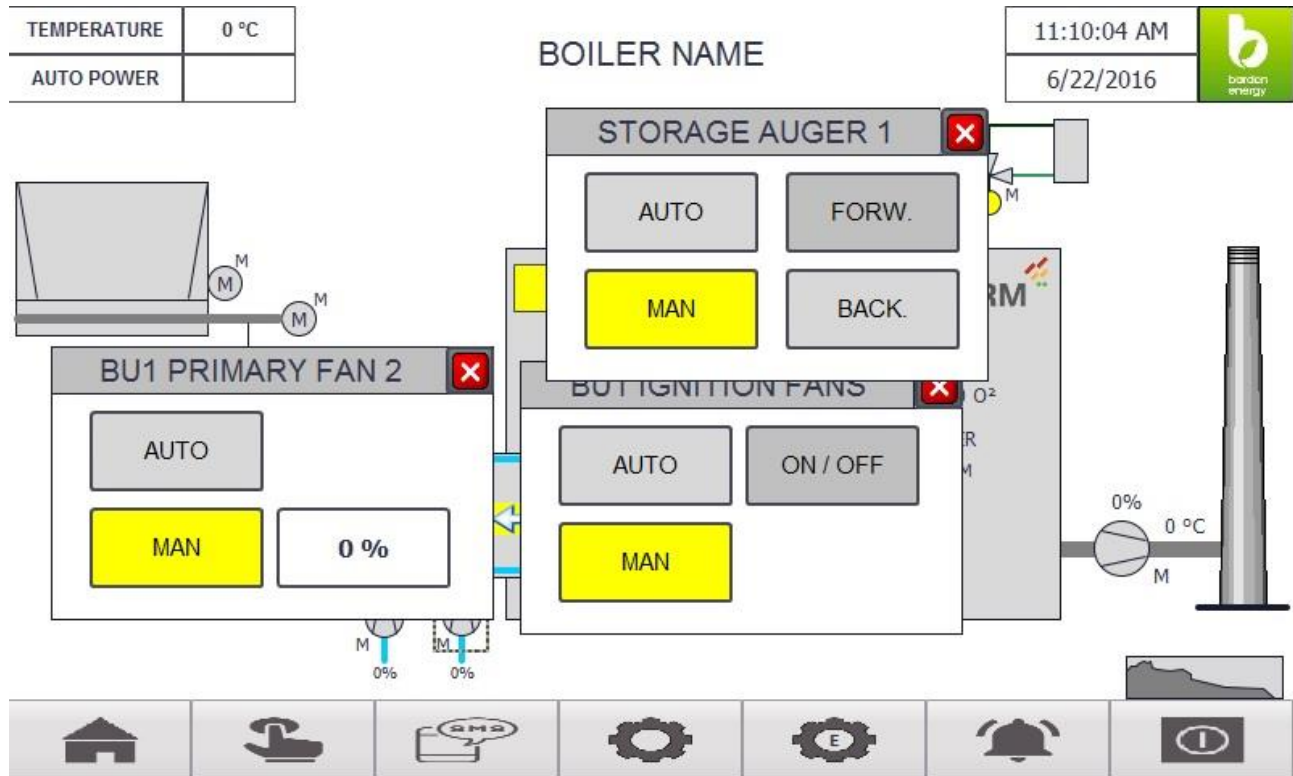


Image 1. Mainpage - manual control

Boiler and burner functions/values (temperatures, power,...) are shown at BOILER-page. Device can be driven manually by pressing device symbol and pop-up window will open.

NOTICE! Remember to set the device back to **AUTO**-mode.

7.1 Alarms

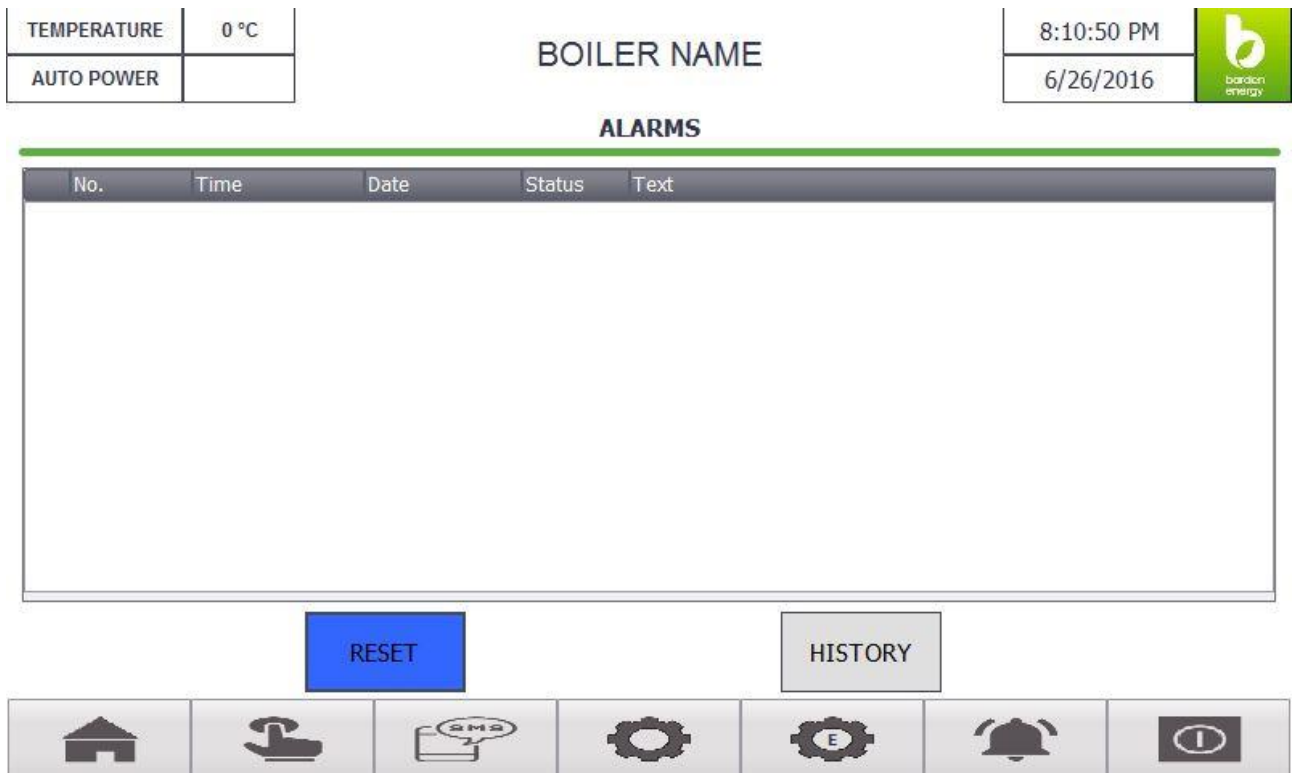


Image 2. ALARMS-page

Alarms are indicated with a yellow triangle appearing on the display. The **ALARMS** -page displays active alarms (Status), time & date and the reason for the alarm (Text). The source of the alarm must be removed before the alarm can be reset (Reset -button). The alarms are recorded in the alarm history.

7.2 Settings

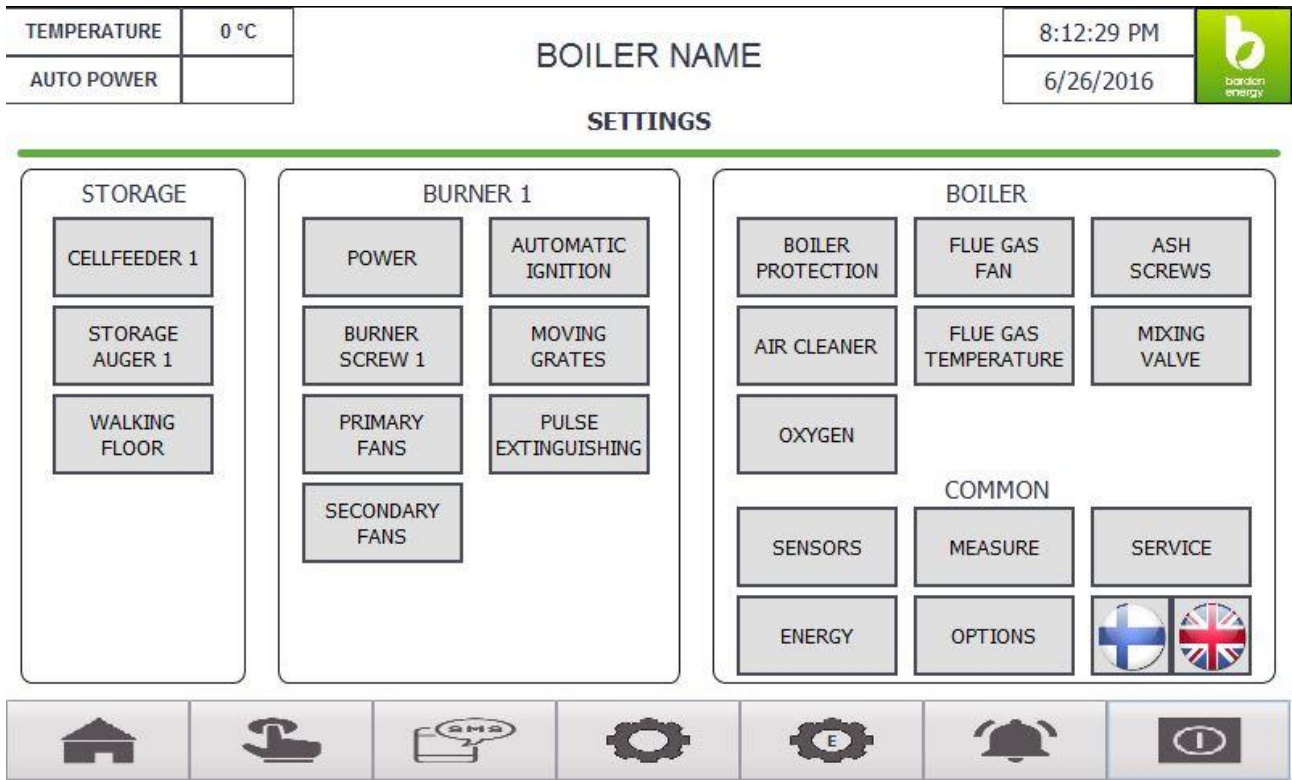


Image 3. SETTINGS –page.

SETTINGS-page is divided to Storage, Burner, Boiler and Common-areas which contain the setting menus for each area. Each button opens up the screen that has the specific settings and parameters for that device/menu.

7.3 Operation

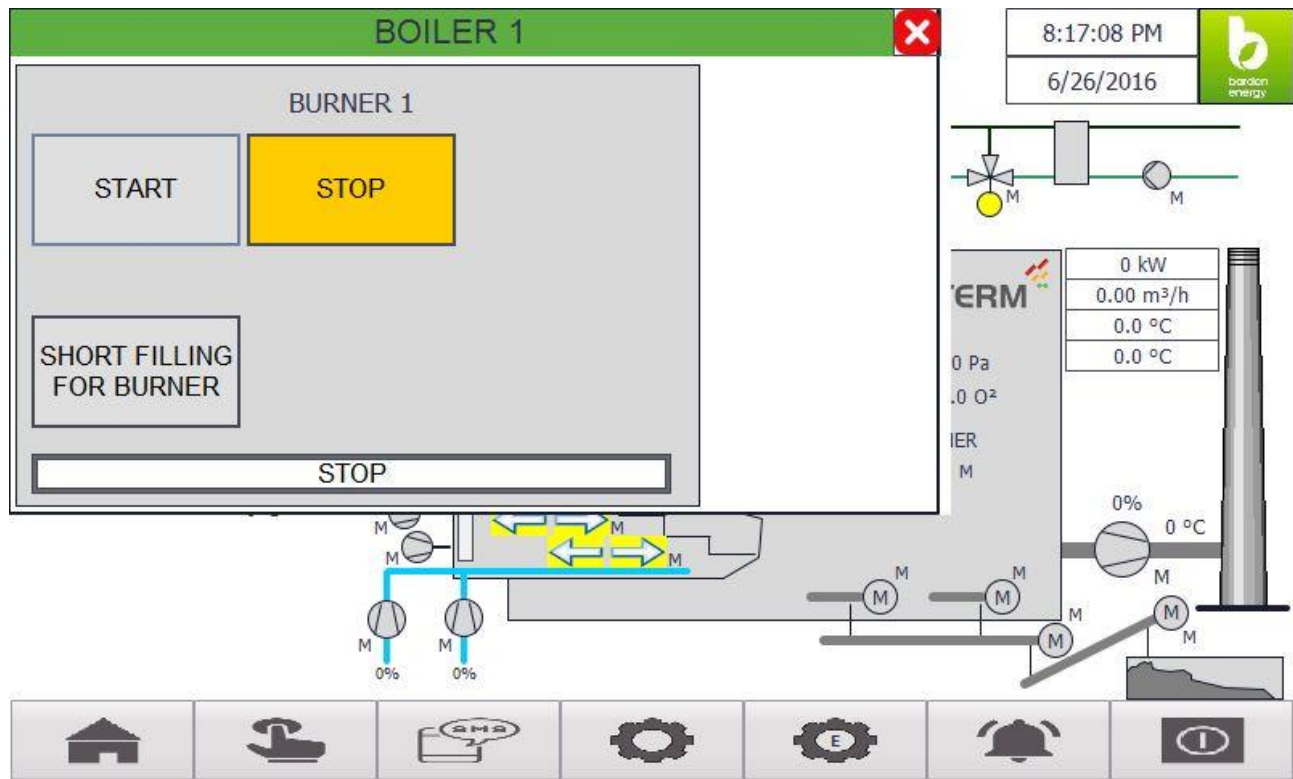


Image 4. OPERATION-page – System in STOP-mode

System is used from OPERATION-page. The system is started with the start button and after ventilation, buttons for choosing the ignition type will follow. The downfiring button will appear also on this page when the system is running.

The system is stopped with the STOP button. However, the pumps and the flue gas fan are stopped from mainpage.

Downfiring-button stops the storage function and burner runs normally. Burner will stop to Flame detection-alarm when fuel ends.

Burnerscrew short filling-button must be activated if burner screw is full of fuel when the system is wanted to start.

MANUAL

Running devices independently or otherwise manually might be necessary when commissioning, doing maintenance or when clearing a fault in the system. All devices can be run manually during normal operation from mainpage. The following functions are controlled here:

- Burner screw
- Storage screw
- Moving floor
- Primary fans
- Secondary fans
- Flue gas fan
- Ash screws
- Moving grate
- Sweeping (can be started from Settings-page)
- Ignition fans
- Network pumps
- Mixing valve

AUTOMATIC

If the burner is set to the **Automatic** mode, the burner will activate the **Power** mode when the flame detection system detects a flame. Burner power is adjusted on a scale of 21–100%. If the flame detection does not detect a flame, the system activates the controlled ignition phase (see section 11. Ignition).

DOWNFIRING


This function stops the storage system operation and the funnel is no longer filled. The system continues to operate as long as the feeding screw and funnel contain fuel. The operation stops when the **Alarm! Flame** message is displayed. The function can be used, for example, during preparations for boiler and burner maintenance.

In accumulator use, the downfiring function is activated automatically when the lower temperature of the accumulator exceeds its setting. The burner will remain in standby mode. The start-up command is given when the accumulator upper temperature falls below the set temperature.

STOP








This button stops all devices of the system, except for the cooling pump and the flue gas fan which must be stopped with their dedicated buttons.

7.4 Options

TEMPERATURE	0 °C	BOILER NAME				8:21:10 PM	
AUTO POWER						6/26/2016	

OPTIONS

BURNER SCREW TEMPERATURE LIMITER	BURNER SCREW FLAME LIMITER	CELLFEEDER	ENERGY MEASUREMENT	ASH SCREW B1	ASH SCREW B2	ASH SCREW C1
SECONDARY NETWORK PUMP 1	SECONDARY NETWORK PUMP 2	EXTINGUISHING PRESSURE-SWITCH NC		ASH SCREW C2	ASH SCREW 1	ASH SCREW 2

The options menu is where the accessories are set. When the button is green, that device is in use. In order for the system to work correctly, the device must be installed according to the circuit diagrams, or by the instructions given by Ariterm, before setting the option on. The options available may not be the same as shown on the picture as they develop constantly.

8. Ignition

When the START button on the **OPERATION** page is pressed, the flue gas fan will perform boiler ventilation (2 min) and the storage auger will fill the funnel. If the flame detection does not detect a flame, the user can select the **Automatic** or **Manual** ignition (NOTE! Automatic ignition is an accessory.) The ignition selection buttons are displayed when the ventilation has been performed and there is fuel in the funnel.

MANUAL IGNITION

With manual ignition, the user can manually run the feeding auger or switch on the primary and secondary blowers.

If the automatic ignition option is enabled, the IGNITION FAN button will also be displayed. The ignition can also be used for manual ignition.

Run the burner screw with the BURNER SCREW button so that the burner head has enough fuel. The storage auger automatically fills the funnel while the flue gas fan maintains an underpressure in the combustion chamber. Ignite the fuel and turn on combustion air fans. Wait for the fuel to properly ignite. You can add more fuel to the burner head. When the flame is large enough, the **Ignition 1** phase can be accepted with the MANUAL IGNITION 2 button, after which the system will proceed to the **Ignition 2** phase.

During the **Ignition 2** phase, the burner is run at a fixed power level, which the user can adjust. In this case, the fuel feeding and air flow is controlled automatically. **NOTE! During the first heating process, the burner should be run at low power (21–30%) for approximately one hour in order to remove humidity from the burner ceramics.** When the flame detection detects a flame, a flame symbol will be displayed. Then you can activate automatic power adjustment by pressing the MANUAL IGNITION READY button. You do not need to wait for the flame information. The end of the **Ignition 2** phase can also be accepted earlier.

The flame information is provided by the flame detection thermostat measuring the temperature of flue gas. When the flue gas temperature exceeds the thermostat limit (approximately 70 °C), the flame information is displayed. The flame detection phase (10 min) is activated after the **Ignition 2** phase. During this phase, the flue gas temperature should increase over the set temperature.

If the system is equipped with automatic ignition, the flame data is monitored during the ignition with an optical flame detection sensor.

8.1 Automatic ignition

If automatic ignition is enabled in the *OPTIONS* menu, the *AUTOMATIC IGNITION* menu is displayed on the *SETTINGS* page. NOTE! Only authorised service professionals can adjust the automatic ignition settings.

The screenshot displays the 'SETTINGS - BURNER 1 - AUTOMATIC IGNITION' screen. At the top, there are status indicators for temperature (0 °C), auto power, boiler name, time (3:05:08 PM), and date (6/22/2016). The settings are organized into two columns of green boxes with white text and values:

- Left Column:**
 - FLAME VALUE: 0 %
 - FLAME LIMIT: 10 %
 - FLAME DELAY: 30 s
 - BURNER SCREW FILLING TIME (short): 15 s
 - BURNER SCREW FILLING TIME (long): 30 s
- Right Column:**
 - IGNITION STEP 1: 240 s
 - IGNITION STEP 2: 420 s
 - HOT AIR GUN RUNNING TIME AT STEP 2: 180 s
 - IGNITION TIME UP -> POWER: 30 s

At the bottom of the settings area, there are two buttons: 'FLAME PID' and 'IGNITION UP -> POWER'. Below the settings is a navigation bar with icons for Home, Back, SMS, Settings, a gear with 'E', a bell, and an information icon.

Image 1. AUTOMATIC IGNITION settings.

Setting	Factory setting	Setting frequency	Function
Flame value	True value	0-100 %	Displays the true reading of the optical flame detection.
Flame limit	5 %	0-100 %	Flame detection limit value for the optical flame detection sensor.
Flame delay	30 s	0-360 s	Flame detection delay.
Ignition step 1	240 s	0-600 s	Length of the Ignition 1 step. Hot air gun and combustion air fans are on.
Ignition step 2	600 s	0-1,200 s	Length of the Ignition 2 step, during which the burner runs at a set power level before switching to automatic adjustment.
Burner screw filling time (short)	20 s	0-360 s	Short burner screw filling time, which can be used when the burner screw is full during ignition.

Burner screw filling time (long)	20 s	0–600 s	Long burner screw filling time, which can be used when the burner screw is empty during ignition.
Hot air gun running time at step 2	30 s	0–360 s	Hot air gun running time after flame detection (ignition step 2).
Ignition time up -> power	30 s	0-360 s	Hot air gun running time when burner goes from upkeeping-mode to power mode. Function can be disabled/enable from the button below.

Automatic ignition is initialised either by the user or automatically by the accumulator upper temperature sensor. The storage auger automatically fills the funnel and the boiler is fanned before ignition. When the funnel is full, the burner screw runs for the duration of the **Burner screw filling time (long)** setting, feeding an appropriate amount of fuel to the burner head. NOTE! If the system is halted by an alarm while the burner screw is full of fuel, the user can select a short filling time during ignition. During short filling, the screw will feed the burner head for the duration of the **Burner screw filling time (short)** setting.

The hot air gun and combustion air fans operate for the duration of the **Ignition step 1** setting. If the flame detection detects a flame, the burner will activate the **Ignition step 2** phase. The optical flame detection sensor must detect a flame during the **Flame delay** setting in order to activate the flame data. If the flame detection fails to detect a flame during the **Ignition step 1** time setting, the fans and ignition stop and the **Alarm! Automatic ignition** alarm is displayed.


During the **Ignition 2** step, the burner runs at a power level configured in the **Burner screw** setting for the duration of the **Ignition step 2** setting. After this the burner automatically activates the power mode. If the flame disappears during the **Ignition 2** step, the **Alarm! Automatic ignition** alarm is displayed.

The **Hot air gun running time at step 2** setting can be used to extend the time the ignition is switched on in the ignition 2 step, during which more fuel is fed into the burner head. For example, moist chips require a longer ignition time.

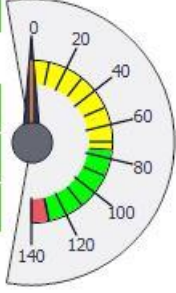
Power settings for the burner screw and the combustion air fans during the ignition steps are set in the *BURNER SCREW / PRIMARY FANS / SECONDARY FANS* settings pages.

The hot air gun can be activated by pressing the **IGNITION UP -> POWER)** once the burner switches from Upkeeping to Power mode.

9. Power control

TEMPERATURE	0 °C	BOILER NAME		2:57:32 PM	
AUTO POWER				6/22/2016	

SETTINGS - POWER CONTROL

TREND / PID	TEMPERATURE SETTING	+0.0 °C	+0.0 °C	
	TEMPERATURE HYSTERESIS	+0.0 °C		
	BURNER 1 POWER	0 %	PID	
AUTO		0 %		
PREHEATING BYPASS NOT IN USE	LOW TEMPERATURE ALARM SETPOINT	+0.0 °C	0 %	




Image 2. Power control settings

Setting	Factory setting	Setting frequency	Function
Temperature setting	80 °C	0–150 °C	Set boiler water temperature. The burner adjusts the power so that the boiler water temperature remains at the set value.
Temperature hysteresis	5 °C	0–50 °C	If the boiler water temperature increases above the set boiler water temperature by the amount of the hysteresis, the burner activates the maintenance mode. When the boiler water temperature decreases by 0.5 x hysteresis, the burner switches back to power mode (e.g., at 82.5 °C)
Burner 1 Power	True value	0-100 %	True burner power
Manual power	21 %	20-100 %	Burner power in MANUAL operation mode. The burner will run at a constant power, until the boiler water temperature increases over

			the set temperature by the amount of hysteresis.
Low temperature alarm setpoint	0,0 C	0-150 C	Boiler water alarm limit (B-alarm).

Burner power is adjusted according to the boiler water temperature. The desired boiler water temperature is entered into the **Temperature setting** field. The burner power PID control maintains the set temperature. The **Hysteresis** setting determines the temperature at which the burner switches to upkeeping mode.

Preheating PID control are used after ignition to prevent overheating. Preheating mode time can be adjusted and the power PID controller can be adjusted slower. Also maximum power can be set during preheating mode.

EXAMPLE: if **Temperature setting** = 80 °C and **Hysteresis** = 5 °C, the burner switches to upkeeping mode when the boiler water temperature reaches 85 °C. When the temperature decreases by 0.5 x **Hysteresis**, 2.5 °C in the example, the burner switches back to power mode (power level 21%).

During normal use the burner is run by automatically adjusting the power according to temperature requirements. In this case, the power is adjusted in 1% increments between 20–100%. The burner can also be run at a fixed power during burner adjustments. The desired power percentage is set with the **Manual power** setting after the AUTOMATIC/MANUAL button is pressed to select the MANUAL mode. In this mode, the burner is run at a fixed power, until the hysteresis switches the burner to upkeeping mode. Upon switching back to power mode, the burner continues at a fixed power level.

By pressing the TREND/PID button, you can review power and boiler water temperature changes within a time range. The trend review tool is particularly useful for adjusting power parameters during commissioning. This also allows the user to adjust the Gain and Ti values of the control. The **Gain** and **Ti** settings (integration time) control the adjustment speed and accuracy.

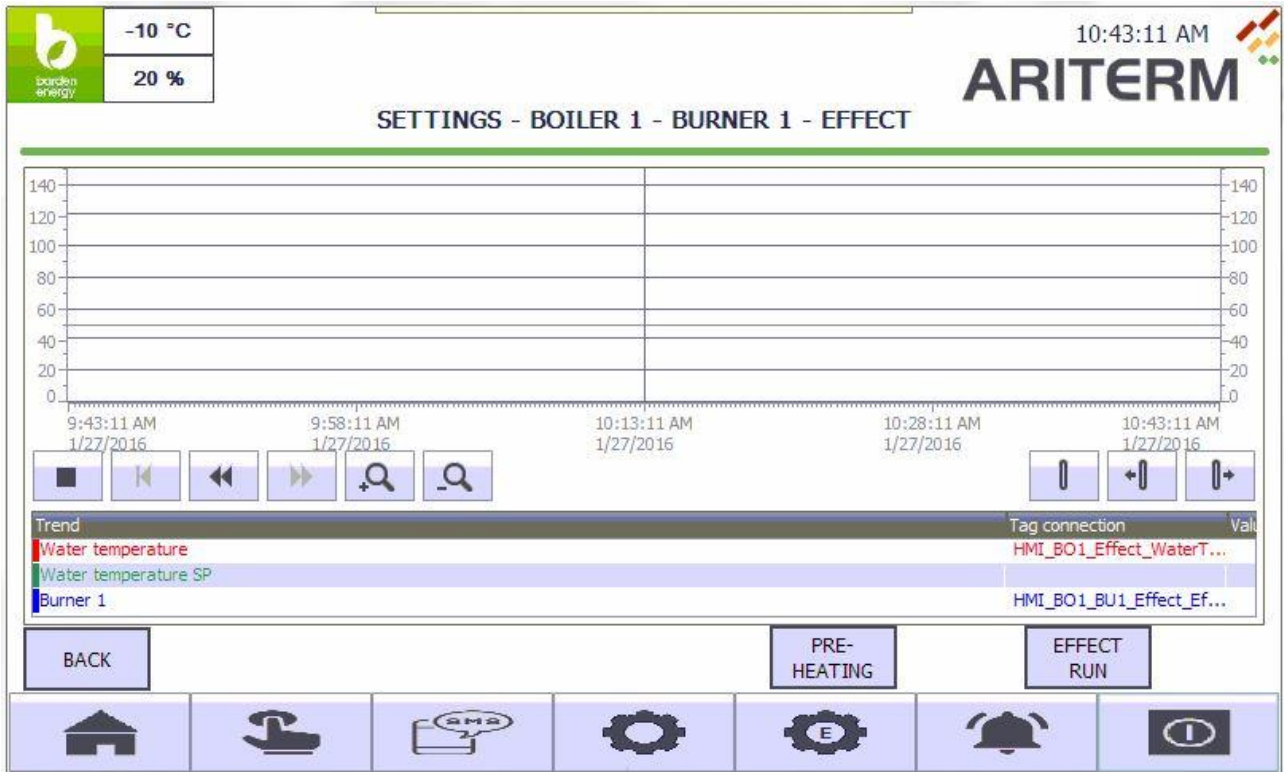


Image 3. EFFECT CONTROL page – Trend.

10. Power settings

The control system adjusts the burner power by controlling the fuel feed (burner screw pulse and pause time ratio) and the rotation speed of the primary and secondary fans according to heat load changes.

The programme has 80 power levels (upkeep mode 20%, power mode 21-100%). The **SETTINGS** page contains the *BURNER SCREW*, *PRIMARY FANS* and *SECONDARY FANS* menus for setting the speed-% of the burner screw and the rotation speed of the primary and secondary fan (0–100%) in five power levels: UPKEEPING, 21%, 50%, 75% and 100%. The programme calculates intermediate power levels according to these basic settings (e.g., 22, 23, 24...%).

10.1 Burner screw settings

The screenshot shows the ARITERM control interface. At the top left, there is a status bar with a 'b' logo and 'borsten energy' text, displaying '-10 °C' and '20 %'. The top right shows the time '10:45:41 AM' and the 'ARITERM' logo. The main title is 'SETTINGS - BOILER 1 - BURNER 1 - BURNER SCREW'. Below this is a table with the following data:

	UP	21%	50%	75%	100%
EFFECT	3.0 %	9.0 %	25.5 %	38.2 %	51.0 %
ON / s	1.8 s	1.8 s	2.8 s	2.8 s	4.8 s
OFF / s	58.2 s	18.2 s	8.2 s	4.5 s	4.6 s
IGNITION	5.0 %				

Below the table are two green buttons: 'LIMITER (TEMP.)' and 'LIMITER (FLAME)'. At the bottom, there is a navigation bar with icons for Home, Phone, SMS, Settings, Emergency, Alarm, and Information.

Image 4. BURNER SCREW settings.

Effect	Factory setting	Setting frequency	Function
UP	0.5 %	0-100 %	Burner screw power in upkeeping mode.
21 %	2.0 %	0-100 %	Burner screw power at 21%.
50 %	5.0 %	0-100 %	Burner screw power at 50%.
75 %	8.0 %	0-100 %	Burner screw power at 75%.
100 %	10.0 %	0-100 %	Burner screw power at 100%.
Ignition	5 %	0-100 %	Burner screw power during Ignition 2 step.

The burner screw power is indicated in percentages. The system calculates the running and pause times automatically according to the power percentage. For example, Power-% = 10% indicates a running time of 1 s and pause time of 9 s. The system calculates the intermediary power percentage automatically.

If the frequency converter is used to control the burner screw, the 100% feed value means that the motor is run constantly at maximum frequency, which has been determined in the frequency converter parameters. When the feed value drops below the **Pulse control limit** -setting, the screw is run with pulses at 50 Hz.

Temperature limiter

Temperature limiter will cut the feeding when boiler temperature rises too high. Temperature limiter can be used to prevent overheating if the normal effect control is too low to cut the power. The temperature limiter can be hidden by disabling it from the options.

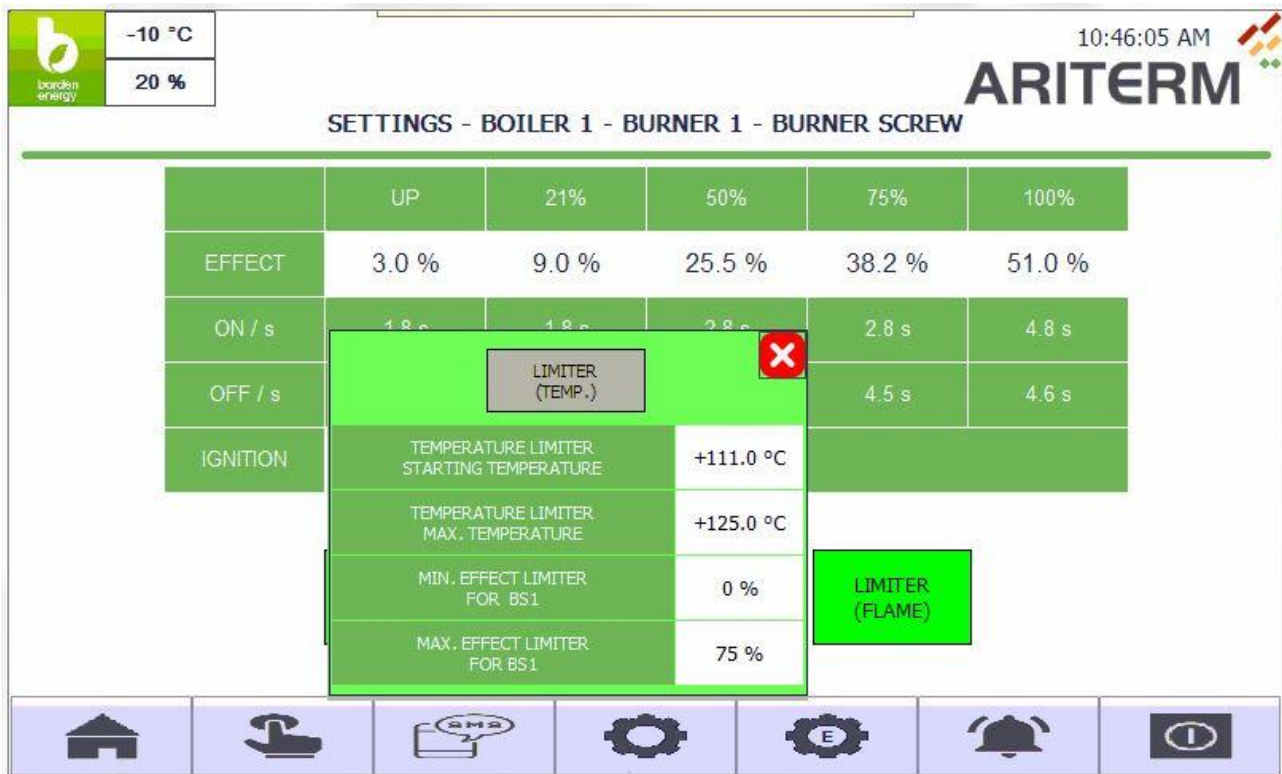


Image 5. Temperature limiter -settings.

Setting	Factory setting	Setting frequency	Function
Temperature limiter starting temperature	0 C	-20...20C	Boiler temperature when burner screw limiter is activated. Temperature is set from boiler setpoint.
Temperature limiter max. temperature	0 C	-20...20C	Boiler temperature when burner screw limiter is cutting feeding according to max effect limiter – setting. Temperature is set from boiler setpoint.
Min effect limiter for BS1	0 %	0-100 %	Burner screw cut rate when boiler temp > limiter starting temp.
Max effect limiter for BS1	0 %	0-100 %	Burner screw cut rate when boiler temp = limiter max temp.

Flame limiter

Flame limiter will cut the feeding when optical flame sensor doesn't see the flame well enough (burning is not good). Flame limiter can be used to prevent bad combustion. The flame limiter can be hidden by disabling it from options.

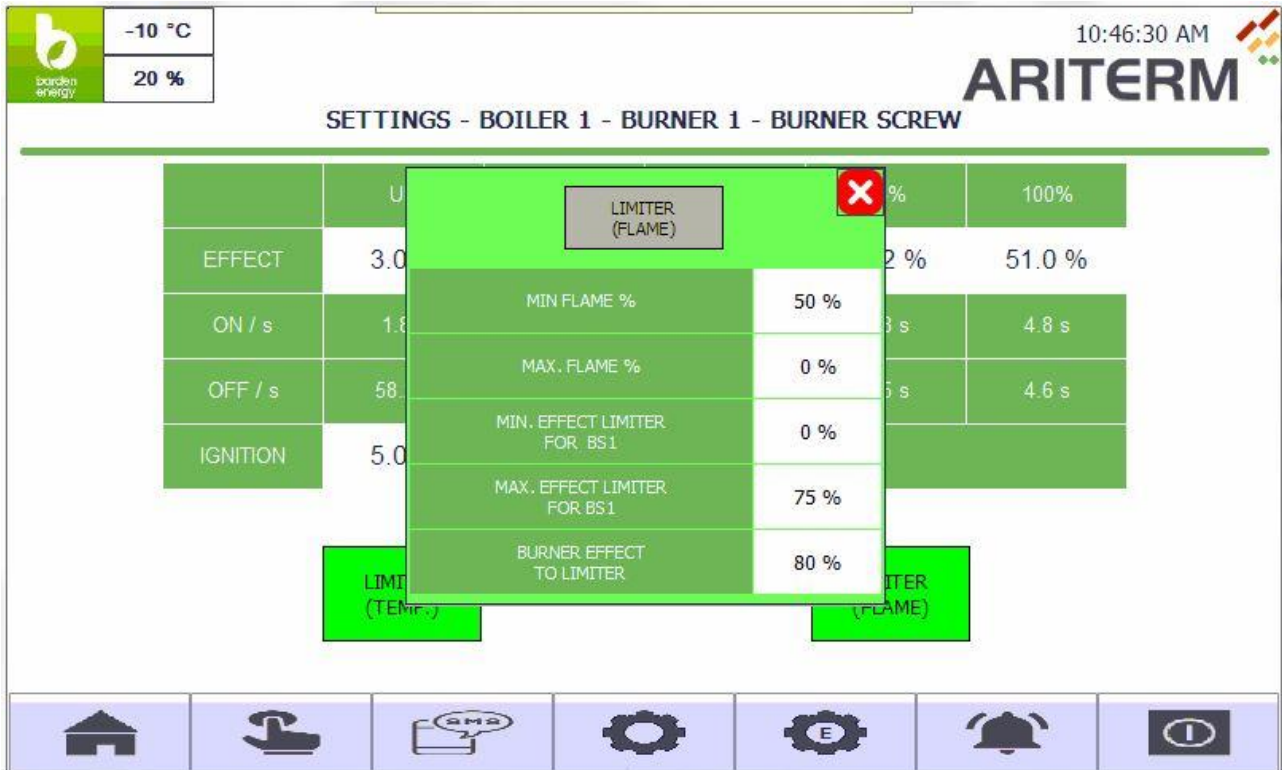


Image 6. Flame limiter-settings.

Setting	Factory setting	Setting frequency	Function
Min flame %	0 C	0-100 %	Optical flame sensor value when burner screw limiter is activated.
Max flame %	0 C	0-100 %	Optical flame sensor value when burner screw limiter is cutting feeding according to max effect limiter –setting.
Min effect limiter for BS1	0 %	0-100 %	Burner screw cute rate when boiler temp > limiter starting temp.
Max effect limiter for BS1	0 %	0-100 %	Burner screw cute rate when boiler temp = limiter max temp.
Burner effect to limiter	80 %	21-100 %	Flame limiter is activated when burner effect > setting.

10.2 Primary fan settings

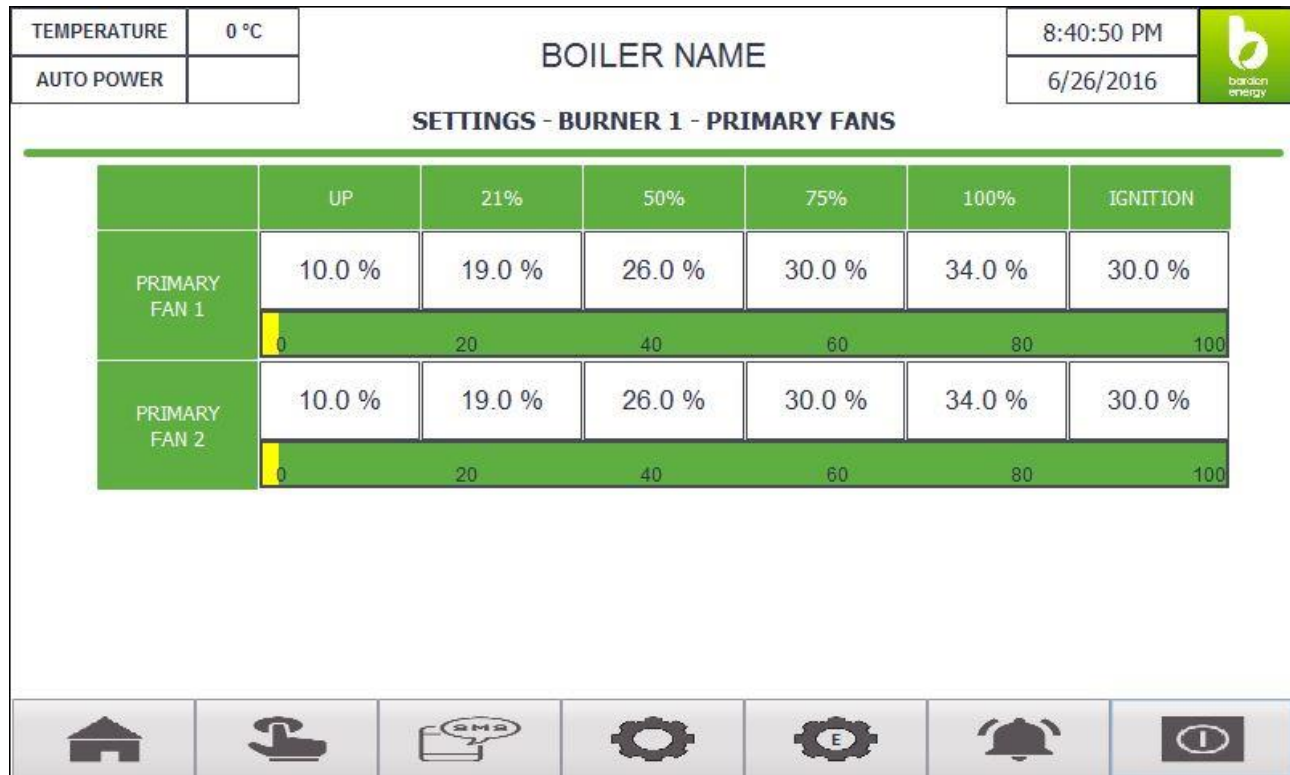


Image 5. Primary fan settings

Effect	Factory setting	Setting frequency	Function
UP	0.0 %	0-100 %	Primary fan power in upkeeping mode.
21 %	25 %	0-100 %	Primary fan power at 21%.
50 %	35 %	0-100 %	Primary fan power at 50%.
75 %	50 %	0-100 %	Primary fan power at 75%.
100 %	70 %	0-100 %	Primary fan power at 100%.
Ignition	20 %	0-100 %	Primary fan power during Ignition 2 step.

The primary fan power is determined between 0–100% for each power point of the chart. The system calculates the intermediary power percentage automatically. The primary fan blows combustion air from underneath the fuel, gasifying the fuel.

10.3 Secondary fan settings

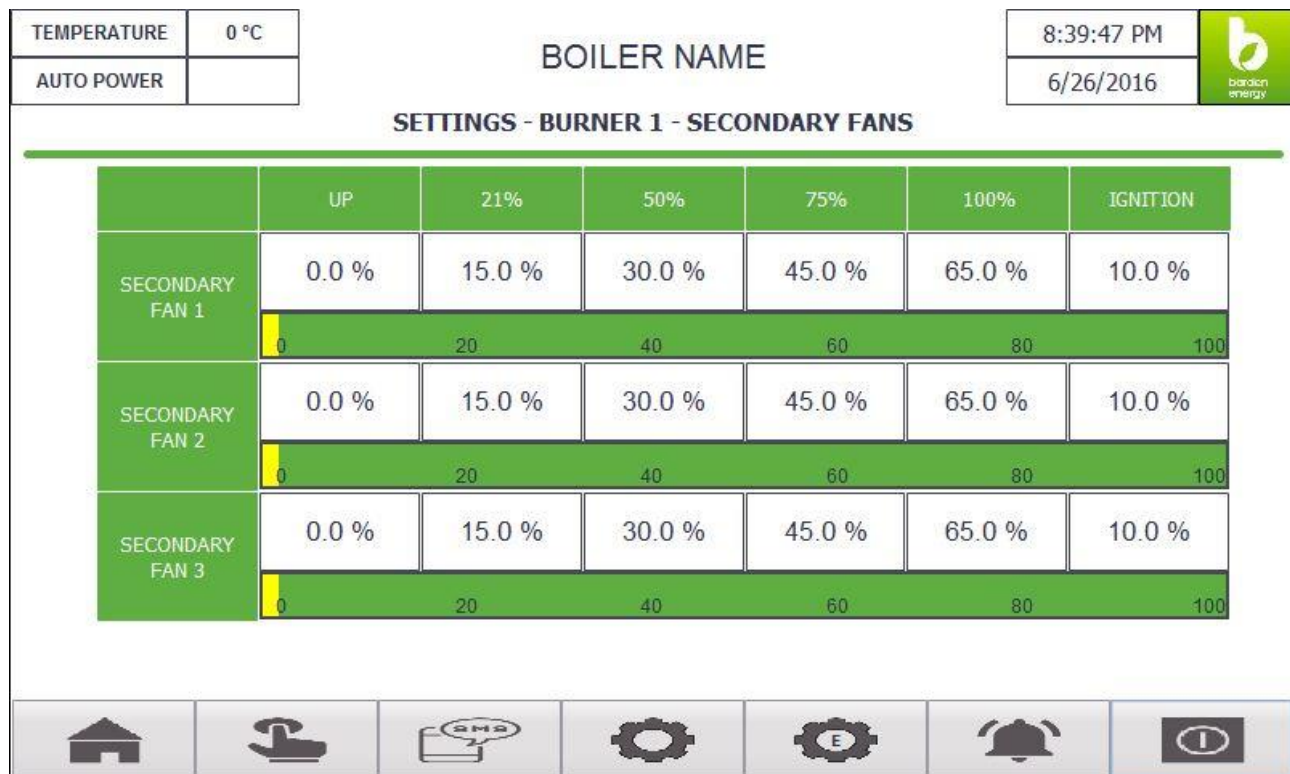


Image 6. Secondary fan settings

Effect	Factory setting	Setting frequency	Function
UP	0.0 %	0-100 %	Secondary fan power in upkeeping mode.
21 %	15 %	0-100 %	Secondary fan power at 21%.
50 %	30 %	0-100 %	Secondary fan power at 50%.
75 %	45 %	0-100 %	Secondary fan power at 75%.
100 %	65 %	0-100 %	Secondary fan power at 100%.
Ignition	10 %	0-100 %	Secondary fan power during Ignition 2 step.

The secondary fan power is determined between 0–100% for each power point of the chart. The system calculates the intermediary power percentage automatically. The secondary fans blow combustion air from above the fuel, burning the gasified fuel.

10.4 Moving grate control

TEMPERATURE	0 °C	BOILER NAME				8:38:13 PM	
AUTO POWER						6/26/2016	

SETTINGS - BURNER 1 - MOVING GRATE 1

	UP	21%	50%	75%	100%
ON / s	1.0 s	1.5 s	1.0 s	1.0 s	1.0 s
OFF / s	60.0 s	37.5 s	30.0 s	22.5 s	15.0 s

SHORT STROKES	99	OPERATING TIME (max)	45	ALARM DELAY	90
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DURING VENTILATION

BACK MOVING GRATE 2









Effect	On / s	Off / s	Function
UP	0.5 s	30 s	Grate movement pulses in upkeeping mode.
21 %	0.5 s	25 s	Grate movement pulses at 21% power.
50 %	1 s	20 s	Grate movement pulses at 50% power.
75 %	1 s	15 s	Grate movement pulses at 75% power.
100 %	1 s	10 s	Grate movement pulses at 100% power.

Setting	Factory setting	Setting frequency	Function
Short move	100 pcs	0–999 pcs	Short grate movement before cleaning movement (full range). If the setting is 0, the grate will only perform cleaning movements.
Max. operation time	20 s	0–360 s	Maximum linear motor running time between limit switches. If the grate does not reach the limit, the running direction will change.
Delay alarm	30 s	0–360 s	If the linear actuator limit switches do not detect any grate movement during the set time, the system will indicate a grate alarm.

The grate of the MultiJet burner is moved with a linear actuator (until 500 kW) or hydraulically. The grate is moved with pulses, which are adjusted according to the burner power level. The basic movement is approximately 2 cm in length, taking place around the outer midline of the linear actuator (in hydraulic operation, the movement between midlines). The number of basic movements can be determined using the **Short move** setting. After this, the grate performs a cleaning movement where the grate moves from one end to the other.

The grate pulses (ON and OFF time) are determined for five power points which the programme uses to calculate times for other power levels.

Same function is used also at BioJet Multi burners grate.

11. Storage auger settings

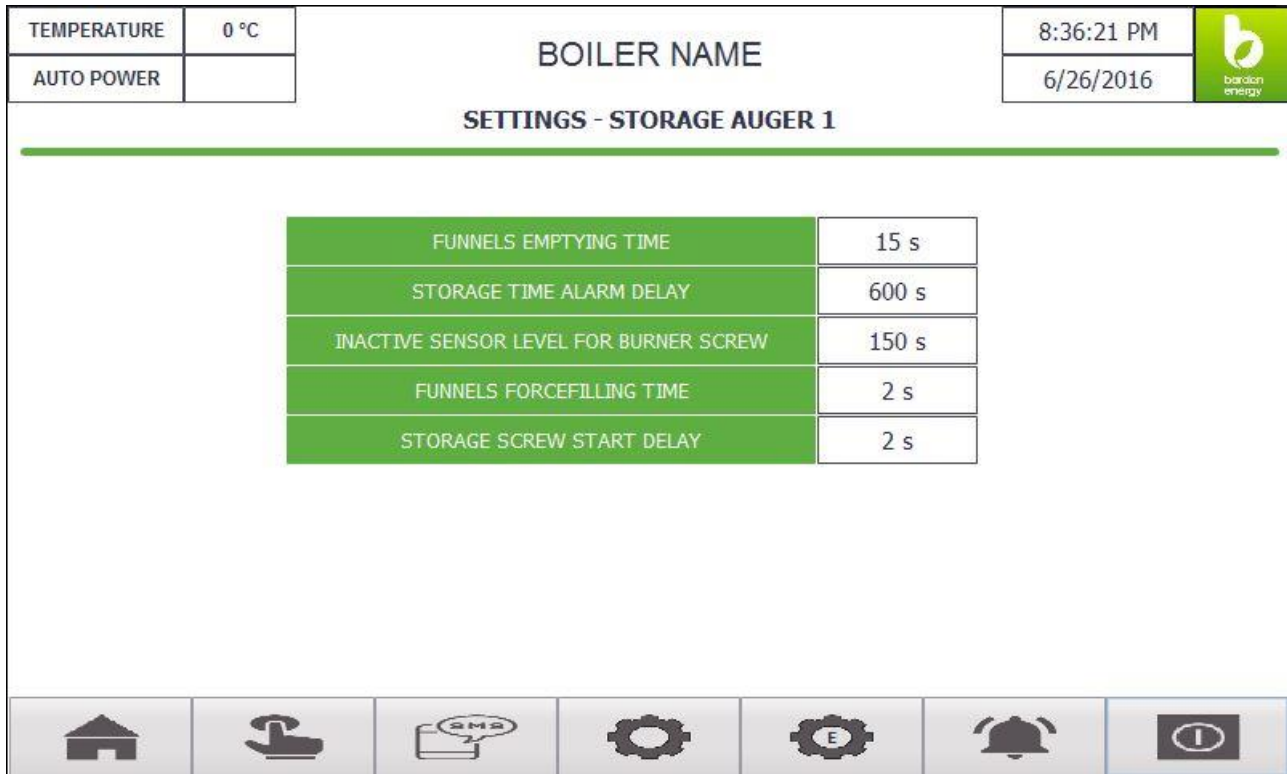


Image 7. STORAGE AUGER settings

Setting	Factory setting	Setting frequency	Function
Funnel's emptying time	15 s	0–60 s	When the funnel photocell pair no longer detects fuel in the funnel, the total operating pulse time of the burner screw is calculated. When the set time is reached, the storage auger is activated. The settings define the lower limit of the funnel. When the photocell pair detects fuel, the storage auger stops.
Storage alarm time delay	600 s	0–1,200 s	The photocell pair must identify the fuel within the set time. If the fuel is not identified, the control logic will display Alarm! Fuel low alarm.
Inactive sensor level for burner screw	150 s	0–600 s	If the funnel photocell pair detects fuel during the set time (calculated with the burner screw pulses), the storage auger is activated for the set duration. The purpose here is to remove any splinters blocking the sensor.

Funnel's forcefilling time	2 s	0–60 s	Storage screw running time after the splinter delay.
Storage screw start delay	2 s	0–60 s	Storage screw start-up delay if the cellfeeder is activated. The cellfeeder must start before the storage auger. NOTE! Settings are displayed if the cellfeeder option is selected.

The photocell pair located in the funnel measures the fuel level. When the funnel photocell pair no longer detects fuel in the funnel, the total operating pulse time of the burner screw is calculated. When the **Funnel's emptying time** setting is reached, the storage auger is activated. Time should be set so that there is always fuel on top of the burner screw. For example, too much time may result in a lack of fuel in the burner screw, which subsequently hinders combustion.

The storage auger fills the funnel, until the photocell pair detects it, stopping the storage auger. When the storage auger has run for the duration of the **Storage alarm time delay** setting, but the funnel photocell pair fails to detect the surface of the fuel, the system indicates the **Alarm! Fuel low** alarm.

If the photocell pair detects fuel according to the configuration of the **Inactive sensor level for burner screw** setting (calculated with the burner screw pulses), the storage auger is activated for the duration of the **Funnel's forcefilling time** setting. This may occur, for example, when a splinter is wedged between the sensors. If the splinter is not removed, the system will indicate the **Alarm! Jam** alarm.

The cellfeeder is started before the storage auger and stopped after the storage auger so that the fuel will not accumulate on the cellfeeder.

12. Flue gas fan

TEMPERATURE	0 °C	BOILER NAME	2:32:40 PM
AUTO POWER			6/22/2016

SETTINGS - FLUE GAS FAN

TREND /
PID

MEASURED PRESSURE	0 Pa
PRESSURE SETTING	
IGNITION	-40 Pa
UPKEEPING	-15 Pa
POWER RUN	-25 Pa
AIR CLEANER	-40 Pa
ALARM LIMIT	40 Pa

Image 8. FLUE GAS FAN settings

Setting	Factory setting	Setting frequency	Function
Measured pressure	True value	-100...100 Pa	True pressure in the combustion chamber. (-) means underpressure.
Ignition	-25 Pa	0...-100 Pa	Combustion chamber pressure setting when burner is in ignition mode.
Upkeeping	-10 Pa	0...-100 Pa	Combustion chamber pressure setting when burner is in upkeeping mode.
Power run	-25 Pa	0...-100 Pa	Combustion chamber pressure setting when burner is in power mode.
Air cleaner	-40 Pa	0...-100 Pa	Combustion chamber pressure setting when boiler sweeping is on.
Alarm limit	20 Pa	0...100 Pa	Combustion chamber overpressure limit, leading to Alarm! Flue (Smoke) gas fan.

The speed of the flue gas fan is regulated according to the underpressure of the combustion chamber. Underpressure can be set for the **Ignition, Upkeeping, Air cleaner** and **Power** modes.

By pressing the TREND/PID button, you can review the flue gas fan adjustments. The combustion chamber underpressure should remain approximately the same as the set value. If the flue gas fan adjustment "wavers", its speed can be adjusted with the **Gain (P)** and **Integration time (Ti)** settings.

13. Accessories

13.1 Moving floor

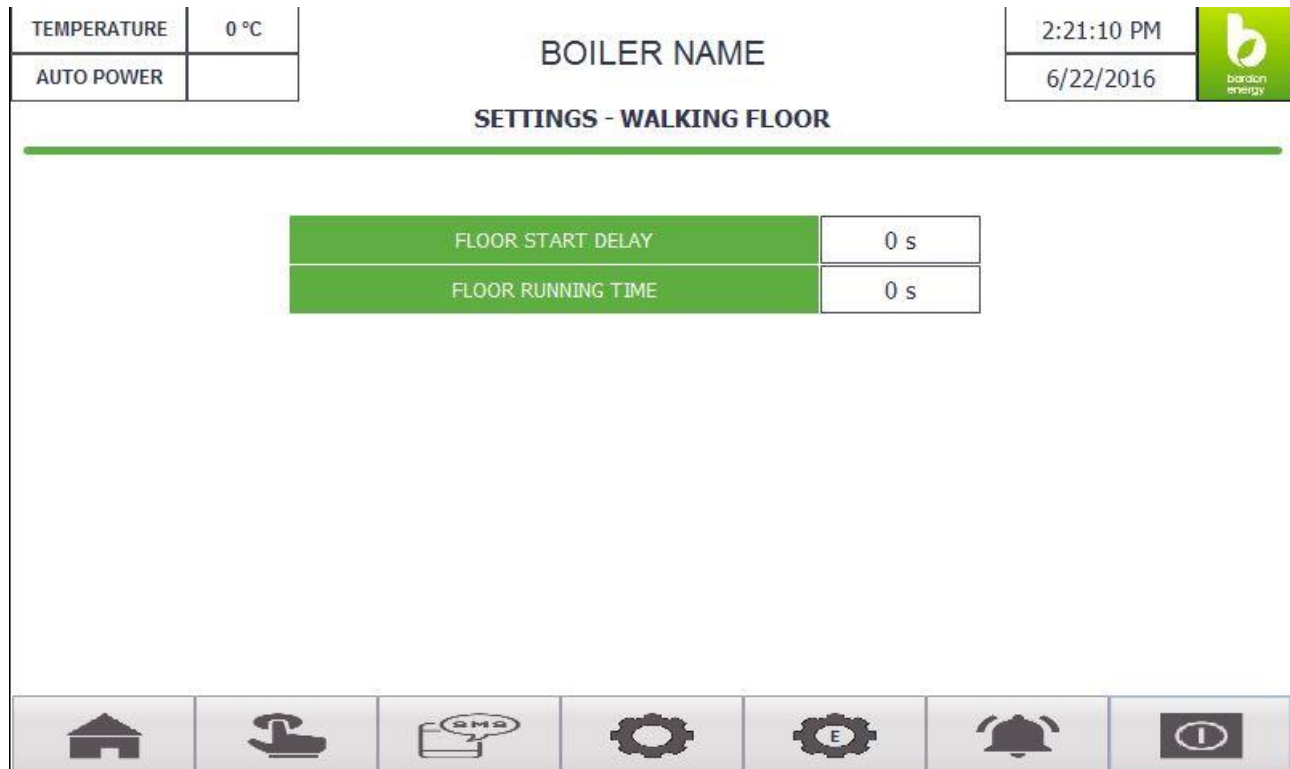


Image 9. MOVING FLOOR settings.

Setting	Factory setting	Setting frequency	Function
Start delay	120 s	0–360 s	When the storage auger has run for the set time, but the funnel sensor has not detected any fuel, the moving floor is activated for the set duration.
Running time	10 s	0–60 s	Moving floor running time.

When the storage auger has run for the set **Start delay** time, but the funnel sensor has not detected any fuel, the bar discharger is activated for the set duration. The bar discharger runs for the duration of the **Running time** setting. Time should be set so that the cylinder performs one reciprocating motion at most.

13.2 Sweeping settings

TEMPERATURE	0 °C
AUTO POWER	

BOILER NAME

2:16:33 PM	
6/22/2016	

SETTINGS - AIR CLEANER

AUTO

TIME 1	4	:	0
--------	---	---	---

START

TIME 2	8	:	0
--------	---	---	---

STOP

TIME 3	12	:	0
--------	----	---	---

COMPRESSOR

TIME 4	18	:	0
--------	----	---	---

TIME 5	22	:	0
--------	----	---	---

TIME 6	0	:	0
--------	---	---	---















Image 10. SWEEPING (air) settings.

You can have six individual times when sweeping will be activated automatically. If the bar is green, the time activation is in use. Start and Stop buttons are coloured when sweeping is active and grey when sweeping is not on at the moment. The compressor button is green when the compressor is on. The buttons can be used to start and stop the sweeping. The compressor can be turned on from the button only in manual mode. Sweeping-settings are defined from SERVICE-menu.

13.3 Pulse extinguishing

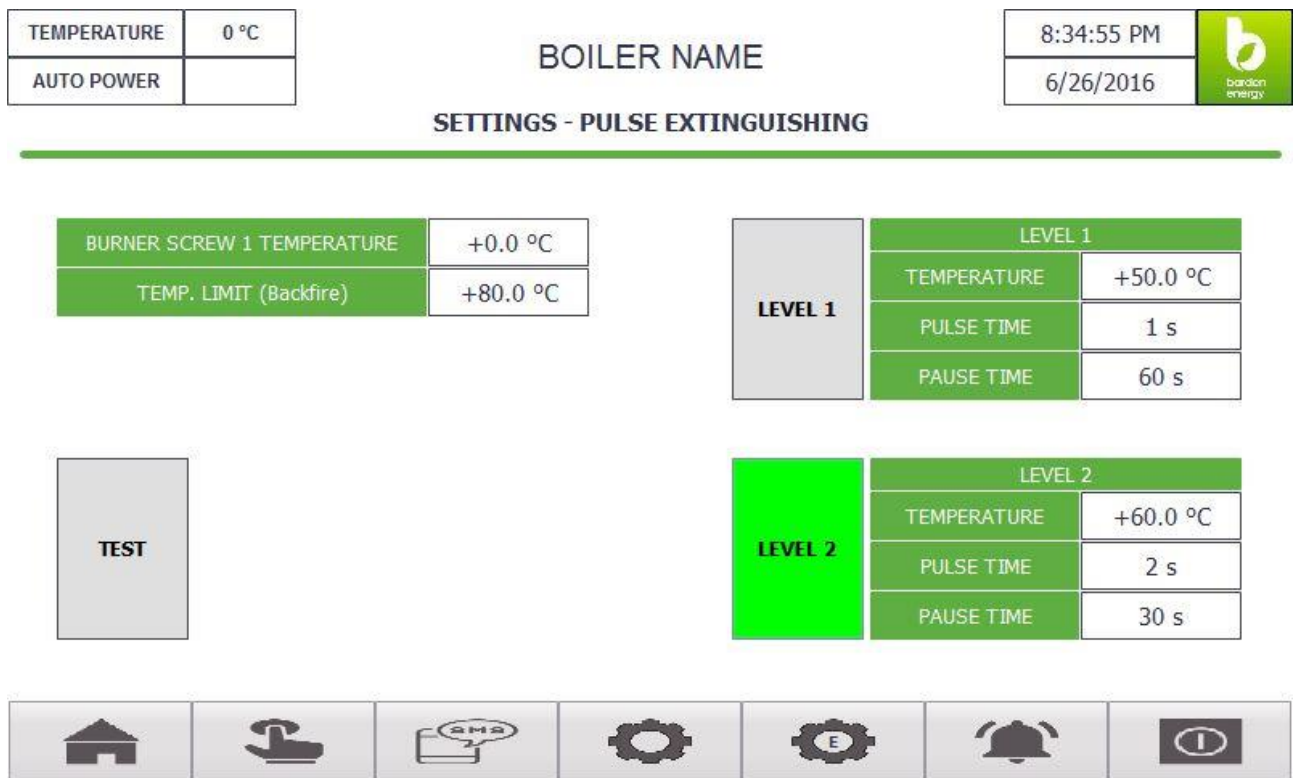


Image 11. PULSE EXTINGUISHING settings.

Setting	Factory setting	Setting frequency	Function
Burner screw temperature	True value	0–150 °C	Burner screw surface temperature
Temp. limit (back fire)	80 °C	0–150 °C	If the burner screw surface temperature exceeds the set temperature, the system reacts similarly to when a back fire thermostat is set off.
Level 1 Temperature	50 °C	0–150 °C	Burner screw temperature at which pulse shutdown level 1 humidification starts.
Level 1 Extinguishing pulse	1 s	0–10 s	Level 1 pulse length.
Level 1 Pause time	60 s	0–360 s	Level 1 pause time.
Level 2 Temperature	60 °C	0–150 °C	Burner screw temperature at which pulse shutdown level 2 humidification starts.
Level 2 Extinguishing pulse	2 s	0–10 s	Level 2 pulse length.
Level 2 Pause time	30 s	0–360 s	Level 2 pause time.

The system can be equipped with a pulse extinguishing system for preventing backfires by humidifying fuel with water when the screw surface temperature increases. There are two humidification temperatures. Pulse extinguishing utilises a Pt100 sensor, which measures the burner screw temperature, and a magnetic valve, which controls the water supply to the burner screw.

NOTE! Water extinguishing cannot be used with pellets.

When the burner screw surface temperature exceeds the **Level 1 temperature** setting, the magnetic valve is controlled according to the **Level 1 Extinguishing pulse** and the **Level 1 Pause time** settings. Pulses are continued until the temperature falls below the setting. If the temperature keeps rising, the system will switch to the faster level 2 pulses. If the burner screw surface temperature exceeds the **Burner screw temperature limit** setting, the burner will react similarly to when a back fire thermostat is set off. The Level 1 and 2 buttons only account to the alarm triggering. If they are in use, the button is green and when the pulse extinguishing level activates, it triggers an alarm. If they aren't in use, the pulse extinguishing will still work according to the set temperatures and times but no alarms will be displayed.

13.4 O₂-Control

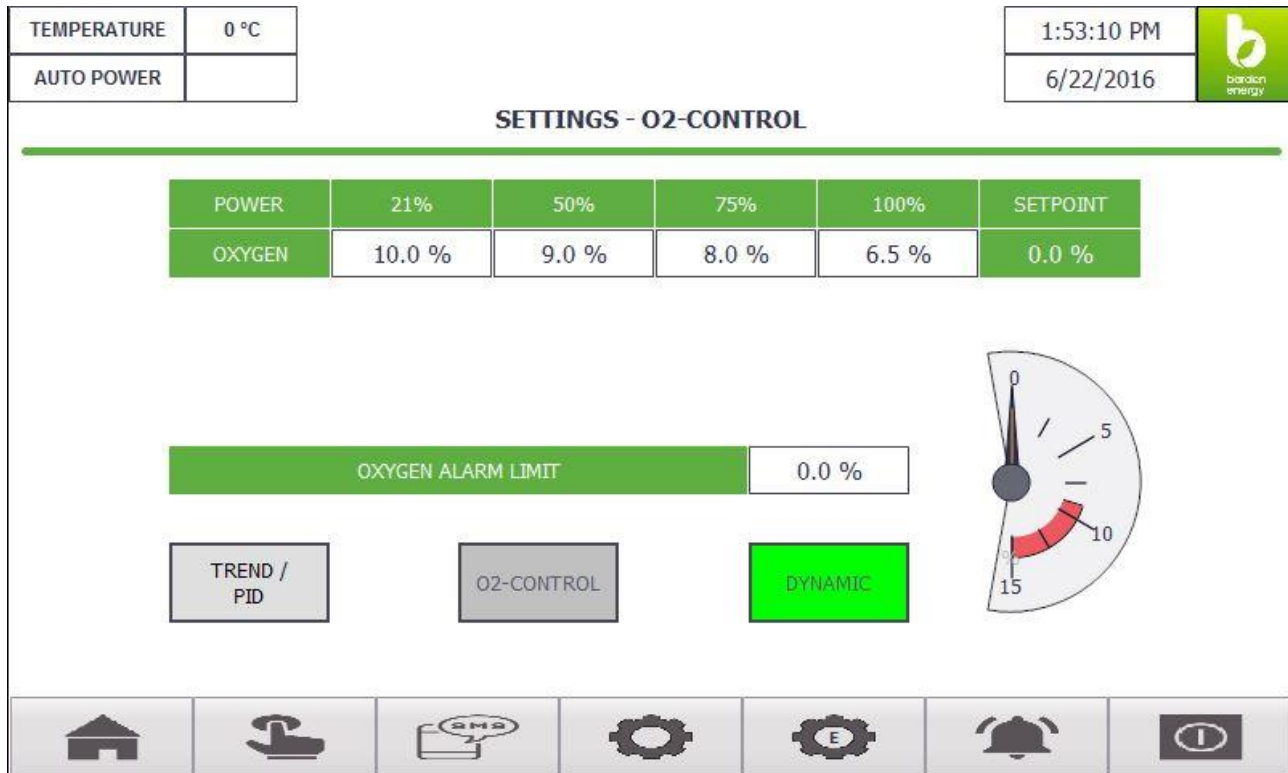


Image 12. O₂ CONTROL settings.

Setting	Factory setting	Setting range	Function
O2 setpoint	8.0 %	6.0-15.0 %	Residual oxygen target value
Measured O2	True value	0-25 %	Residual oxygen true value
Oxygen alarm limit	0.5 %	0-8.0 %	Residual oxygen alarm limit. Stops the burner if oxygen is below this limit.

The residual oxygen content of the flue gas is measured with a lambda sensor (accessory). The O₂-CONTROL button determines whether the measured value is applied to the secondary fan power or just displayed as a residual oxygen value. The required oxygen limit is configured in the **O₂ setpoint** setting (static-mode). O₂ setpoint can be set separately for different effects in dynamic-mode. The recommended residual oxygen level is approximately 7–8% in high power. The residual oxygen value can also be viewed on the **MAIN** page. When the O₂-control is enabled, it controls the operation of the secondary fan. The correction percentage is displayed on the right.

The **Control min.** and **Control max.** settings determine how much the oxygen measurement impacts the secondary fan control. The aim of the limits is to

prevent the secondary fan from being halted due to small values and to prevent high/low blower speeds in case dirt accumulates on the sensor.

There are two different ways to use oxygen control: fixed value or dynamic value, when wanted oxygen value depends on burner power.

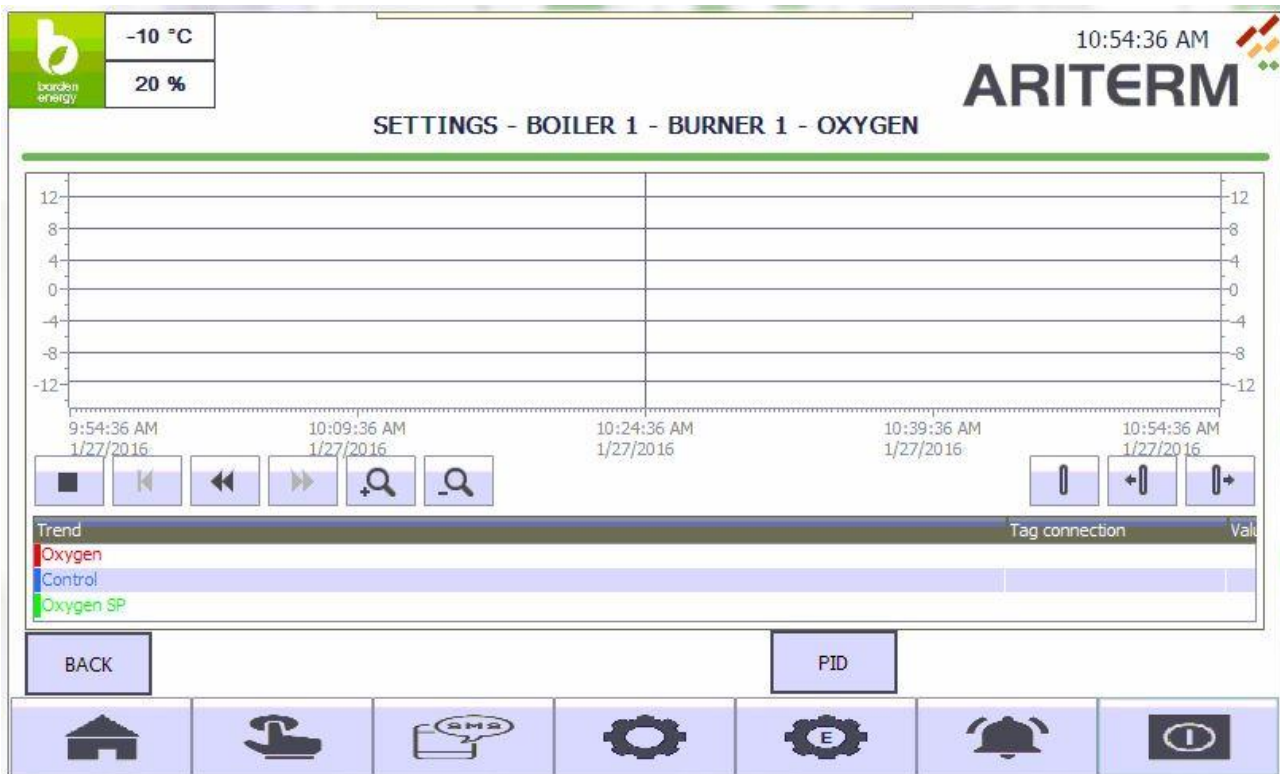


Image 13. O2 control Trend

By pressing the TREND/PID button, you can monitor the residual oxygen values. This also allows the user to adjust the Gain and Ti values of the control. The **Gain** and **Ti** settings (integration) control the adjustment speed and accuracy.

13.5. Ash screws

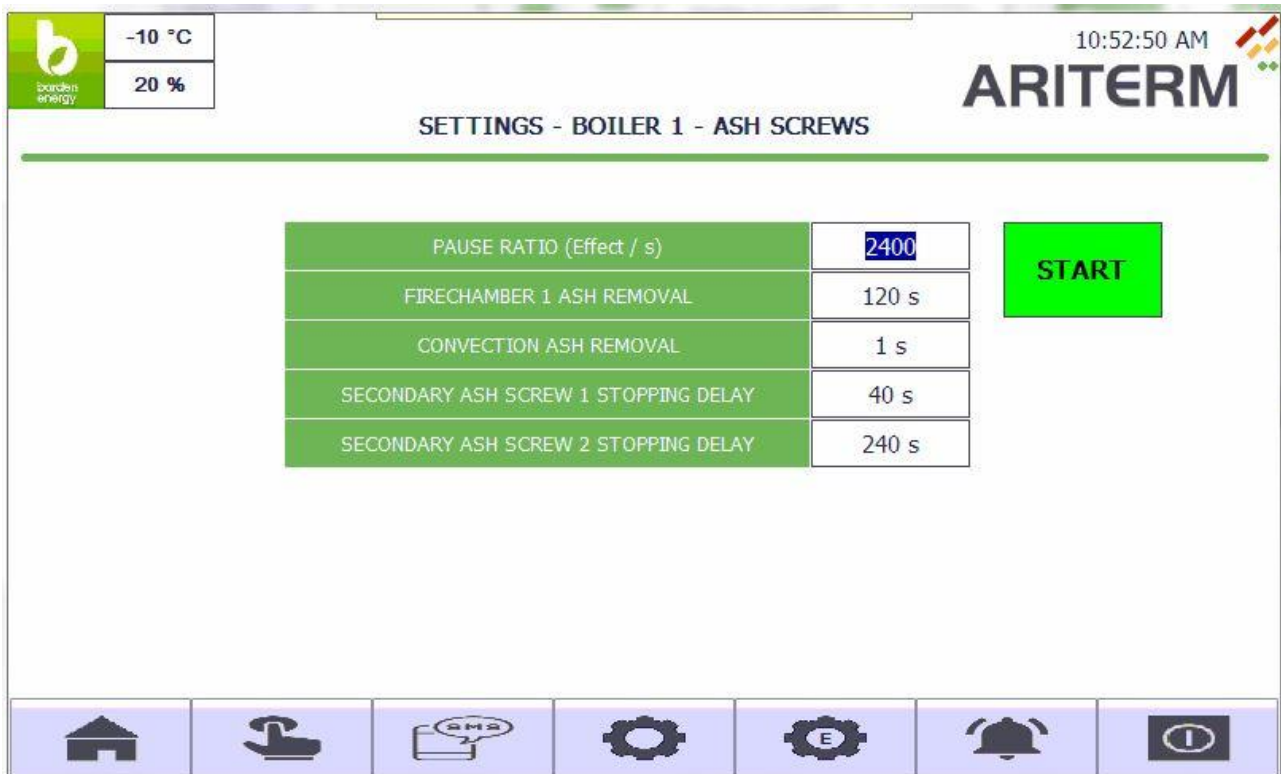


Image 14. ASH SCREW settings at SERVICE-menu

Setting	Factory setting	Setting range	Function
Pause ratio (Effect/s)	7200 s	0-32000 s	Pause time between ash removal cycles at 100% burner power
Firechamber 1 ash removal	120 s	0-300 s	Running time for ash screw B1
Convection ash removal	120 s	0-300 s	Running time for ash screw C1
Secondary ash screw 1 stopping delay	40 s	0-300 s	Running time for secondary ash screw 1 after the ash removal cycle
Secondary ash screw 2 stopping delay	240 s	0-300 s	Running time for secondary ash screw 2 after the ash removal cycle

Ash screws are run according to the burner power. At higher burner power levels, the pause is shorter than at lower burner power levels. The **Running time** setting determines the running duration of the ash screws. The **Pause ratio** setting determines the ash removal pause length at 100% burner power level. For example, if the burner runs at 50% power, the pause is twice as long.

13.6 Flue gas temperature

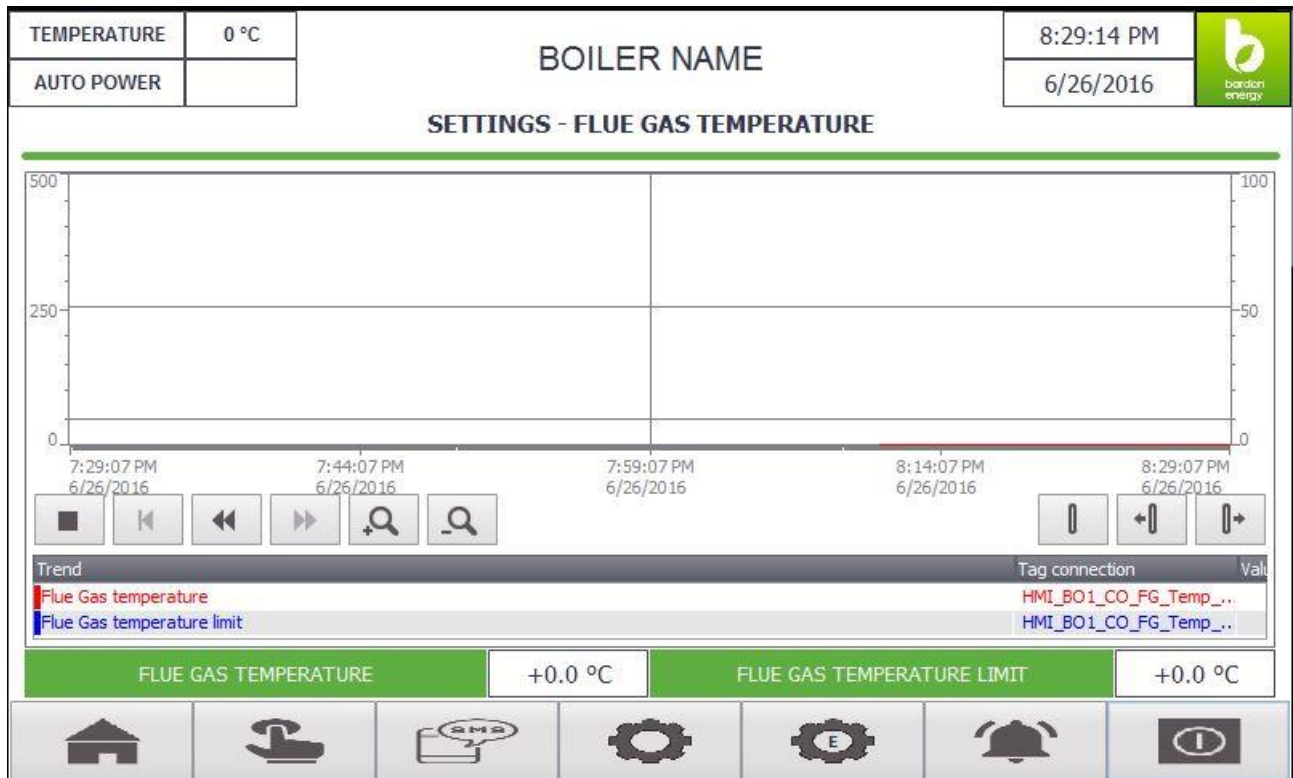


Image 15. FLUE GAS TEMPERATURE settings.


The maximum flue gas temperature (**Temperature limit** setting), at which the system will indicate an alarm and stop the system, is configured in the **Flue gas temperature** setting. The page also indicates flue gas temperature and trend.

Flue gas temperature is also displayed on the **MAIN** page.

setting should be set higher than the burner stopping temperature in order to increase the burner power.

The boiler return water should be set at 70 °C with an automatic control valve or a heating circuit control device.

13.7 Energy meter

TEMPERATURE	0 °C	BOILER NAME	8:30:22 PM	
AUTO POWER			6/26/2016	

NETWORK - ENERGY

TREND WATER TEMPERATURE	ENERGY	0 MWh
TREND EFFECT	EFFECT	0 kW
TREND FLOW	OUTGOING WATER TEMPERATURE	+0.0 °C
	RETURN WATER TEMPERATURE	+0.0 °C
	FLOW	+0.00 m ³ /h











Image 16. Energy meter page

The energy meter (Multical 801) gives the total energy, momentary power, flow and return water temperature as well as flow readings. The scaling depends on the programming of the energy meter.

13.8 GSM alarms

TEMPERATURE	0 °C	BOILER NAME	8:29:48 PM	
AUTO POWER			6/26/2016	

GSM SETTINGS

GSM STATUS

0

SIGNAL STRENGTH %

100

50

0

GSM IN USE

||| OFF

TEST

NUMBER 1

|| OFF

NUMBER 2








|| OFF

NUMBER 3

|| OFF

NUMBER 4

|| OFF



The user can define four telephone numbers where SMS alarms/warnings are sent. NOTE! The SIM card must be empty and the PIN code query must be disabled before installing the SIM card into a GSM modem.

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14. Troubleshooting

Alarm messages indicate the cause of each alarm. The alarms will be displayed in chronological order. Always find out the first source of the problem. A malfunction can lead to several alarm texts on the display. For example, a safety circuit malfunction can be caused by a back fire.

See the following chart for possible sources of problems and solutions. The source of the problem should be located and corrected before restarting the system. The malfunction is reset on the ALARMS page.

If one of the safety devices indicates an alarm, the main contactor will also open and the message **Alarm! Safety circuit** will be displayed.

Alarm	Cause of problem	Inspect
Alarm! Safety circuit	Main contactor 100K1 has been set off due to a safety device. Stops the burner. NOTE! The pumps and the flue gas fan remain in operation.	Check the screen to see which safety device has given the alarm.
Alarm! Burners over temperature	Burner overheating thermostat has been set off.	Inspect the overheating thermostat status and reset if necessary. Determine the cause of overheating (e.g., cooling pump) before restarting the system.
Alarm! Boiler water over temperature	Boiler overheating thermostat has been set off.	Inspect the overheating thermostat status and reset if necessary. Determine the cause of overheating (e.g., circulation pump) before restarting the system.
Alarm! Boiler water under temperature	The boiler water temperature has fallen below the alarm limit.	
Alarm! Backfire	The backfire thermostat has been set off.	Inspect the operation of the backfire thermostat and the temperature setting. Backfire can be caused by, for example, incorrect power settings (in upkeep mode) or low underpressure in the combustion chamber.
Alarm! Burner limit switch	The limit switch has opened.	Check the limit switch status and find out the cause.
Alarm! Dry boiling	The dry boiling protection has been set off.	Inspect the protection status and reset if necessary. Determine the cause of the alarm (e.g., low network

		pressure) before restarting the system.
Alarm! Flame	The flame detection thermostat does not detect a flame when the burner is in power mode.	Inspect the flame detection thermostat setting (approximately 70 °C) and operation. If the limit is set too high, it may prevent the sensor from detecting the flame. Inspect the cleanliness and operation of the flame detection sensor. Inspect the upkeeping power settings. If power is too low, the ember may go out.
Alarm! Automatic ignition	The optical flame detection sensor has not detected a flame during ignition.	Inspect the automatic ignition settings. Test the operation of the ignition and the optical flame detection sensor/thermostat.
Alarm! Fuel low 1	The storage auger has run for the duration of the Storage alarm time delay setting, but the funnel photocell pair has not detected any fuel.	Check the fuel level in the storage or if the fuel has been vaulted. Check the storage settings.
Alarm! Fuel low 2	The storage auger has run for the duration of the Storage alarm time delay setting, but the funnel 2 photocell pair has not detected any fuel.	Check the fuel level in the storage or if the fuel has been vaulted. Check the storage settings.
Alarm! Burner cooling pump	1. The pump fuse has tripped. 2. The safety switch is open	Check the safety switch and fuse and make sure that the pump is working correctly.
Alarm! Boiler water mixingpump	1. The pump fuse has tripped. 2. The safety switch is open	Check the safety switch and fuse and make sure that the pump is working correctly.
Alarm! Networkpump	1. The pump fuse has tripped. 2. The safety switch is open	Check the safety switch and fuse and make sure that the pump is working correctly.
Alarm! Primary fan 1	1. The fan fuse has tripped. 2. The fan is jammed. 3. The safety switch is open.	Check the safety switch and fuse and test the fan operation on the Manual page. Check the error code given by the frequency converter.
Alarm! Primary fan 2	1. The fan fuse has tripped. 2. The fan is jammed. 3. The safety switch is open.	Check the safety switch and fuse and test the fan operation on the Manual page. Check the error code given by the frequency converter.

Alarm! Secondary fan 1	<ol style="list-style-type: none"> 1. The fan fuse has tripped. 2. The fan is jammed. 3. The safety switch is open. 	Check the safety switch and fuse and test the fan operation on the Manual page. Check the error code given by the frequency converter.
Alarm! Secondary fan 2	<ol style="list-style-type: none"> 1. The fan fuse has tripped. 2. The fan is jammed. 3. The safety switch is open 	Check the safety switch and fuse and test the fan operation on the Manual page. Check the error code given by the frequency converter.
Alarm! Fire chamber's over pressure	<ol style="list-style-type: none"> 1. There is overpressure in the combustion chamber. 2. The flue gas fan is not working correctly. 3. The overpressure transmitter of the combustion chamber is not working correctly. 	<ol style="list-style-type: none"> 1. Check the overpressure switch setpoint value and units. 2. Check the operation of the flue gas fan from the Manual menu. 3. Check the overpressure switch alarm limit and connection.
Alarm! Burner screw	<ol style="list-style-type: none"> 1. The burner screw actuator protection has tripped 2. Burner screw contactor. 3. The burner screw is jammed. 4. The safety switch is open. 	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the burner screw operation from the Manual menu.
Alarm! Cellfeeder	<ol style="list-style-type: none"> 1. The cellfeeder actuator protection has tripped 2. Cellfeeder contactor 3. The cellfeeder is jammed. 4. The safety switch is open. 	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the cellfeeder operation from the Manual menu.
Alarm! Storage auger 1	<ol style="list-style-type: none"> 1. The storage auger actuator protection has tripped 2. Storage auger contactor 3. The storage auger is jammed. 4. The safety switch is open. 	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the storage auger operation from the Manual menu.
Alarm! Storage auger 2	<ol style="list-style-type: none"> 1. The storage auger actuator protection has tripped 2. Storage auger contactor 3. The storage auger is jammed. 4. The safety switch is open. 	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the storage auger operation from the Manual menu.
Alarm! Bar discharger	<ol style="list-style-type: none"> 1. The bar discharger motor protection has tripped 2. Bar discharger contactor. 3. The safety switch is open. 	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the bar

		discharger operation from the Manual menu.
Alarm! Ash screw 1	1. The ash screw motor protection has tripped 2. Ash screw 1 contactor. 3. The ash screw is jammed. 4. The safety switch is open.	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the ash screw operation from the Manual menu.
Alarm! Ash auger 2	1. The ash screw motor protection has tripped 2. Ash screw 2 contactor. 3. The ash screw is jammed. 4. The safety switch is open.	Check the safety switch, the current limit for the motor protector and the condition of the contactor. Test the ash screw operation from the Manual menu.
Alarm! Moving grate 1 or 2	1. The linear actuator is jammed 2. Wrong connection.	Check the connection and test the grate operation from the Manual menu.
Alarm! Low oxygen	1. Residual oxygen is below the set limit.	Inspect fan operation and adjust the burner by using a flue gas analyser.
Alarm! Flue (Smoke) gas temperature	1. The flue gas temperature has exceeded the alarm limit.	Clean the boiler and inspect the convection hatch sealing.
Alarm! Flue (Smoke) gas fan	1. There is overpressure in the combustion chamber	Inspect the operation/alarm limit of the flue gas fan and the underpressure transmitter.
Alarm! Jam 1	1. The funnel photocell pair has detected fuel during the Inactive sensor level for burner screw setting	Inspect the funnel and remove the blockage.
Alarm! Jam 2	1. The funnel 2 photocell pair has detected fuel during the Inactive sensor level for burner screw setting	Inspect the funnel and remove the blockage.
Alarm! Pulse extinguishing	1. There is no pressure in the extinguishing system.	Check the network pressure and the pressure switch setting.
Alarm! Electric break > 15 minutes	1. Power shortage has lasted for over 15 minutes.	The system must be restarted.
SMS error	1. No SMS provider number 2. Bad connectivity	1. Set a messaging centre number in the SMS settings 2. Inspect the connection and place the antenna outside, if necessary.
Pulse extinguishing level 1 activated)	1. The burner screw surface temperature exceeds level 1.	
Pulse extinguishing level 2 activated	1. The burner screw surface temperature exceeds level 2.	

Alarm! External silo level low	1. The silo pellet level is below the set limit.	Add more fuel to the storage.
Alarm! Emergency stop buttons	1. The emergency stop button has been pressed	Reset the Emergency stop button.