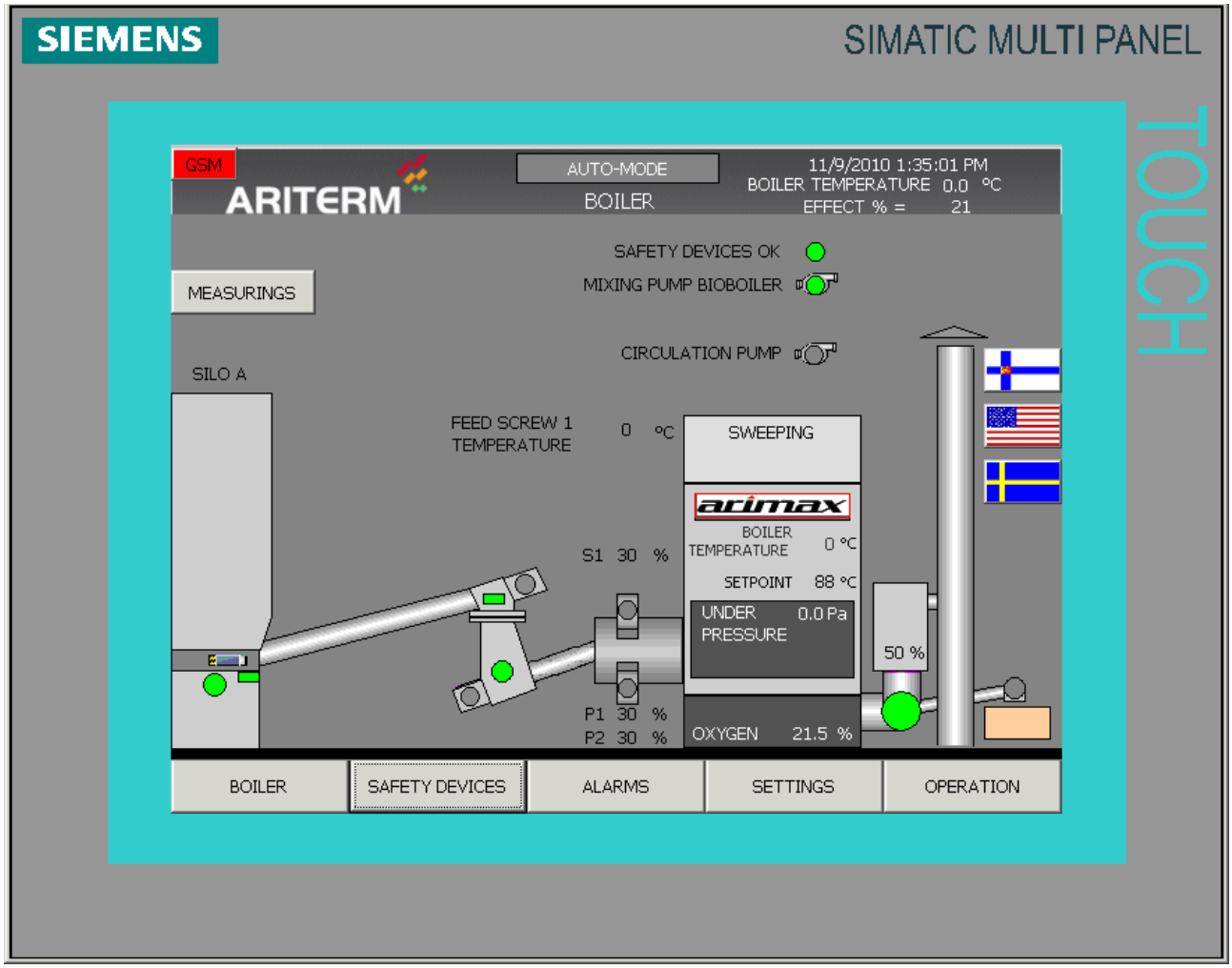
Arimatic 1000

User Manual



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1 GENERAL

The Arimatic 1000 is a versatile control centre for bio heating systems. The system controls are carried out using a programmable computer. The system's interface is a graphic touch-screen which makes it easy to use the system. However, read this manual carefully before using the system. Keep this manual in a place where it is easily available when needed.

The Arimatic1000 control centre is usually project-specific manufactured. Different system variations have been taken into account in the programme, so one important action when using the control centre for the first time is to set the controlling computer's programme definitions to match the heating system to be used. Although the programme is ready for several additional features, the centre is not equipped with components for those functions which are not included in the project in question. Delivery-specific electrical images are supplied with the control centre.

The operating panel display pages have been divided logically into clear parts. Thus the system's operational principle is dealt with in connection with each display page. This manual is a general guide for a pellet heating system up to 500kW burner power. The instructions regarding the use of the Biojet 700 burner and PS08 pellet feeder are found as an appendix at the end of the manual.

2 CONTROL CENTRE SPECIFICATIONS

Arimatic1000 centres are made of high quality components. The system's computer, operating panel, frequency converters, contactors, motor protectors, and other parts are made by Siemens. The centre is cooled by a thermostat controlled fan.

NOTE! The main switch is on the centre door. This is used to switch the centre's electricity supply off before the door can be opened. The main switch DOES NOT switch off the UPS device (battery back-up device for control computer, GSM modem, etc.).

- Control computer: Siemens ET200-F
- Operating panel: Siemens MP277 8”

Cover equipment:
- One 3-phase wall socket (16A)
- Two 1-phase wall sockets (16A)
- One socket, 16A, for the compressor/ash extractor socket, RCD protected
- Four sockets, 10A, for lighting the premises, for example
- UPS device as standard UPS secured power for boil-dry protection and the pulse extinguishing system, incl. 2 spares (total max 2A)
- Cooling fan
- On the centre door: emergency stop-button and the main switch

Control centre standard interfaces and functions:

Controls and sockets for the motor, pump and fan:
- Burner screw (forward/back)
- Storage screw (forward/back)
- Bar discharger hydraulic machinery (in woodchip systems)
- Primary fan (frequency converter controlled, Micromaster 420)
- Secondary fan (frequency converter controlled, Micromaster 420)
- Flue gas fan (frequency converter controlled, Micromaster 420)
- Cooling pump for the Biojet burner
- Mixer pump for boiler water
- Alert relay
- Controls for the automatic sweeping system

Alerts/Safety devices (specified alerts):
- Burner overheating protection
- Back fire thermostat
- Burner transition limit
- Furnace overpressure switch
- Current guard
- Emergency Stop-switch
- Flue gas overheating alert
- Flame monitoring thermostat
- Fault alert for the Biojet burner cooling pump
- Boiler water overheating thermostat
- Boiler water overpressure switch
- Boil-dry protection
- Boiler water low pressure
- Power cut alert
- Pressure alert for the extinguishing system
- Limit switches for the TPYM storage and drop hopper doors
- Fault information for the motor, pump and fan controls

Other outputs/measurements:
- Drop hopper surface guard (capacity sensor/photocell)
- Boiler water temperature
- Residual oxygen reading
- Furnace low pressure

Control options:
- Second storage screw (storage screws can be next to each other or in a series)
- Fuel mix ratio controls (storage screws controlled with the frequency converter)
- Rotation valve for pellets (Stoftteknik JM20)
- Cycle water pump
- Pellet silo transition lower limit alert (if two silos, both with lower limit sensors, are in use, the silo transition can be made automatically)
- Biojet T burner grate maintenance bar ("pusher") control
- MultiJet burner grate control
- Control of the ash screws (forward/back), max. 4
- Controls for opening the storage roof (if the storage discharge machinery is included in the Ariterm delivery!)
- Pressure increase pump
- Alternating use for circulation pumps
- Controls for two control valve circuits (control valve control with 0-10V messages, exit water and incoming water temperature measuring 4…20mA measuring message)
- Pulse controlled back fire protection (for woodchip systems)
- GSM modem for text message alerts
- Remote use connection (with an Internet browser)
- Automatic sweeping system expansion max. 25 nozzles
- Controls for PS08 pellet feeder
- Controls for Biojet700 burner's second primary fan

Documentation:

- Circuit diagrams
- Lay-out photographs of the centre
- List of components

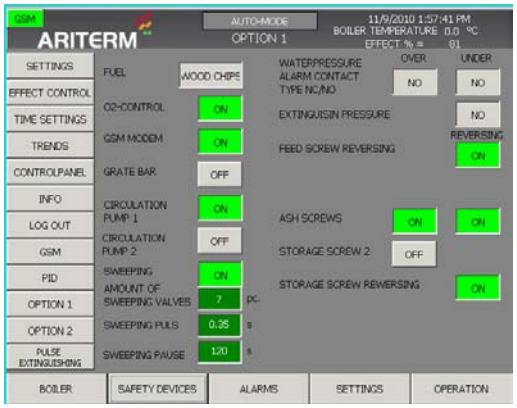
3 SYSTEM INTRODUCTION AND USE

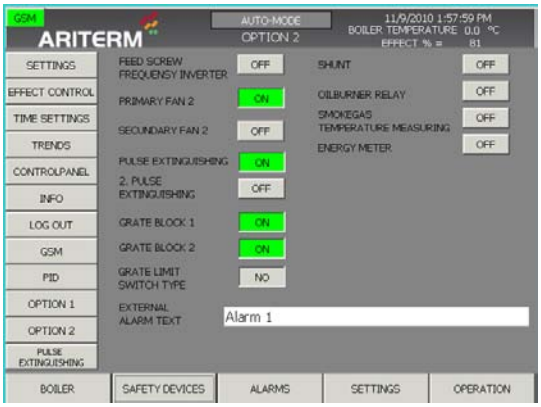
The computer programme has been designed to suit both pellet and woodchip systems which differ from each other mainly with respect to storage automation. This manual describes the issues relating to the use of the pellet system. The system's usage can be improved with several extra options for which the computer programme is ready.

The graphic interface enables easy management of the system. The interface is divided into four main pages, between which you can navigate using the buttons on the bottom of the screen. The top part of the interface which displays the date, time, and the name of the active page, the usage mode of the burner, the boiler's water temperature and the current power step is common to all screens. The screen is used by touching the active fields.

When you first start using the system, determine which system type is being used and which extra functions it is equipped with. This system definition is made by using the operating panel main menu *"SETTINGS"* and the *"OPTIONS"* and *"OPTIONS 2"* submenus. These settings determine which items are displayed for the user in the operating panel pages and which control applications are in use in the computer programme.

NOTE! THESE SYSTEM SETTINGS MUST BE MADE BEFORE THE SYSTEM IS STARTED UP!





We will go through the automatic sweeping as an example of the accessories:

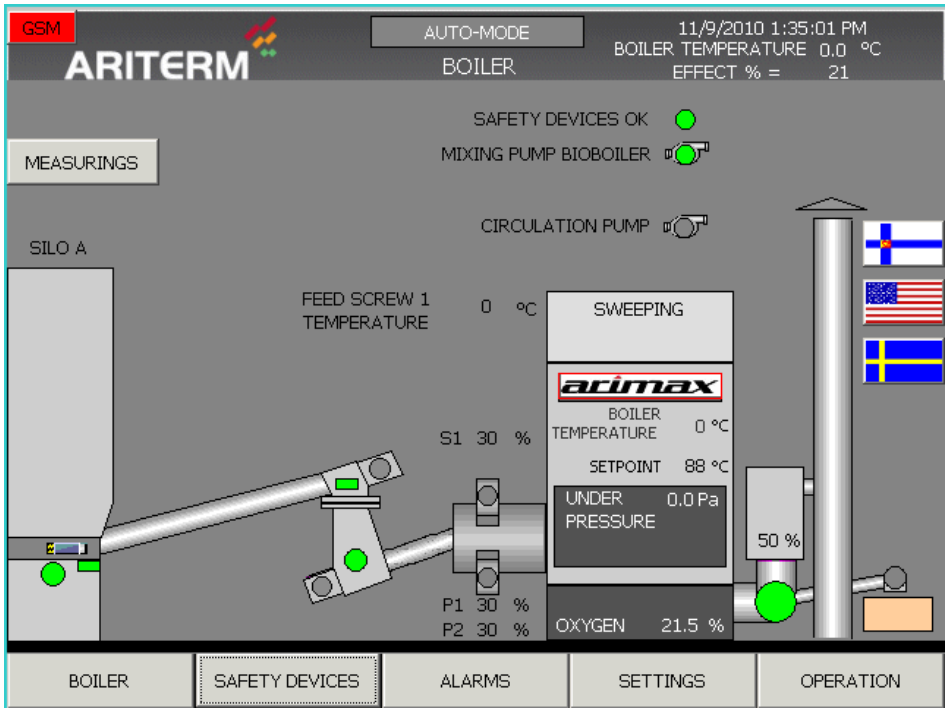
If this equipment is not installed in the boiler, the screen will not display its time-setting fields. When you wish to activate the automatic sweeping, select from the *"OPTIONS"* page *"SWEEPING"* on, i.e. go to the "ON" mode. After this determine how many compressed air nozzles are included in the sweeping system (*"AMOUNT OF SWEEPING VALVES"*), the length of the nozzle's pressure strike (*"SWEEPERS OPERATIONAL PERIOD"*, set the value 0.35 sec.) and the length of the period between the pressure strikes (this is influenced by the effectiveness of the air compressor, i.e. how quickly it can be charged). After these settings are programmed, the circles indicating the sweeper nozzles appear on the top of the boiler on the *"BOILER"* page of the operating panel. When sweeping is in use these circles change to green as the sweeping progresses. In addition to this the six frequency fields which determine the frequency of the sweeping operation appear in the *"FREQUENCY"* submenu of the *"SETTINGS"* menu. These can be used to activate the required amount of operational periods by using the ON/OFF button on the right. The *"GENERAL"* submenu under the *"SETTINGS"* menu displays the low pressure which you wish to retain during the sweeping (*"Sweeping low pressure"*).

The same principle concerns the system's accessories: the residual oxygen measuring, GSM-modem, the pusher (the burner's grate bar), ash screws, cycle water pump, rotation valve, the

second storage screw, the second primary fan (700kW Biojet burner) and the pulse controlled back fire protector (in woodchip systems).

NOTE! THE CONTROL CENTRE IS DELIVERY-SPECIFIC. THE CENTRE IS NOT EQUIPPED WITH THE REQUIRED COMPONENTS FOR ADDITIONAL MOTORS, FOR EXAMPLE!

3.1 BOILER



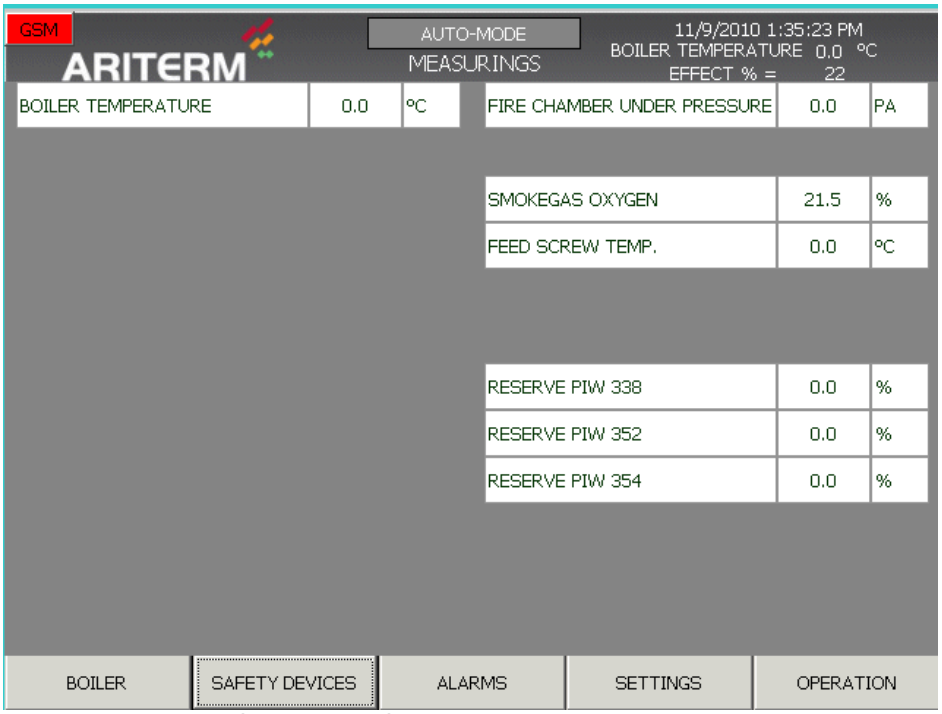
The operating panel *"BOILER"* page displays the following:

- The header field shows the percentage of the burner's power (67% in the picture)
- User mode (the picture shows "*AUTO MODE*"). Other drive modes are *"MANUAL MODE"*, *"NOT IN USE" and "FIRING 1 & 2".*
- The actual value and the default value of the boiler water temperature
- The rotating speeds of the primary fan and the secondary fan
- The rotating speed of the flue gas fan
- Residual oxygen content (if that option is in use)
- Flame monitoring information (the flame symbol inside the burner is displayed when the flue gas sensor detects a flame in the burner)
- Automatic sweeping mode (if that option is in use)

Round circles indicate the status of the fans, pumps and motors. Green indicates that the motor is on, grey indicates that it is stopped and red indicates that there is a fault in the device. The exceptions are the statuses of the silo lower limit sensor and the drop hopper. In these the red colour indicates that the sensor cannot detect pellets.

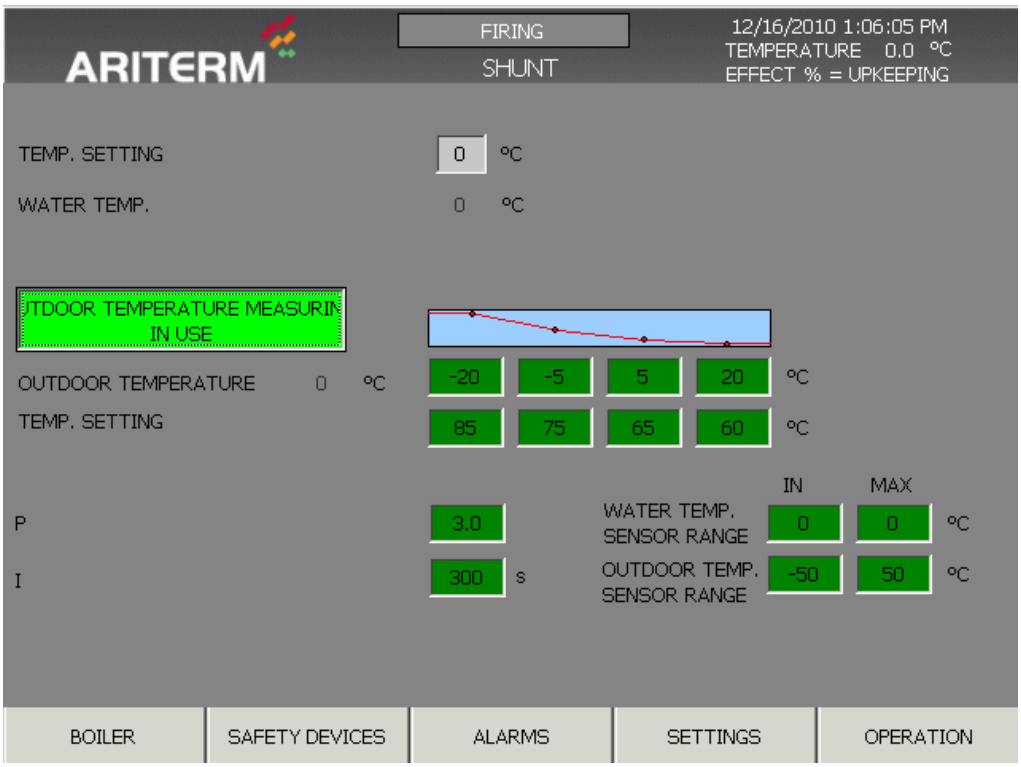
You cannot change the settings for the system functions from the boiler page. These are determined in the *"SETTINGS"* menu.

3.1 MEASUREMENTS



All the establishment's measurement values are on the Measurements page.

3.2 WATER CONTROL VALVE SETTINGS



You can change the water control valve settings on the Shunt page. When outdoor temperature measurement is in use, the control valve adjusts the water temperature according to the outdoor temperature, as shown with the diagram.

3.3 SAFETY DEVICES

The *"SAFETY DEVICES"* page displays the status of the safety devices and alerts connected to the control computer. Active alerts are shown in red.

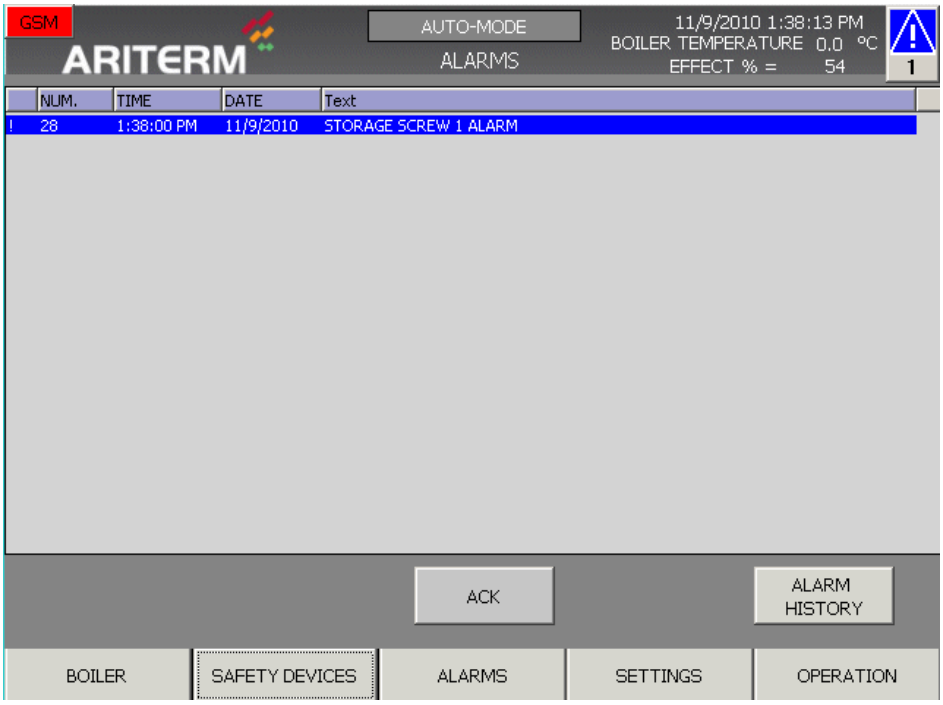
In an alert situation, first remove the fault from the system and then acknowledge the alert by pressing the *"SAFETY DEVICES CHECKED"* button. The system will continue working.

Alerts will stop all devices connected to the safety devices, except the flue gas fan and the burner cooling pump, which must always be on. In connection with the back fire alert the feeding unit will be pushed forward to ensure that any smouldering fire in the unit is returned back to the burner. The cause of the alert is displayed on the operating panel and the message is forwarded as a general alert. In an alert situation the alert list is displayed on the screen. Each alert must be acknowledged separately on the panel.

Alerts which will stop operations:
- water temperature is exceeded
- water overpressure and low pressure
- burner overheating protection
- boil-dry protection
- flue gas fan operating information (frequency converter)
- primary air fan operating information (frequency converter)
- secondary air fan operating information (frequency converter)
- burner cooling pump motor protection / operation information
- flame monitoring thermostat
- back fire thermostat (the feeding unit operates for a set time)
- furnace overpressure
- burner transition limit
- feeding unit motor protection

Warning alerts (information to the operating panel, message to the user)
- ash screw motor protection
- storage screw motor protection
- hydraulic machinery motor protection
- mixing pump fault
- drop hopper door limit/TPYM storage door limit (shared channel)
- oil burner fault
- storage alert
- grate alert

3.4 "ALERTS"

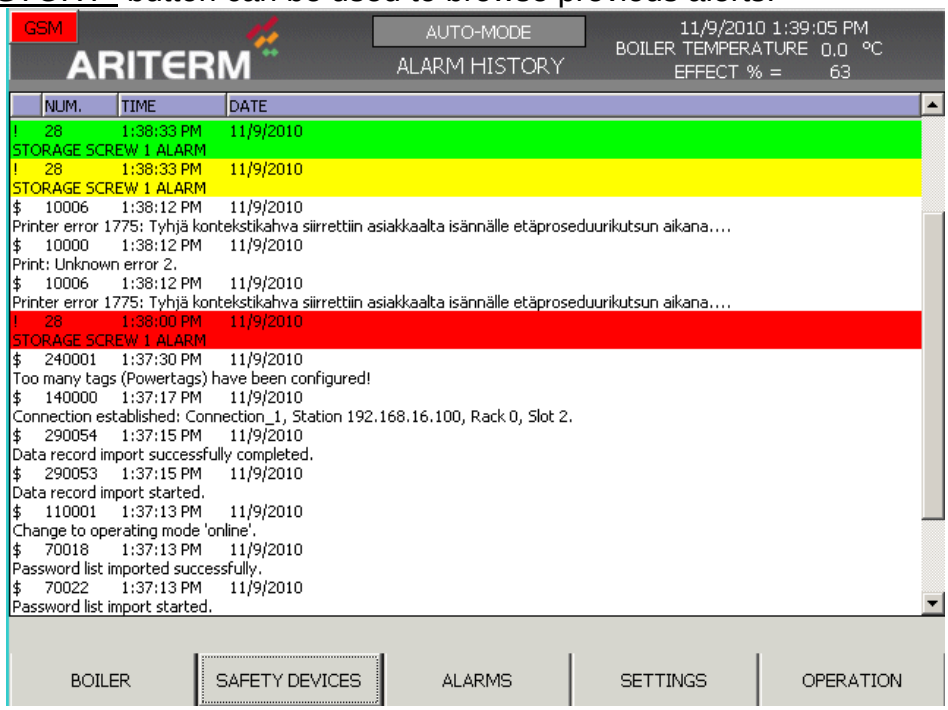


The *"ALERTS*" page displays the active alerts in the system. The alerts are displayed in chronological order, which makes it easier to find out the reason for the alert.

As an alternative to the *"SAFETY DEVICE"* page, alerts can be acknowledged with the *"CHECK"* button on this page.

3.5 ALERT HISTORY

The *"ALERT HISTORY"* button can be used to browse previous alerts.

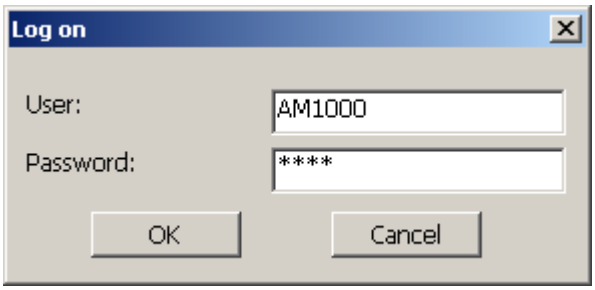


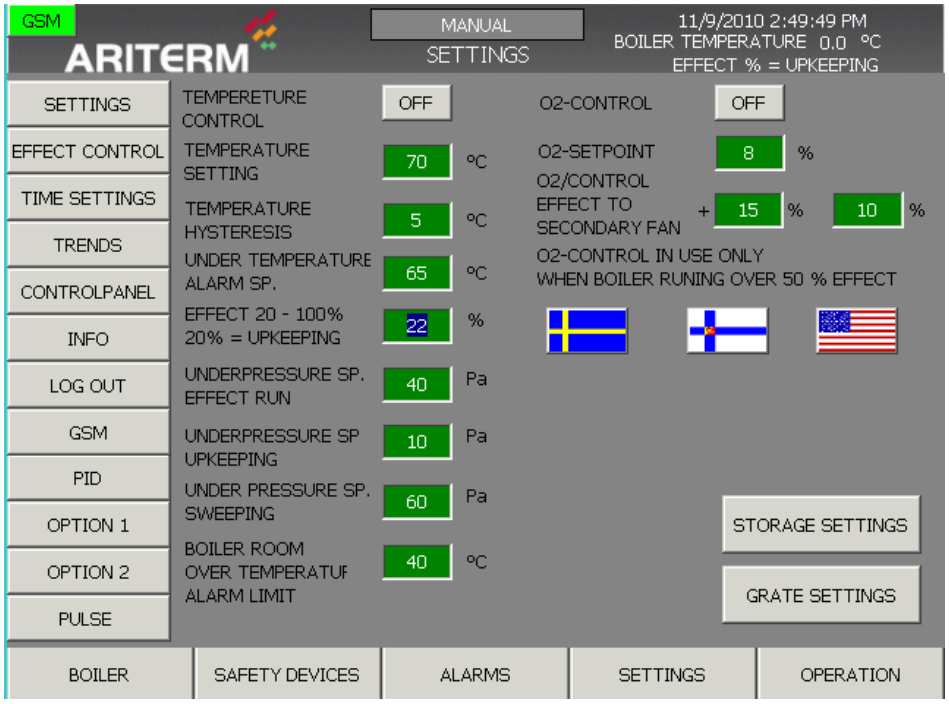
3.6 SETTINGS / GENERAL

Some of the settings values require logging in. The user level ID's are:

User: user **User for the option settings: AM1000**

Password: user **Password for option settings: 2008**





"Temperature control": Select ON when you want the burner's power to be adjusted according to the power requirements.

"Water default value": Specifies the desired target temperature for the boiler water.

"Water hysteresis": Specifies the temperature difference which makes the burner switch to *"Maintenance"* burner. For example, in a situation where the *"Water default value"* is set to 80°C, but the temperature exceeds 85°C, the burner switches to maintenance. When the temperature has decreased to 80°C, the burner switches back to the previous power step. If the burner is being used in the *"Temperature control" OFF* mode, the hysteresis determines the gap where the fixed power is used. If the *"Water default value"* is set to 80°C, the fixed power is up to 85°C, after which the burner switches to maintenance until the temperature has decreased to 80°C. After this the burner switches back to the fixed power.

Power 20-100%, 20%=maintenance: Determines a fixed power step, which is used when "*Temperature control"* is in *OFF* mode.

Low pressure setting with power function: Flue gas fan low pressure setting which should be retained at a power function (power 21%-100%). The furnace low pressure is measured with a low pressure sensor which provides the value which is used to adjust the flue gas fan rotation speed.

Maintenance low pressure setting: The maintenance burning is set with its own lower low pressure setting.

"Sweeping low pressure". When automatic sweeping is in use, it is set with its own low pressure setting, which the flue gas fan control aims to retain.

Oxygen control: When residual oxygen measuring is selected from the *"OPTIONS"* menu, the residual oxygen control is selected by pressing *ON*. The target oxygen value for the burning process is set in the *"O2"* field. Oxygen control affects the secondary fan rotation speed. *"Oxygen control effect on the secondary fan +/-"* determines the limits to how much, at most, the oxygen control can change the secondary fan rotating speed. The limits are set so that the secondary fan is not stopped when used at low power, and the fan control cannot start "sliding" to fast speeds

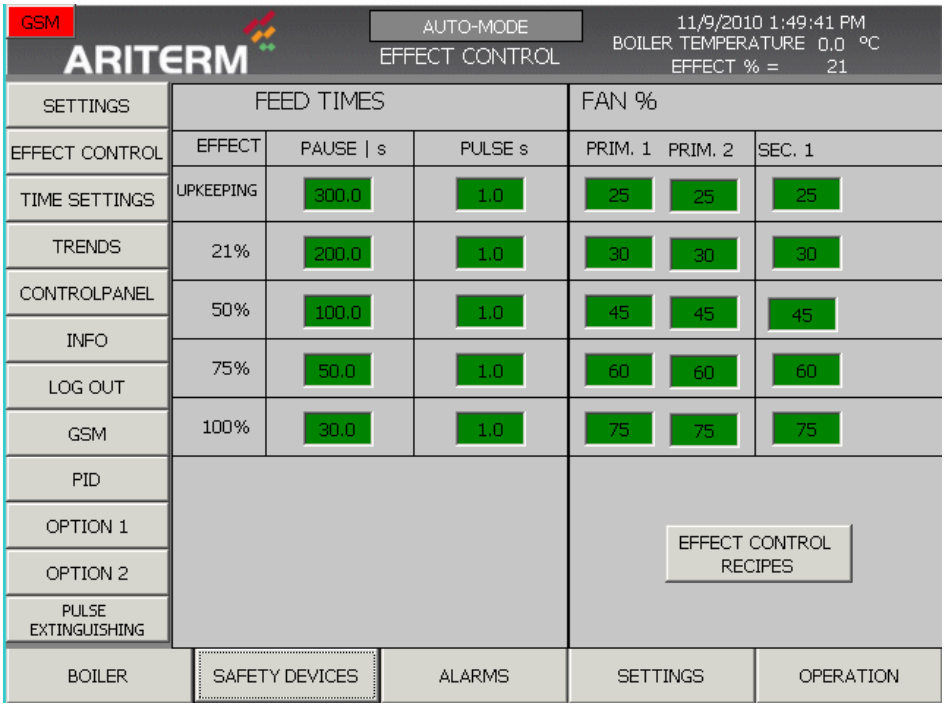
when the sensor gets dirty. Before activating the oxygen control, you must, however, determine basic values for the secondary fan in the *"POWER SETTINGS"* menu. The control has an effect on these values.

You can access the submenus of the *"SETTINGS"* main menu on the left side of the page.

3.7 SETTINGS / POWER CONTROL

The control computer controls the burner's power by changing the fuel feed (the ratio between the feeding unit pulse and pause frequencies) and the rotating speeds of primary and secondary fans by reacting to the fluctuations in the heating load. The control is based on the PT-100 sensor (4…20mA measuring message) which measures the water temperature.

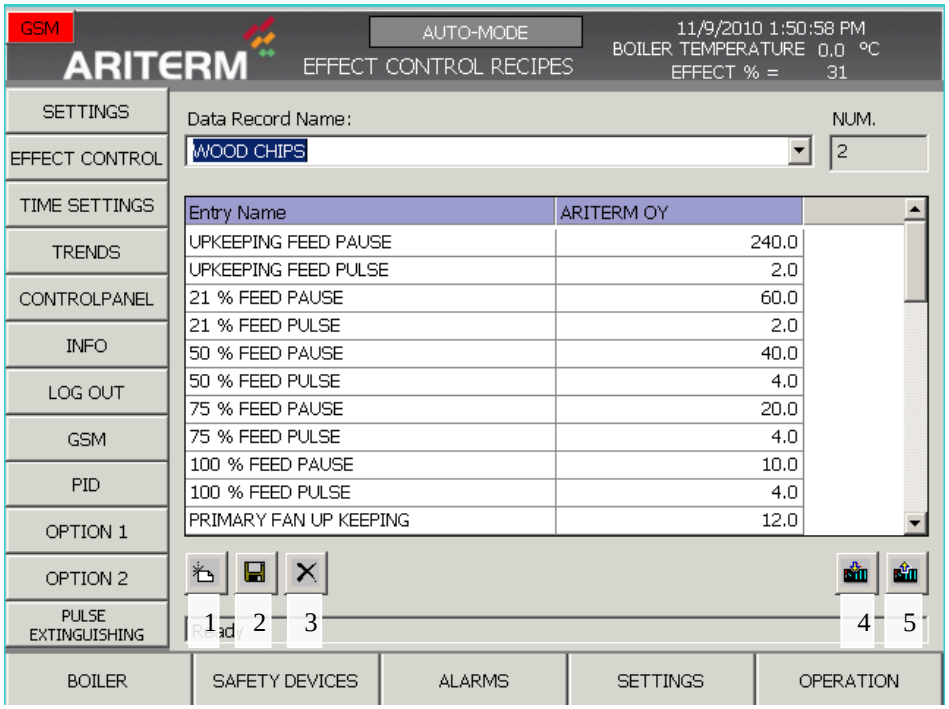
The computer programme has 80 power steps (21%-100%+ maintenance burning), which are used by the control. The operating panel settings determine the basic settings for the feeding unit operational and pause frequencies as well as the rotation speed for the primary and secondary fans (0-100%) with four power steps (21%, 50%, 75% and 100%). In addition to this the feeding and blowing values are determined for the so-called maintenance burning (*"MAINTENANCE"*). The computer programme calculates the intermediate steps according to these basic settings (for example 22 %,23 %,24 %,25 %…).



The *"POWER CONTROL"* page determines the burner's power at different power steps. The power is determined according to the *"Pause frequency"* and *"Operational frequency"* settings. The fan's power is used to control burning at each power step. The control uses all values between 21% and 100%. The fan stops if its standard value is below 10%.

3.8 SETTINGS / POWER CONTROL / POWER CONTROL COMBINATIONS

"POWER CONTROL COMBINATIONS" This tool is used to create new power combinations, to save the set values as a combination, to load the computer's power control settings into the blank table for saving, and to delete old combinations.

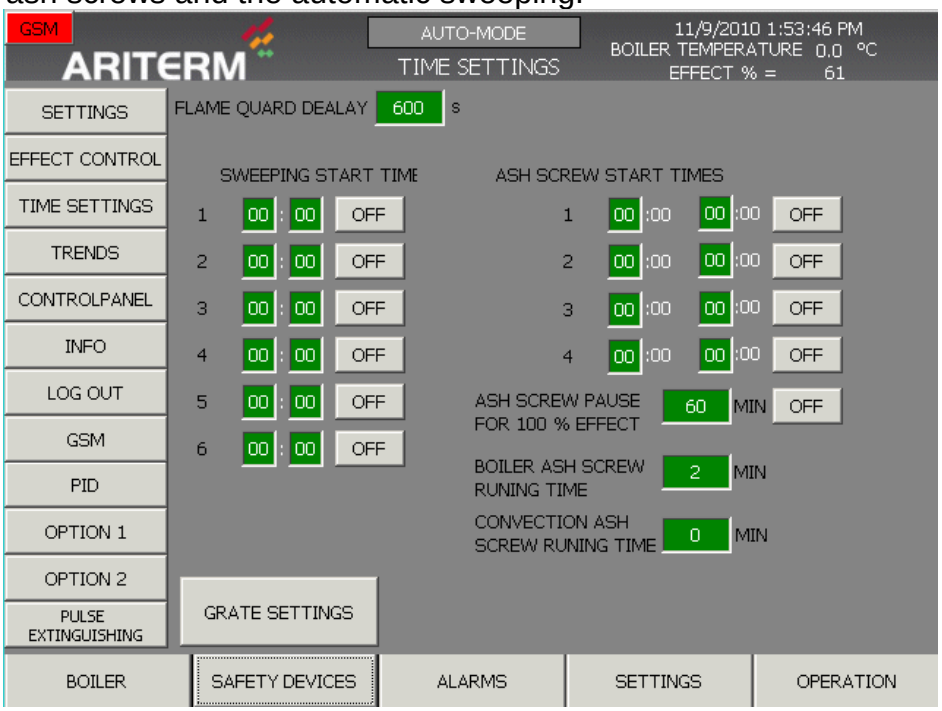


When you wish to create a new power table, press the number 1 button and determine the required *"Record name"*. When you have entered the required values in the fields, save them using the save icon (no. 2). The cross (no. 3) deletes the selected record.

Button no. 5 is used to load the computer's set values into the record and the record can be saved. Button no. 4 is used to load the selected combination into the computer.

3.9 SETTINGS / FREQUENCIES

"FREQUENCIES": On this page you can determine the essential operational frequencies for the storage system, ash screws and the automatic sweeping.



Sweeping start times: You can determine six times for the sweeping frequencies. The set time is activated with the ON/OFF button on the right side of the frequency field.

NOTE! TURN THE COMPRESSED AIR SWEEPING OFF IN A MAINTENANCE SITUATION! THIS IS DONE BY USING THE *"MAINTENANCE"* button in the *"MANUAL"* mode in the "*OPERATION"* menu.

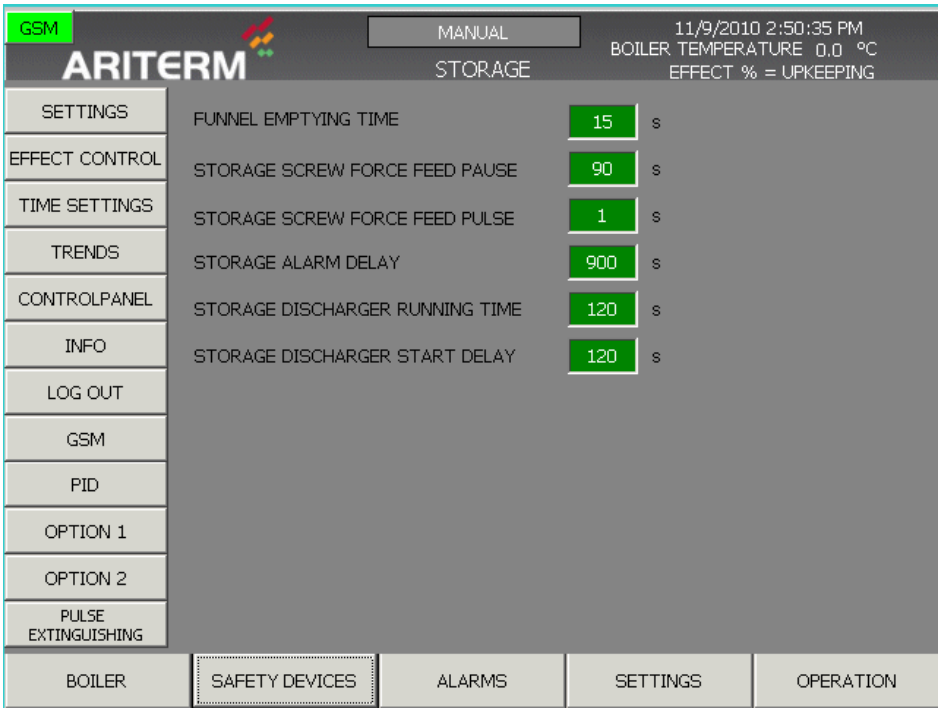
When the sweeping period starts first there is a delay when the compressor is charging. This delay is as long as the value specified for the *"Sweeping pause"* setting. Determine this time when starting to use the device according to the compressor's performance, i.e. how long the compressor takes to charge. Automatic sweeping only works with the timer when the burner is automated and on power operation. Sweeping is prevented during the maintenance mode and during fault situations.

Ash screw start time: You can determine two times for the ash screws to operate. The set time is activated with the ON/OFF button on the right side of the frequency field. During the period the screw in the ash space works periodically whilst the screw to the ash chamber works all the time.

Ash screw operational time: Determines the length of time for driving the ash screws.

Flame monitoring delay: Determines the length of time when flame monitoring is bypassed when the burner moves to power operation. The delay allows the flue gases to heat up exceeding the temperature limit determined on the electronic thermostat.

3.10 STORAGE SETTINGS



Storage screw 1 hopper emptying time: The hopper's lower limit is determined according to the feeding unit functioning time. When this theoretical time limit is reached, the storage screw is used until the hopper sensor indicates the upper limit.

If the drop hopper sensor does not recognise the drop hopper surface even when the storage screw is functioning, the storage alert is given after a specified time (*"PA storage fault delay"*).

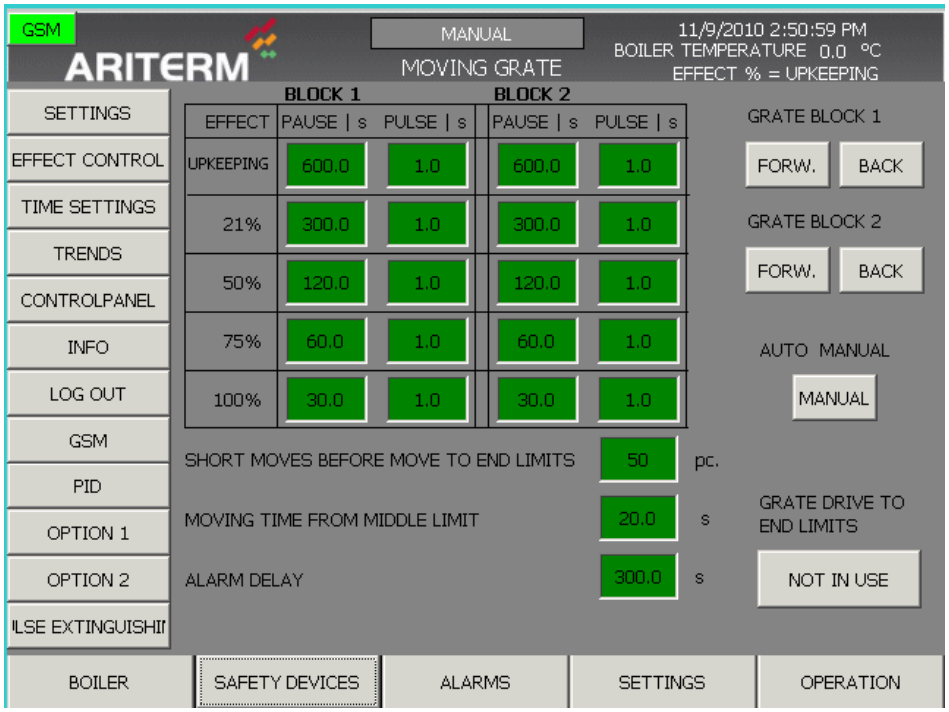
The storage screws' speed guide determines the storage screws' rotation speed, which is normally 100%.

Silo selection determines which silo is providing the fuel.

In this case automatic change allows the silo to be changed automatically when it is empty.

When operation from both silos is selected both silos provide fuel at the same time.

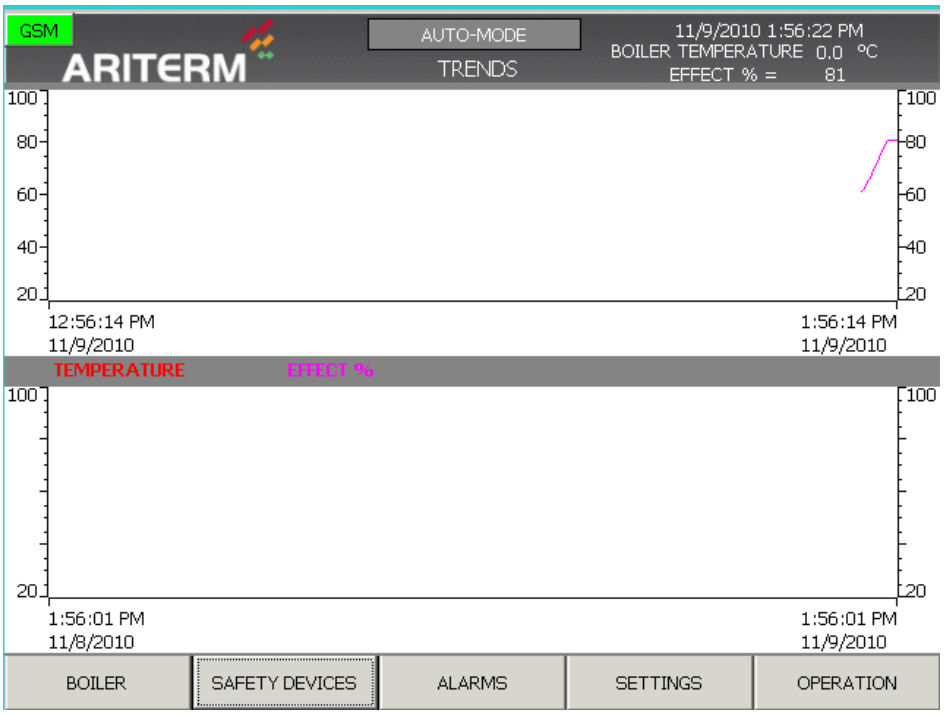
3.11 MOVING GRATE SETTINGS



Moving grate settings. You can set pause and use times for the upper and lower grates separately. The grate is driven back and forth between the centre limits during the drive time until the grate has been to the centre limit a maximum number of times, after which the grate is driven once to both end limits according to pause and use times. If the grate cannot reach the limit during the maximum use time before the change of direction, the grate's direction is changed. And if the centre limit is not detected during the fault delay, the grate fault message appears. The grate's movement speed is controlled with the machine's speed settings.

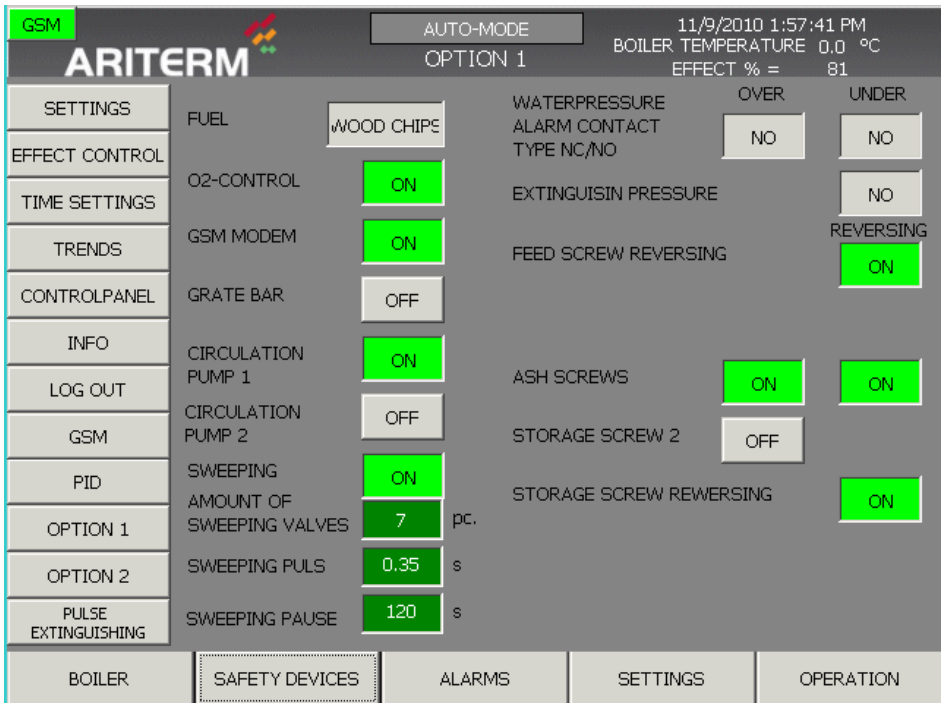
3.12 SETTINGS / TRENDS

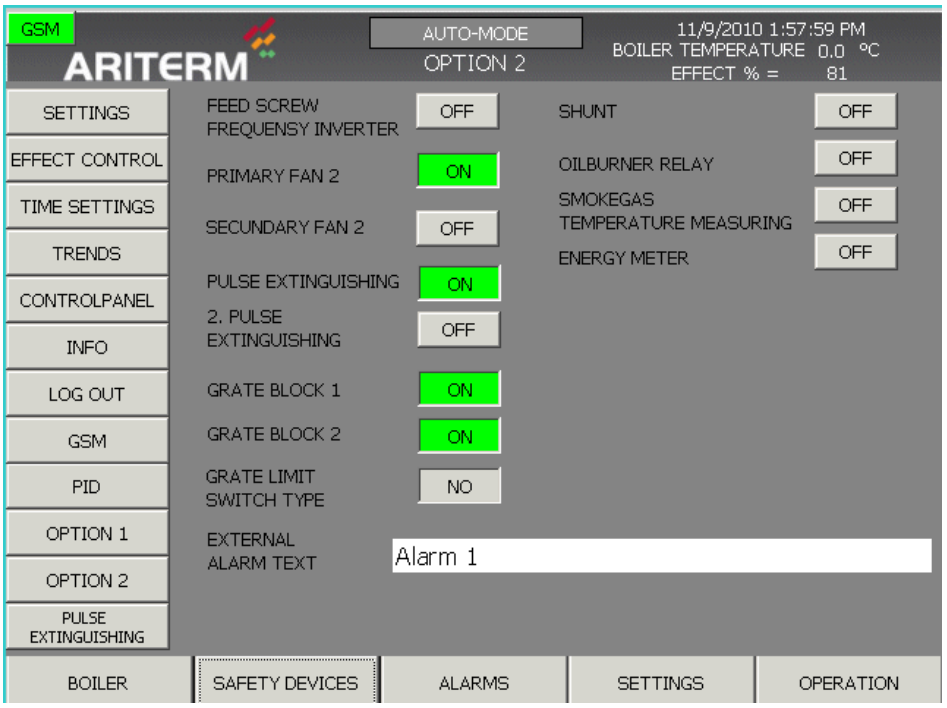
The Trends page displays history information about the temperature changes and the burner's power. The upper picture shows the history for the last hour and the lower for the last 24 hours. The water temperature is shown by the red curve and the power by the pink curve.



3.13 SETTINGS / OPTIONS

The *"OPTIONS"* page is used for system settings. Select first either woodchip or pellet system, after which the screen displays the accessories and additional functions.





3.14 SETTINGS / GSM

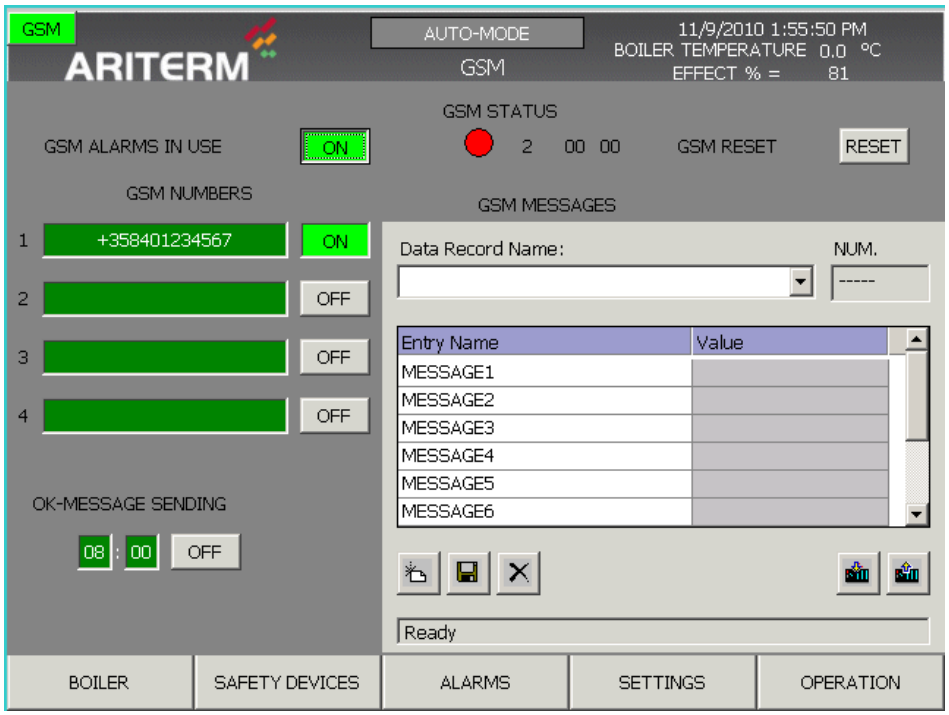
The *"GSM"* submenu in the *"Settings"* menu is used to determine the text message alert settings. GSM must be selected for use from the *"OPTIONS"* menu.

GSM alerts in use: Select ON/OFF to determine whether or not the alert messages are in use. For example, during maintenance you may receive unfounded alerts, so it is advisable to turn the text message alerts off.

GSM numbers: You can select four recipients for alert transmission. The numbered fields are activated using the ON/OFF button.

GSM status: When the circle is green the GSM modem is ready. Red indicates that there is a problem with sending the alert.

GSM reset: If there is a problem with the GSM modem it can be reset by pressing the *"Reset"* button.



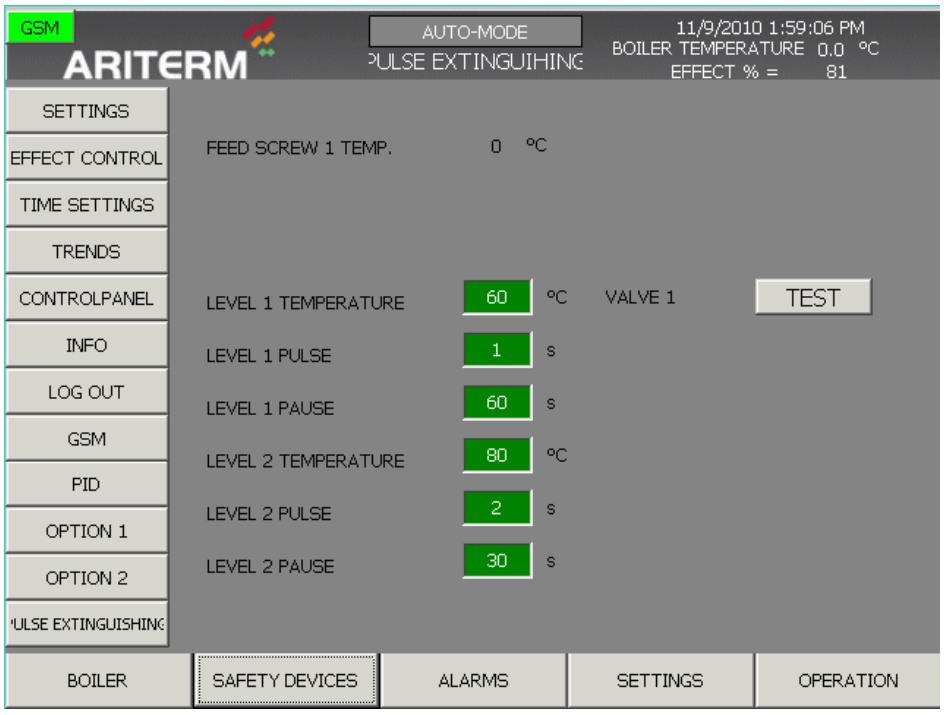
GSM messages: **You can specify 9 GSM messages and name them as you wish. You can manage the records in the same way as described in the power control combinations. The default alert names are as follows:**

1=Motor error
2=Fan error
3=Power cut
4=Extinguishing system pressure
5=Transfer limit (door limits)
6=Back fire
7=Storage alert
8=Safety device
9=Emergency - Stop

Different alerts are grouped in nine separate categories according to the following table.

Rotation valve error	1
Feeding unit error	1
Bar discharger error	1
Ash screw error	1
Pusher error	1
Storage screw 1 error	1
Storage screw 2 error	1
Flue gas fan error	2
Primary fan error	2
Secondary fan error	2
Power cut more than 12 minutes Equipment stopped.	3
Extinguishing system pressure	4
Burner transition limit	5
Back fire	6
Fuel storage alert	7
Silo lower limit error	7
Boiler water low pressure	8
Boiler water overheating	8
Boiler water overpressure	8
Boil-dry	8
Flame error	8
Flue gas overheating	8
Furnace low pressure	8
Current guard error	8
Fire end overheating	8
Emergency Stop	9
Mixer pump for boiler water	9
Fire end cooling pump	9
Power cut less than 12 minutes	Do not send

3.15 SETTINGS / PULSE EXTINGUISHING



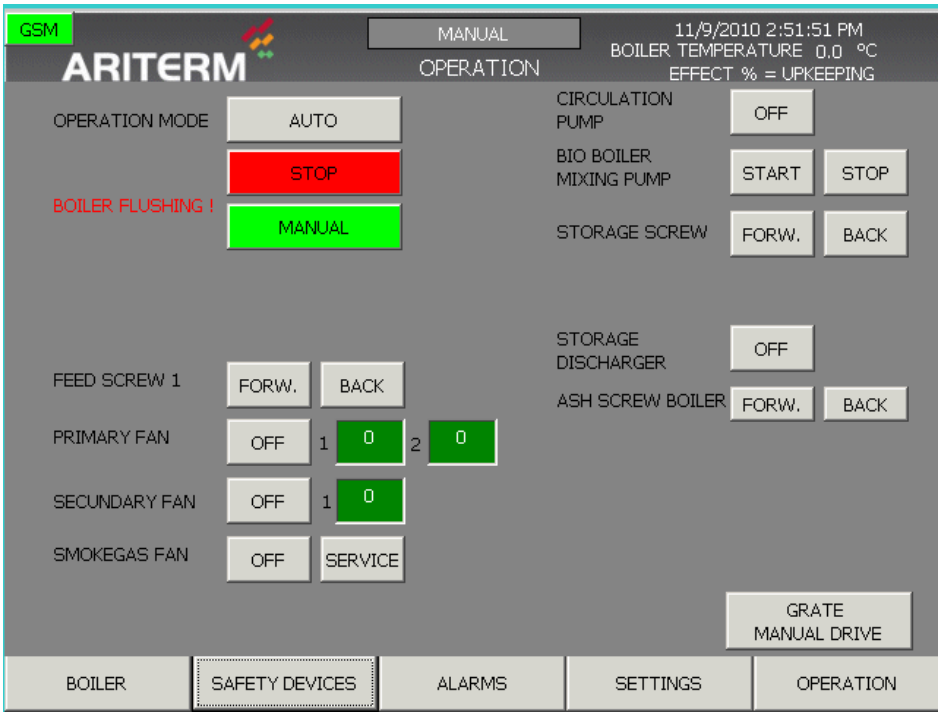
The pulse extinguishing system is used to prevent a back fire starting by dampening the fuel with water when the screw's surface temperature increases. The value "FEEDING UNIT 1 TEMPERATURE" indicates the current temperature on the screw surface. The surface temperature is measured using the PT100 sensor (4…20mA measuring message). There are two operational temperatures for dampening.

"LEVEL 1 TEMPERATURE": When the set temperature is reached, the magnetic valve is used to provide a pulse lasting the length of time specified in the "LEVEL 1 EXTINGUISHING PULSE" field, followed by a pause ("LEVEL 1 PAUSE TIME"). This pulsating is continued until the temperature has decreased below the default value. If the screw temperature increases despite the level 1 pulsating, the pulsation goes up to level 2.

The extinguishing valve function can be tested with the "VALVE 1" "TEST" button.

NOTE! Water extinguishing is not suitable for pellets! The function must be activated on the "OPTIONS 2" tab before use. An AVTA extinguishing valve must be installed into the feeder unit in addition to the pulse extinguishing system.

3.16 OPERATION



The *"OPERATION"* page is used to select how the system is operated. *"AUTO"* is the normal operating mode, when the system operates according to set operating parameters. When the *"AUTO"* mode is on, the *"OPERATING"* page can be used to stop/start the burner's cooling pump and the water's mixer pump. It is also possible to start pressure sweeping manually.

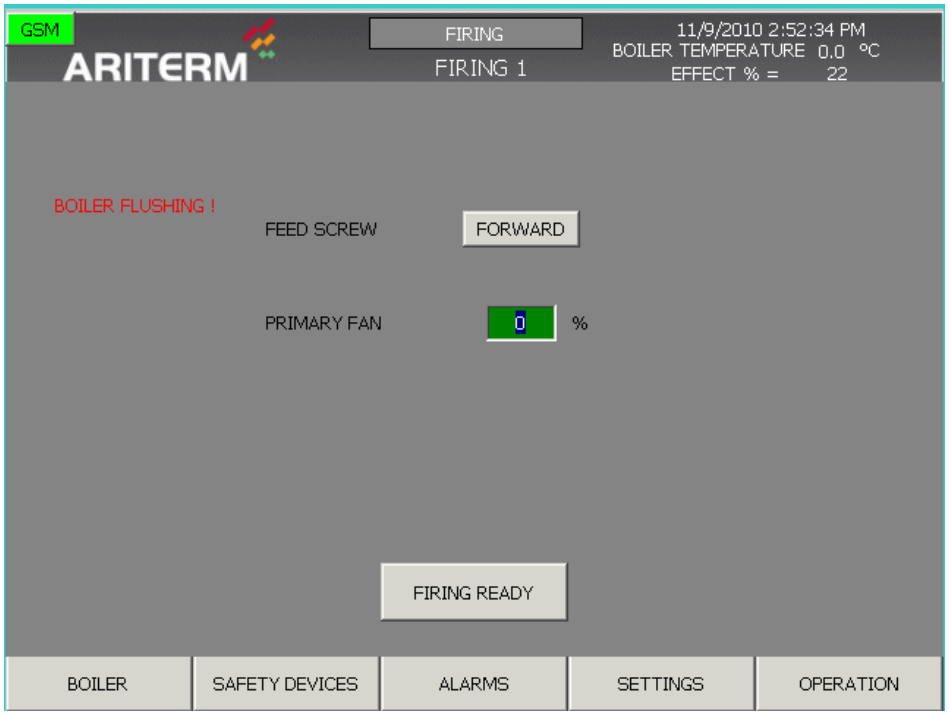
The *"STOP"* function stops all system functions.

"BOILER SHUTDOWN" stops the storage system functions and the system shuts down when the drop hopper and screw are empty of pellets. This function is useful especially when you prepare for boiler and burner maintenance.

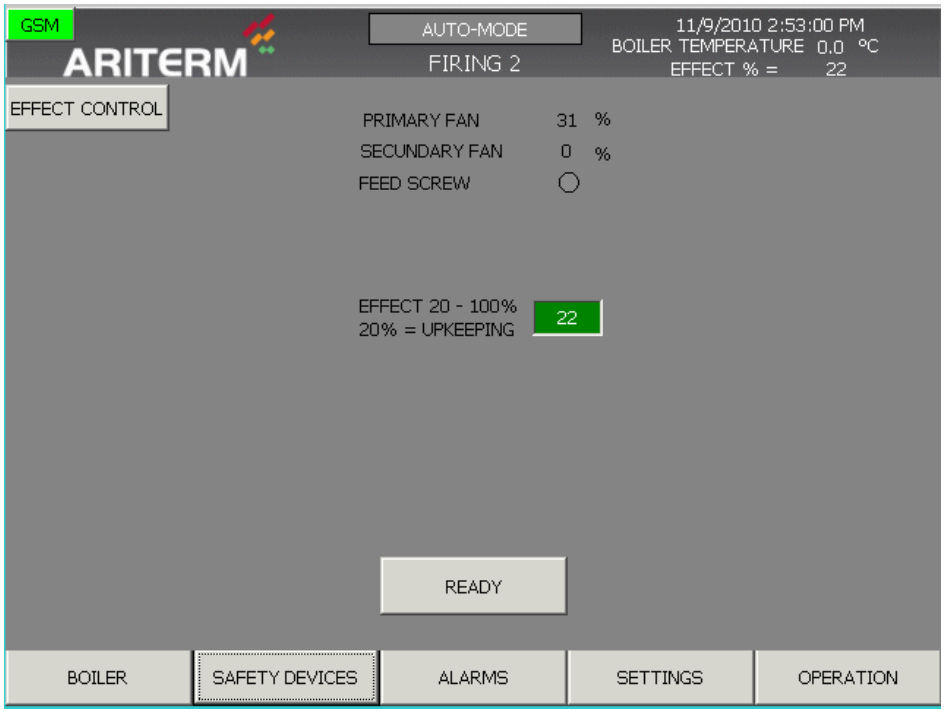
When you select *"MANUAL"* mode, you can operate the screws and fans manually. When you select the flue gas fan "MAINTENANCE" mode, you can set the fan controls with a fixed frequency of 0-100% of the 0-50Hz frequency range. The "MAINTENANCE" mode is helpful during maintenance when boiler doors must be kept open. When Maintenance mode is selected, automatic sweeping is not in use.

3.17 FIRING

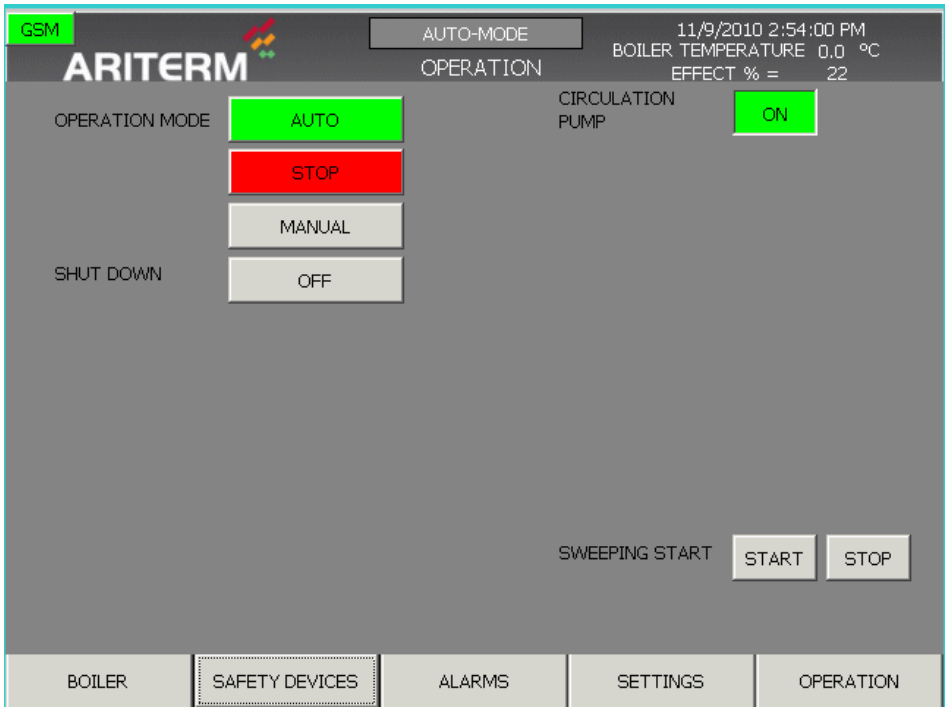
When AUTO is selected, but the flue gas sensor cannot detect a flame in the boiler, the user is directed to the guided firing stage. The screen displays a page where it is possible to operate the feeding unit and use the primary fan. Use the *"FORWARD"* button to drive fuel to the burner and light it. When the pellets are lit, start the fan, i.e. enter the value 20, for example, in the field. Use the *"FORWARD"* button to drive more pellets to the burner and increase blowing. When the fuel is lit and the flame has "grown" and is burning, press the "*FIRING READY*" button and go to the next stage.



The burner is operated with a fixed power step which the user increases at his or her discretion. At this stage the user does not need to change the blowing strength, because the blowing percentages are determined by the set values in the power table, i.e. each power step has a certain control value for the fans.



When the flue gas sensor detects the flame, the *"READY"* button turns green. When it is pressed the burner moves to automatic operation. The user does not need to wait for the flame information; he/she can press the *"READY"* button before this.



4 TERMS OF WARRANTY

Ariterm Oy grants the control centre a two-year warranty from the installation date. The warranty covers any operational, raw material or component faults in the control centre. The manufacturer is not responsible if the fault is caused by installation error, misuse or mishandling. If repairs are started without the manufacturer's permission, the warranty is not valid. The factory is not liable for any indirect damages or costs caused by the product.

Ariterm Oy reserves the right to decide the method used for the repairs under warranty. Ariterm Oy is not responsible for damages outside the warranty period, but they can be agreed case-specifically.