

IML (Industrial Multi Logic) ELECTRONIC CONTROL PANEL

OPERATING INSTRUCTIONS

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1

GENERAL INFORMATION

This document is the Technical Manual of the electronic control panel installed on Unical 24 hr/72 hr series steam generators equipped to "Operate without continuous supervision" by a person authorised to run it up to a maximum of 24 hr/72 hr.

certified as a SET in compliance with the Essential Safety Requirements of Directive 97/23/EC "P.E.D. - Pressure Equipment Directive" according to the B+F conformity assessment modules.

These series of steam generators are manufactured, tested and

1.1 - DEFINITIONS



ATTENTION!

Information or procedure which, if not strictly followed, can cause dangerous situations.



NOTE

Information or procedure which can facilitate and simplify maintenance operations or part of the text of particular importance that you want to point out.



WARNING

Information or procedure which, if not strictly followed, can cause damage to the system or to the single components.

1.2 - SAFETY INFORMATION



ATTENTION!

THE BAHR' 24 hr (72 hr) GENERATOR IS EQUIPPED AND CERTIFIED TO OPERATE WITHOUT CONTINUOUS SUPERVISION BY A PERSON AUTHORISED TO RUN IT UP TO A MAXIMUM OF 24/72 hr.

regulations in force, following the instructions described in this manual; also, any operation must be carried out by professionally qualified and authorised personnel.



ATTENTION!

THE RUNNING OF THE STEAM GENERATOR MUST BE ASSIGNED TO QUALIFIED PERSONNEL AS DEFINED BY ITALIAN LEGISLATIVE DECREE 1 MARCH 1974 IT IS STRICTLY FORBIDDEN FOR PERSONS NOT SPECIFICALLY ENABLED TO USE, RUN, MAINTENANCE THE GENERATOR.



ATTENTION!

The BAHR 24 hr (72 hr) series steam generators must be operated within the limits for which they were designed; any other use must be considered improper and therefore dangerous.



ATTENTION!

Incorrect installation, inadequate use and maintenance of the appliance can cause damage to persons or property, for which the MANUFACTURER is not liable. CAREFULLY READ AND FOLLOW THE INSTRUCTIONS CONTAINED IN THIS MANUAL BEFORE CARRYING OUT ANY OPERATION.

These design limits are given:

- on the CE data plate applied on the appliance;
- on the CE declaration of conformity supplied with the generator.



ATTENTION!

This manual is an integral and essential part of the supply and must be delivered to the user.

In the event that the generator is transferred in use or sold to other Users (change of destination or move) make sure that the appliance is transferred together with this installation, use and maintenance manual so that it can be consulted by the entrusted installer, the maintenance technician and the new owner. Before starting installation, fill the system, start the ignition process or undertake any maintenance, carefully read the instructions and procedures contained in this manual; they provide important information regarding the safety of the system and the safety of persons.

The installation, operation and maintenance must be carried out in compliance with the



ATTENTION!
THE GENERATOR IS NOT DESIGNED TO BE INSTALLED OUTDOORS, BUT MUST BE LOCATED WITHIN THE APPROPRIATE PREMISES (BOILER ROOM).

OUTDOOR OPERATION CAN DAMAGE THE SET, THUS RESULTING IN SERIOUS DANGER DUE TO:

- collapse/burst of framework aimed at the pressure containment for embrittlement of the metal parts of the framework making up the pressurised body;
- collapse/burst for failed operation/inhibition of the safety and adjustment accessories;
- damage due to impairment of safety equipment/

- adjustment due to the action of rainwater;
- minimum temperature not compatible with the minimum allowable for the set/components, during the expected life.
- impairment of the IP protection of electrical parts not suitable for operating the set outdoors under the action of atmospheric agents

1.3 - USER OBLIGATIONS PURSUANT TO THE LEGISLATION IN FORCE



ATTENTION!
PURSUANT TO THE LEGISLATION IN FORCE IT IS NOT PERMITTED TO OPERATE THIS GENERATOR BEFORE YOU HAVE COMMUNICATED COMMISSIONING TO THE NATIONAL CONTROL BODIES AS PRESCRIBED IN "DECREEE 1 December 2004, no. 329, Regulation with standards for the commissioning and use of pressure equipment and assemblies referred to in article 19 of the Legislative Decree 25 February 2000, no. 93" to which the equipment User must strictly adhere because RESPONSIBILITY of the same.

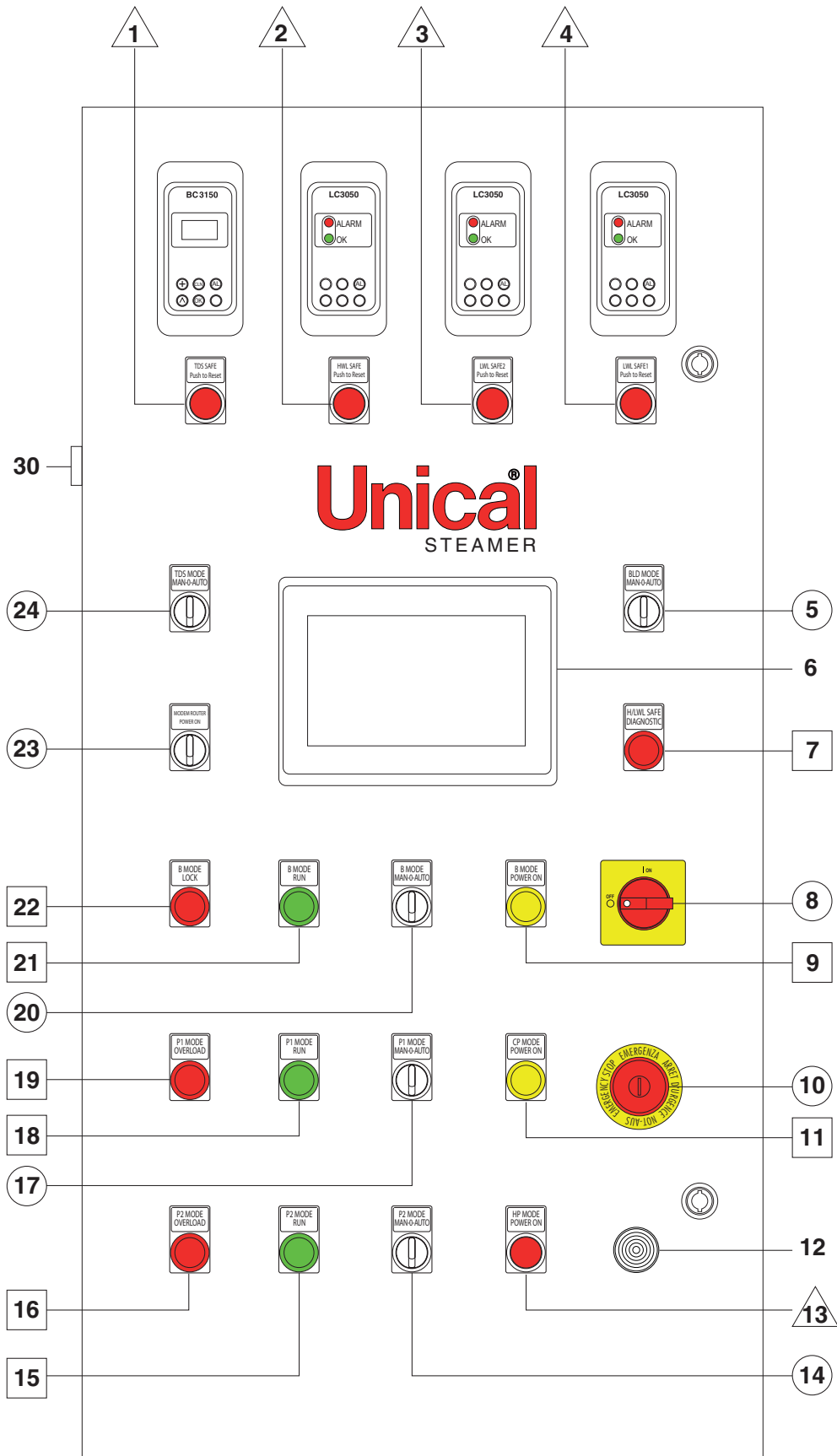


The set is excluded from commissioning verification as it meets art. 5, paragraph d) of the Italian Ministerial Decree. 1st December 2004 no.329. Nevertheless, the "User" MUST COMMUNICATE COMMISSIONING TO THE LOCAL AUTHORITIES USING THE METHOD DESCRIBED IN ART. 6 OF THE SAME, AS SPECIFIED BELOW:

- obligation to communicate commissioning to the local ISPEL and ASL as defined in art.6 of the Italian Ministerial Decree 1st December 2004 no.329.
- obligation to submit the steam generator to the periodic inspections required by Law set forth in Italian Ministerial Decree 1st December 2004 no.329, in the Table in Annex B, namely:
 - Internal visit and operation verification every 2 years;
 - Integrity check every 10 years.

2

BOILER IML (Industrial Multi Logic) CONTROL PANEL



2.1 - PANEL KEY

- 6 Touch Screen operator pnel
- 12 Alarm buzzer
- 30 USB-HMI Output

Luminous alarm buttons

- 1 **TDS SAFE - Push to Reset:** Salinity control unit alarm indicator (optional)
- 2 **LWL SAFE 1 - Push to Reset:** Low level probe 1 alarm indicator
- 3 **LWL SAFE 2 - Push to Reset:** Low level probe 2 alarm indicator
- 4 **HWL SAFE - Push to Reset:** High level probe alarm indicator (optional)
- 13 **HP SAFE - Push to Reset:** Safety pressure switch alarm indicator

Luminous indicators

- 7 **H/LWL SAFE DIAGNOSTIC:** Level probe(s) anomaly detection alarm
- 9 **B MODE POWER ON:** Burner power on
- 11 **CP POWER ON:** Electrical control panel on
- 15 **P2 MODE RUN:** Pump 2 in operation (optional)
- 16 **P2 MODE OVERLOAD:** Pump 2 circuit breaker tripped (optional)

- 18 **P1 MODE RUN:** Pump 1 in operation
- 19 **P1 MODE OVERLOAD:** Pump 1 circuit breaker tripped
- 21 **B MODE RUN:** Burner in operation
- 22 **B MODE LOCK:** Burner locked

Selectors/Switches

- 5 **BLD MODE - MAN-0-AUTO:** Boiler drain operating mode (optional)
- 8 MAIN SWITCH
- 10 EMERGENCY STOP BUTTON
- 14 **P2 MODE - MAN-0-AUTO:** Pump 2 operating mode (optional)
- 17 **P1 MODE - MAN-0-AUTO:** Pump 1 operating mode
- 20 **B MODE - MAN-0-AUTO:** Burner operating mode
- 23 **MODEM ROUTER - POWER ON:** Router modem activation for remote connection (optional)
- 24 **TDS MODE - MAN-0-AUTO:** Salinity control unit operating mode (optional)

2.2 - MAIN FEATURES OF THE IML CONTROL PANEL

The IML control manages all adjustment devices and interfaces with the safety devices that are approved in accordance with the provisions of the regulations falling within the PED.

The electronic safety relays, PED approved, have secondary electromechanical relays in cascade, compared to the cat.IV prescribed for steam boilers.

The software functions are enabled in suitable settings menus, depending on the devices installed, and which may vary from case to case.

The basic IML panel controls the following:

- working pressure switch;
- safety pressure switch (PED);
- pressure transducer;
- setpoint probe;
- 2 probes + safety controller for low water level (PED);

- capacitive probe level transducer
- burner ON/OFF, 2-stage, 3-stage, 3-point modulating, modulating with proportional signal;
- 1 water supply pump.

As an option the following can be added:

- 1 high level probe (PED);
- probe + safety controller for control and bleeding due to high salinity level (TDS);
- timer valve for sediment drainage, with dirt separator functions;
- 1 water supply pump, as a second safety pump;
- kit for remote installation of alarms.

2.3 - SOFTWARE

The software constituting the IML is the software on the PLC together with the one on the operator panel (HMI). Data input from the control devices on the boiler and data input as data entered by the operator on the panel are processed by the PLC software. The data resulting from the processes are output to the control devices (burner, pump, valves, etc.) and to the panel that graphically shows them on the display in a user-friendly tree menu.

2.4 - SYSTEM ACCESS

START PROCEDURE

Access the control panel by turning the main yellow/red switch (8) to I.

The HMI panel (touch screen) turns on immediately and the PLC start-up cycle starts, lasting for about 30 seconds.

The following screens will be shown:

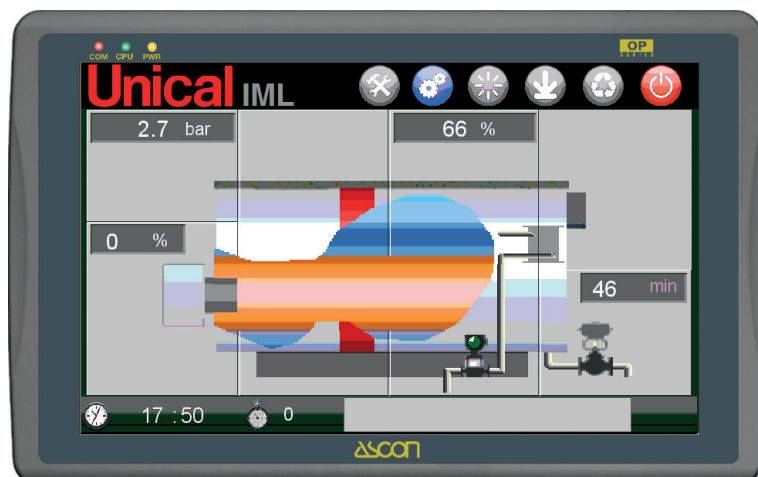
Starting screen:



Access screen:



Home page screen:

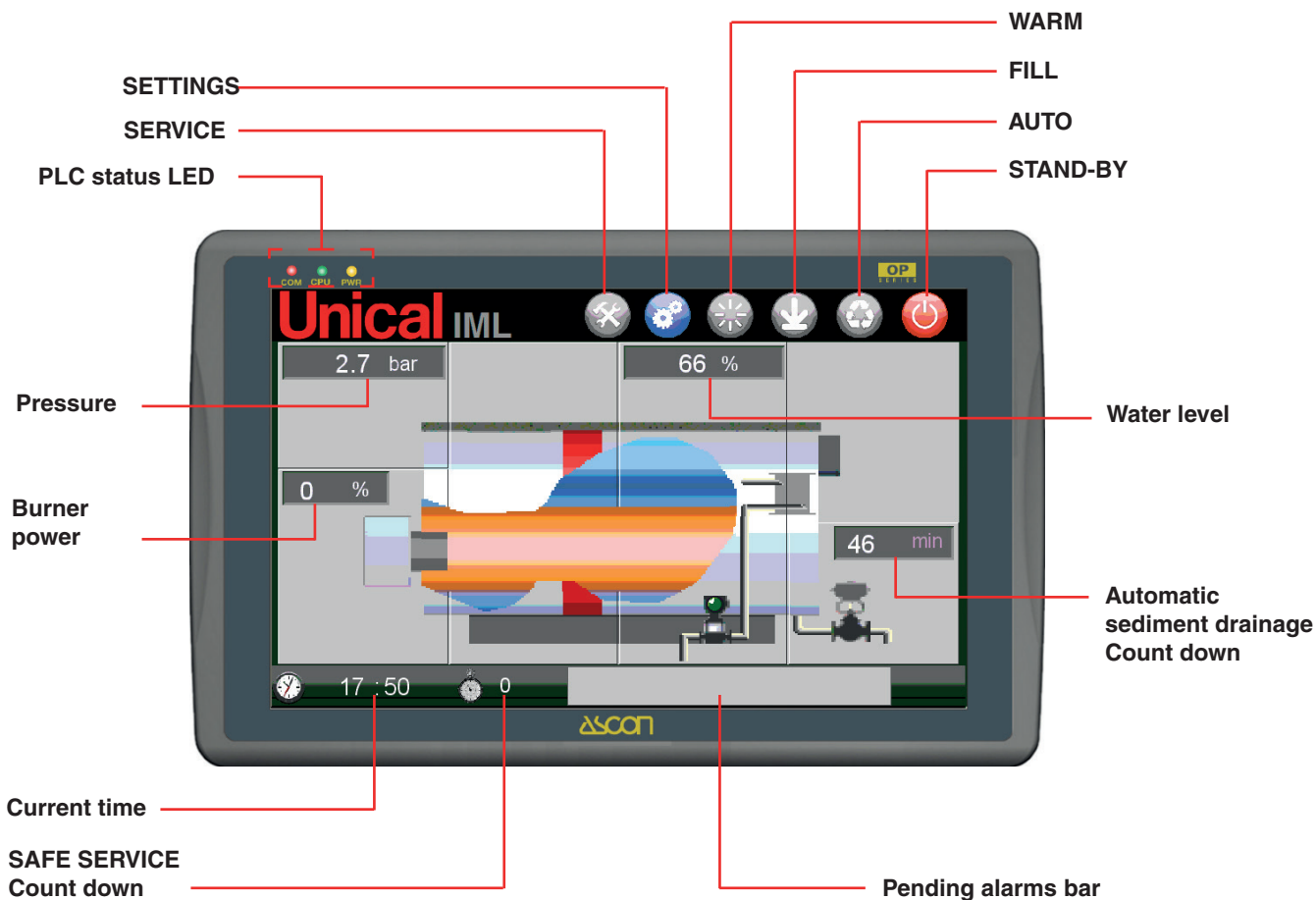


2.5 - Description of the HOME page and of the FUNCTIONS

The HOME PAGE is displayed during normal operation of the boiler.

In the centre of the screen the steam generator is represented by a synoptic panel.







The main variables that regulate its operation are explained.



The variables are:

- Pressure in boiler in bar
- Water level in boiler in % value;
- Burner operating status and power assigned; Electrical conductivity for TDS (if enabled) in $\mu\text{S}/\text{cm}$;
- Automatic Blow Down system status (if enabled) and count-down to valve opening in min;
- Active operating mode (stand-by mode, auto mode, fill mode, warm up mode) which are described below;
- Current time;
- Count-down for safety services (24/72 hr);
- Pending alarms bar.

The operating modes are displayed and can be selected on this page.
The modes available are:



	FUNCTION ACTIVE	FUNCTION NOT ACTIVE
STAND BY MODE		
AUTO MODE		
FILL MODE		

Press the icon to activate the function selected.

The enabling status of the function is displayed by the change in status of the image.

To disable the function another mode must be selected: as the modes are alternative, by enabling one mode the others are disabled.

A fourth icon represents **WARM UP MODE** which is an “automatic” mode, meaning it automatically activates during cold starts until **AUTOMODE** is activated.


	FUNCTION ACTIVE	FUNCTION NOT ACTIVE
WARM UP MODE		

STAND BY MODE

The control at each switch-on activates the **STAND BY MODE** by default.


With this mode the PLC is on standby: all settings (burner-pressure, pump(s)-level, TDS/valve bleed, blow down/dirt separator valve) are disabled.

Control remains activated of the alarm statuses input from the safety devices and referral of the values read by the transducers (pressure, level, TDS, etc.).

The  key is also used as a STOP button.

AUTO MODE (Automatic power supply operation)

Press  to activate **AUTO MODE**, i.e. automatic operation

shown with the change in status of the  icon.
The boiler is completely controlled by the IML system.


All transducers that send signals detected to the boiler are active; the PLC processes the input signals, with the logic that is


described in the following chapters, to adjust the boiler's control devices.

The controls are active on the alarm statuses input from the safety devices which, when activated, cause the forced stop of the steam generator.

Management of the pump is explained in detail in the **LEVEL SETTINGS PAGE** chapter.

FILL MODE

Press  to activate **FILL MODE**, i.e. controlled water filling of the boiler function, during which operation of the burner is disabled.

Activation of the fill function is displayed with the change in status of the  icon..

Filling is done to take the water level to the setpoint level, that is, up to when the water touches the setpoint probe electrode. When the water touches the electrode, the fill function stops.

Allows the first filling, controlled by the setpoint probe, and then allows the first adjustment operations of the capacitive level probe, which will "support" the adjustment.

The fill function is also used for recalibration and periodic controls required in the boiler's user manual.

WARM UP MODE

The **WARM UP MODE** activates when, after the **AUTO MODE** has been activated, the system detects pressure lower than the **P WARM UP** minimum pressure set (see **PRESSURE PAGE**).

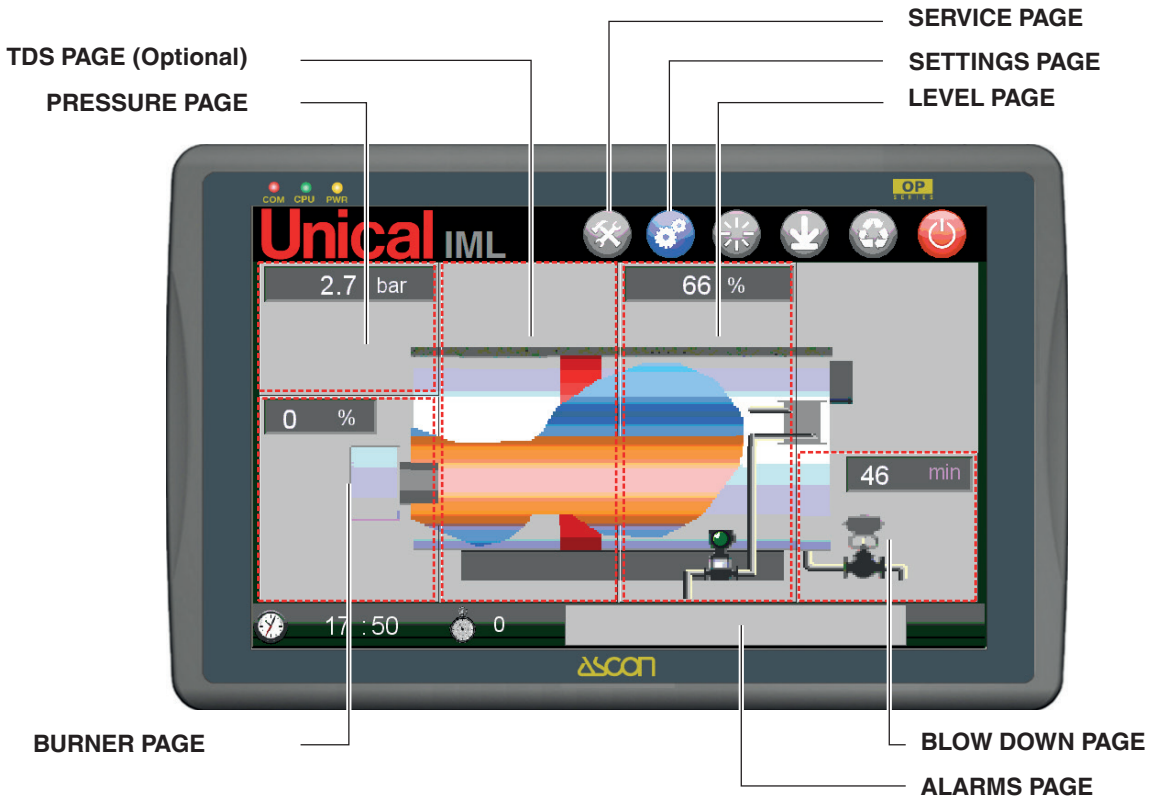
Its activation is automatic. With this mode active, management of the supply pump and level control system varies.




Management of the pump is explained in detail in the **LEVEL SETTINGS PAGE** chapter.


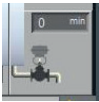



ACCESS TO THE PAGES

The specific pages of the individual control devices are accessed from this page by pressing the dedicated zone on the synoptic panel.

Access zones to the pages:



PRESSURE PAGE	
BURNER PAGE	
TDS PAGE (optional)	

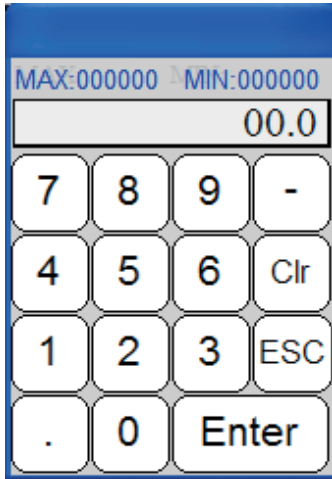
LEVEL PAGE	
BLOW DOWN PAGE	
SERVICE PAGE	
SETTINGS PAGE	
ALARMS PAGE	

ENTERING VALUES

The numerical and alphanumeric values on all of the IML system's pages are entered by touching the field in which you want to enter and/or edit the value.

Numerical value fields

For numerical values touch the field to display a numerical keypad:

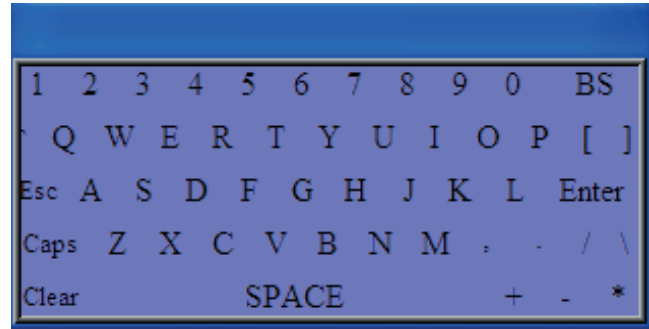


At the top any limits (MAX and MIN) are shown for the value to be entered.

Press **Enter** to confirm the value.

Alphanumeric value fields

For alphanumeric values touch the field to display the keypad:



Press **Enter** to confirm the value.

2.6 DEFAULT SETTINGS

GENERATOR IDENTIFICATION



GENERATOR CONFIGURATION (System boiler configuration)

Page can be accessed and modified only by the ADMINISTRATOR.

3

PROCEDURES

3.1 - ACCREDITATION PROCEDURE AND QUALIFICATIONS

USER LOGIN

The IML system is structured to manage three different user levels:


GUEST = guest user allowed to browse the displayed pages, it is the user to be used during normal operation of the generator;

USER x = users from USER 1÷4, are intended for operators authorised to control the generator, password-protected. The USERS are allowed to modify the generator's adjustment parameters;

ADMINISTRATOR = system administrator, intended for the installer and/or UNICAL service centre personnel and is password-protected. The ADMINISTRATOR is allowed access to all of the pages and complete modification of the entire system.

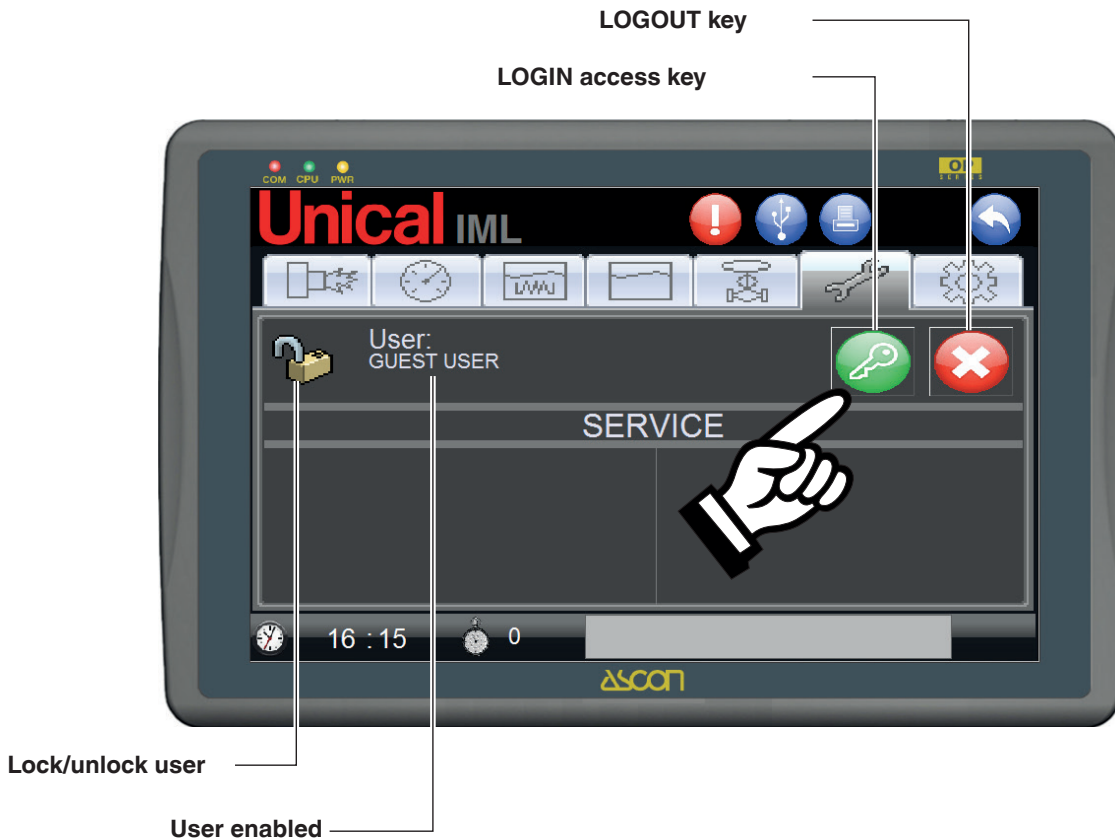
The IML upon start-up enables access as a GUEST.

For every modification authentication as a different user is required.

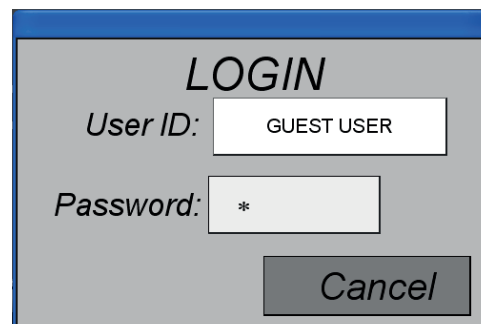
Press  on the home page to access the SERVICE page for user authentication.

The SERVICE page is as follows:

The login  and logout  keys are on the right.



Press the login key to access the user selection window and enter the password.

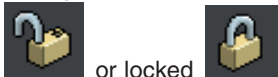


The top zone of the **SERVICE** page is dedicated to managing users.



Press on the **User ID** field to activate the drop-down menu to select the user.

A padlock is displayed on the far left:



its unlocked or locked status depends on the user connected; it is also displayed on the near right.

The **UNLOCK** status corresponds to a **GUEST** as access for this user is not password-protected.

The **LOCK** status corresponds to a **USER 1 ÷ 4** and **ADMINISTRATOR** as they are password-protected.

Once you have made your selection, the user selected will be

written in the **User ID** field, then for **USER 1 ÷ 4** and **ADMINISTRATOR** you need to enter the correct passwords, which are:

USER 1	1021
USER 2	1022
USER 3	1023
USER 4	1024
ADMINISTRATOR	PROTECTED

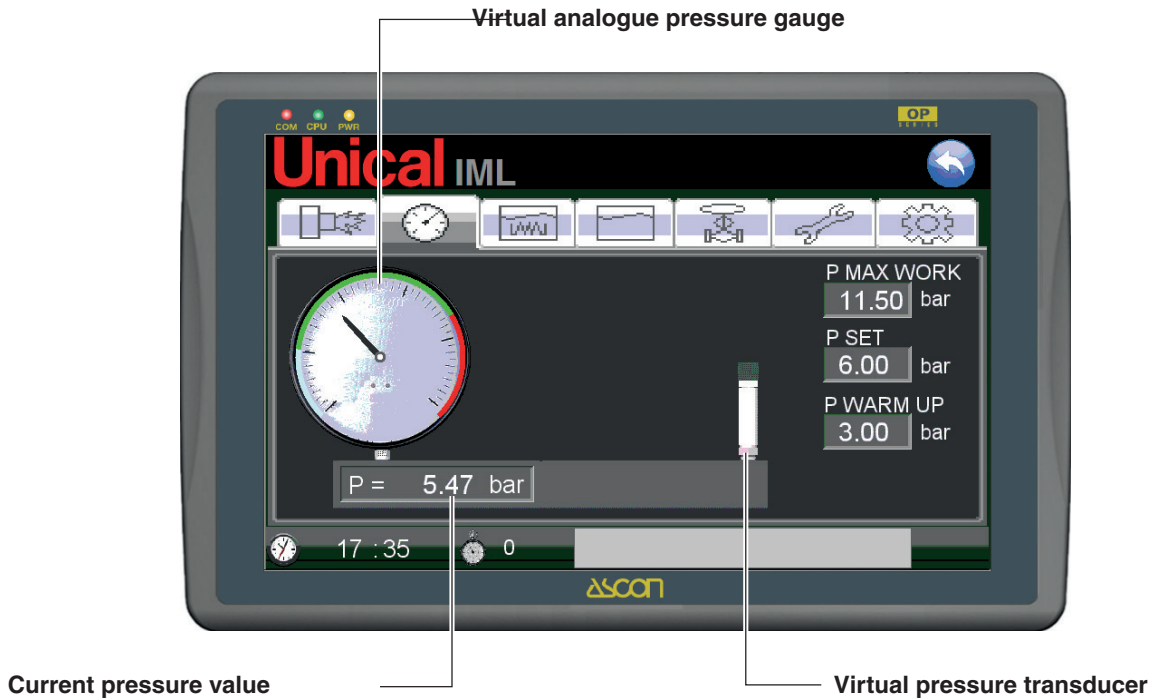


if the password entered is correct, the **LOGIN** key is activated; press to access.

Press **LOGIN** to confirm.

3.2 - PRESSURE PAGE

The Pressure page is dedicated to managing the boiler's steam pressure. The page is as follows:



The instrument holder tube of the boiler, on which the pressure control instruments are mounted, is represented virtually on the screen.

On the left there is a virtual analogue pressure gauge which makes reading of the optimal operating zone (green zone) fast and intuitive.

The scale field of the pressure gauge is divided into three coloured zones that identify:

- blue zone** (zone in which the **WARM UP MODE** is activated)
- green zone** (generator's optimal working zone)
- red zone** (safety zone)

The current P pressure value, in bar, is shown in the field at the bottom of the pressure gauge.

On the other side of the tube the pressure transducer is represented, on the right of which there are three fields for setting:

- P MAX WORK** (pressure at beginning of red zone - maximum working pressure)
- P SET** (working pressure)
- P WARM UP** (pressure at end of green zone - pressure that defines the limit below which the cold start mode or **WARM UP MODE** activates)



The pressure transducer is set by the manufacturer



The P MAX WORK value is set by the manufacturer

SETTING THE "P SET" and "P WARM UP" values (USER 1÷4 login)

Proceed as follows to correctly set the values:

Press the **P WARM UP** field.
A numerical keypad will be displayed indicating the previously entered **PMAX WORK** value as the maximum limit to be entered. Enter the value that will define the limit below which the system will activate the cold start mode.



Press the **P SET** field.
A numerical keypad will be displayed indicating the previously entered **PMAX WORK** value as the maximum limit to be entered, and the **P WARM UP** value as the minimum limit to be entered.

CORRECTING THE TRANSDUCER READING

(USER 1 ÷ 4 login).

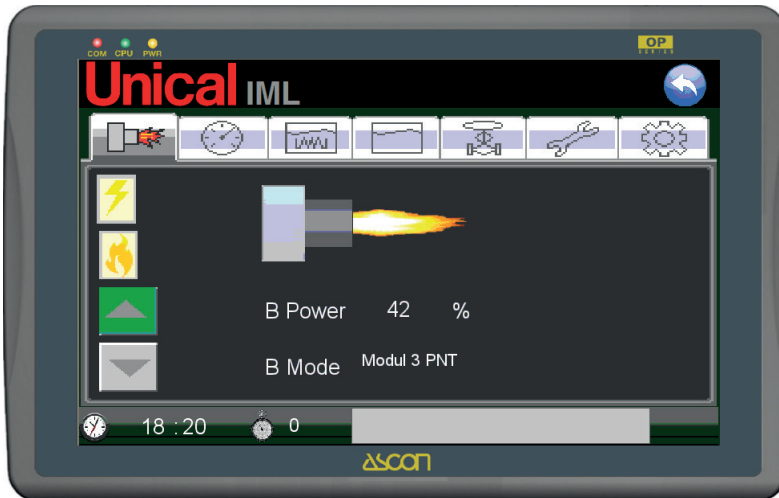
Between the pressure gauge and the transducer is the field for correcting the transducer reading with respect to the real pressure gauge on the boiler.



Use the up  and down  keys to slightly correct the value read by the transducer to make it consistent with that indicated by the boiler's (physical) pressure gauge.

3.3 - BURNER PAGE

The BURNER PAGE is dedicated to displaying the operating statuses of the burner.
The page is shown as follows:



The burner in operation is shown on the BURNER PAGE.

as a percentage from 0 to 100%.





The operating status is displayed by a flame of variable length and shape, in relation to the power assigned by the control to the burner.

The name **B Mode** indicates the active operating mode, which can be selected on the next page as per the following table:

The power value assigned is shown with the name **B POWER**

“B Mode” burner operating mode	TYPE OF BURNER
ON-OFF	SINGLE-STAGE
2STG	2-STAGE
3STG	3-STAGE
Modul 3 PNT	3-POINT MODULATING
Modul IML	MODULATING WITH SHUTTER MOTOR CONTROL WITH 4-20 mA ANALOGUE SIGNAL. Modulation via IML
Modul EXT	MODULATING WITH EXTERNAL CONTROLLER TO THE PLC

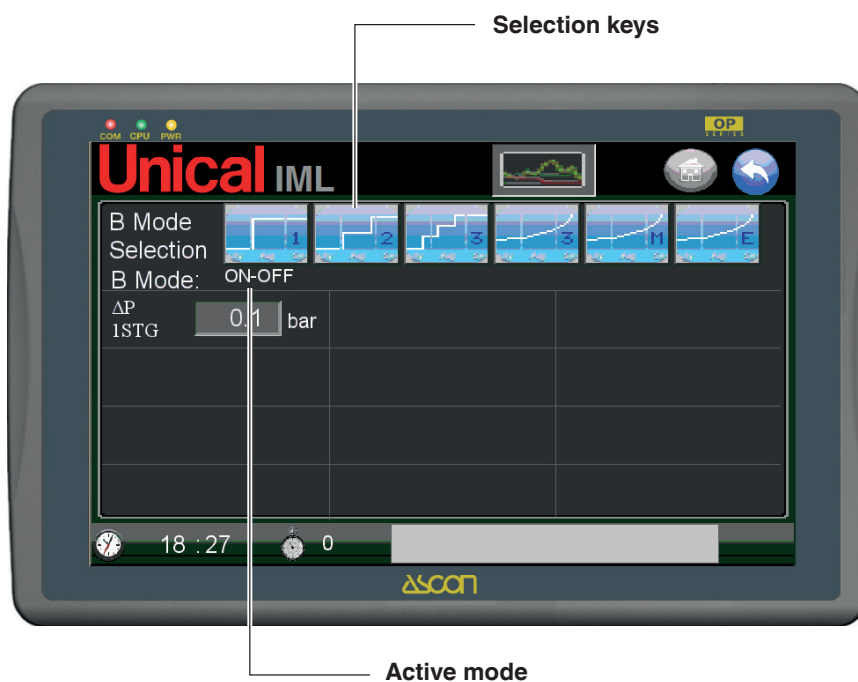
By activating the different operating modes available, the corresponding luminous indicators are activated that identify the operating status of:

Status	Enabled status display	Disabled status display	Displayed
FLAME		-	all modes
1STG – 1st stage flame		-	all modes
2STG – 2nd stage flame		-	2 STG and 3 STG modes
3STG – 3rd stage flame		-	3 STG mode

With USER 1÷4 and ADMINISTRATOR login the virtual key next to the burner is activated; this allows access to the BURNER SETTINGS PAGE.

BURNER SETTINGS PAGE (USER 1÷4 and ADMINISTRATOR login)

The BURNER SETTINGS PAGE is dedicated to managing operation of the burner; this allows you to select the operating mode and to enter the operating parameters values.
The page is shown as follows:



At the top are the burner's operating mode selection keys, which are:

B MODE	Type of operation	Selection key
ON-OFF	Single-stage	
2 STG	2-stage	
3 STG	3-stage	
MODUL 3 PNT	3-point modulating	
MODUL IML	Proportional modulating	
MODUL EXT	Modulation with external device	

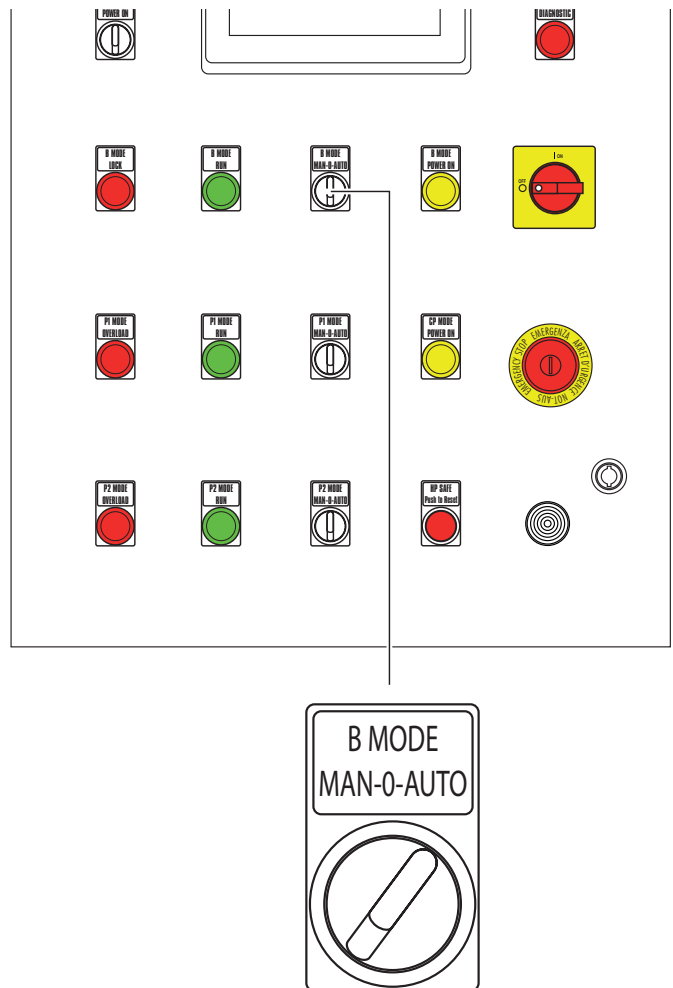
Electronic control is managed by a pressure transducer with scale field 0÷1.6 bar for boilers operating at 1 bar 0, or scale field 0÷16 bar for boilers operating at 12 or 15 bar.

The pressure transducer continuously controls the pressure status.

BURNER ADJUSTMENT

The selector on the front of the panel has three positions.

- MAN** the burner is adjusted only by consent of the working pressure switch which gives consent for ON-OFF operation, or 1st Flame-OFF for 2-stage, 3-stage, modulating burners. It is considered as an emergency operating mode.
- 0** neither the PLC nor the pressure switch have given consent to the burner.
- AUTO** consent and flame adjustment occurs via the PLC outputs, based on the various adjustment algorithms available. It is considered as the normal operating mode.



Technical features and dimensions

SINGLE-STAGE BURNER MODE (ON-OFF)

The power of the burner is controlled based on the pressure set-point set, **P SET** (PRESSURE PAGE).

On the page is the field: **ΔP 1STG** (= 1st stage of flame delta ignition pressure, in bar);

The page is as follows:



Operating logic:

With $P \leq (P \text{ SET} - \Delta P \text{ 1STG})$ pressure detected, the control will ignite the 1st stage of flame until it reaches a $P \geq P \text{ SET}$ value, after which it will extinguish.

Also see "Common Functions of Single-Stage, 2-Stage and 3-Stage Burner Control" chapter.

2-STAGE BURNER MODE (2 STG)

With activation of the control mode for 2-stage burners, named **2STG**, two new fields are displayed and activated: **ΔP 2STG** 2nd stage of flame delta ignition pressure, in bar;

DELAY 2STG 2nd stage of flame ignition delay in minutes.

The page is shown as follows:



Operating logic:

The burner's 1st and 2nd stages of flame are ignited as follows:

the 1st stage of flame is always ignited based on the **P SET** and on the ΔP 1STG, as previously described for the single-stage burner;

the 2nd stage of flame is ignited as follows:
when the pressure value read is $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG})$, a **DELAY 2STG** timer delay is started;

When the **DELAY 2STG** has timed out, if the pressure $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG})$ was maintained, then the control will ignite the 2nd stage of flame. The **DELAY 2STG** time is reset.

If during the **DELAY 2STG** time the pressure rises to a $P > (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG})$ value, then the **DELAY 2STG** time is reset and the 2nd stage of flame remains off. The **DELAY 2STG** timer will restart for the pressure status $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG})$.

When it has been ignited, the 2nd stage of flame will extinguish when the pressure rises to a value of $P > (P \text{ SET} - \Delta P \text{ 1STG})$, whilst the 1st stage relay will extinguish for $P \geq P \text{ SET}$ pressure.

3-STAGE BURNER MODE (3 STG)

With activation of the control mode for 3-stage burners, named **3STG**, in addition to the single and 2-stage fields, two new ones are displayed and activated.

The new fields are:

ΔP 3STG 3rd stage of flame delta ignition pressure, in bar;
DELAY 3STG 3rd stage of flame ignition delay in minutes.

The page is shown as follows:



Operating logic:

The 1st, 2nd and 3rd stages of flame are ignited as follows:

the 1st and 2nd stages of flame are managed as described above for the single-stage and 2-stage burner; when the pressure value read is $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG} - \Delta P \text{ 3STG})$, then a **DELAY 3STG** time delay is started;

When the **DELAY 3STG** has timed out, if the pressure $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG} - \Delta P \text{ 3STG})$ was maintained, then the control will ignite the 3rd stage of flame. The **DELAY 3STG** time is reset.

If during the **DELAY 3STG** time the pressure rises to a $P > (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG} - \Delta P \text{ 3STG})$ value, then the **DELAY**

3STG time is reset and the 3rd stage of flame remains off. The **DELAY 3STG** timer will restart for the pressure status $P \leq (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG} - \Delta P \text{ 3STG})$.

When it has been ignited, the 3rd stage of flame will extinguish when the pressure rises to a value of $P > (P \text{ SET} - \Delta P \text{ 1STG} - \Delta P \text{ 2STG})$.

Common Functions of Single-Stage, 2-Stage and 3-Stage Burner Control

During the entire management cycle of the burner, the Burner Lock logic input control must be enabled, and if this signal is shown then there must be an alarm warning, displayed as **BMODE LOCK**. See the "ALARMS PAGE" chapter for more details.

3-POINT MODULATING BURNER (MODUL 3PNT)

With activation of the control mode for 3-point modulating burners, named **MODUL 3PNT**, the burners are managed that control opening of the combustion air adjustment shutter with 3-point mode, or rather, with open-stop-close commands.

The 3 status are adjusted with a derivative/integrative function.

With this mode enabled on the page, the fields relative to the **2 STG** and **3 STG** modes are disabled, whilst new fields for management of the flame modulation are displayed and activated.

The new fields are:

- RANGE** field for derivative/integrative adjustment in bar;
- TIME D** derivative time in seconds;
- TIME I** integrative time in seconds;
- DEAD ZONE** dead zone around which adjustment is not made, in bar;
- TIME AIR GATE** burner air shutter opening time, in seconds;
- DELAY FLAME** no flame delay time, in sec.
- CTRL FLAME** delay time for controlling flame stability for modulation consent, in sec.

The page is shown as follows:



Operating logic:

The burner's 1st stage of flame is ignited and the Primary Combustion Air Shutter is modulated as follows:

the 1st stage of flame is put on ON, depending on the pressure setpoint (P SET on PRESSURE PAGE) and on the pressure differential ΔP 1STG. With $P \leq (P \text{ SET} - \Delta P \text{ 1STG})$ pressure detected, the control will ignite the 1st stage of flame and will maintain it until it reaches a $P \geq (P \text{ SET} + \Delta P \text{ 1STG})$ value, after which it will extinguish. (NOTE: the ΔP 1STG value must be higher than the proportional band within which the PID function operates).

When the 1st stage of flame is ignited, a flame stability control time **CTRL FLAME** is activated within which, if the no flame signal occurs, the air shutter is closed and the no flame time delay **DELAY FLAME** is started, after which a **B NO FLAME** alarm is triggered; if during the no flame **DELAY FLAME** time, the no flame signal stops, the time calculation **CTRL FLAME** restarts, at the end of which consent is given to the modulation via PID calculation.

NOTE: to improve efficiency of the adjustment, the **DELAY FLAME** and **CTRL FLAME** times must be reduced as much as possible, and be consistent with the type of burner installed.

The electronic control calculates the derivative/integrative function which aims at reaching the pressure setpoint (P SET), detecting the pressure transducer value and activating the air shutter opening and closing outlets, with modulated pulses, so as to obtain an approximation of the P SET pressure setpoint. This must be done without the pressure exceeding the P SET (clearly there are some tolerances), as quickly as possible and using the ON-OFF relays as little as possible.

The Flame Present signal must however be monitored continuously since, if it is missing, in addition to immediately closing the air shutter, the **DELAY FLAME** will be activated again, after which the system signals the **B NO FLAME** alarm if there is no steady flame present signal.

If during the **DELAY FLAME** time the flame present signal returns, then the **DELAY FLAME** resets and the **CTRL FLAME** delay restarts: if the active flame present signal remains stable for the entire **CTRL FLAME** time, then the system again controls the air shutter, via calculation of the PID function, otherwise control is recalculated with the **DELAY FLAME/CTRL FLAME** time.

IML MODULATING BURNER (MODUL IML)

The MODUL IML control mode is specific for modulating burners with position sensor of the combustion air shutter or of the fan motor speed variation (inverter), therefore with analogue output signal (4-20 mA).

The output signal value is adjusted with a derivative/integrative function.

With this mode enabled on the page, the fields relative to the **2 STG** and **3 STG** modes are disabled, whilst new fields for management of the flame modulation are displayed and activated.

The new fields are:

- RANGE** field for derivative/integrative adjustment in bar);
- TIME D** derivative time in seconds);
- TIME I** integrative time in seconds);
- DEAD ZONE** dead zone around which adjustment is not made, in bar);
- TIME AIR GATE** burner air shutter opening time, in second2);
- DELAY FLAME** no flame delay time, in sec).
- CTRL FLAME** delay time for controlling flame stability for modulation consent, in sec.

The page is shown as follows:



The burner's 1st stage of flame is ignited and the Primary Combustion Air Shutter is modulated as follows:

the 1st stage of flame is put on ON, always depending on the pressure setpoint (P SET on PRESSURE PAGE) and on the pressure differential ΔP 1STG with $P \leq (P \text{ SET})$ pressure detected, the control will ignite the 1st stage of flame and will maintain it until it reaches a $P \geq (P \text{ SET} + \Delta P \text{ 1STG})$ value, after which it will extinguish. (NOTE: the ΔP 1STG value must be higher than the proportional band within which the PID function operates).

When the 1st stage of flame is ignited, a flame stability control time **CTRL FLAME** is activated within which, if the no flame signal occurs, the air shutter is closed and the no flame time delay **DELAY FLAME** is started, after which a **B NO FLAME** alarm is triggered; if during the no flame **DELAY FLAME** time, the no flame signal stops, the time calculation **CTRL FLAME** restarts, at the end of which consent is given to the modulation via PID calculation.

The electronic control calculates the derivative/integrative function which aims at reaching the pressure setpoint set (P SET), detecting the pressure transducer value and setting the 4-20 mA output value so as to obtain an approximation of the P SET pressure setpoint. This must be done without the pressure exceeding the P SET (clearly there are some tolerances), as quickly as possible and with the least signal variations as possible.

The Flame Present signal must however be monitored continuously since, if it is missing, in addition to immediately closing the air shutter, the **DELAY FLAME** will be activated again, after which the system signals the **B NO FLAME** alarm if there is no steady flame present signal.

If during the **DELAY FLAME** time the flame present signal returns, then the **DELAY FLAME** resets and the **CTRL FLAME** delay restarts: if the active flame present signal remains stable for the entire **CTRL FLAME** time, then the system again controls the air shutter, via calculation of the PID function, otherwise control is recalculated with the **DELAY FLAME/CTRL FLAME** time.

EXTERNAL MODULATING BURNER (MODUL EXT)

The **MODUL EXT** control mode is specific for modulating burners managed with electronic control external to the PLC and specific (normally provided by the burner manufacturer).

The adjustment made by the IML system behaves so as to enable the 1st stage of flame with $P \leq (P \text{ SET} - \Delta P \text{ 1STG})$ pressure detected, the control will ignite the 1st stage of flame and will

maintain it until it reaches a $P \geq (P \text{ SET} + \Delta P \text{ 1STG})$ value, after which it will extinguish. (NOTE: the $\Delta P \text{ 1STG}$ value must be higher than the proportional band within which the PID function operates).

The page is shown as follows:



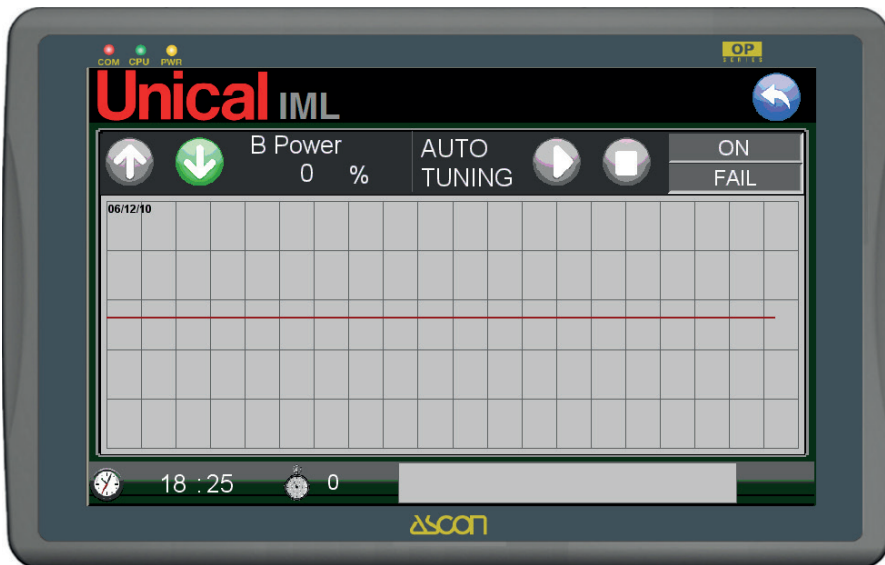
The operating parameters are adjusted on the external controller by following the manufacturer's operating instructions, taking care to match the P SET pressure setpoint on the PLC to the setpoint on the external controller.

ADJUSTMENT PARAMETERS SETTINGS PAGE

The **ADJUSTMENT PARAMETERS SETTINGS PAGE** can be accessed from the burner setting page and which displays the trend chart of the pressure with respect to assigned pressure

setpoint (P SET on PRESSURE PAGE) and the statuses of the burner.

The page is as follows:





The **red line** represents the pressure setpoint, P SET.
 The **green line** the trend of pressure in the boiler from the pressure transducer.

BURNER AUTOTUNING

Burner autotuning is a function that allows the IML system to perform adjustment cycles to find the best parameters for setting the derivative/integrative function managing flame modulation.

The following statuses are displayed for the MODUL 3PNT mode:

opening  and closing  of the air shutter.

At top right are the START AUTOTUNING  and ABORT AUTOTUNING  commands.



CONTACT THE UNICAL TECHNICAL SERVICE FOR THE ABOVE AUTOTUNING OPERATIONS.



3.4. LEVEL ADJUSTMENT - LEVEL PAGE

The LEVEL PAGE is dedicated to managing the level of water in the boiler and the loading pump that ensures its refilling.

The IML system for adjustment of the level relies on these sensors:

- a level transducer (capacitive electrode probe) which transmits an analogue signal (4-20 mA);
- a second ON-OFF electrode probe which defines the height of the level setpoint, called SETPOINT PROBE;
- two safety probes for low level;
- a possible safety probe for high level;
- a pressure transducer.

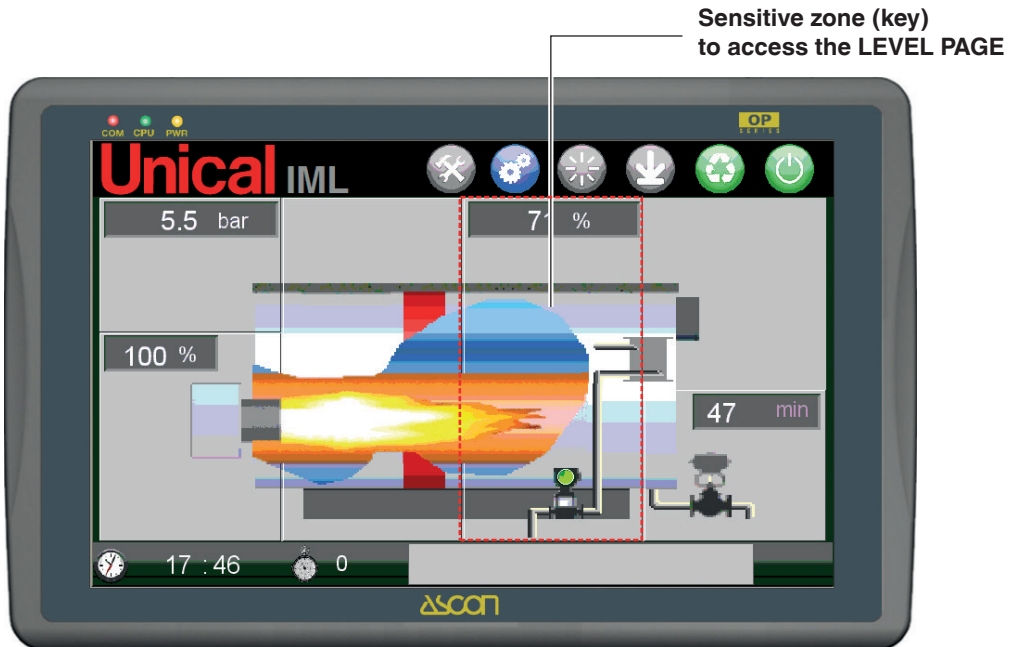
Adjustment is performed with:

- 1 or 2 water supply pump(s);
- possible three-way or proportional flow control valve, or possible inverter for speed adjustment of the motor pump;

There are five adjustment modes which vary according to the following statuses:


- burner operation;
- economiser;
- boiler operating status (STANDBY, AUTO, WARM UP, FILL).

The level of water detected by the capacitive probe is displayed on the HOME PAGE and on the LEVEL PAGE. Press the key on the HOME PAGE, defined by the "loading pump" zone, to access the LEVEL PAGE.



The following is displayed on the main page:

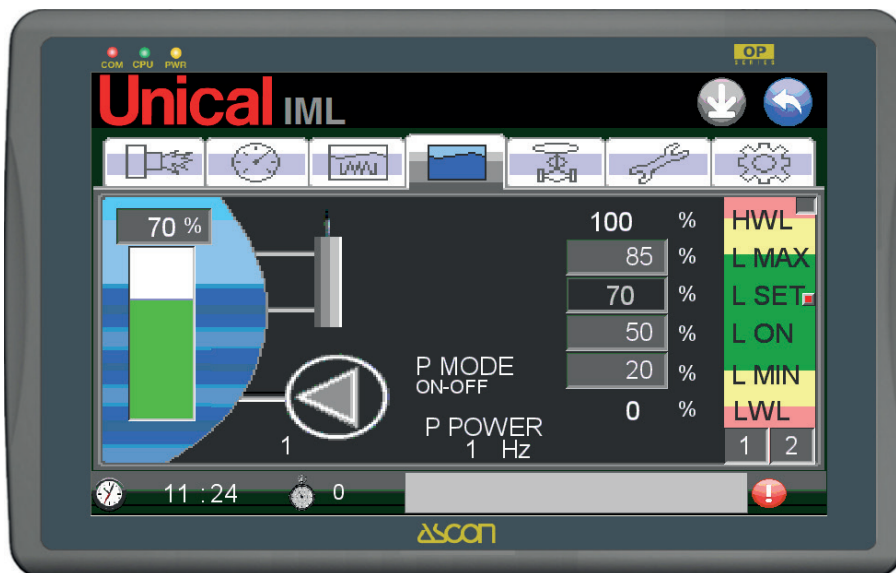
- the current level value in percentage, as described in the following paragraphs.

- the status of the pump: on  and off  .

From the other pages on the first level press the following key to access:



The LEVEL PAGE is as follows:



The page shows the status of the level control devices (pumps and probes) and the settings of the intervention limits for adjustments.

The operating status of the water loading pump is displayed by the pump's rotary movement (pump working and green) and the static image (pump stopped and grey).

On the left a filling bar represents the level, and above, a field with the numerical value with a scale from 0 to 100%, whose meaning is described later in this section.

On the right of the screen there are the indication/entering fields of the level limits, in order of height, which are:

- **HWL** (high level safety – value calculated which cannot be edited – always 100%);
- **L MAX** (maximum value required for overflow - value can be edited);
- **L SET** (setpoint level to which adjustment is aimed – value calculated which cannot be edited);
- **L ON** (hysteresis threshold for adjustment activation – val-

- **L MIN** (minimum adjustment threshold – value can be edited);
- **LWL** (low level safety – value calculated which cannot be edited – always 0%).

The only fields which can be edited on this page are: **L MAX**, **L ON** and **L MIN**.

The other values are calculated by the system and depend on that set on the next page, called **LEVEL PROBE SETTINGS PAGE**, **accessible only by the ADMINISTRATOR**.

Therefore the measuring field of 0÷100% corresponds to the height of the level that varies from the value corresponding to the intervention threshold of the low level safety probes LWL (0%) and the intervention threshold of the high level safety probe HWL, if present, or software threshold (100%). The setpoint probe usually requires that the difference in mm between the LWL and HWL is 100 mm, which leads to a correspondence of 1 mm = 1%.

A coloured bar indicates the adjustment field and the safety zones; the range identified by the green zone (between L MAX and L MIN) is the field in which the level is adjusted during automatic operation, AUTO MODE (see explanations on the HOME PAGE).

The yellow fields are temporary fields: the level touches these fields only during temporary operating phases, such as cold start, WARM UP MODE and FILL MODE.

The red zones are the intervention bands of the high level safety probes (HWL) and the low level ones (LWL). The lamps associated with the HWL and LWL alarms are in the red zones.



Use the two UP and DOWN keys to increase and decrease the value sent by the probe, with +-1% resolution, as described on the LEVEL PROBE SETTINGS PAGE.



With ADMINISTRATOR login



The virtual key is activated, next to the level probe, allowing access to the LEVEL PROBE SETTINGS PAGE (Default setting).



With USER 1÷4 and ADMINISTRATOR login

The zone is displayed for adjustment, fine calibration, of the level probe.

3.5 - MINIMUM WATER LEVEL SAFETY LEVEL SWITCHES - LWL (LOW WATER LEVEL)

Two low level safety electrode probes are installed on the boiler.

They are set at the same length and are double for back-up of the safety devices.

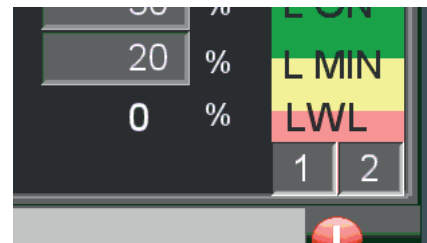
The level height of the LWL probes is at about 70 mm lower than the SETPOINT PROBE.

If the water reaches this level and uncovers the electrode of the probe(s), with a delay of about 10 sec. the relays of the relative safety devices (PED approved and with fail safe logic) are triggered, interrupting, with secondary relays (4 for each probe/controller), the chain of consents to the burner, thus interrupting operation.

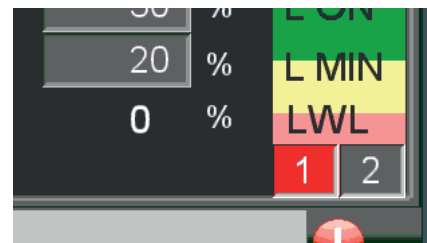
Intervention of the low level probes LWL is noted by:

- The alarm buzzer;
- The **LWL SAFE1** or **LWL SAFE2** luminous button lights up on the front door of the panel;
- **LWL SAFE1** or **LWL SAFE2** alarm on the operator panel.

The relative luminous indicator lights up at bottom right on the LEVEL PAGE.



Indicators off = no alarms



Indicator 1 on = LWL SAFE1 alarms present

If a LWL SAFE alarm is triggered, first understand and eliminate what caused excessive lowering of the level, then restore the water level.

To reset the alarm restore the level until the water touches the probes then press the flashing luminous button.

3.6 - SETPOINT PROBE

The SETPOINT PROBE physically identifies the normal level of water in the boiler, to which adjustment is aimed. It consists of an electrode probe connected to an electronic relay, which in turn is connected to a PLC input. It is set at 70 mm above the threshold of the LWL probes.

The exact value corresponding to the height value of the SETPOINT PROBE with respect to ZERO of the level transducer must be entered in the L SET field.

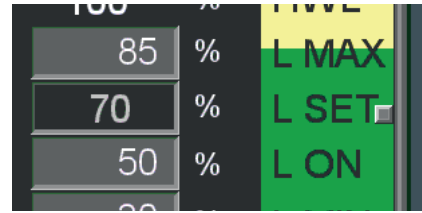
This value is then adjusted once the boiler has been filled for the first time using the procedure described in the following paragraph.

In this way a consistent percentage value will be calculated which will be the real SETPOINT for the control system.

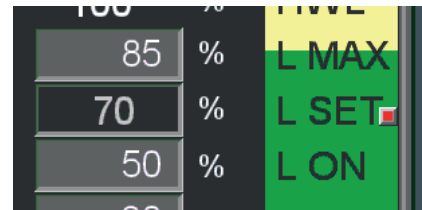
Any corrections can be made using the ADJUSTMENT function on the LEVEL PAGE.

The status of the physical probe is displayed with an indicator on the LEVEL PAGE.

The indicator off means that the level of water is below L SET. The indicator on means that the water touches the probe electrode.



Indicator off = level below probe threshold



Indicator on = level reached

3.7 - MAXIMUM WATER LEVEL SAFETY LEVEL SWITCH – HWL (HIGH WATER LEVEL)

The HWL function is the protection against excessive water filling, defined as High Level Water. It can operate in two different modes:

- In standard mode, relying on the value sent by the capacitive probe, as set on the LEVEL PROBE SETTINGS PAGE, and equivalent to 100% (generators not equipped with HIGH LEVEL safety level switch);
- In optional mode, relying on a high level safety electrode probe, the same type as that used for the LWL function. This mode is activated on the ADVANCED SETTINGS page, accessible only with ADMINISTRATOR login and is a default setting.

The level height of the HWL probe is at about 30 mm higher than the SETPOINT PROBE.

If the water reaches this level and touches the electrode of the probe, with a delay of about 10 sec. the relay of the relative safety device (PED approved and with fail safe logic) is triggered, interrupting, with 4 secondary relays, the chain of consents to the burner, thus interrupting operation.

Intervention of the high level probe HWL is noted by:

- The alarm buzzer
- The HWL SAFE luminous button lights up on the front door of the panel (only with physical probe present)
- HWL SAFE alarm on the operator panel.

The relative luminous indicator lights up at top right on the LEVEL PAGE.

3.8 - LEVEL SETTINGS (WATER LEVEL CONTROL)



With **USER 1÷4** and **ADMINISTRATOR** login

The access key to the **LEVEL SETTINGS PAGE**



is activated.

The **LEVEL SETTINGS PAGE** is dedicated to managing the water level in the boiler; this allows you to select the operating mode and to enter the operating parameters values.

The page is shown as follows:



At the top are the water loading pump operating mode selection keys, which are:

ON-OFF	ON - OFF	
2 STG	2-stage with inverter	
MODUL INV	Modulating with inverter	
MODUL 3 PNT	Modulating with 3-way valve	
MODUL V	Modulating with proportional control valve	

The various modes work differently on the pump also in relation to other variables, which are:


- Burner ON-OFF;
- With or without economiser;
- Active boiler operating status (Stand-By, AUTO, Warm-Up, Fill).

If two water loading pumps (kit upon request) are set, the LEVEL SETTINGS PAGE is:



The IML control can automatically switch between the two pumps in consideration of:

- operating load (if the limit set on the SERVICE PAGE is exceeded, the control changes the active pump to balance the wear of both pumps);
- possible faults (in the event of faults during operation of the active pump, the system will activate the other pump; see "ALARMS PAGE" paragraph).

At the top is the  key to enable/disable the automatic switch function.

The active status is indicated with "P Switch" which has two alternative statuses: AUTO and MANUAL. The active pump is indicated with "P active", that can indicate P1 or P2.

If the automatic switch is disabled, the user must choose the pump. Next to the pumps the pump selection key is active, so touch the required pump to select the active pump.



Technical features and dimensions



With INVERTER

With an INVERTER the system applies the following procedure for automatic or manual switch:

- interruption of 4-20 mA signal to the inverter;
- interruption of command to pump 1 contactor;
- activation of pump 2 contactor signal;
- reactivation of 4-20 mA signal to the inverter.

For details on automatic switch between pump 1 and pump 2 based on the load (operating hours, see ORDINARY SERVICE chapter).

Use the selector on the front of the panel to override operation of the pumps released from the PLC control logic. See PUMP(S) MANUAL OPERATION chapter.

PUMP ON-OFF MODE

Use the ON and OFF of the water feeding pump to adjust the level.

When you press  the page becomes:



The control thresholds are:

- L SET = upon reaching going up (from the bottom) the pump is turned OFF;
- L MIN = upon reaching going down (from the top) the pump is turned ON;

as set on the LEVEL PAGE.

The following parameters can be set on the page:

- TIME Δ L (maximum time to restore a value equal to Δ L MIN, described in the next step, after which the TIME MIN P1 alarm is triggered, see ALARMS chapter);
- Δ L MIN (minimum value to be exceeded in the time set in TIME Δ L, described in the next step);
- TIME L SET (maximum time to reach the L SET in seconds, after which the TIME LSET alarm is triggered, see ALARMS chapter).

Above the figure of the pump there are two fields for control of the pulse operation.
The first field is the ON time, the second is the OFF time.



Description of the function:



This mode must not be activated if the ECONOMISER function is enabled (with economiser).

- 1) With control in STANDBY MODE: the level control is disabled.
- 2) **With control in AUTO MODE:** when the level falls to touch L ON, i.e. $L \leq L_{ON}$, the pump is activated until the level returns to the setpoint, i.e. $L \geq L_{SET}$. With water level $L > L_{SET}$ the pump is stopped.

3) With control in FILL MODE:

- with water level $L \leq L_{MIN}$ (on LEVEL PAGE) - ΔL P ON the pump is on.
- With water level $L > L_{MIN}$ (on LEVEL PAGE) the pump is turned off and STANDBY MODE is activated.

4) With control in WARM UP mode: with water level $L \leq L_{MIN}$ (on LEVEL PAGE) the pump is turned on until the water level is $L > L_{MIN}$ (on LEVEL PAGE), or rather, when the pump is turned off.

ON-OFF mode summary table

Statuses to be considered with the level lowering and (rising):

AUTOMODE	WARMUP MODE	
OFF	OFF	- HWL
OFF	OFF	- L MAX
OFF (ON)	OFF	- L SET
ON	OFF	- L ON
ON	ON	- L MIN
		- LWL

2 STG PUMP MODE

Use the pump in 2-stage mode with inverter to adjust the level.

When you press the key the page becomes:



The speed of the pump's motor will vary from the set minimum speed (e.g. 30%) at the maximum speed (e.g. 100%).

Other than the fields already described in the ON-OFF mode, the following fields are enabled:

- INV MAX inverter adjustment maximum limit for 2nd stage speed, in %;
- INV MIN inverter adjustment minimum limit for 2nd stage speed, in %.

Description of the function:

- 1) **With control in STANDBY MODE**
The level adjustment is disabled.

2) With control in AUTO MODE

If the ECONOMISER is disabled:

- when the water level falls below the setpoint until it touches L ON, i.e. $L \leq L_{ON}$, the speed of the pump is minimum, meaning the percentage of the inverter is = INV MIN, and this speed is maintained until it touches the setpoint, i.e. $L \geq L_{SET}$.
- If instead the level falls further until it touches L MIN, i.e. $L \leq L_{MIN}$, the speed of the pump is maximum, meaning the percentage of the inverter is = INV MAX, until it touches L ON, i.e. $L \geq L_{ON}$; after which the speed returns = INV MIN, until it touches L SET, i.e. $L \geq L_{SET}$.
- With water level $L > L_{SET}$ the pump is stopped.

If the ECONOMISER is enabled, the status of the burner becomes involved.

With burner off (1st stage of flame = OFF):

- If the water level falls below the setpoint until it touches L MIN i.e. $L \leq L \text{ MIN}$, the speed of the pump is maximum, meaning the percentage of the inverter is = INV MAX, and this speed is maintained until it touches L ON, i.e. $L \geq L \text{ ON}$.
- When the water level is higher than L ON, i.e. $L > L \text{ ON}$, the pump is kept at a standstill while waiting for the burner to ignite.

With burner on (1st stage of flame = ON):

- If the water level is higher than the setpoint but not higher than L MAX, i.e. $L \text{ SET} \leq L < L \text{ MAX}$, the pump is pulse activated at the minimum speed (ON and OFF intervals).
- If the level is higher than L MAX, i.e. $L > L \text{ MAX}$, the pump is stopped.
- If the water level is lower than the setpoint but higher than L MIN, i.e. $L \text{ MIN} \leq L < L \text{ SET}$, the pump is activated at the minimum speed, acting on the inverter at the frequency = INV MIN.
- If the level falls below L MIN, i.e. $L < L \text{ MIN}$, the pump is activated at the maximum speed, acting on the inverter with the maximum percentage = INV MAX.

3) With control in FILL MODE

- with water level lower than L MIN, i.e. $L \leq L \text{ MIN}$ (on LEVEL PAGE), the pump speed is maximum, acting on the inverter with the maximum percentage = INV MAX.
- with water level higher than L MIN, i.e. $L > L \text{ MIN}$, the pump is kept off and the STANDBY MODE is activated.

4) With control in WARM UP MODE (burner =ON)

If the ECONOMISER is disabled:

- with water level lower than L MIN, i.e. $L \leq L \text{ MIN}$ (on LEVEL PAGE), the pump speed is maximum, acting on the inverter with the maximum percentage = INV MAX.
- with water level higher than L MIN, i.e. $L > L \text{ MIN}$, the pump is kept off to allow expansion of the water when the temperature rises.

If the ECONOMISER is enabled:

- with water level lower than L MIN, i.e. $L \leq L \text{ MIN}$, the pump speed is maximum, acting on the inverter with the maximum percentage = INV MAX.
- with water level higher than L MIN and lower than L MAX, i.e. $L \text{ MIN} < L \leq L \text{ MAX}$, the pump is pulse activated at a minimum speed acting on the inverter with the minimum percentage = INV MIN with ON-OFF cycles, to protect the ECONOMISER and ensure there is no boiling in it.
- with water level higher than L MAX, i.e. $L > L \text{ MAX}$, the pump is kept off.

2STG mode summary table

The "NO ECONOMISER" columns are to be read with descending level:

AUTO MODE			WARMUP MODE		
NO ECONOMISER	ECONOMISER		NO ECONOMISER	ECONOMISER	
	BURN = ON	BURN = ON		BURN = ON	
OFF	OFF	OFF	OFF	OFF	- HWL
OFF	PULSES	OFF	OFF	PULSES	- L MAX
INV MIN	INV MIN	OFF	OFF	PULSES	- L SET
INV MIN	INV MIN	OFF	OFF	PULSES	- L ON
INV MAX	INV MAX	INV MAX	INV MAX	INV MAX	- L MIN
					- LWL

MODUL INV PUMP MODE

Use the rotation speed of the pump with the inverter in modulating mode to adjust the level.

When you press  the page becomes:



The value of the level continuously detected by the transducer allows you to modulate the rotation speed of the pump's electric motor by means of an inverter.

The frequency values for correcting the level are calculated by the integrative/derivative function.

Other than the fields already described in the ON-OFF and 2 STG mode, the following fields are enabled:

- PR band within which the derivative function is activated, in level %;
- TD derivative function calculation time in seconds;
- TI integrative function calculation time in seconds.

Description of the function:

1) With control in STANDBY MODE

The level adjustment is disabled.

2) With control in AUTO MODE

If the ECONOMISER is disabled then:

- Using a PID function, the level control will maintain a value equal to L SET by varying the frequency value assigned to the pump by means of an inverter. [integrate with function description and meaning of variables...].
The minimum (INV MIN) and maximum (INV MAX) adjustment percentages set limits to the signal output from the PLC to the inverter, and consequently to the frequency assigned by the inverter to the pump's motor. When the pump starts being controlled, a timer starts counting the adjustment time to check whether the system is adjusting enough to increase the level, such that there is a level gain equal to ΔL MIN in the TIME ΔL , but no later than the absolute time equal to TIME L SET.
- If instead the level falls until it touches L MIN, i.e. $L \leq L$ MIN, then the speed of the pump is maximum, meaning the percentage of the inverter is = INV MAX, until it ex-

ceeds L MIN, beyond which the PID function becomes involved again. With the logic described in the previous paragraph.

If the ECONOMISER is enabled, the status of the burner becomes involved. In this condition the parameters for counting the level restore time (ΔL MIN, TIME ΔL , TIME L SET) are not taken into account.

With burner off (1st stage of flame = OFF) then:

- With burner off the control does not maintain the setpoint level assigned, equal to L SET, but allows it to be lowered until it touches L MIN, i.e. $L \leq L$ MIN, the speed of the pump is maximum, meaning the percentage of the inverter is = INV MAX and this speed is maintained until it touches L ON, i.e. $L \geq L$ ON.

With burner on (1st stage of flame = ON) then:

- The PID function is activated to calculate the pump speed modulation aiming for L SET, thus calculating the percentage to be assigned to the inverter between the minimum and maximum limits set.
- If the level falls below L MIN, i.e. $L < L$ MIN, the pump is activated at the maximum speed, acting on the inverter with the maximum percentage = INV MAX until it touches L ON.

3) With control in FILL MODE:

- (see that described for 2 STG mode)

4) With control in WARM UP MODE (burner =ON):

- (see that described for 2 STG mode)

MODUL INV mode summary table

AUTO MODE			WARMUP MODE		
NO ECONOMISER	ECONOMISER		NO ECONOMISER	ECONOMISER	
	BURN = ON	BURN = ON		BURN = ON	
PID	PID	OFF	OFF	OFF	- HWL
PID	PID	OFF	OFF	PULSES	- L MAX
PID	PID	OFF	OFF	PULSES	- L SET
PID	PID	OFF	OFF	PULSES	- L ON
INV MAX	INV MAX	INV MAX	INV MAX	INV MAX	- L MIN
					- LWL

MODUL 3 PNT PUMP MODE

Use the open/stop/close (3 ways) of the modulating valve to adjust the level.

As the valve is between the pump and the boiler, its opening or closing creates a variation in the water flow from the supply pipe.

The variation in flow in relation to the collection of steam power (read also as water consumption) will also maintain it constant.

When you press  the page becomes:



Other than the fields already described in the ON-OFF and 2 STG mode, the following fields are enabled:

- PR band within which the derivative function is activated, in level %;
- TD derivative function calculation time in seconds;
- TI integrative function calculation time in seconds;
- DEATH ZONE dead band, or rather insensitive zone around the L SET setpoint value, in level %;
- RUN TIME V valve run time, in seconds.

Description of the function:

1) **With control in STANDBY MODE**

The level adjustment is disabled.

2) **With control in AUTO MODE**

If the ECONOMISER is disabled:

- Using a PID function, the level control will maintain a val-

ue equal to L SET by using the open-stop-close (3 ways) of a modulating flow valve. The times to be assigned to the three statuses (open-stop-close) are calculated with the PID function. [integrate with function description and meaning of variables...].

When the pump starts being controlled, a timer starts counting the adjustment time to check whether the system is adjusting enough to increase the level, such that there is a level gain equal to ΔL MIN in the TIME ΔL , but no later than the absolute time equal to TIME L SET.

- If the level falls until it touches L MIN, i.e. $L \leq L$ MIN, then the valve is opened until it exceeds L MIN, beyond which the PID function becomes involved again. With the logic described in the previous paragraph.

If the ECONOMISER is enabled, the status of the burner becomes involved. In this condition the parameters for counting the level restore time (ΔL MIN, TIME ΔL , TIME L SET) are not taken into account.

With burner off (1st stage of flame = OFF):

- the control does not maintain the setpoint level assigned, equal to L SET, but allows it to be lowered until it reaches L MIN, i.e. $L \leq L$ MIN. When L MIN has been touched, the valve is completely opened and the pump is activated to restore the level up to L ON, i.e. $L \geq L$ ON.

With burner on (1st stage of flame = ON):

- The PID function is activated to calculate the valve modulation aiming for L SET, thus calculating the times to be assigned to the three statuses (open-stopped-closed).
- If the level falls below L MIN, i.e. $L < L$ MIN, the valve is completely opened and the pump is activated to restore the level up to L ON, i.e. $L \geq L$ ON.

3) With control in WARM UP MODE (burner =ON):

- with water level lower than L MIN, the valve is completely opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L$ MIN.
- with water level higher than L MIN, i.e. $L > L$ MIN, the pump is kept off and the valve is stopped. STANDBY MODE is activated.

4) With control in WARM UP MODE (burner =ON)

If the ECONOMISER is disabled:

- with water level lower than L MIN, the valve is completely

opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L$ MIN.

- with water level higher than L MIN, i.e. $L > L$ MIN, the pump is kept off and the valve stops to allow expansion of the water when the temperature rises.

If the ECONOMISER is enabled:

- with water level lower than L MIN, i.e. $L \leq L$ MIN, the valve is completely opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L$ MIN.
- with water level higher than L MIN and lower than L MAX, i.e. L MIN $< L \leq L$ MAX, the pump is pulse activated with the valve open for 1/4 of the valve run time (RUN TIME V) to ensure minimum movement of the ECONOMISER at intervals and to protect it from overheating and from the water boiling in it.
- with water level higher than L MAX, i.e. $L > L$ MAX, the pump is kept off.

MODUL INV mode summary table

AUTO MODE			WARMUP MODE		
NO ECONOMISER	ECONOMISER		NO ECONOMISER	ECONOMISER	
	BURN = ON	BURN = ON		BURN = ON	
PID	PID	OFF	OFF	OFF	- HWL
PID	PID	OFF	OFF	V 1/4 -PULSES	- L MAX
PID	PID	OFF	OFF	V 1/4 -PULSES	- L SET
PID	PID	OFF	OFF	V 1/4 -PULSES	- L ON
V OPEN	V OPEN	V OPEN	V OPEN	V OPEN	- L MIN
					- LWL

MODUL V PUMP MODE

Use the analogue signal (4-20 mA) towards the opening control of a modulating valve to adjust the level. As the valve is between the pump and the boiler, its opening or closing creates a

variation in the water flow from the supply pipe.

When you press  the page becomes:



Other than the fields already described in the ON-OFF and 2 STG mode, the following fields are enabled:

- PR band within which the derivative function is activated, in level %;
- TD derivative function calculation time in seconds;
- TI integrative function calculation time in seconds;
- DEATH ZONE dead band, or rather insensitive zone around the L SET setpoint value, in level %;
- RUN TIME V valve run time, in seconds.

Description of the function:

1) With control in STANDBY MODE:
The level adjustment is disabled.

2) With control in AUTO MODE

If the ECONOMISER is disabled:

- Using a PID function, the level control will maintain a value equal to L SET by using an analogue signal varying from 4 to 20 mA towards the opening control device of the flow modulating valve. The value is calculated using the PID function. [integrate with function description and meaning of variables...]. When the pump starts being controlled, a timer starts counting the adjustment time to check whether the system is adjusting enough to increase the level, such that there is a level gain equal to $\Delta L \text{ MIN}$ in the TIME ΔL , but no later than the absolute time equal to TIME L SET.
- If the level falls until it touches L MIN, i.e. $L \leq L \text{ MIN}$, then the valve is opened (20 mA) until it exceeds L MIN, beyond which the PID function becomes involved again.

With the logic described in the previous paragraph.

If the ECONOMISER is enabled, the status of the burner be-

comes involved.

In this condition the parameters for counting the level restore time ($\Delta L \text{ MIN}$, TIME ΔL , TIME L SET) are not taken into account.

With burner off (1st stage of flame = OFF):

- the control does not maintain the setpoint level assigned, equal to L SET, but allows it to be lowered until it reaches L MIN, i.e. $L \leq L \text{ MIN}$. When L MIN has been touched, the valve is completely opened (20 mA?) and the pump is activated to restore the level up to L ON, i.e. $L \geq L \text{ ON}$.
- With burner on (1st stage of flame = ON):
- The PID function is activated to calculate the valve modulation aiming for L SET, thus calculating the analogue value between 4 and 20 mA to be transmitted to the modulating valve control device.
- If the level falls below L MIN, i.e. $L < L \text{ MIN}$, the valve is completely opened and the pump is activated to restore the level up to L ON, i.e. $L \geq L \text{ ON}$.

3) With control in FILL MODE (burner =ON):

- with water level lower than L MIN, the valve is completely opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L \text{ MIN}$.
- with water level higher than L MIN, i.e. $L > L \text{ MIN}$, the pump is kept off and the valve is stopped. STANDBY MODE is activated.

4) With control in WARM UP MODE (burner =ON)

If the ECONOMISER is disabled:

- with water level lower than L MIN, the valve is completely opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L \text{ MIN}$.
- with water level higher than L MIN, i.e. $L > L \text{ MIN}$, the pump is kept off and the valve stops to allow expansion of the water when the temperature rises.

If the ECONOMISER is enabled:

- with water level lower than L MIN, i.e. $L \leq L \text{ MIN}$, the valve is completely opened and the pump is activated to restore the level until it is higher than L MIN, i.e. $L \geq L \text{ MIN}$.
- with water level higher than L MIN and lower than L MAX, i.e. $L \text{ MIN} < L \leq L \text{ MAX}$, the pump is pulse activated with the valve open with value (1/4 from closure - 8 mA?) to ensure minimum movement of the ECONOMISER at intervals and to protect it from overheating and from the

water boiling in it.

- with water level higher than L MAX, i.e. $L > L \text{ MAX}$, the pump is kept off.

MODUL INV mode summary table

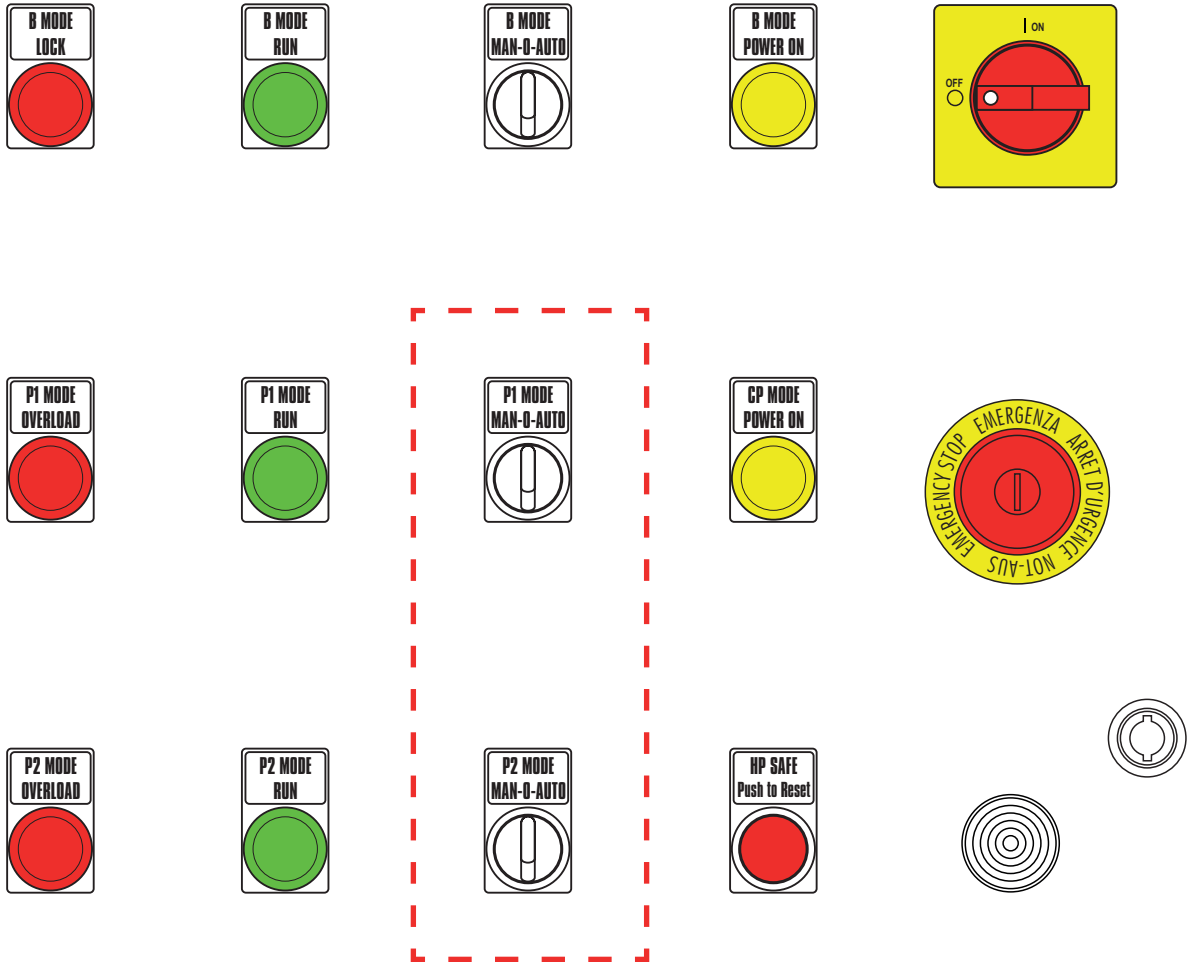
AUTO MODE			WARMUP MODE		
NO ECONOMISER	ECONOMISER		NO ECONOMISER	ECONOMISER	
	BURN = ON	BURN = ON		BURN = ON	
PID	PID	OFF	OFF	OFF	- HWL
PID	PID	OFF	OFF	V 1/4 -PULSES	- L MAX
PID	PID	OFF	OFF	V 1/4 -PULSES	- L SET
PID	PID	OFF	OFF	V 1/4 -PULSES	- L ON
V OPEN	V OPEN	V OPEN	V OPEN	V OPEN	- L MIN
					- LWL

PUMP(S) MANUAL OPERATION

There is also the possibility of manually forcing operation of the pumps by bypassing the PLC and using the selectors on the front of the panel.

The procedure is as follows:

- Put the P (1 or 2) MODE MAN-0-AUTO selector on MAN.



If the INVERTER kit is used proceed as follows:

- > Put the P MODE selector on the IML panel on 0.
- > Put the selector on the INVERTER panel on 0.
- > Put the P MODE selector on the IML panel on MAN.
- > Put the selector on the INVERTER panel on MAN.



In the event of manual override with two pumps, activate one pump at a time.

3.9 - TDS PAGE

TDS is the abbreviation of Total Dissolved Solids, i.e. the total amount of dissolved salts.

The amount of salts dissolved in the water is measured indirectly by a probe that feels the electrical conductivity of the water.

The probe has an integrated temperature sensor since the value of conductivity varies when the water temperature changes; the combination of the two values interpreted by the electronics on the probe generates a consistent 4-20 mA signal.

By enabling the TDS function the system activates to adjust the value of conductivity by comparing the value read by the probe with the SETPOINT value set in the system.

When the setpoint value is exceeded, the control acts by commanding the water bleed valve to open which, by causing the level in the boiler to lower, will actuate the loading pump, thus filling the boiler with "new" water (water with low level of TDS/ conductivity).

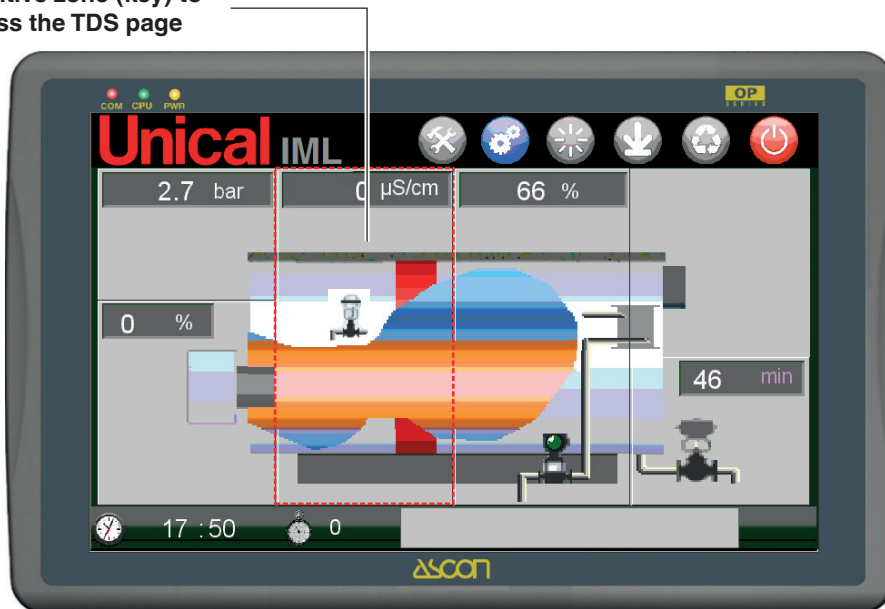
The valve has ON-OFF control modes, with a time interval on opening and closing for the entire time the TDS value is being requested to lower.

A second conductivity threshold is set as a limit value for safety block of the entire generator; if this threshold is exceeded, the high TDS alarm is triggered and operation of the burner is locked.

The TDS function is optional and can be selected on the "ADVANCED SETTINGS" page, accessible only by the ADMINISTRATOR

When the function has been enabled on the home page, the bleed valve associated with control of the TDS is shown on the boiler's synoptic panel and the access keys to the specific function control page are enabled.

Sensitive zone (key) to access the TDS page



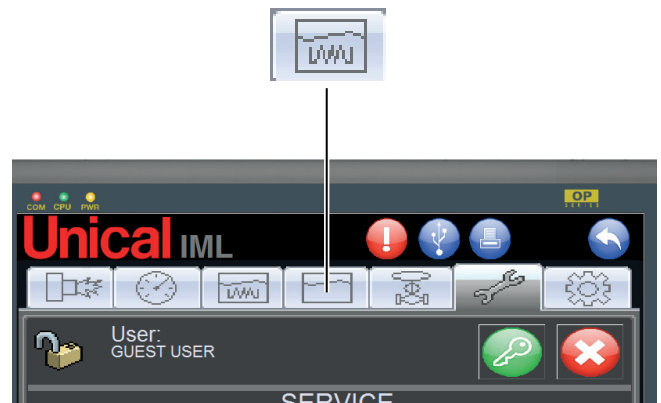
The following is displayed on the main page:

- the current conductivity value read by the probe, in the field above the sensitive zone;

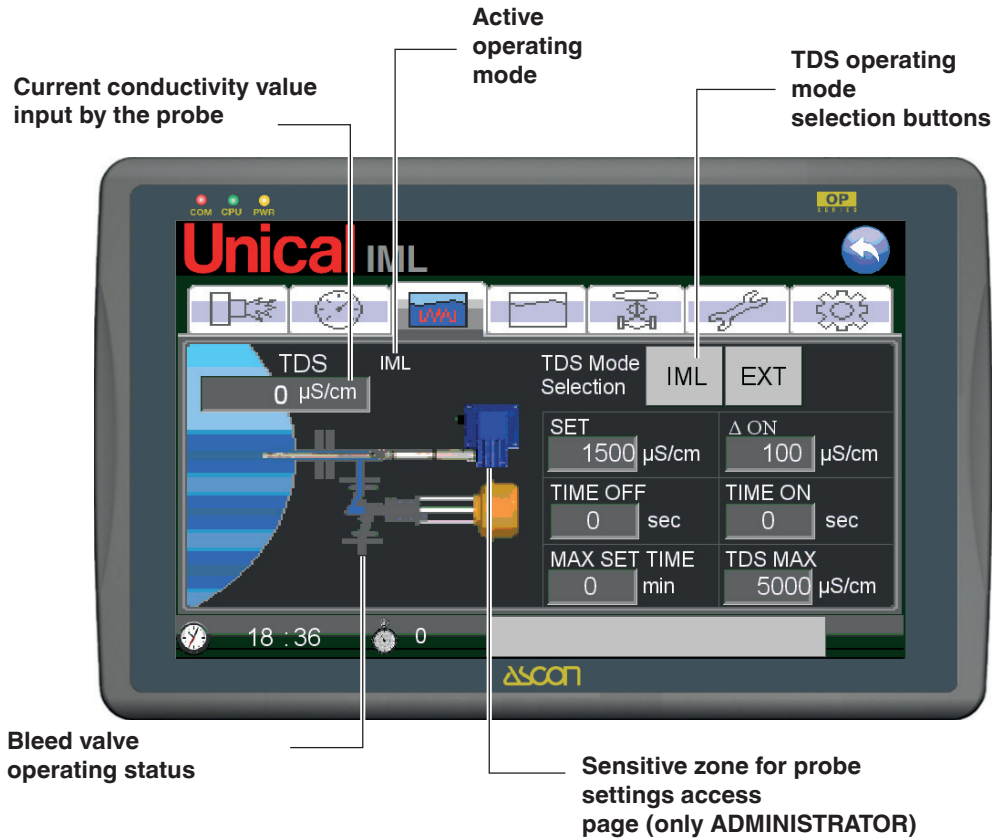
- the status of the bleed valve (closed and open



The TDS page can also be accessed from the other pages (BURNER, PRESSURE, etc.) by pressing the relative access key.



The TDS page is as follows:



The conductivity control system consisting of probe and water bleed valve is shown on the TDS page. The current conductivity value (value read by the probe) is displayed in a box and expressed in $\mu\text{S}/\text{cm}$.

The status of the bleed valve is displayed by the output spray (valve open) or by no spray (valve closed).

valve open

valve closed



External TDS mode (EXT)

For the EXT mode the conductivity probe is connected to an electronic device external to the PLC. Control and safety is assigned to an external device.

The valve control is enabled by activating the PLC output named "TDS CONTROL" (B7 terminal). When the EXT mode has been enabled, the page is shown as follows:



Fields are not displayed for setting the parameters as they are all set by the external controller. All settings are done on the external device. In this mode the TDS SAFE alarm is disabled due to no probe signal.

Description of operating mode:

The functions are disabled on the IML system and are carried out by the external device.

If the safety threshold of the external device is exceeded, said device triggers the alarm, which is read by the IML system as a TDS SAFE EXT alarm, and the STAND-BY status is activated.

A contact of the device acts directly on the chain of consents to

the burner, thus blocking operation.

In STAND-BY mode the control disables the PLC output named "TDS CONTROL" (B7 terminal), to interrupt the bleed valve control by the external device, which could cause the water level to lower, thus becoming non-restorable by the pump(s).

Approved devices.

Devices that can be used are:

1. GESTRA system consisting of mod. LRGT 16-1 probe and mod. KS90 controller
2. SPIRAX SARCO system consisting of mod. CP32 probe and mod. BC3150 controller

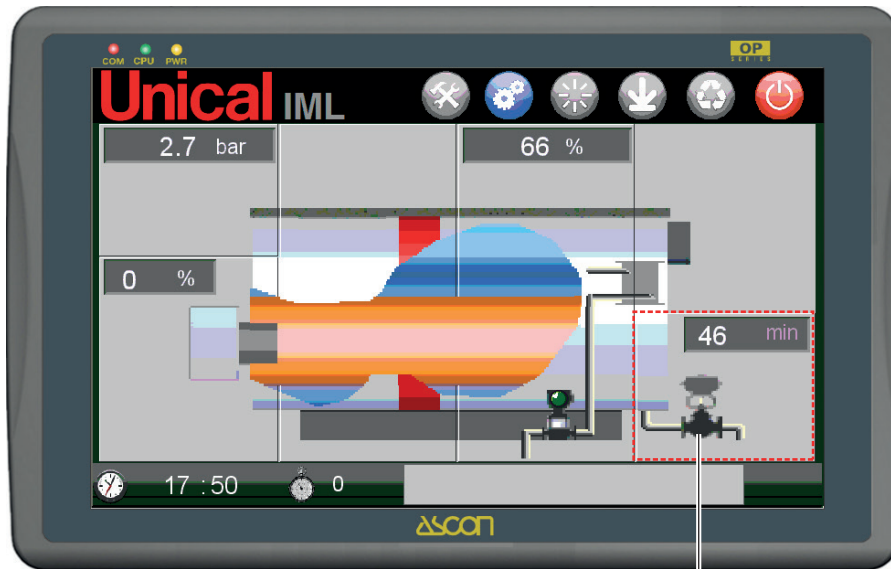
The controller settings are done by the manufacturer.

3.10 - BLOW DOWN PAGE

Blow Down is a timed discharge system that ensures expulsion of the heavy particles dissolved in the water that create sludge which, being heavier, sinks to the bottom of the boiler.

The BLOW-DOWNTDS function is optional and can be selected on the "ADVANCED SETTINGS" page, accessible only by the ADMINISTRATOR

When the function has been enabled on the home page, the dirt separator valve associated with control of the BLOW DOWN is shown on the boiler's synoptic panel and the access keys to the specific function control page are enabled.



Sensitive zone (key) to access the BLOW DOWN page

The following is displayed on the main page:

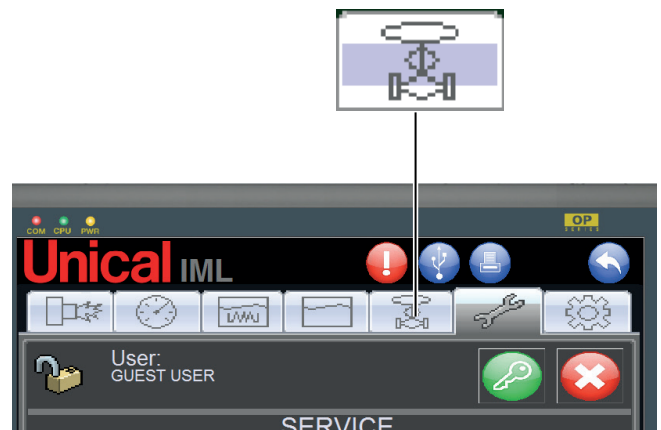
- time remaining until the next sludge discharge;

- the status of the bleed valve

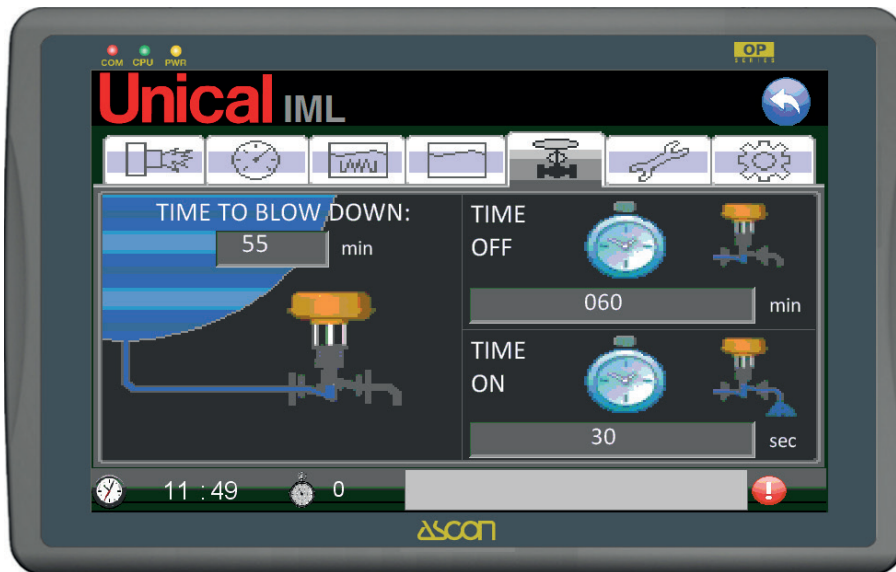


The access key is enabled also from the other specific pages (BURNER, PRESSURE, etc.).

The TDS page can also be accessed from the other pages (BURNER, PRESSURE, etc.) by pressing the relative access key.



The BLOW DOWN page is as follows:



It consists of a quick-opening valve controlled by the IML system as regards opening and closing times.

Expulsion of the sludge is effective when, after quick opening of the valve, there follow moments of opening that are not excessively long; prolonged opening does not allow the sludge to be continuously dredged from the bottom towards the pipe and as a result only water would be expelled, with consequent dispersion of useful energy.

There are three fields on the page for displaying/entering values.

The fields are:

TIME TO BLOW DOWN
display of time remaining until next bleed;

TIME OFF
entering the interval time between the bleeds;

TIME ON
entering the opening time of the dirt separator valve;



The values can be entered and edited only with USER 1÷USER 4 login

3.11 - SERVICE

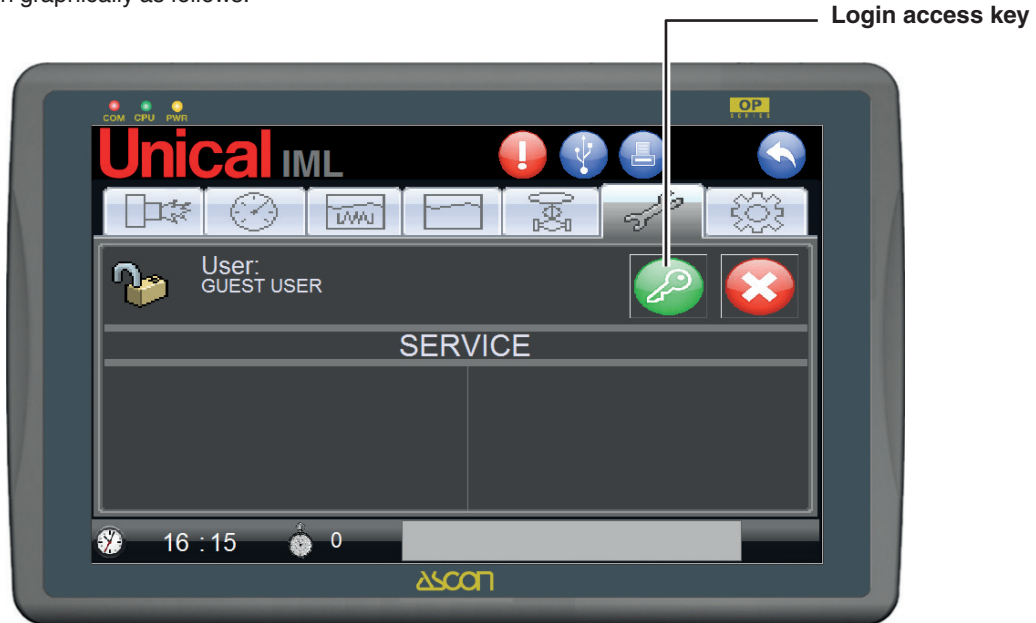
The SERVICE page is dedicated to all of the IML system's main-tenance operations.

The following operations are managed from this page:

- User authentication via Login

- Ordinary Service
planned maintenance service of the burner and water supply pump(s)
- Safe Service
boiler safety devices inspection service

The page is shown graphically as follows:



Only after authentication, with USER 1÷USER 4 and/or ADMINISTRATOR login, will the access fields to SERVICE and to SAFE SERVICE be enabled.

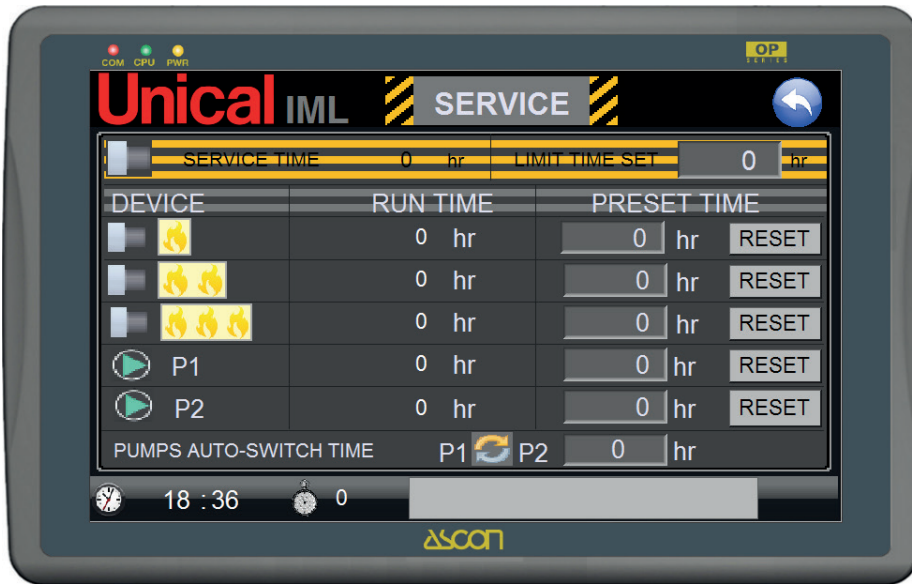
The page is shown graphically as follows:



ORDINARY SERVICE

The SERVICE page displays the burner and water supply pump(s) operating meters. The limit can also be set in hours to request maintenance of the

burner and the differential limit between the operating hours of the two pumps (when available). The page is shown graphically as follows:



BURNER SERVICE

During the burner's operating and control cycle there will be a check of the Flame Present logic Input that will activate the icon on the BURNER PAGE.

A partial time counter is reset at each service and which is constantly compared with the limit set on the SERVICE SETTINGS PAGE, after which the system will send a message requesting service of the burner, called BURNER SERVICE.

After the service has been completed, the partial counter will be reset by pressing the reset key.

Both the partial counter and the total counter (1st flame) can be reset from the keypad/display.

PUMPS OPERATING TIMES METER

During the burner's operating cycle there will be a check of the status of the P1 and P2 (if available) pumps' contactors.

Detection of these "activated" inputs determines increase of the timers - PUMP 1 COUNTER and PUMP 2 COUNTER.

The difference in hours between PUMP 1 COUNTER and PUMP 2 COUNTER is compared with a settable value on the SERVICE SETTINGS PAGE which defines the limit in hours between Pump 1 and Pump 2 operating hours, after which the system switches between the pumps.

SAFE SERVICE

Safe service is dedicated to control and maintenance of the safety devices that oversee the steam generator and must be run every 24 or 72 hr of operation.

The controls are carried out as prescribed by the regulations in force.

SAFE SERVICE is a function that can be set on the ADVANCED SETTINGS paged (**Setting only with ADMINISTRATOR login**).

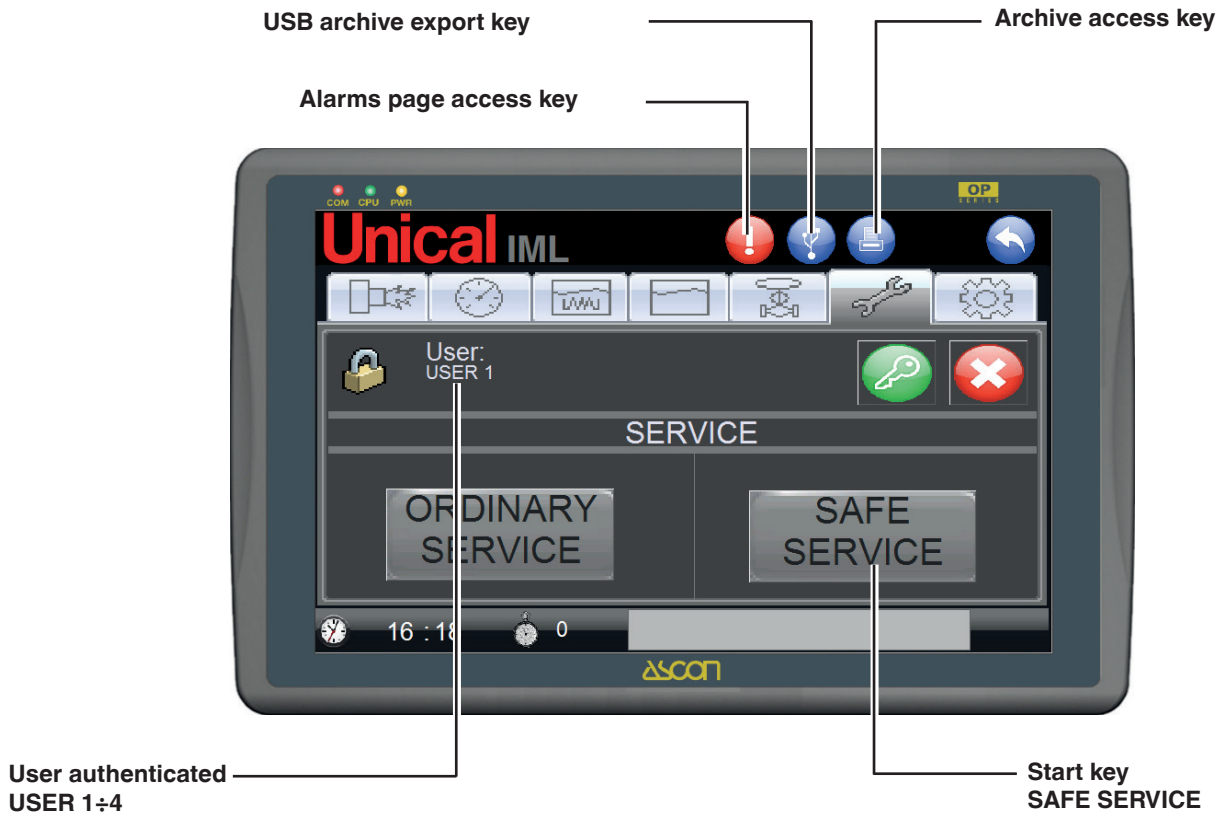
The logic of the SAFE SERVICE function is that the system counts the operating hours of the generator, comparing them to the set limit that can be 24 or 72 hours. The countdown is displayed in the bar at the bottom of the home page, next to the clock.



When the countdown counter reaches the value=1 hr, the system displays a message requesting service; this remains active on the home page up to operator intervention.

When the time has passed the generator enters **STANDBY mode**, thus interrupting operation of the burner (but not operation of the pumps). In this phase activation of the **AUTO mode** is prevented.


The operator can restart the **AUTO mode** only after having run the programmed controls cycle. First he/she must be authenticated with **USER 1÷4** on the **SERVICE** page. When authenticated, a key will be enabled for access to the **SAFE SERVICE**.



The first screen of the SAFE SERVICE is shown initially as follows:

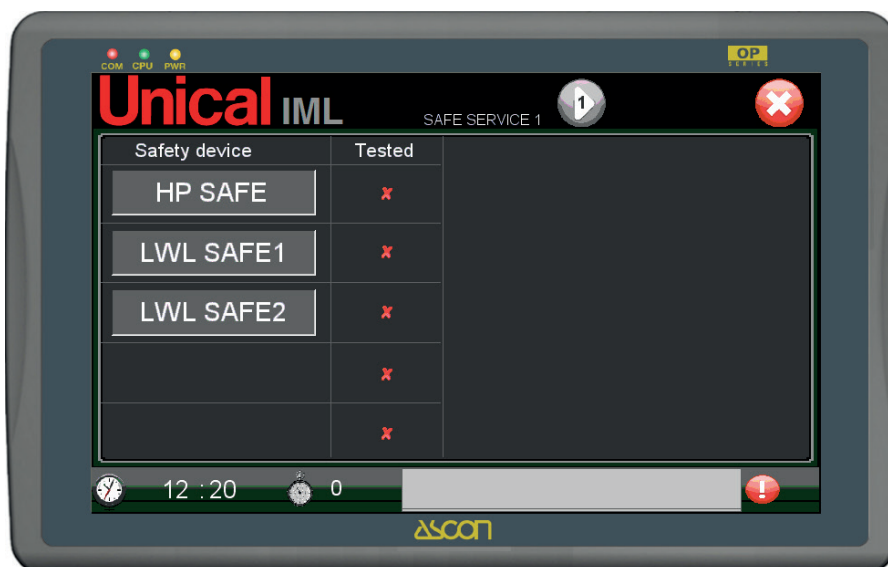


Optional
Available only if the HWL SAFE and TDS SAFE EXT functions are enabled

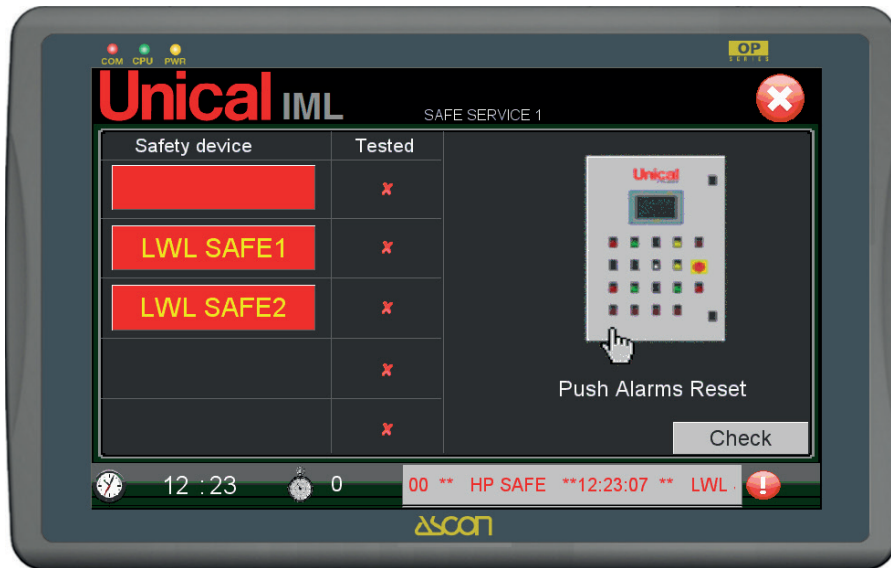
- 1) Press  to start the first phase, which causes the self-retaining relay to open:
- Safety pressure switch (HP SAFE);
 - Low level water safety level switch no.1 (LWL SAFE1);
 - Low level water safety level switch no.2 (LWL SAFE2);

- High level safety level switch (HWL SAFE) if provided and enabled*.

*If HWL is disabled the relative alarm will not be displayed.




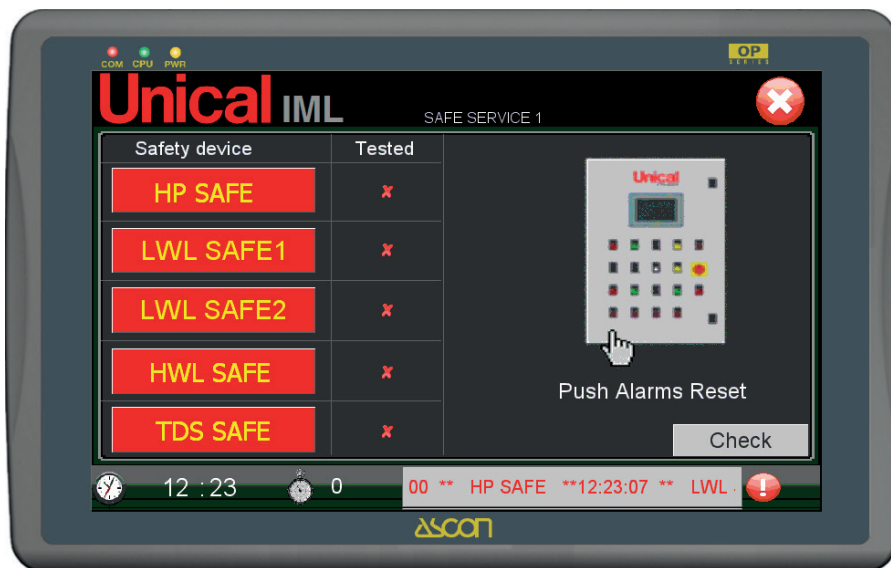
- 2) After a few seconds the following alarms should be triggered:
- HP SAFE,
 - LWL SAFE1,
 - LWL SAFE2
- and HWL SAFE if available.



- After 10 seconds the PLC closes the DO7 digital input and checks that the alarms are active:
- HP SAFE;
 - LWL SAFE1;
 - LWL SAFE2;
 - HWL SAFE*.
- *If HWL is disabled

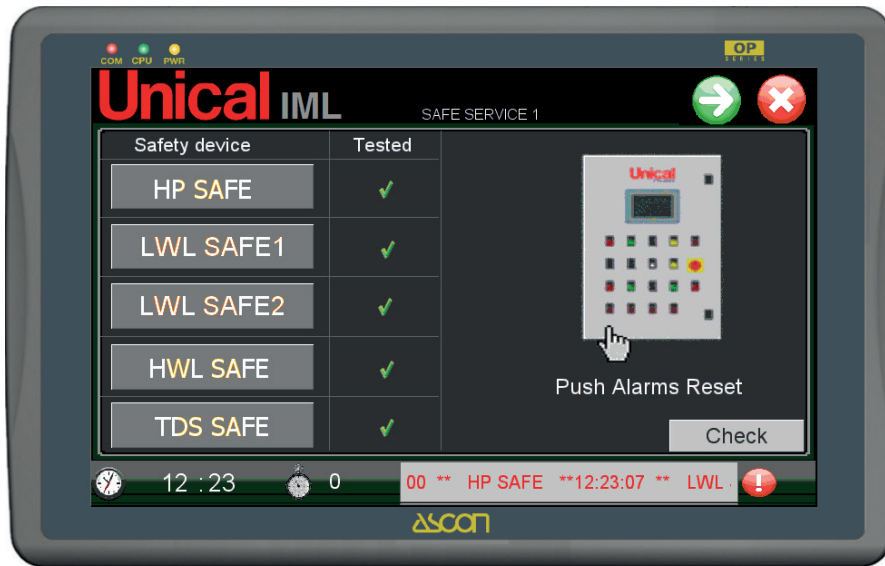
- 3) If they are all present, a dedicated bit is put on ON, which we will call "Safe service phase 1", used as a flag enabling you to continue with the SAFE SERVICE procedure.



- 4) If all of the alarms are present, there are two possibilities:
- a. if the TDS is not enabled (ADVANCED SETTINGS page), the reset phase is activated;
 - b. if the TDS is enabled (ADVANCED SETTINGS page IML+EXT or EXT type), the  key is enabled and if pressed causes interruption of the conductivity probe which, in turn, sends the safety device in alarm. After a few seconds the TDS SAFE alarm will be triggered.



- 5) Now proceed with the reset phase by pressing the buttons on the front of the panel, as shown in the image that appears on the right of the screen. Each time reset is done, the system puts the check symbol at the side of every safety device.


- 6) If all are enabled you will continue with the SAFE SERVICE procedure.
An image appears asking the user to reset the alarms by pressing the buttons on the front of the control panel.



- 7) After having reset the alarms, the warnings turn off and you should then press  .
Flags  light up indicating that the tests were carried out successfully.

On the second SERVICE DATA SAVING PAGE there are fields for entering the analysis values of the supply water and of the boiler water.

The analyses are to be carried as prescribed by the regulations in force or as described in the boiler's use and maintenance manual, with the use of specific water analysis tools.

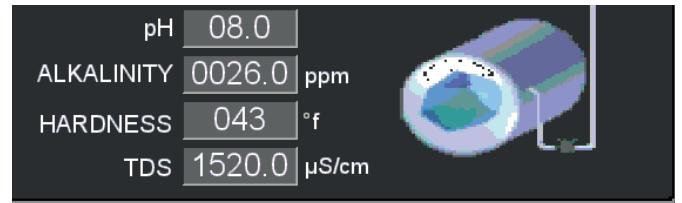
- 8) The  key is enabled; press to go to the SERVICE DATA SAVING page.





The following information is shown on the screen:


- SERVICE N.ID Incremental value proposed by the system. Possibility of entering a different value. Identification number for saving
- USER N.ID Value read. User who ran the test
- DATE Value read. Date of the test
- TIME Value read. Time of the test
- HP Value read. Safety device result (from the previous page)
- LWL1 Value read. Safety device result (from the previous page)
- LWL2 Value read. Safety device result (from the previous page)
- HWL Value read. Safety device result (from the previous page)
- TDS Value read. Safety device result (from the previous page)

- Ph Value to be entered. Ph of the supply water.
- HARDNESS Value to be entered. Total hardness of the supply water




- Ph Value to be entered. Ph of the boiler water
- ALKALINITY Value to be entered. Alkalinity of the boiler water
- HARDNESS Value to be entered. Total hardness of the boiler water
- TDS Value to be entered. Electrical conductivity of the boiler water.

10) When the data relative to the water have been entered press  next to each single field to confirm, which will occur with the change in status of the key in .

11) When all of the check symbols are present, the saving key  will be enabled.





- 12) Press  to save all of the just completed SAFE SERVICE data in the internal memory of the operator panel.
- 13) If the ID number is already taken by a position in the archive, the system will request confirmation to overwrite.

On the SERVICE page press  to access the service archive.

The SERVICE ARCHIVE page is as follows:



Use  and  to change the page for scrolling through the archive.

Each page displays four tests. Next to each line are the keys that display the single service, **OPEN** and **DEL** to delete.

A service display page is:



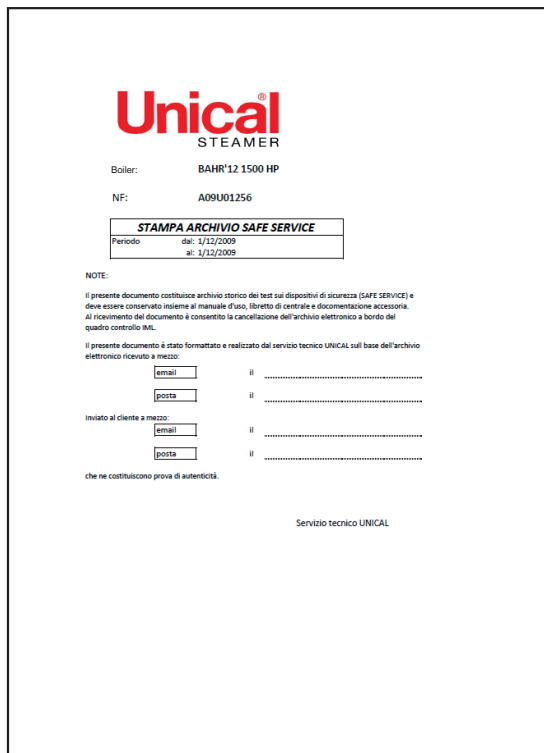
The maximum number of tests that can be saved is 400. When the memory is full the data archive must be exported onto a mass storage device via the USB port on the front of the panel, next to the main display.

DEL to empty the electronic archive, passing all of the individual lines of the archive **DEL** erasing the existing records, restarting from the service with NR. ID. 1.

On the SERVICE page press  to export the data. The file **recipe_a.rcp** has been downloaded onto the USB device.. After having downloaded the file, the customer can press

The file must be sent to the UNICAL technical service who will format it and transform it into a printable file. The file, in pdf format, is then sent by the UNICAL technical service to the customer who will, after having printed it, store it with the technical documentation of the boiler, as required by the regulations.

The formatted file sent to the customer:



Unical®
STEAMER

Boiler: BAHR 12 1500 HP
NF: A09U01256

STAMPA ARCHIVIO SAFE SERVICE
Periodo dal: 1/12/2009
al: 1/12/2009

NOTE:
Il presente documento costituisce archivio storico dei test sui dispositivi di sicurezza (SAFE SERVICE) e deve essere conservato insieme al manuale d'uso, libretto di centrale e documentazione accessoria. Al ricevimento del documento è consentito la cancellazione dell'archivio elettronico a bordo del quadro controllo IMI.

Il presente documento è stato formattato e realizzato dal servizio tecnico UNICAL sulla base dell'archivio elettronico ricevuto a mezzo:


email
posta
Inviato al cliente a mezzo:
email
posta

che ne costituiscono prova di autenticità.

Servizio tecnico UNICAL

LEGENDA:

Service nr.	TEST	U.m.	RISULTATO	SEZIONE
1	HP SAFE	-	9	SAFE
	LWL SAFE1	-	9	
	LWL SAFE2	-	9	
	HWL SAFE	-	9	
	TDS SAFE	-	9	
	Ph	-	3	H2O
	DUREZZA	°f	4	ALIMENTAZIONE
	Ph	-	3	
	ALCALINITA'	ppm	6	H2O
	DUREZZA	°f	7	CALDAIA
	CONDUCCIBILITA'	µS/cm	8	



Unical®
STEAMER

Archivio controlli
SAFE SERVICE

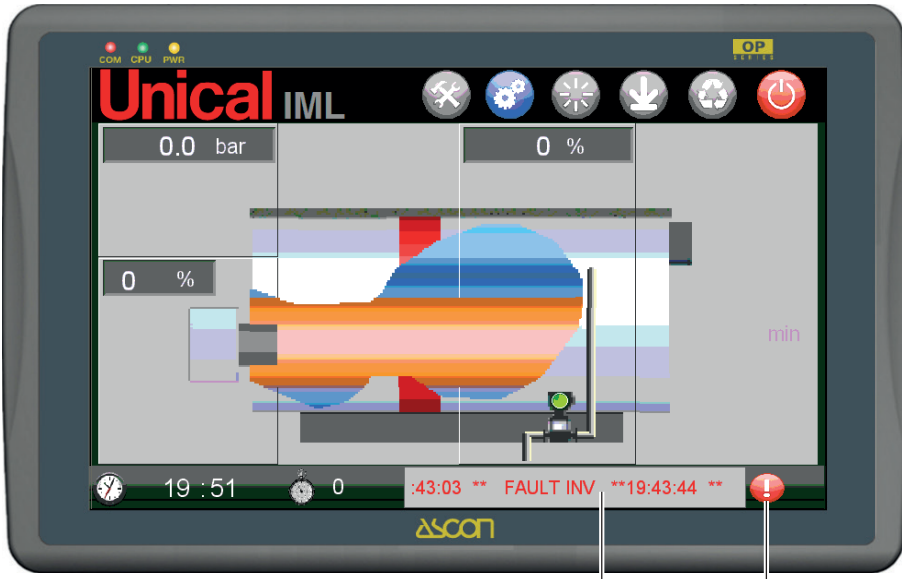
Data stampa: 02/12/2009

Service nr.:	TEST	U.m.	RISULTATO	SEZIONE
1 Data: 1/12/2009 Ora 14:18:20 Utente nr.: 3	HP SAFE	-	16260,0	
	LWL SAFE1	-	16260,0	
	LWL SAFE2	-	16260,0	SAFE
	HWL SAFE	-	16260,0	
	TDS SAFE	-	16260,0	
	Ph	-	8,0	H2O
	DUREZZA	°f	32,0	ALIMENTA
	Ph	-	8,8	
	ALCALINITA'	ppm	68,0	H2O
	DUREZZA	°f	37,0	CALDAIA
	CONDUCCIBILITA'	µS/cm	1500,0	
2 Data: 1/12/2009 Ora 14:19:53 Utente nr.: 1	HP SAFE	-	16260,0	
	LWL SAFE1	-	16260,0	
	LWL SAFE2	-	16260,0	SAFE
	HWL SAFE	-	16260,0	
	TDS SAFE	-	16260,0	
	Ph	-	7,6	H2O
	DUREZZA	°f	30,0	ALIMENTA
	Ph	-	7,8	
	ALCALINITA'	ppm	65,0	H2O
	DUREZZA	°f	34,0	CALDAIA
	CONDUCCIBILITA'	µS/cm	1520,0	
3 Data: 1/12/2009 Ora 14:21:36 Utente nr.: 4	HP SAFE	-	16260,0	
	LWL SAFE1	-	16260,0	
	LWL SAFE2	-	16260,0	SAFE
	HWL SAFE	-	16260,0	
	TDS SAFE	-	16260,0	
	Ph	-	7,6	H2O
	DUREZZA	°f	32,0	ALIMENTA
	Ph	-	7,7	
	ALCALINITA'	ppm	62,0	H2O
	DUREZZA	°f	32,0	CALDAIA
	CONDUCCIBILITA'	µS/cm	1580,0	


3.12 - ALARMS PAGE

The alarms controlled by the system are displayed, with appropriate IDs, on the scroll bar at the bottom of the home page and on a dedicated page.

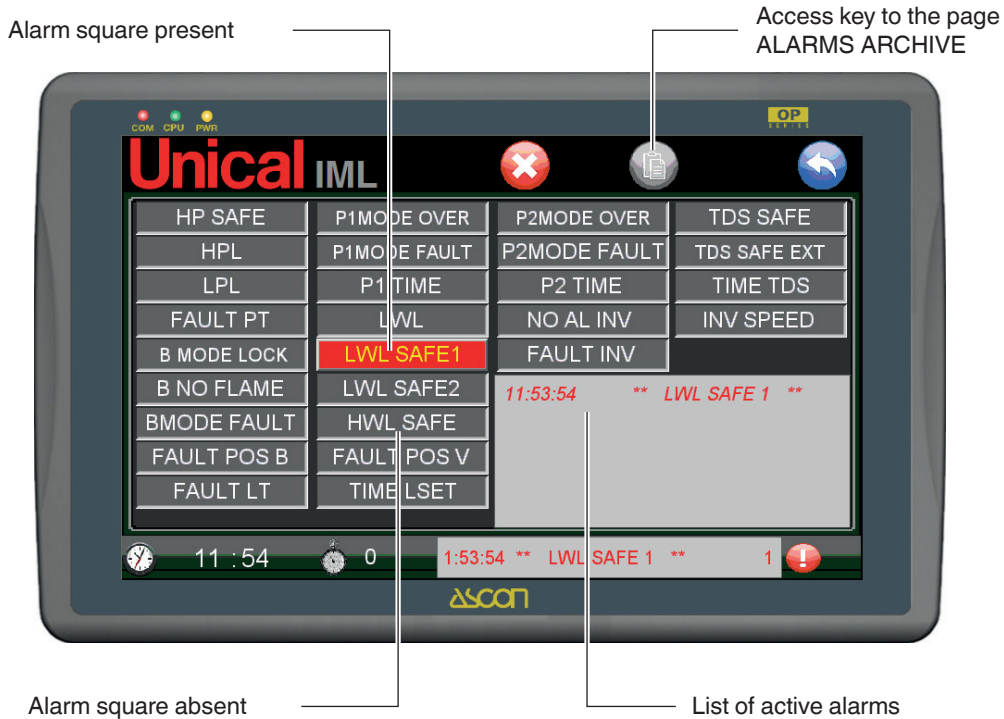
On the home page the IDs of the pending alarms scroll on the bar so that multiple alarms are displayed simultaneously.



Scroll bar
Access key to the ALARMS page

Press  to access the alarms page. The ALARMS page is a mosaic of squares; each tile is a lamp associated with an alarm. The on (red square) or off (grey square) status is updated in real time, or rather, the square remains on while the alarm associated to it is active.

On the bottom of the screen there is a descriptive zone of the alarms present with date of intervention and IDs. The alarms page is shown as follows:



Alarm square absent
List of active alarms

The IDs of the alarms controlled by the IML system are:

BMODE LOCK	Burner Lock
B NO FLAME	No Flame
HP SAFE	Safety Pressure Switch intervention
HPL	Permanent Overpressure Level reached
LPL	Permanent Low Pressure Level reached
FAULT PT	Pressure Probe Fault
LWL SAFE 1	1st Minimum Level Safety Control triggered
LWL SAFE 2	2nd Minimum Level Safety Control triggered
HWL SAFE	High Level Probe intervention
LWL	Permanent Minimum Water Level reached
TIME LSET	Time-Out maximum time to reach the water setpoint level
FAULT LT	Level Probe Fault
P1MODE FAULT	Pump 1 Not Started
P2MODE FAULT	Pump 2 Not Started
P1MODE OVER	Pump 1 Circuit Breaker Tripped
P2MODE OVER	Pump 2 Circuit Breaker Tripped
TIME MIN P1	Time-Out maximum time for minimum increase of the water level for Pump 1
TIME MIN P2	Time-Out maximum time for minimum increase of the water level for Pump 2
FAULT INV	Inverter Fault
NO AL INV	No Inverter Power
TDS SAFE	TDS maximum level of protection (from PLC)
TDS SAFE EXT	TDS maximum level of protection (from independent device)
TIME TDS	Time-Out maximum time to reset TDS Setpoint

The alarms highlighted in **red** are alarms associated with the safety devices external to the PLC and have electromechanical retaining systems. They are reactivated on the PLC automatically with timed control.

The alarms highlighted in **yellow** have software self-retaining systems, therefore they will be reset on the operator panel with appropriate unlock keys.

The alarms highlighted in **green** do not have software self-retaining systems, therefore they will be active only during continuation of the root cause but will remain archived in the alarms log.

Alarms associated with safety devices

LEVEL ALARMS

ALARM ID	DESCRIPTION ALARM	SYSTEM SAFETY INTERVENTION	ALARM ID	RESET ALARM
LWL SAFE 1	MANUALLY RESET THE SAFETY LEVEL SWITCH TO REACH THE MINIMUM SAFETY LEVEL OF WATER IN THE BOILER	BURNER LOCKED	Luminous button on panel and buzzer	"Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will FIRST ensure that the water level has been taken above the safety limit and THEN will press the "LWL SAFE1" alarm reset button-indicator on the front panel of the Electrical control panel. Once the alarm condition has been physically removed, this alarm will automatically reset.
LWL SAFE 2	MANUALLY RESET THE SAFETY LEVEL SWITCH TO REACH THE MINIMUM SAFETY LEVEL OF WATER IN THE BOILER	BURNER LOCKED	Luminous button on panel and buzzer	"Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will FIRST ensure that the water level has been taken above the safety limit and THEN will press the "LWL SAFE2" alarm reset button-indicator on the front panel of the Electrical control panel. Once the alarm condition has been physically removed, this alarm will automatically reset.
HWL SAFE	MANUALLY RESET THE SAFETY LEVEL SWITCH TO REACH THE MAXIMUM SAFETY LEVEL OF WATER IN THE BOILER	BURNER LOCKED	Luminous button on panel and buzzer	"Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will FIRST ensure that the water level has been taken below the safety limit and THEN will press the "HWL SAFE" alarm reset button-indicator on the front panel of the Electrical control panel. Once the alarm condition has been physically removed, this alarm will automatically reset.

PRESSURE ALARM

ALARM ID	DESCRIPTION ALARM	SYSTEM SAFETY INTERVENTION	ALARM ID	RESET ALARM
HP SAFE	MANUALLY RESET THE SAFETY PRESSURE SWITCH TO REACH THE MAXIMUM PRESSURE IN THE BOILER	BURNER LOCKED	Luminous button on panel and buzzer	"Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will FIRST manually reset the safety pressure switch, after the pressure level has been taken below the safety limit, and THEN will press the "HP SAFE" alarm reset button-indicator on the front panel of the Electrical control panel. Once the alarm condition has been physically removed, this alarm will automatically reset.

TDS ALARM

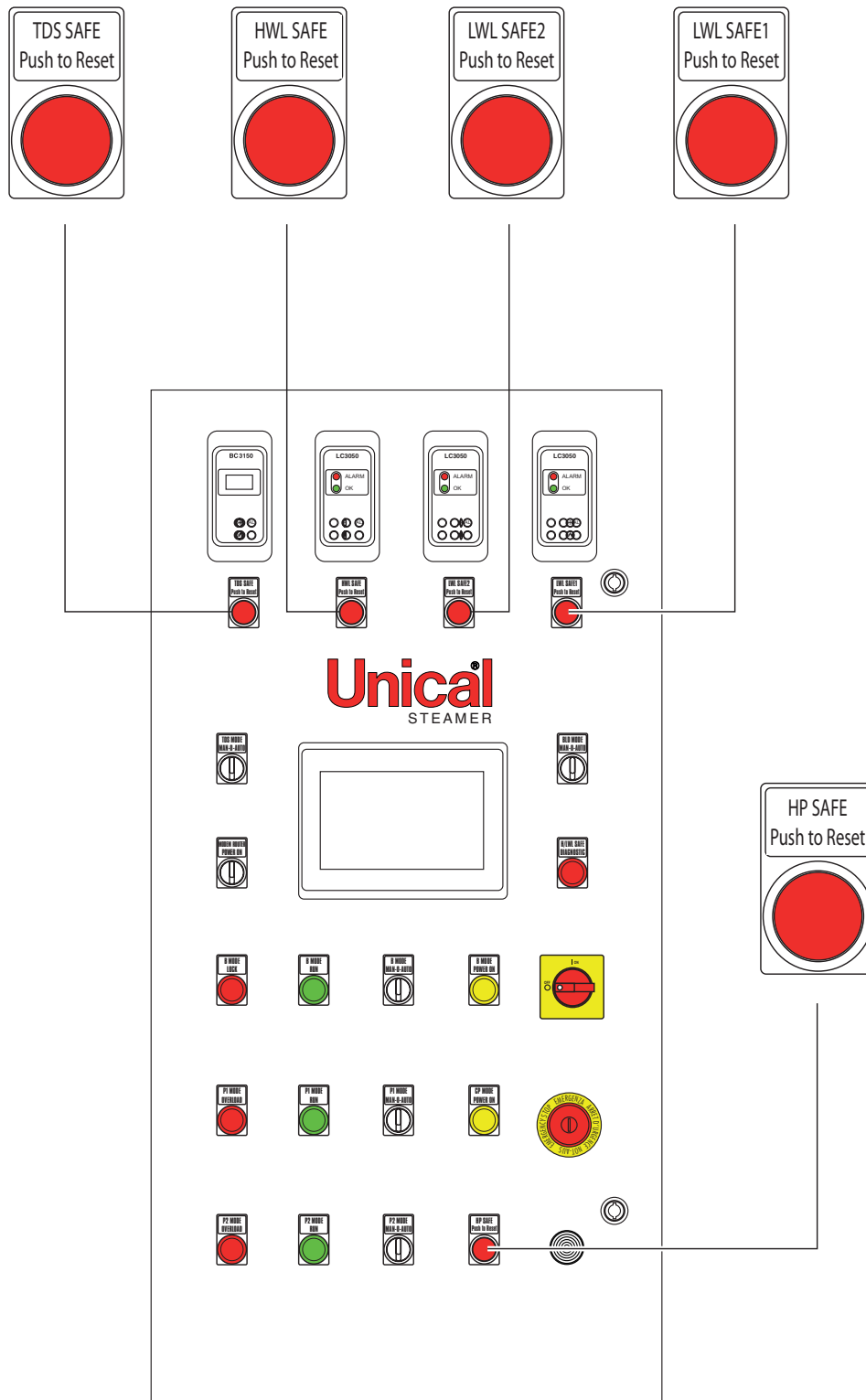
ALARM ID	DESCRIPTION ID	SYSTEM SAFETY INTERVENTION	ALARM ID	RESET ALARM
TDS SAFE EXT	SALINITY CONTROL UNIT INTERVENTION (TDS = Total Dissolved Solids) FOR EXCEEDING THE TDS SAFETY VALUES IN THE BOILER WATER	BURNER LOCKED	Luminous button on panel and buzzer	Luminous button on the panel and buzzer The "Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will FIRST manually reset the level of salinity in the boiler water, including using procedures assisted by PLC and made available on own PLC, upon occurrence of this warning. THEN, when the level of water salinity has been taken to below the safety threshold set by the TDS unit external controller, will press the "TDS SAFE" alarm reset button-indicator on the front panel of the electrical control panel. Once the alarm condition has been physically removed, this alarm will automatically reset.

ALARMS ASSOCIATED WITH SERVICE DEVICES

ALARM ID	DESCRIPTION ALARM	SYSTEM SAFETY INTERVENTION	ALARM ID	RESET ALARM
B MODE LOCK	Burner control equipment operating lock signal	BURNER LOCKED	Luminous indicator on panel	"Physical reset" of the alarm status can be done ONLY by hand and directly by the system maintenance technician who will access the unlock button-indicator on the burner itself. Once the alarm condition has been physically removed, this alarm will automatically reset.
B NO FLAME	Burner lock signal	NO FLAME	Luminous indicator on panel	This alarm is reset only by the User Terminal of the PLC.

The position of the reset buttons on the front of the control panel for alarms:

- **LWL SAFE1,**
 - **LWL SAFE2,**
 - **HWL SAFE,**
 - **HP SAFE,**
 - **TDS SAFE**
- is as follows:



The burner locked alarm reset button **BMODE LOCK** is on the burner itself.

Alarms log page

All alarms that can be activated are archived and controlled by the system on a specific page which is as follows:

The archive is structured and displayed with a list of alarms showing these properties:

- Alarm name
- Activation date
- Activation time

The alarms on the list can have three different colours according to their status:

- **Active alarm**
These are alarms that are still active, either because the causes that triggered them are still present, or because they are considered by the system, in order to allow only manual reset.
- **Alarm withdrawn, but not acknowledged**
These are alarms that are no longer active and are without retaining system. The causes that triggered the alarms have disappeared.
- **Alarm acknowledged**
Historical alarms which have been acknowledged with



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