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Document Title

Operating Manual

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1

Centrifuge Model	
HX/L 1250/800	
Comi Condor Serial Number	Comi Condor Job number
4554-55-56-57	C3376-77-78-79
Customer Name	
MOLYCORP MINERALS	
Customer Project	Customer Job number

Table of contents

Table of figures

1. INTRODUCTION

1.1 Scope

This operator manual is produced by Comi Condor S.p.A. to explain the use of the peeler centrifuge with scraping knife, horizontal axis type HX/L 1250/800.
This operator manual is composed of seven parts. Following table describes the content of each part:

Introduction	Brief description of the centrifuge, its operation modes, safety prescriptions for centrifuge and operators.
Local control panel	Description of local control panel, pushbutton functions, operator terminal and its graphical pages.
Operator terminal use	Centrifuge control, operative mode, alarms.
Login procedures	Procedure to access to the system (login), access levels
Phase parameters setup	Definition of phase parameters that compose the production recipe
Centrifuge operation	Description of centrifuge operation mode, the production phases and the auxiliary functions.
Alarm diagnostic	Contains alarm messages, possible causes, acknowledge and reset operations.

This Operator Manual describes the local control panel, the operator terminal, the human-machine interface and all operations for the correct use of the centrifuge.

The Instruction Manual contains the details on the mechanical components and the electrical devices installed on the centrifuge and the inertisation system. All maintenance instructions and operative descriptions are described in the Instruction Manual. The Operator Manual can be considered part of the Instruction Manual for the relevant description of the Human-Machine Interface.

All other documents that are relevant for the centrifuge design, like the Functional Specification, wiring diagrams, validation documents (FAT and SAT) etc. , integrate the information given by this Operator Manual and should be considered for the correct use of the centrifuge.

1.2 Safety Important Notices

Following Operator Manual is integral part of the centrifuge and contains all information to operate with the centrifuge in safety conditions and to keep it efficient throughout its life cycle. This document suppose that all safety prescriptions and norms are respected in the place where the centrifuge is going to operate. The centrifuge is NOT ATEX certified, therefore it is NOT allowed to operate in possible explosive atmosphere. Refer to the Instruction Manual for detailed description of the centrifuge, installation, maintenance and operations.
Any machine, if improperly used, can be dangerous and therefore safety is also responsibility of the operators that use it. The Operator Manual describes all procedures that must be actuated and respected in order to operate safely and to obtain the desired final product.

ATTENTION !

THE CENTRIFUGE IS NOT ATEX CERTIFIED SO IT IS NOT ALLOWED TO USE THE CENTRIFUGE IN POSSIBLE EXPLOSIVE ATMOSPHERE.

ATTENTION !

REFER TO THE INSTRUCTION MANUAL FOR INSTALLATION, MAINTENANCE AND OPERATIONS OF THE CENTRIFUGE.

IT IS STRICTLY FORBIDDEN TO USE THE CENTRIFUGE IN A DIFFERENT MANNER, OTHER THAN THOSE DESCRIBED IN THESE MANUALS, WITHOUT A PREVIOUS WRITTEN AUTHORIZATION OF COMI CONDOR S.P.A.

Comi Condor S.p.A. could not eliminate or foresee any possible condition that could cause incidents during centrifuge operations. Therefore all personnel (operators, qualified technicians) addicted to the centrifuge, must read carefully all these manuals and respect all prescriptions, contained in all relevant documents of use and safety.

The client must in any case evaluate all safety conditions related to the process, develop adequate Safety Procedures and grant that all personnel is instructed and operates always in complete safety conditions.

Comi Condor S.p.A. recommends that all technical information contained in this Operator Manual are used as prescriptions, dispositions and safety norms and are inserted as part of the safety system of the whole plant in which the centrifuge is inserted.
The centrifuge must be used only by qualified and instructed personnel. It is always necessary that personnel (operators, qualified technicians and others) uses always individual protection devices, wear adequately and use appropriate tools, in respect to all norms in place for use and maintenance of machine .

Before installing and operating with the centrifuge the client is obliged to read carefully and completely this Operator Manual issued according the European Community Directive 98/37/CE (“Machine Directive”) and follow carefully all indications here described.

ATTENTION !

THE CENTRIFUGE CANNOT OPERATE IN POTENTIALLY EXPLOSIVE ATMOSPHERE, BUT IT REQUIRES PARTICULAR OPERATIONS AND ATTENTION. REFER TO SAFETY NORMS AND PRESCRIPTIONS AND GENERAL SAFETY RULES OF THE PLANT

1.3 Remarks

ATTENTION

To indicate situations that, if proper steps are not taken, could cause damages to the centrifuge and lead to a serious fault condition, physical injury or death.

WARNING

Indications for operators and maintenance to avoid damaging the centrifuge and to grant safe operations . Operators and maintenance workers must be instructed prior to operate with / on the centrifuge.

NOTE

Information that could be particularly important for the comprehension and the operation of the machine. These notes are used when the reader is required to pay special attention

WARNING

THIS DOCUMENT IS BASED ON INFORMATION AVAILABLE AT THE MOMENT OF ITS PUBLICATION. IN SPITE OF THE EFFORTS FOR ASSURING THE GREATEST ACCURACY, THE INFORMATION CONTAINED IN THIS MANUAL COULD NOT COVER ALL THE DETAILS AND THE HARDWARE AND SOFTWARE MODIFICATIONS, NOR FORESEE ALL THE CIRCUMSTANCES THAT COULD OCCUR DURING INSTALLATION, SET UP, OPERATION AND MAINTENANCE. COMI CONDOR S.P.A. DOESN'T CONTRACT ANY OBLIGATION TOWARDS THE OWNERS OF THIS MANUAL CONCERNING SUBSEQUENT MODIFICATIONS THAT COULD BE MADE.
COMI CONDOR S.P.A. DOESN'T GIVE ANY EXPLICIT, IMPLICIT OR INSTITUTIONAL GUARANTEE AND IT DOESN'T TAKE ANY RESPONSIBILITY FOR THE PRECISION, THE COMPLETENESS OR THE USEFULNESS OF THE INFORMATION CONTAINED IN THE MANUAL.

2. LOCAL CONTROL PANEL

The centrifuge Local Control Panel is installed close to the centrifuge. The operator should have access (login) to the centrifuge control system prior to any operation in order to define phase parameters.
The operator starts, monitors and selects the operating modes from the Operator Terminal. Phases are handled by function keys, pushbuttons and switches of the Touchscreen Operator Terminal. The graphic screen shows information about the sequence and the alarms. It is possible to define the phase parameters in the relevant pages with the alphanumeric keys.

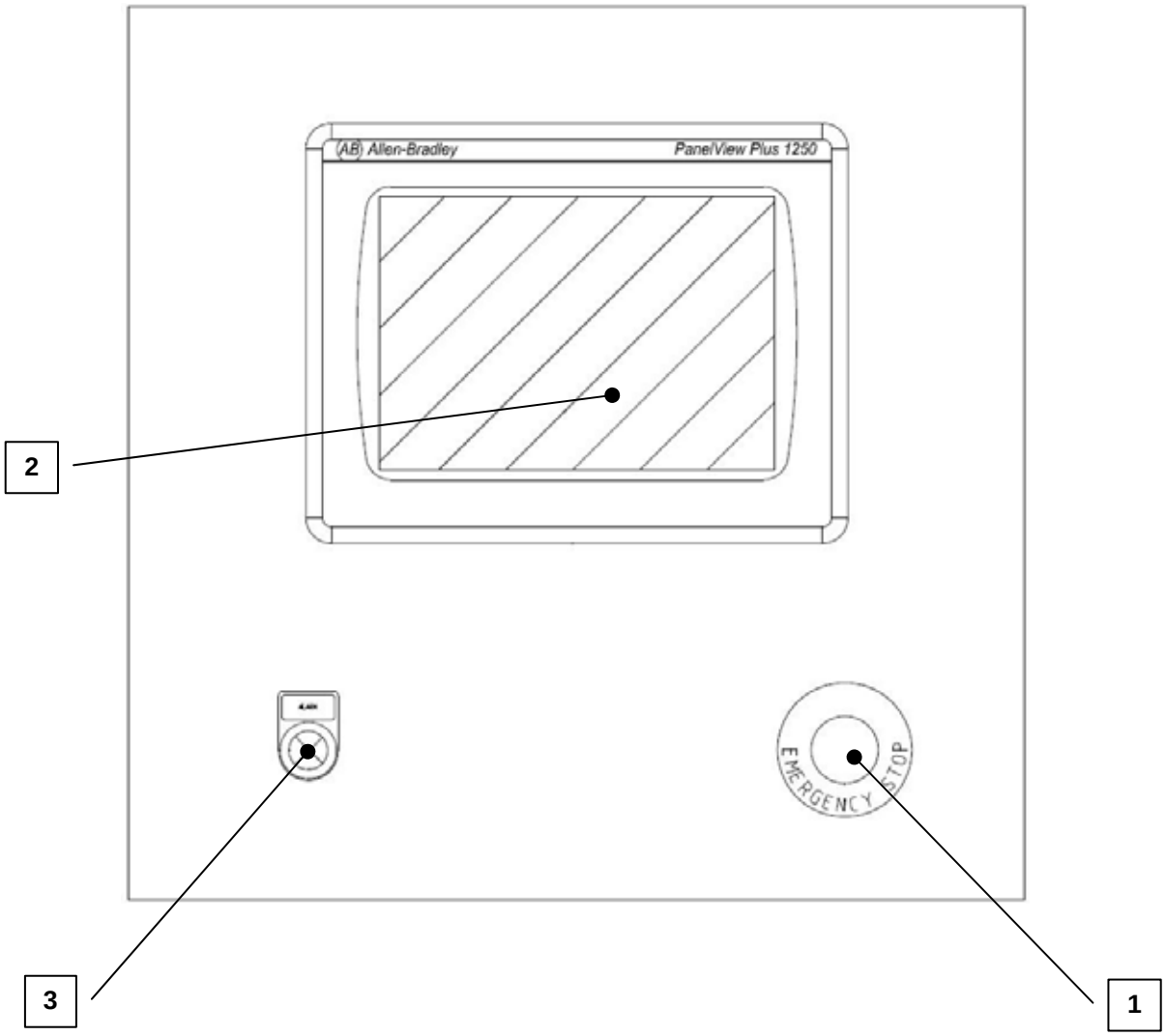


Fig.1 *Local control panel*

LEGENDE		
1. Emergency pushbutton **2. Operator terminal**	**3. Alarm lamp**	

2.1 Control devices

Pos	*Type of control*	*Description*
1	**Emergency pushbutton** 	The Emergency Pushbutton will stop the centrifuge, shutdown power of motors and valves. All running phases are aborted.
2	**Operator terminal (Touchscreen)** 	Through the graphical Touchscreen it is possible to: ➢ Access the system (login) with UserId and Password ➢ Define phase parameters of production (Recipes) ➢ Verify centrifuge status, devices, process and plant valves ➢ Verify alarms, acknowledge and reset ➢ Visualize bearing temperatures, centrifuge vibrations, cake thickness etc.
3	**Alarm lamp** 	The alarm lamp is activated when an alarm is active.

2.2 Operator terminal

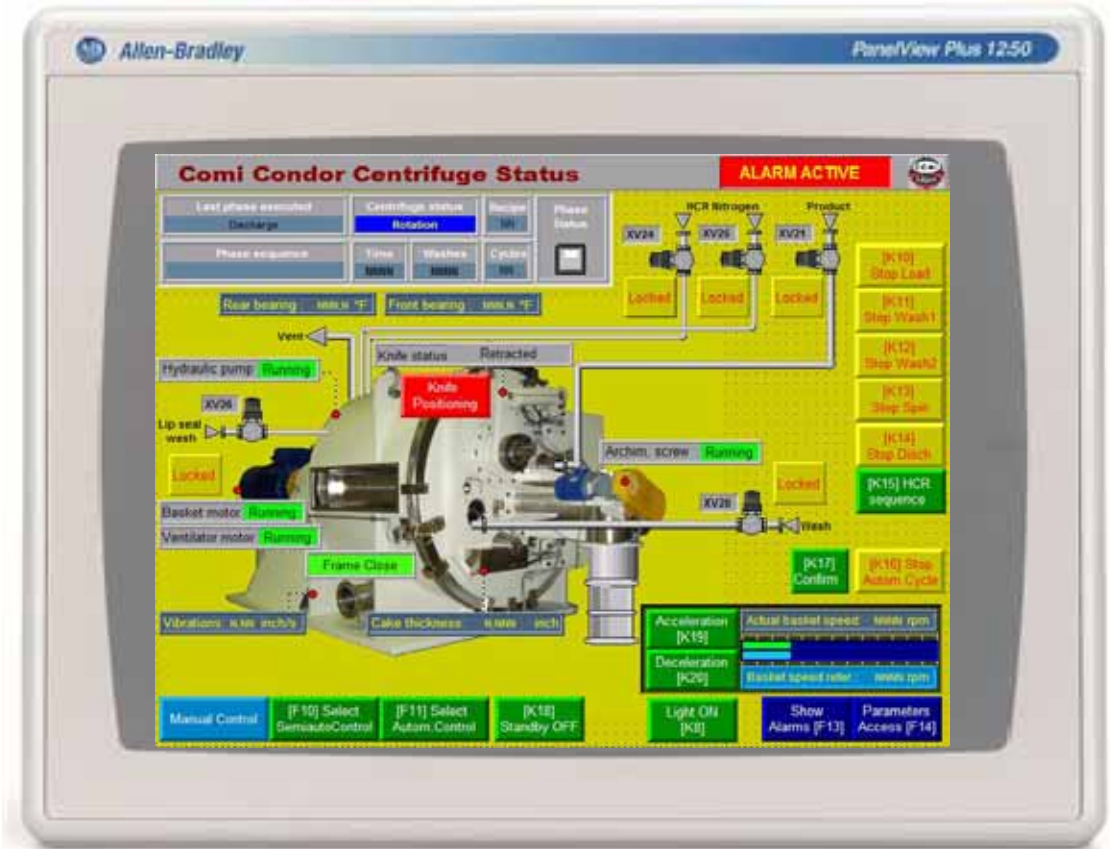
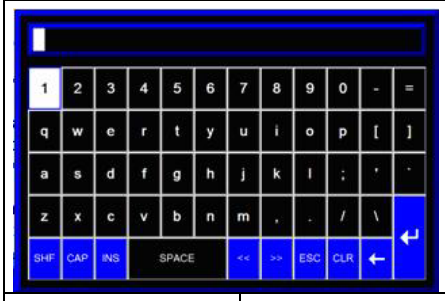


Fig.2 *Touchscreen terminal*

The operator terminal is a touchscreen graphical display. The Function keys, phase keys, page recall pushbuttons and variable input fields can be directly selected on the display.

Keys	***Function***	***Description***
Acceleration [K19]	Function keys	The function keys are associated to different functionalities according to the actual page displayed. The operator should use them to execute particular actions within the page. In example acceleration / deceleration keys. The Function keys are described in the following chapters.
[K10] Start Load	Phase Keys	The phase are associated to different functionalities according to the actual operation mode (production / cleaning) and control mode (semiautomatic / automatic). The operator should use them to activate each single phase or automatic cycle. The phase keys are described in the following chapters.
Alarms View [F13]	Alarm page	The page recall keys are described in the following chapters. The alarm management keys are very important for the correct use of the centrifuge. If an alarm is active, it recalls the alarm page on the screen. NOTE: It is necessary to reset the active alarm in the alarm page.

Keys	Function	Description
Reset Alarm [F3]	Alarm reset	This function key should be used to reset the active alarm.
Help [F5]	Alarm help	This function key should be used to activate the help page for the active alarms.
Parameters Access [F14]	Parameters access	This function key should be used to access the login page
Log In [F7]	Login	This function key should be used to log to the system.
LogOut [F8]	Logout	This function key should be used to logout from the system.
	Numeric keyboard	The numeric keys are used to set the numeric variable values. The numeric keyboard appears on the touchscreen when a numeric variable is selected.
	Alphanumeric keyboard	The characters are obtained with the alphanumeric keyboard in order to enter UseID and Passwords.
←	Delete key	Deletes the variable value. It can be used also to correct errors while digiting the UserID or Password.
↵	Enter key	Confirms the entered value of the variable or UserID or Password.
ESC	Escape key	Resets the variable, UserID or Password inserted.
SHF	Shift key	Use the Shift key to enter capital letters . NOTE: UserID and Passwords are case sensitive.

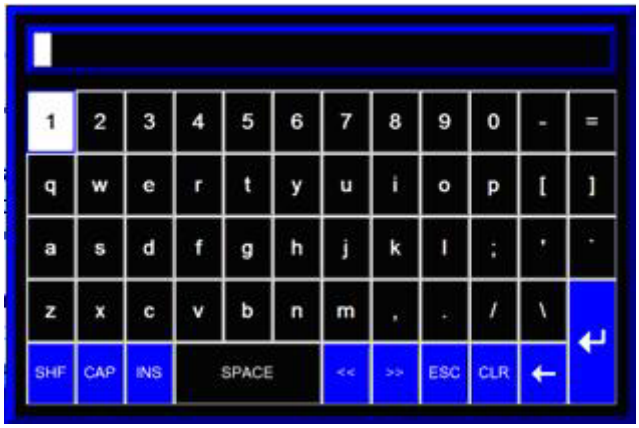


Fig.3 *QWERTY Keyboard*

The Qwerty keyboard appears on the touchscreen when an alphanumeric field is selected on the touchscreen.

3. OPERATOR TERMINAL AND CONTROL

3.1 Centrifuge main page

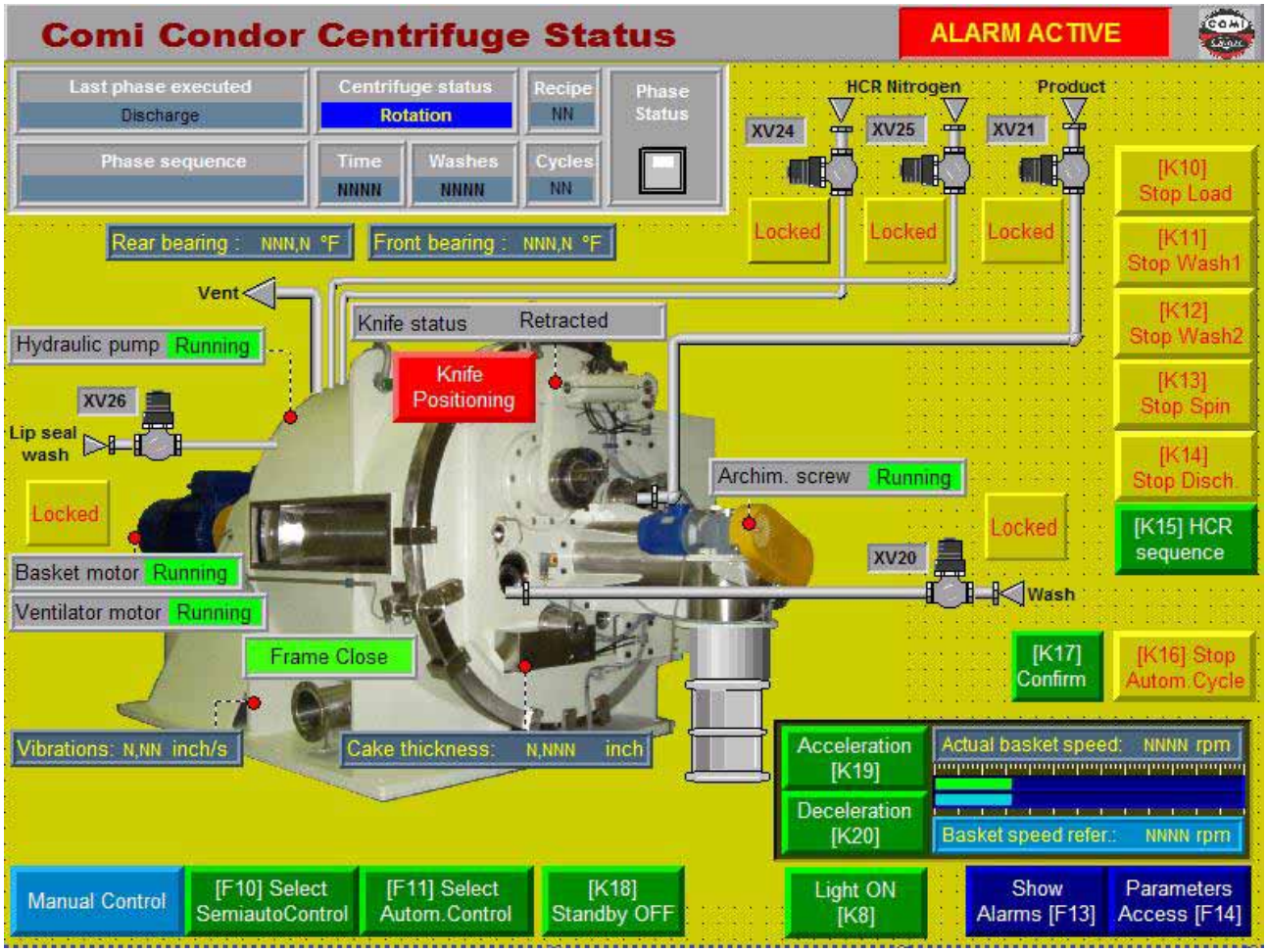


Fig.4 *Centrifuge main page*

The centrifuge main page enables the control of the centrifuge. Several function keys activate different base functionalities depending on the current status of the centrifuge, the operative mode (manual / semiautomatic / automatic). Other function keys allow the operator to access to the system (login) in order to activate the phases, define the recipe phase parameters and manage the eventual alarms.
The following chapters describe the status visualizations, the function of the phase keys and of the other function keys and all other graphical pages of the operator terminal.

3.1.1 Centrifuge status visualization

The centrifuge main page is the first page shown on the centrifuge control system startup. All centrifuge and plant main process data are indicated. The principal devices and instruments are visualised graphically.

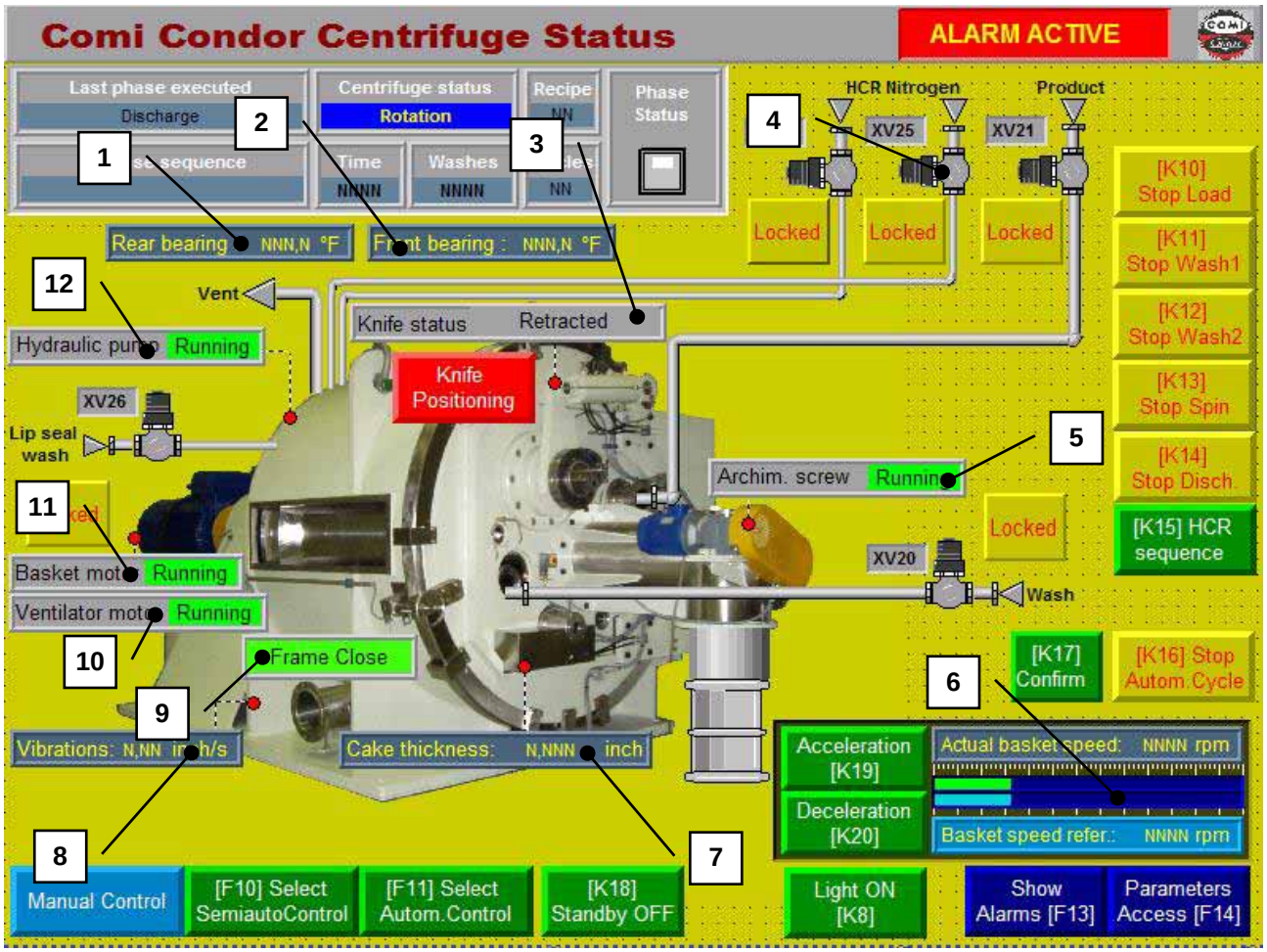


Fig.5 *Centrifuge devices status*

1. Rear bearing temperature
2. Front bearing temperature
3. Scraping knife status (retracted, extracted etc)
4. Valves status : loading, washing, etc.
5. Archimedean screw motor: Status (grey=stop, green= running, red=alarm.)
6. Basket rotation motor: Speed (actual & setpoint)
7. Cake thickness
8. Vibrations value
9. Frame status (grey=close;red=open)
10. Ventilator motor: Status (grey=stop, green= running, red=alarm.)
11. Basket rotation motor status
12. Hydraulic unit motor status

NOTE: Process valves and motors status are represented in the main page with the following colours [GREEN] Valve opened or motor started; [GREY] Valve closed o motor stopped; [RED] Alarms

3.1.2 Centrifuge operation visualization

In production main page all information required to control the centrifuge status are displayed. In particular it is possible to verify:

- Actual phase (loading, washing…)
- Phase current step (waiting initial speed, loading…)
- Phase status (active, acceleration, pause…)
- Phase time counting
- Operative mode (production, cleaning, sterilization)
- Operation Mode (semiautomatic, automatic)
- Selected recipe
- Number of cycles to perform in automatic mode
- Actual access level (administrator, engineer, operator…)
- Washings status (cycles, quantity setpoint, totalised quantity, wash tank level

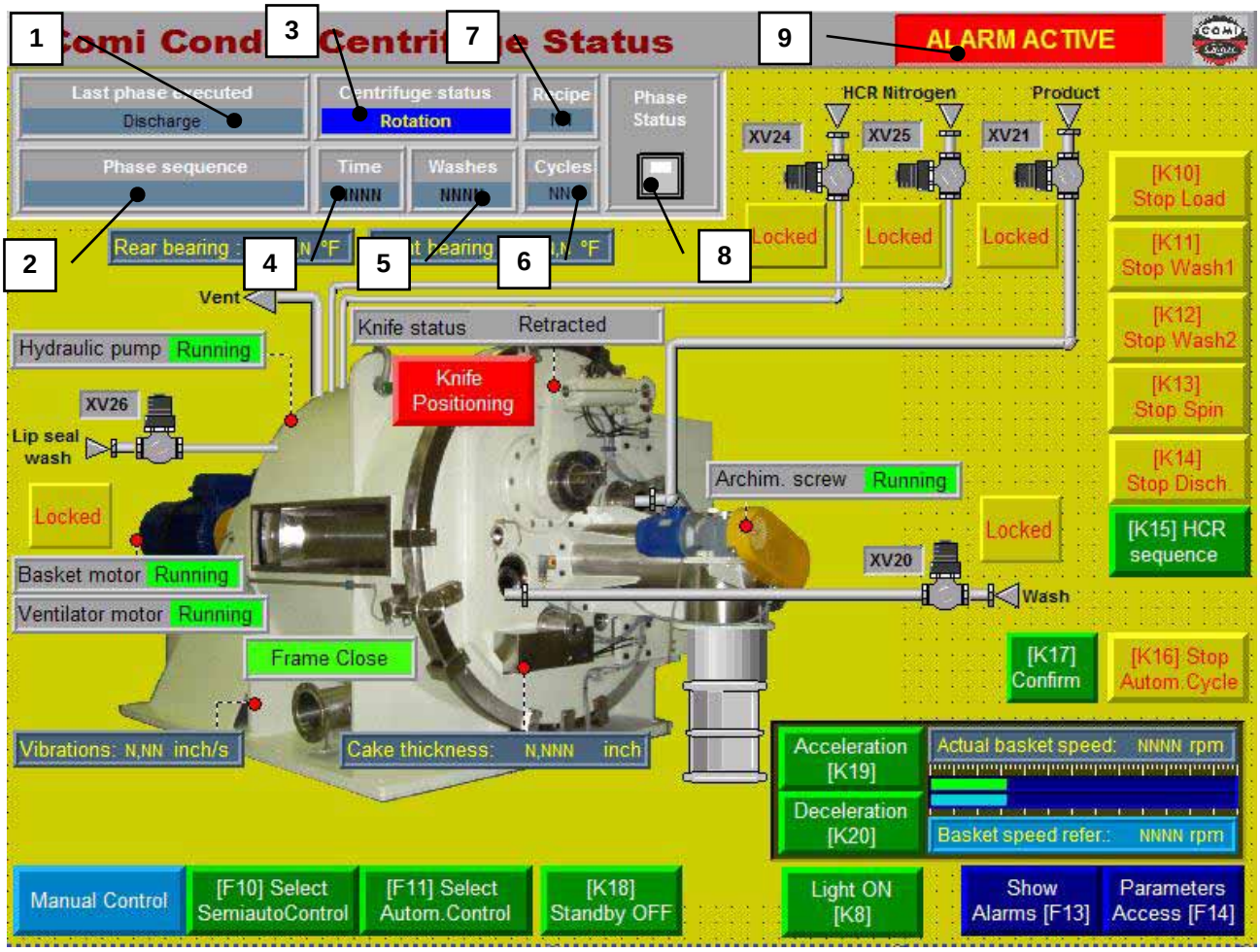


Fig.6 *Operation visualization on main page*

1. Current active /last performed phase
2. Active phase step
3. Centrifuge status indication (running, acceleration, alarm)
4. Phase time counting
5. Number of washings
6. Number of automatic cycles
7. Recipe number
8. Phase status lamp (grey=not active, green=running, yellow=standby)
9. Alarm active indication

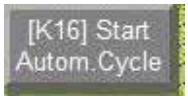
3.2 Phase keys

The following phase keys are used to select the operative and control mode of the centrifuge and to activate the centrifuge phases.

<table>
<tr><th>Keys</th><th>Function</th><th>Description</th></tr>
<tr><td> 
</td><td>Manual, Semiautomatic, Automatic Mode selector</td><td>This selectors define the sequence control mode. Three different sequence control modes are defined only in production operative mode:

<table><tr><td>Manual</td><td>No phase can be activated. The process valves can be opened for maintenance operation or to verify / prepare the plant for operation.</td></tr><tr><td>Semiautomatic</td><td>The sequence of phases is defined directly by the operator that uses the relevant pushbuttons to activate the phase. Any phase sequence is defined by the selected recipe parameters.</td></tr><tr><td>Automatic</td><td>The sequence of phases is defined inside the automatic cycle. The phase parameters are defined by the selected parameters.
In production mode, the phases are performed in sequence, until a programmed number of cycles is reached or until loading slurry is finished.</td></tr></table>
The selection of the control mode can be performed only with inactive centrifuge and it causes the phase abort if the centrifuge is already running.
The current mode activates the relevant pushbuttons on the main page</td></tr>
<tr><td>  </td><td>Phases activation keys Production semiautomatic mode
Loading
Washing 1 & 2
Centrifugation
Discharge
Heel cake removal</td><td>Depending on the actual Production Semiautomatic mode selection, the function keys can start/stop the relevant production phase.
Each single phase function key is operative, only if the Semiautomatic Mode is selected.
The pushbuttons for production mode are : loading, washing, centrifugation, discharge and only after the cutting step the heel cake removal sequence.
When the button is pushed, if all alarm conditions are respected, the phase starts.
When the phase is active, the relevant function key ends the phase.

  NOTE
The phases can be actived only if following conditions are respected: centrifuge close, production semiautomatic mode, no critical alarm active.</td></tr>
</table>

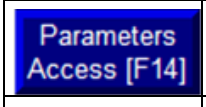
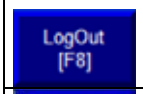
Keys	***Function***	***Description***
 	**Start / Stop automatic cycle Production automatic mode** Start / stop cycle	The production cycle can be performed when the Automatic mode is selected. The operator can activate the automatic cycle with the relevant function key. If the same button is pushed while a phase is running, the cycle is aborted.  NOTE The automatic cycle can be actived only if following conditions are respected: centrifuge close, production automatic mode, no critical alarm active  NOTE The automatic cycle can be reactivated after a critical alarm by pushing again the relevant pushbutton. The cycle prosecutes from the last activated phase.
	**Operator confirm** *(Beginning of phase)*	Depending on the current configuration of the phase parameters, some phase may prosecute only after having pushed the operator confirm pushbutton.
	**Pause (Stand-by) On / Off** *(With active phase)*	The current phase can be temporarily paused by pushing the stand-by pushbutton. All process phases are closed, the centrifuge remains at the actual speed in safe conditions. The phase sequence prosecutes by pushing again the stand-by pushbutton. The standby will stop the knife movement during the discharge phase. The basket rotation remains active at current speed setpoint.
 	**Open / Close valve manual command. Locked condition**	In manual mode it is possible to command the manual opening/closing of the single process valve, providing the command is not locked by alarm or required conditions (i.e. centrifuge close and basket speed)

3.3 Page selection keys and auxiliary functions

The following keys should be used to call the different pages and to activate basic auxiliary function of the centrifuge. Additional description and required operations are described in the relevant page.

<table>
<tr><th>Key</th><th>Function</th><th>Description</th></tr>
<tr><td> 


</td><td>Basket speed regulation

Acceleration
Deceleration</td><td>The operator can regulate the speed in both semiautomatic and automatic modes.
<table>
<tr><th>Semiautomatic mode</th><th>Automatic mode</th></tr>
<tr><td>PHASE NOT ACTIVE (IDLE)
By pushing <u>“acceleration”</u> the maximum speed is set; by pushing again the pushbutton, the actual speed is set.
By pushing <u>“deceleration”</u> the speed is set to zero; by pushing again the pushbutton, the actual speed is set.</td><td>CYCLE NOT ACTIVE (IDLE)
By pushing <u>“acceleration”</u> the maximum speed is set; by pushing again the pushbutton, the actual speed is set.
By pushing <u>“deceleration”</u> the speed is set to zero; by pushing again the pushbutton, the actual speed is set.</td></tr>
<tr><td>PHASE ACTIVE
if the operator pushes the <u>“acceleration”/“deceleration”</u> pushbutton, and keeps it pushed, the basket rotation increases/decreases within the fixed limit of the Parameter set point plus 200RPM. The increment step is 10 rpm every 2 second. When the pushbutton is released, the centrifuge remains at the actual speed.</td><td>CYCLE ACTIVE
if the operator pushes the <u>“acceleration”/“deceleration”</u> pushbutton, and keeps it pushed, the basket rotation increases/decreases within the fixed limit of the Parameter set point plus 200RPM. The increment step is 10 rpm every 2 second. When the pushbutton is released, the centrifuge remains at the actual speed.</td></tr>
</table></td></tr>
<tr><td> 
</td><td>Knife reset</td><td>Reset knife position
The operator can reset the knife position, if the “knife out of position” alarm is active.</td></tr>
<tr><td> 
</td><td>Lamp On / Lamp Off</td><td>The centrifuge light lamp should be used to illuminate the internal process area (basket) of the centrifuge. When the lamp is turned on, a timer is started that will switch it off automatically after three minutes. The operator can eventually switch it off manually with the function key.</td></tr>
<tr><td> 
</td><td>Parameters access</td><td>This function key should be used to access the login page and then to access all phase parameters and centrifuge setup pages, depending on the current access level. Some operations and successive pages are reserved to high access level.</td></tr>
<tr><td> 
</td><td>Login
  </td><td>The login module can be called on the operator terminal in order to log in and operate the centrifuge or to change phase parameters. When none is logged, other level function keys are disabled.Refer to the relevant chapter for the details on the login procedure and access levels.</td></tr>
<tr><td> 
</td><td>Logout</td><td>This function key can be used to logout from the centrifuge control system. If none is logged to the system, then no operation is possible. Refer to the login procedure for further details</td></tr>
<tr><td> 
</td><td>Password update</td><td>This function key can be used to update the password before its expiry.</td></tr>
</table>

Key	*Function*	*Description*
	**Visitor level page**	This function key recalls the visitor level page (without login), that allows to verify the values of recipe, phase parameters, alarm setpoint and hour counters, but not to modify them.
	**Level pages**	These function keys recall the different level pages (with login), that allow configuration of recipe, phase parameters, alarm setpoint and hour counters, access maintenance mode for PLC IO verification , according to the defined access level.
	**Alarm page**	If an alarm is active, it recalls the alarm page on the screen. In the alarm page it is possible to select the alarm with the arrow keys and then reset the alarms with the relevant key. Refer to the alarm management procedure for further details.
	**Scroll alarms**	These buttons select the alarm in the alarm page. Single alarm can be selected for single alarm acknowledge. Refer to the alarm management procedure for further details.
	**Reset alarms**	This function key resets the alarms.  **NOTE** Alarms can be reset only if the cause that has generated them is eliminated and the alarm action has been completed. In example a shutdown alarm can be reset only when the actual speed is zero. Refer to the alarm management procedure for further details.
	**Close page**	This function key closes the alarm page and returns to the previously diplayed page.
	**Help page**	This function key recalls the alarm help page on the screen. All currently active alarms are scrolled in the help page. Indications about alarm cause, effect and remedy are suggested in order to solve the problem in the shortest time.
	**Latch help**	This function key stops the automatic scroll of the alarm help in order to allow reading of a specific required help.
	**Alarm history page**	This button selects the alarm history page where it is possible to scroll all occurrence of alarms. All alarm history are saved on the operator terminal hard disk drive into a csv file. Refer to the alarm history page for further details.
	**Alarm acknowledge**	The alarm acknowledge takes place through the operator panel by selecting the alarm in the alarm page and then acknowledging with the relevant acknowledge key. Refer to the alarm management procedure for further details.
	**Clear history**	This function key is enabled only with high access level and allows the administrator to delete all alarm history.
	**Scroll alarms**	These buttons select the alarm in the alarm history page. Single alarm can be selected for single alarm acknowledge. Refer to the alarm management procedure for further details.
	**Return**	This function key closes the alarm page and returns to the previously diplayed page.

The following keys are used in the other pages of the graphical operator terminal.

Key	*Function*	*Description*
Load [K1] / Wash1 [K2] / Wash2 [K3] / Spin [K4] / Discharge [K5]	**Phase parameters pages**	Each button recalls the single phase page, where it is possible to define all the phase parameters.
Parameters [K6] / History [K7]	**Alarm setpoint and history page**	This function keys recall the centrifuge software alarm setpoint page and the alarm history page. Setup of values and some functionality is reserved to high access level.
AI [K9] / AO [K10] / DI [K11] / DO [K12]	**Maintenance mode PLC IO pages**	This button recalls the maintenance mode, where it is possible to verify / force directly all the PLC Input / Output. In particular AI recalls the PLC analogue input page, AO recalls the PLC analogue output page, DI recalls the PLC digital input page, DO recalls the PLC digital output page
ON [K9]	**Set digital output**	This button activates the selected digital output
OFF [K10]	**Reset digital output**	This button resets the selected digital output
Hours [K13]	**Working hours page**	This button recalls the centrifuge working hours page
Reset [K1]	**Reset working hour**	This button resets the relevant centrifuge working hour
ID-CODE View [F4]	**Codes page**	This button recalls the UserID and Password initial status page. Every level can modify his own password. Refer to the login procedure for further details.
Shut Down PanelView	**Shutdown HMI**	This button will shutdown the HMI runtime program and it should be used ONLY to access the PC operative system and the HMI download menu to update the program if modifications are required and agreed with Comi Condor S.p.A. ⚠ ATTENTION ! DO NOT STOP THE HMI RUNTIME PROGRAM WHEN THE CENTRIFUGE IS IN OPERATION. SOFTWARE ENGINEERS SHOULD BE AUTHORISED IN WRITTEN FORM BY COMI CONDOR S.P.A. PRIOR TO SHUTDOWN THE APPLICATION.

3.4 Manual mode main page

When the manual mode is selected, the main page displays the process valves manual valve command pushbuttons. The centrifuge must be close and the basket must be in rotation over the minimum speed. No phase can be activated. The process valves can be opened for maintenance operation or to verify / prepare the plant for operation.

ATTENTION !

MANUAL MODE IS OPERATED UNDER DIRECT RESPONSIBILITY OF THE OPERATOR. INCORRECT USE CAN CAUSE SERIOUS DAMAGE TO THE CENTRIFUGE AND SERIOUS INJURY TO OPERATORS.
NORMAL USE OF THE CENTRIFUGE IS FORESEEN IN SEMIAUTOMATIC OR AUTOMATIC MODE , WITH COMPLETE CONTROL OF PHASE SEQUENCE, PROCESS VALVES AND BASKET ROTATION SPEED BY THE CENTRIFUGE CONTROL SYSTEM. MANUAL MODE SHOULD BE USED ONLY FOR MAINTENANCE OPERATION OR TO VERIFY / PREPARE THE PLANT FOR OPERATION.

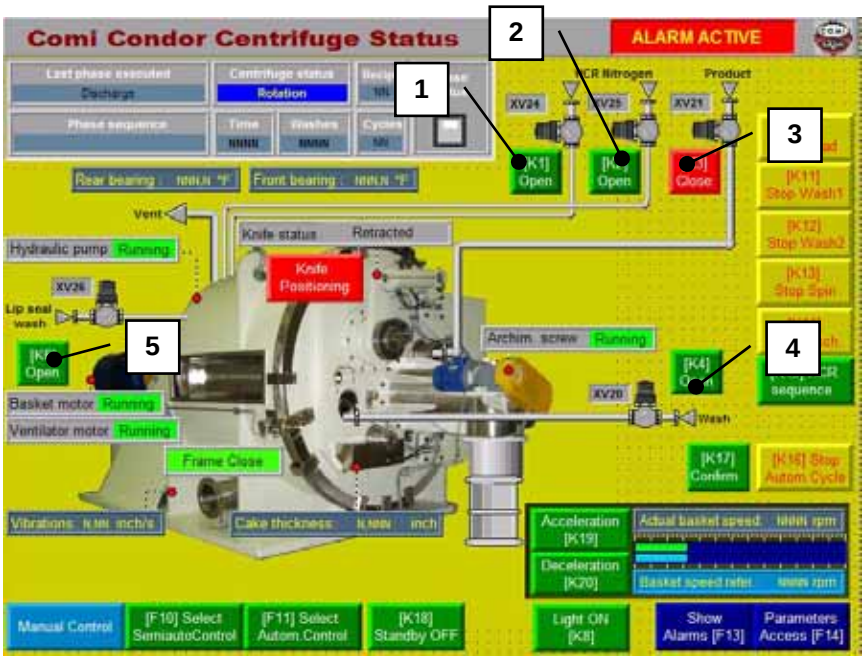


Fig.7 *Manual mode main page*

1. Heel cake removal valve 1 command
2. Heel cake removal valve 2 command
3. Loading valve command
4. Washing valve command
5. Lip seal cleaning valve command

Manual Control The operator should activate the manual mode with this function key.

[K1] Open This function key opens the required process valve

[K3] Close This function key closes the required process valve

Locked This label is shown if the valve command function key is locked by a critical alarm or minimum basket speed.

3.5 Semiautomatic mode main page

When the semiautomatic mode is selected, the main page displays the phase command pushbuttons. No critical alarm should be present in order to activate a process phase. The operator has direct control over the phase selection and process sequence.

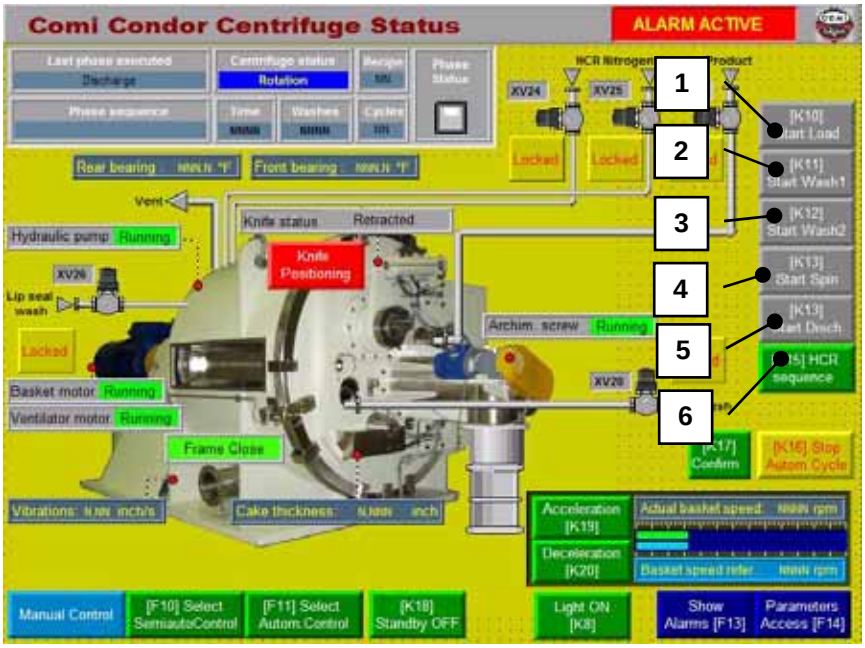


Fig.8 *Semiautomatic mode main page*

1. Loading phase command
2. Washing1 phase command
3. Washing2 phase command
4. Spinning phase command
5. Discharge phase command
6. Heel cake removal sequence command (only at end of cutting)

Semiauto Control The operator should activate the manual mode with this function key.

[K17] Confirm This function key should be used to confirm and proceed with the discharge phase, if the corresponding parameter is activated.

[K18] Standby OFF This function key activates the standby of the phase, that closes the process valves, stops the knife and freezes the phase time counting.

3.6 Automatic mode main page

When the automatic mode is selected, the main page displays the cycle command pushbutton. No critical alarm should be present in order to activate the process cycle. The cycle has a fixed structure and phases are executed from loading,washing, spin and finally discharge .

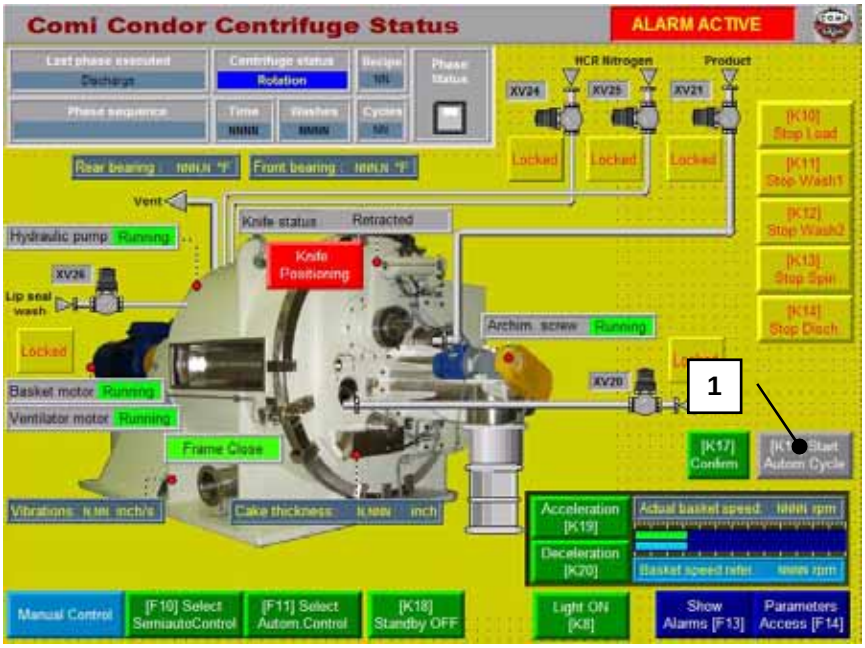


Fig.9 *Automatic mode main page*

1. Automatic cycle command

Auto Control The operator should activate the manual mode with this function key.

[K17] Confirm This function key should be used to confirm and proceed with the discharge phase, if the corresponding parameter is activated.

[K18] Standby OFF This function key activates the standby of the phase, that closes the process valves, stops the knife and freezes the phase time counting.

3.7 Alarm page

All conditions that cause an anomalous situation for the centrifuge operation, generate an alarm. When an alarm is active following indications recall the operator attention:

1. The alarm box is activated
2. The alarm lamp flashes

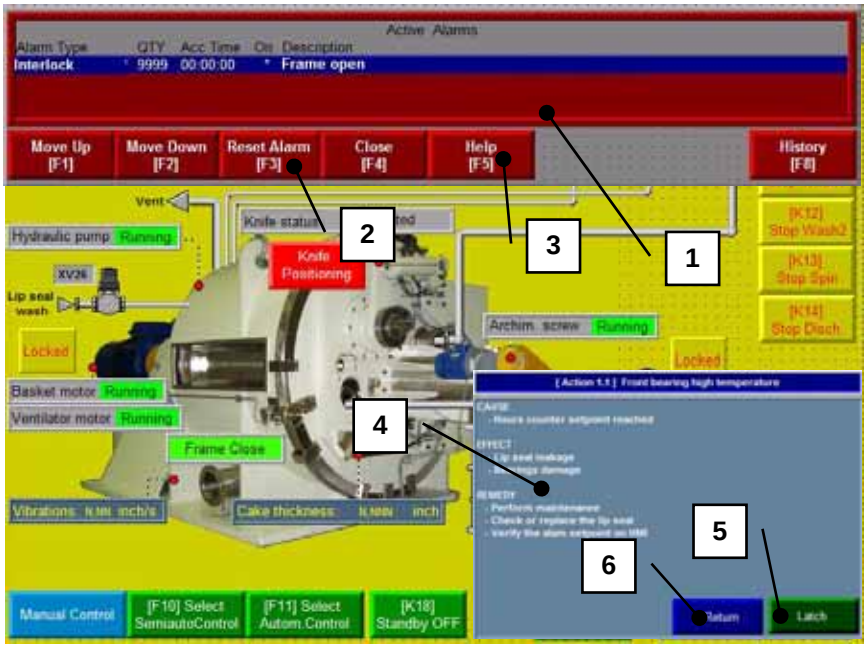


Fig.10 *Generic alarm indication*

Fig.11 *Alarm page*

1. Alarm active page
2. Reset function key
3. Help [F5] Help page recall key
4. Alarm help page
5. Latch Latch / unlatch key to stop the scroll of alarms
6. Press the Return button < Return to exit the alarm help display

The alarm page describes the alarm type, the time of the event, the alarm description.
The following Alarm type are possible:

- Message (only inidcation)
- Warning (safety speed)
- Shutdown (zero speed)
- Interlock (zero speed)

Use the Move Up [F1] or Move Down [F2] buttons to scroll the different available alarms.
Press the Reset Alarm button Reset Alarm [F3] to delete the alarms.

Press the Close button Close [F4] to exit the alarm reference page and back to main graphic page.

Press the History [F8] button to visualize the alarm history page

NOTE :Alarms can be reset only if the cause that has generated them is eliminated and the alarm action has been completed. In example a shutdown alarm can be reset only when the actual speed is zero.

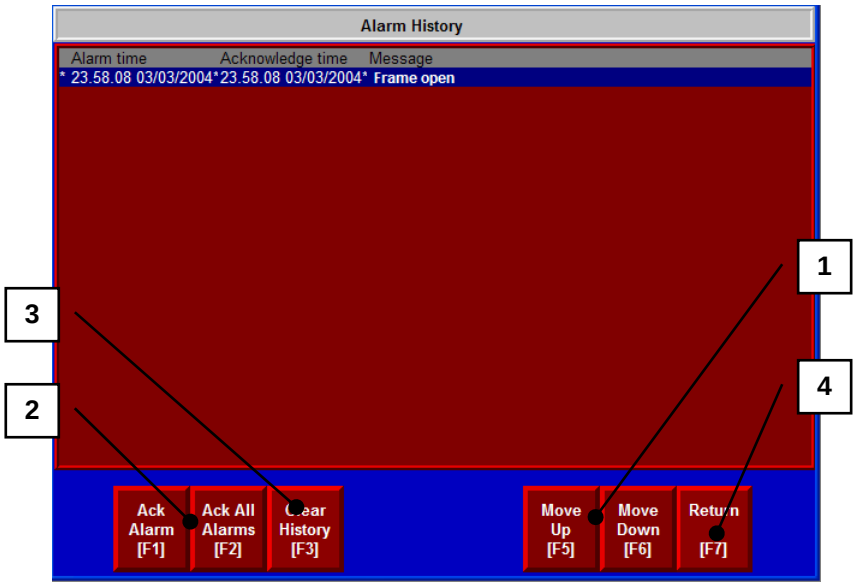


Fig.12 *Alarm history page*

1. Press the 

buttons to to scroll the different active alarms
2. Press the 

buttons to acknowledge the selected or all alarms
3. Press the 

button to clear all alarms history memory
4. Press the 

button to exit the alarm history page

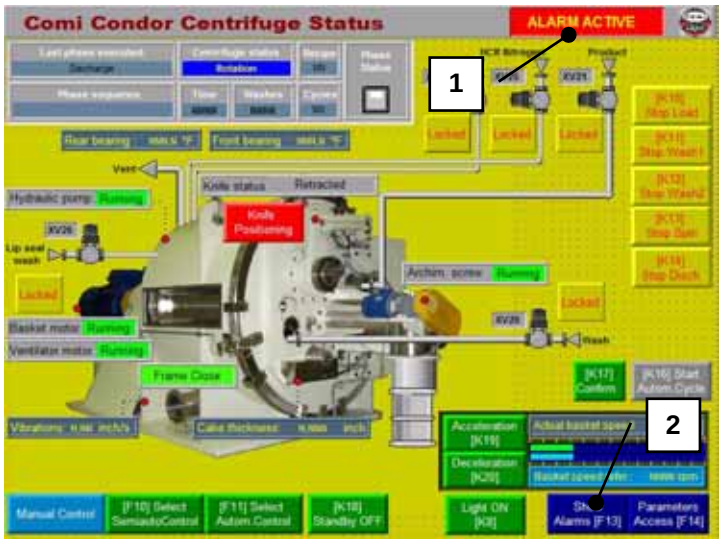


Fig.13 *Alarm indication*

If an alarm remains active the "**ALARM ACTIVE**" indication is displayed on the main page; the operator should push the alarm view key to return to the alarm screen

1. Alarm status box
2. Alarms View button 

The description of all alarms with possible causes and suggestions to reset can be found in the relevant chapter.

4. ACCESS TO THE SYSTEM – LOGIN PROCEDURE

4.1 Identification codes and access

The centrifuge control system is designed as a close system. The access can be performed in the login page that is called from the main graphic page with the relevant Parameters Access [F14] function key.
Access to the system is limited to enabled operators only from the local control panel and will be attained via combination of User name and Password.
User names are predefined in the system with the corresponding access level. The initial Password should be modified and kept updated by the User after its own login to the system.
Both User name and Password are alphanumeric values. Valid User names and Passwords are unique, different from zero, and it is suggested tohave a minimum length of eight and to contain at least one number. Three generations of passwords are kept in memory before allow the reuse by the operator. Operators can update their own password in the relevant password update box.

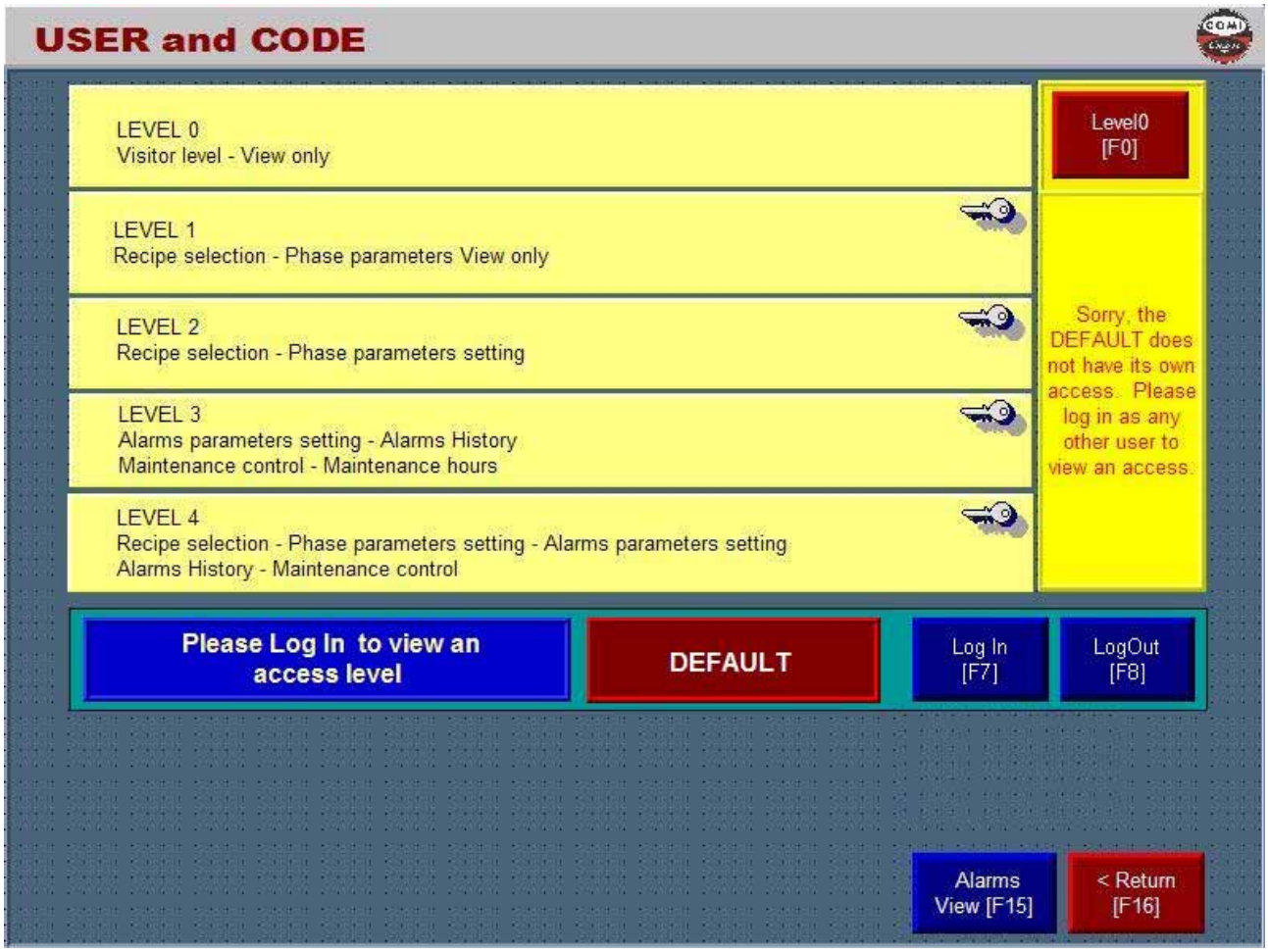
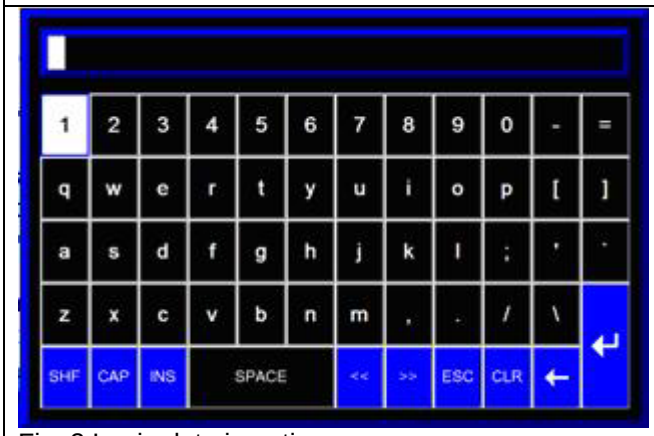


Fig.14 *Login page*

The access to the control system is performed by entering User name and relevant Password in the relevant logon box that is activated by the login [Log In F7] function key. Input of password is not shown on the digital screen, to ensure security. Each user can redefine its own password.

ACCESS TO THE SYSTEM – LOGIN PROCEDURE	
 Fig. 1 Logon box	Select the login [Log In F7] button in the login page in order to activate the logon box to start the session of connection to the system
 Fig. 2 Login data insertion	Insert the identification code (User name) and the access code (Password) with the alphanumeric keyboard, taking care to respect upper case letters and numbers as indicated by the system administrator.  WARNING ! Passwords should be known by authorized personnel only

When the operator does the first access to the system or when the password expiry is close, the operator should update his own password with the relevant [Change Pwd F9] function key.
The operator should insert the new password and repeat it in the confirmation field to verify its correctness.
The access codes (Passwords) should be composed of 8 characters, unique, different from zero, have a minimum length of eight and contain at least one number. Three generations of passwords are kept in memory before allow the reuse by the operator.
Once the new password is inserted, the new password must be used for all successive login of the operator.

 WARNING
The Password must be known and preserved with care by the authorised personnel. Input of password is not shown on the digital screen, to ensure security.

After the login to the system, the operator has a connection time of 15 minutes to select recipes, phase parameters and activate maintenance centrifuge controls. The operator is automatcally logged out after this time. The operator can disconnect from the system at any time with the [LogOut F8] logout button.

4.2 Access level (Group)

There are four levels of security and access for the parameter setup and one level for visualization only.

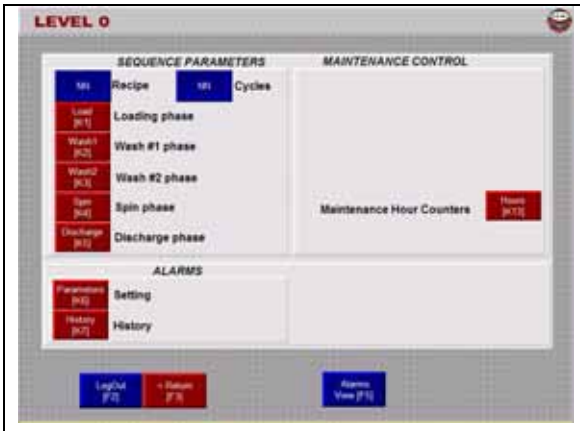


Fig.15 *Visitor level page*

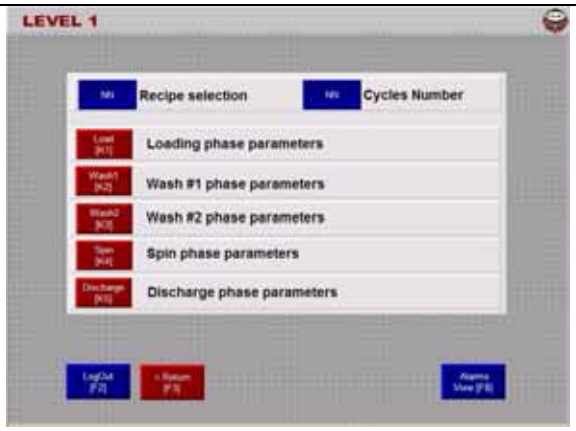


Fig.16 *Operator level page*

Fig.17 *Supervisor level page*

Fig.18 *Engineer level page*

Fig.19 *Administrator level page*

The access level pages are the following:

- Level 0 – Visitor
- Level 1 – Operator
- Level 2 – Supervisor
- Level 3 – Engineer
- Level 4 – Administrator

The operator can disconnect from the system with the LogOut [F8] logout button.

Push the return < Return [F16] button to recall the previous page

Level	***Only visualization of parameters***
Function	**Visitor**
Recipe visualization	●
Phase parameters visualization	●
Maintenance hour counters	●
Alarm setpoint and history visualization	●

Level	***Parameter definition and commands***			
	1	***2***	***3***	***4***
Function	**Operator**	**Supervisor**	**Engineer**	**Administrator**
Alarm acknowledge and reset	●	●	●	●
Control and operation mode selection	●	●	●	●
Speed manual control	●	●	●	●
Start /stop phase in semiautomatic mode	●	●	●	●
Operator confirm	●	●	●	●
Start /stop cycle in automatic mode	●	●	●	●
Recipe selection	●	●	●	●
Phase parameters definition		●	●	●
Alarm setpoint parameters definition			●	●
Maintenance and PLC IO test			●	●
UserID & Password visualization				●
Runtime disable				●

Depending on the active level the read/write operation is enabled.


NOTE
Not all the page selections are possible to all active levels. Ask your higher degree collegue for the functionalities that are not possible with your level.

5. CENTRIFUGE PARAMETERISATION

5.1 Recipe setup

After the login to the system it is possible to access the relevant phase page with the phase button.

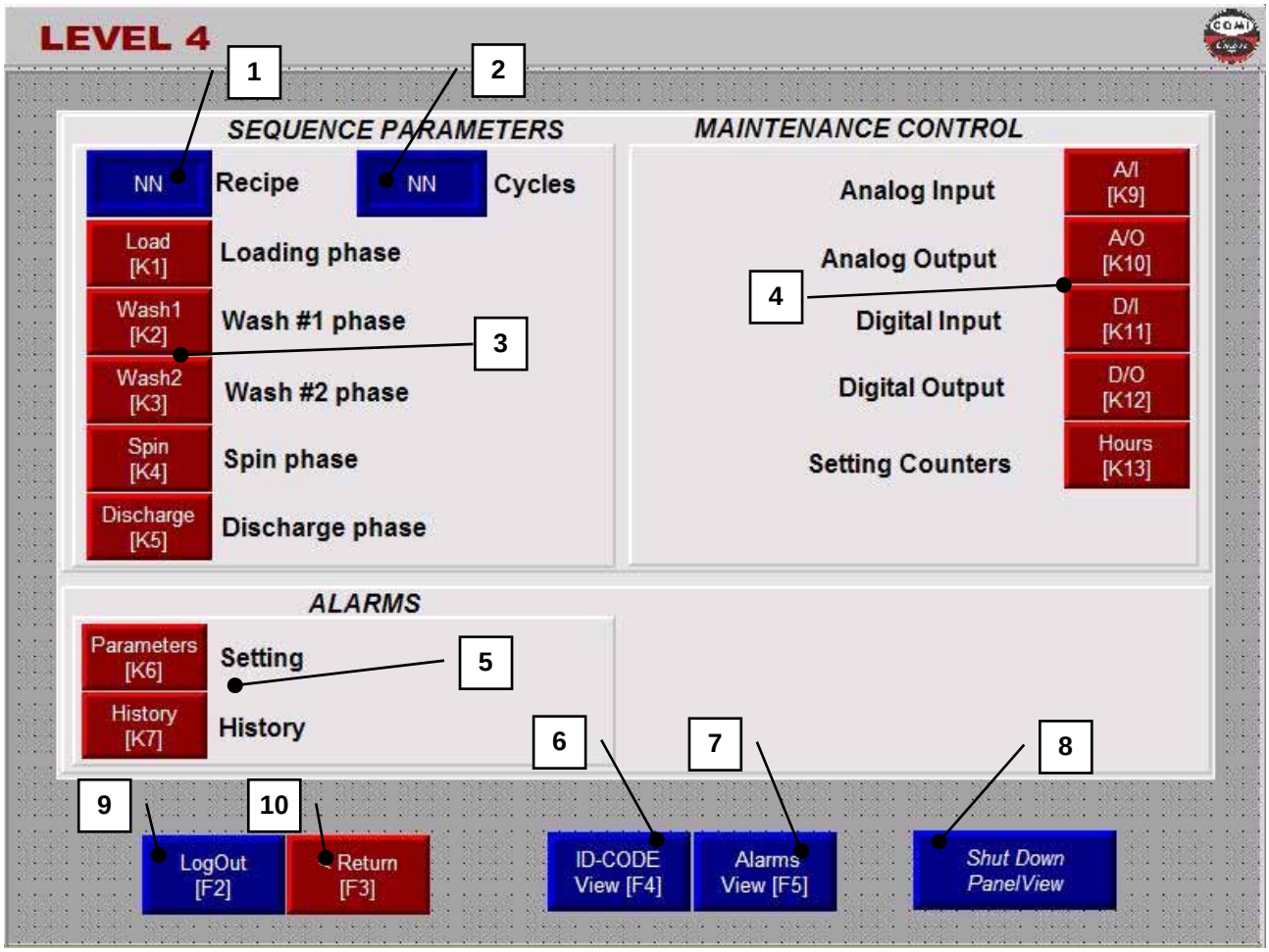
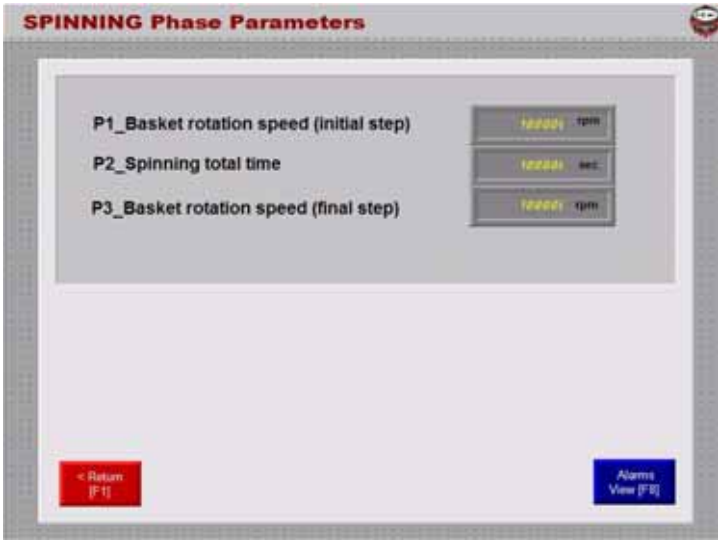
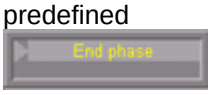


Fig.20 *Recipe setup page*

1. Recipe number selection
2. Number of automatic cycle selection
3. Phase parameters definition pages
4. Maintenance PLC IO and hour counters
5. Alarm setpoint and history pages
6. Initial UserID and passwords page
7. Alarm page visualization
8. Shutdown runtime button
9. Logout button to disable selections
10. Return to previous page

5.2 Parameters definition procedure

Depending on the access level it is possible to visualize or change the fundamental parameters for the correct operation of the centrifuge and of the plant.

PARAMETERS DEFINITION PROCEDURE	
 Fig. 3 Numeric parameter change ATTENTION If values outside the range are inserted, then a message will appear on the screen and the previous value will be set back.	In order to define a numeric parameter it is sufficient to select the field directly on the touchscreen. If the user level is adequate and the insert field is enabled, then the Numeric keyboard will appear.  Insert the new value and confirm with Enter key. The ESC key deletes the modified data that has not been acknowledged yet; the previous edited values will be displayed.
 Fig. 4 Alphanumeric parameter	In order to define an alphanumeric parameter with predefined selection  (i.e. phase confirm selection or endphase selection) the user can select from multiple options with the arrows  keys Press Enter  button, to confirm the input data

5.3 Alarm setpoint parameter page

It is possible to access the Alarm and operative setpoint page with the relevant button in the level page.

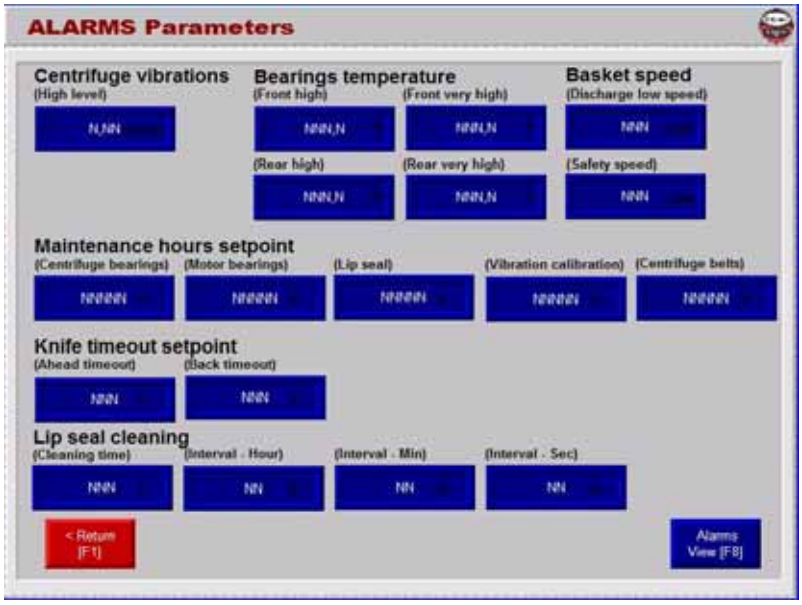


Fig.21 *Alarm thresholds definition*

DANGER!
Alarm setpoint parameters are critical for the correct operation of the centrifuge and for the safety of personnell. Respect all indications of Comi Condor S.p.A. , all safety norms and ATEX requirements.
Only authorised personnell of high level (Engineer or Administrator) can modify these parameters, only after written authorisation by Comi Condor S.p.A. Electrical Office technicians (UTE).

Push the return < Return [F1] button to recall the previous page.

Following alarms and operative setpoints can be defined:

Temperature alarms	***Description***		***Unit***	***Value***
Front bearing	**High temperature**	First alarm threshold, informs the operator that the bearing is insufficiently lubricated or overloaded. The alarm does not stop the centrifuge.	°F	140.0 ÷ 194.0
	Very high temperature	Second critical alarm threshold, informs the operator that the bearing is insufficiently lubricated or overloaded. The alarm stops the centrifuge.	°F	194.0 ÷ 248.0
Rear bearing	**High temperature**	First alarm threshold, informs the operator that the bearing is insufficiently lubricated or overloaded. The alarm does not stop the centrifuge.	°F	140.0 ÷ 194.0
	Very high temperature	Second critical alarm threshold, informs the operator that the bearing is insufficiently lubricated or overloaded. The alarm stops the centrifuge.	°F	194.0 ÷ 248.0
Vibration alarms	***Description***		***Unit***	***Value***
Centrifuge	**High vibrations**	First alarm threshold, informs the operator that the centrifuge is unbalanced or overloaded. The alarm does not stop the centrifuge.	inch/s	0.19 ÷ 0.59
Speed alarms	***Description***		***Unit***	***Value***
Centrifuge	**Too low discharge speed**	Informs the operator that the discharge speed is too low to enable the cutting sequence.	rpm	20 ÷ 100
	Safety speed	Safety speed setpoint used for warning alarms. The speed is reduced to this value if a warning alarm is active and speed is higher.	rpm	150 ÷ 400

Operation alarms	***Description***		***Unit***	***Value***
Bearings	**Wearing**	Maintenance indication, informs the operator that the bearing has to be verified and eventually changed. The alarm does not stop the centrifuge.	hours	1000 ÷ 30000
Motor bearings	**Wearing**	Maintenance indication, informs the operator that the motor bearing has to be verified and eventually changed. The alarm does not stop the centrifuge.	hours	1000 ÷ 30000
Lip	**Wearing**	Maintenance indication, informs the operator that the lip seal has to be verified and eventually changed. The alarm does not stop the centrifuge.	hours	1000 ÷ 30000
Belts	**Wearing**	Maintenance indication, informs the operator that the belts have to be verified and eventually changed. The alarm does not stop the centrifuge.	hours	1000 ÷ 30000
Vibration sensor	**Calibration**	Maintenance indication, informs the operator that the vibration sensor has to be verified and eventually calibrated. The alarm does not stop the centrifuge.	hours	1000 ÷ 30000
Lip seal cleaning	***Description***		***Unit***	***Value***
Cleaning time	**Cleaning time**	Effective cleaning time for the lip seal. After each interval the lip seal cleaning valve will open for the time specified in this parameter	sec	1 ÷ 999
Interval hours	**Hour interval**	The time interval between cleanings can be defined in this parameter	H	0 ÷ 23
Interval minutes	**Minutes**	The time interval between cleanings can be defined in this parameter	Min	0 ÷ 59
Interval seconds	**Seconds**	The time interval between cleanings can be defined in this parameter	Sec	0 ÷ 59

NOTE Centrifuge cleaning is performed manually after production. Only the lip seal cleaning is performed automatically after a defined time interval to preserve the lip seal functionality.

5.4 Phase parameters - Recipes and menu

It is possible to access the production parameter page with the relevant phase button in each Level page. In this page it is foreseen the Recipe number selection and the Number of repetitions of the automatic cycles.

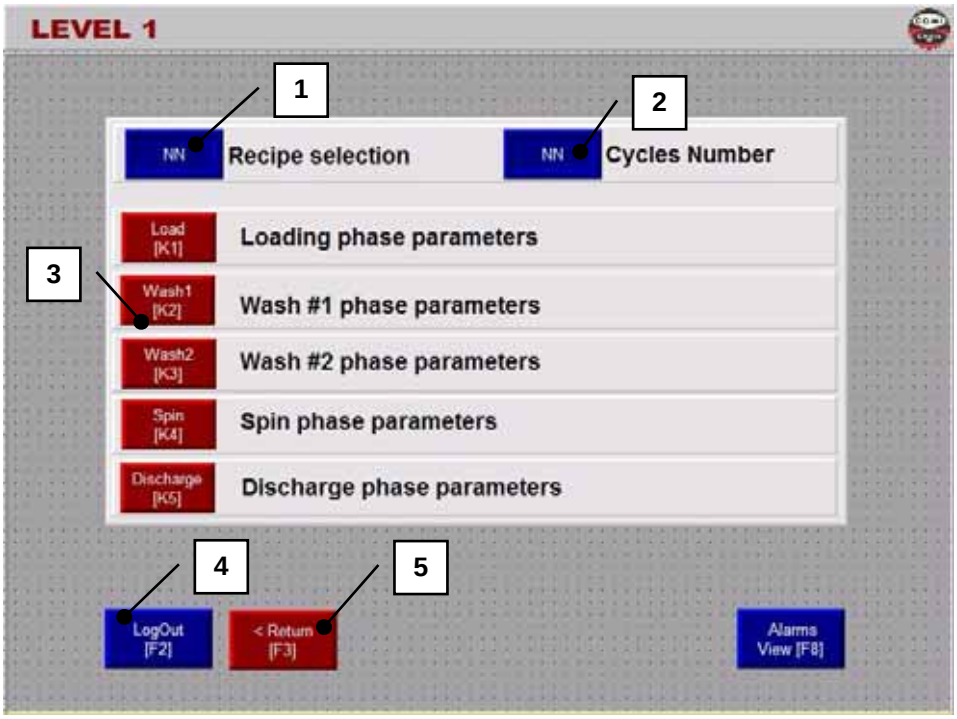


Fig.22 *Recipe definition*

The possible operation of the Recipe page are detailed in the following pages.

The operator can disconnect from the system with the logout button.

Push the return button to recall the previous page

Position	Description	Operative mode
1 NN	Recipe number that is loaded / saved (1÷10)	All
2 NN	Number of repeated automatic cycles (0÷99)	
3 Load [K1] / Wash1 [K2] / Wash2 [K3] / Spin [K4] / Discharge [K5]	Loading phase	Production ▪ Semi-automatic ▪ Automatic
	Washing1 and 2 phases	
	Centrifugation phase	
	Discharge and heel cake removal phase	

RECIPE MANAGEMENT PROCEDURE

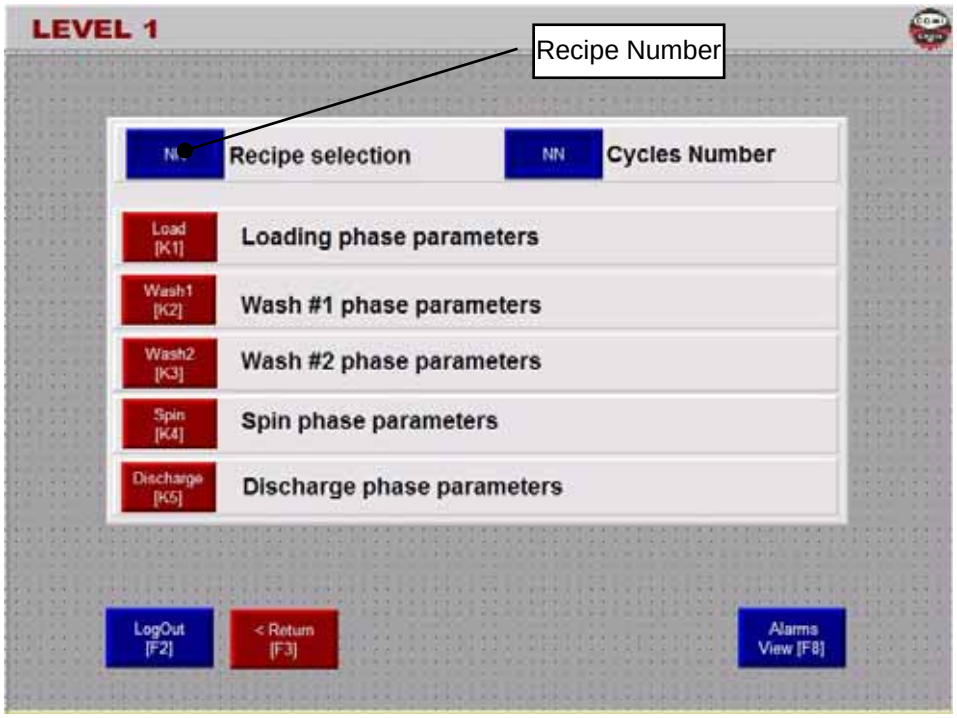


Fig.23 *Definition of new recipe to be loaded*

LOAD A PREVIOUSLY ARCHIVED RECIPE
In order to load a previously stored recipe from the archive, the user should enter the Recipe Number with the numeric keybard in the relevant field and confirm with enter.

Instantly all phase parameters of all phases that compose the recipe (all production phases) are loaded to the centrifuge control system.

It is possible to perform the loading of the recipe only after having been logged to the centrifuge control system at **Operator** level at the minimum.

Similarly it is possible to define the number of repeated cycles.

AUTOMATIC MODE	
Description	***Acceptable Values***
Recipe Number Defines actual recipe for production . The selected recipe is valid for semiautomatic and automatic modes.	1÷20
Number of repeated cycles It determines the number of cycle's sequences automatically repeated. If it is set to zero, the cycles are continuously repeated.	0÷99

5.5 Phase parameters

Production operative mode is used to perform all phases that compose the batch: loading, washings, centrifugation and finally discharge and heel cake removal. The production phases set of parameters are normally defined by the supervisor (shiftmanager). The selected set of parameters becomes the active recipe for production. All parameters of all phases need to be defined. Both automatic and semiautomatic modes use the same set to select the phase parameters. All phase parameters pages can be accessed with the relevant function keys.

5.5.1 Loading phase

Fig.24 *Loading phase parameters*

It is possible to access the loading parameter page with the relevant button in the level page.

Push the return < Return [F16] button to recall the previous page

Following parameters are foreseen for this phase:

Parameter	***Description***	***Range***
P1_LOAD	***Basket rotation speed.*** Basket rotation speed for loading.	150÷1200 rpm
P2_LOAD	***Total time.*** Phase total time counting; it starts at the beginning of the phase when the loading valve is open. An adequate value allows to complete loading with the desired cake thickness. If total time expires and endphase is selected by quantity, an insufficient load is detected and the repetition of automatic cycles is suspended being the reactor empty. Instead, if endphase is selected by time, the sequence stops feeding and jumps to the final spinning without alarms.	1÷9999 sec
P3_LOAD	***Max cake thickness.*** Value of the cake thickness surveyed into the basket.	0.195÷4.920 inch
P4_LOAD	***Draining basket rotation speed.*** Basket rotation speed for the centrifugation during the draining sequence. (between reloadings)	150÷1200 rpm
P5_LOAD	***Draining time.*** Time of product centrifugation, after having reached the max thickness into the basket surveyed by cake detector. It is used to allow the liquid draining after closing of the valve, in order to have more solid product inside the basket.	1÷999 sec
P6_LOAD	***Spinning basket rotation speed.*** Basket rotation speed for the final centrifugation after loading.	150÷1200 rpm
P7_LOAD	***Spinning total time.*** Counting of the final centrifugation after loading.	1÷9999 sec
P8_LOAD	***Endphase selection*** The endphase can be selected on the effective reaching of the required cake thickness or simply on the expiry of total time.	▪ By thickness ▪ By time

5.5.2 Washing 1 and 2 phases

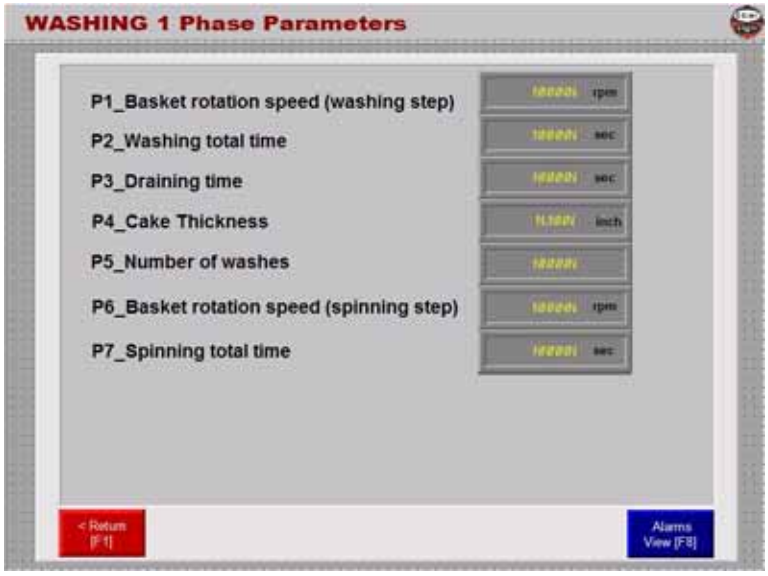


Fig.25 *Washing1 phase parameters*

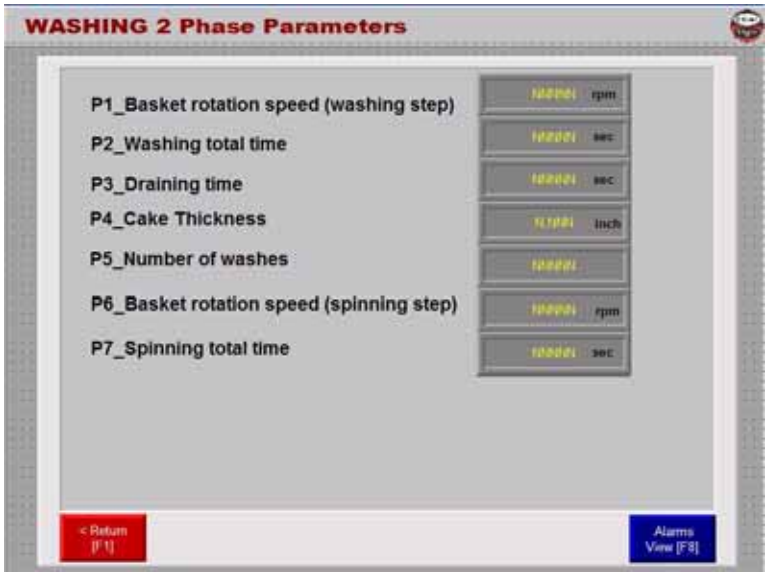


Fig.26 *Washing2 phase parameters*

It is possible to access the washing parameter page with the relevant button in the level page.

NOTE

This sequence is equal for both WASHING 1 and WASHING 2 phases but with different parameters. Different washing liquid can be used for washing 1 and washing 2 with different quantities or speed. A washing phase can be skipped in the automatic cycle by setting the number of washings to zero.

Push the return < Return [F16] button to recall the previous page

Following parameters are foreseen for these phases:

Parameter	*Description*	*Range*
P1_WASH	***Washing basket rotation speed*** Basket rotation speed for the washing.	150÷1200 rpm
P2_WASH	***Washing total time*** Washing total time counting; it starts when the washing valve is open	1÷9999 sec
P3_WASH	***Draining time*** Time of closing at the washing valve, after having reached the maximum thickness into the basket. It is set to allow the liquid draining after closing the washing valve.	1÷999 sec
P4_WASH	***Max cake thickness.*** Value of the cake thickness surveyed into the basket; above this value the washing valve is closed for the draining time.	0.195÷4.920 inch
P5_WASH	***Number of washings*** Counting of washing sequences, to divide the total quantity in more steps, after each step a spinning sequence is performed. If the number of washings is set to zero, the phase is not performed within the automatic cycle. If the number is set to one, the whole washing quantity is passed through the cake in one sequence.	0÷99
P6_WASH	***Spinning basket rotation speed*** Basket rotation speed for the centrifugation step after washing.	150÷1200 rpm
P7_WASH	***Spinning total time***. Counting of the centrifugation total time after washing.	1÷9999 sec

5.5.3 Centrifugation phase

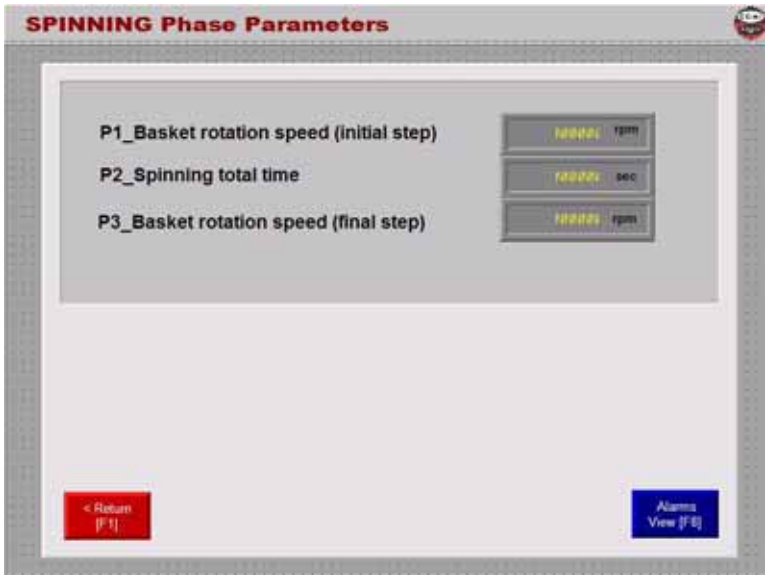


Fig.27 *Centrifugation phase parameters*

It is possible to access the centrifugation parameter page with the relevant button in the level page.

Push the return < Return [F10] button to recall the previous page

Following parameters are foreseen for this phase:

Parameter	***Description***	***Range***
P1_SPIN	***Basket rotation initial speed***. Basket rotation speed for the spinning	150÷1200 rpm
P2_SPIN	***Phase total time counting*** it causes the phase end	1÷9999 sec
P3_SPIN	***Basket rotation final speed***. Reduce or maintain basket rotation speed at the phase end	150÷1200 rpm

5.5.4 Discharge and heel cake removal phase

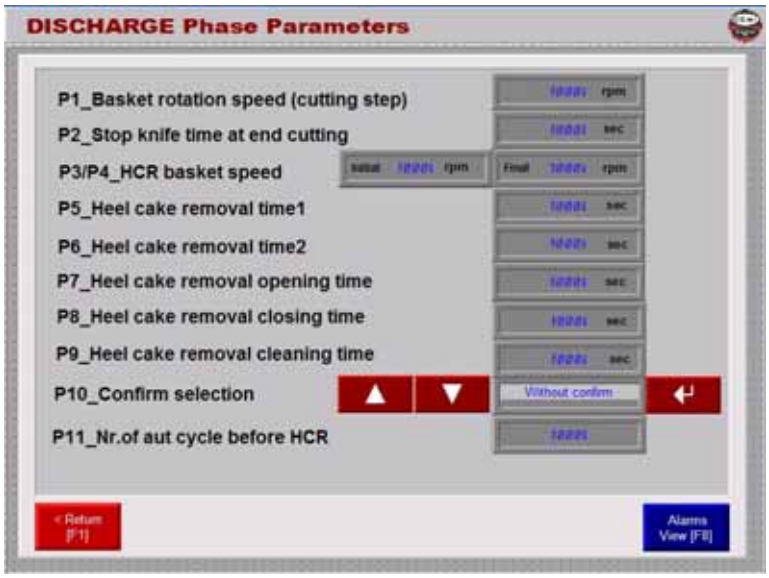


Fig.28 *Discharge phase parameters*

It is possible to access the discharge and heel cake removal parameter page with the relevant button in the level page.

Push the return < Return [F16] button to recall the previous page

Following parameters are foreseen for this phase:

Parameter	***Description***	***Range***
P1_DISCH	***Cutting basket rotation speed***. Basket speed during the cutting step.	50÷1200 rpm
P2_DISCH	***Stopping time at end of cutting.*** Time for maintaining the knife in final position, to allow the cloth cleaning	1÷999 sec
P3_DISCH	***Heel cake removal initial basket speed*** Basket speed during nitrogen blowing	50÷100 rpm
P4_DISCH	***Heel cake removal final basket speed*** Basket speed for cleaning the basket after the heel removal	50÷300 rpm
P5_DISCH	***Heel cake removal total time 1.*** Nitrogen blowing total time with valve1.	1÷9999 sec.
P6_DISCH	***Heel cake removal total time 2.*** Nitrogen blowing total time with valve2.	1÷9999 sec.
P7_DISCH	***Heel cake removal valve opening time.*** Valve Opening interval during the total time.	1÷99sec
P8_DISCH	***Heel cake removal valve closing time.*** Valve Closing interval during the total time.	1÷99 sec.
P9_DISCH	***Heel cake removal basket cleaning time.*** Basket cleaning time at the final basket speed.	1÷9999 sec.
P10_DISCH	***Discharge confirmation selection*** Activation of the cutting sequence automatically "WITHOUT CONFIRM " or manually after operator start " WITH CONFIRM".	• *WITHOUT CONFIRM* • *WITH CONFIRM*
P11_DISCH	***Number of cycles before heel cake removal*** Number of discharge cycles before activation of heel cake removal phase in Automatic mode. If zero is selected, heel cake removal is never performed. if one is selected, HCR is performed every discharge cycle. With a greater value, cycle counting is performed	0÷99 cycles

6. CENTRIFUGE OPERATION

The centrifuge has a single operative control mode in LOCAL, that means that all the operations of the centrifuge (phase sequnces, recipe parameterisation etc) are controlled by the operator from the Local Control Panel.
The control modes can be selected with the Operator Terminal and is the only the following:

- **Production** : in this mode the operator can enable all phases that are part of the batch. (loading, washing, centrifugation, discharge). The automatic cycle start pushbutton activates the relevant automatic sequence.

Centrifuge cleaning is performed manually after production. Only the lip seal cleaning is performed automatically after a defined time interval to preserve the lip seal functionality.

There are three operation modes:

- **Manual**, no phase can be activated. The process valves can be opened with single manual command to verify / prepare the plant for operation.
- **Automatic**, where the sequence of phases is defined into the cycle and runs automatically till a programmed number of cycles. The phase parameters are defined into the recipe;
- **Semi-automatic**, where the operator freely controls the sequence of phases (loading, washings, centrifugation, discharge), whose parameters are defined in the recipe

An additional functional mode can be activated only by high access levels (engineer, administrator):

- **Maintenance**, where the maintenance engineer freely controls the PLC IOs through an individual command all inputs /outputs connected to valves, motors, without any alarm control.

ATTENTION !
IN MAINTENANCE MODE, IMPROPER USE MAY CAUSE DAMAGES TO THE CENTRIFUGE AND LEAD TO A SERIOUS FAULT CONDITION, PHYSICAL INJURY OR DEATH.
ONLY AUTHORIZED AND TRAINED PERSONNEL CAN OPERATE IN MAINTENANCE MODE.
COMI CONDOR S.P.A. IS NOT RESPONSIBLE FOR ANY SORT OF DAMAGE ARISING FROM IMPROPER USE OF THE MAINTENANCE MODE BY THE CLIENT.

6.1 Auxiliary functions

6.1.1 Emergency stop

The emergency stop can stop the centrifuge in case of danger. When the emergency is pushed all the phases are disabled and motors are disabled and valves fail to their safe condition.

WARNING !

EMERGENCY STOP BUTTON CAN CAUSE THE LOSS OF THE CURRENT PRODUCTION. WET PRODUCT MAY FALL IN THE BASKET AND CAUSE EXCESSIVE VIBRATIONS AND CENTRIFUGE UNBALANCE.
USE THE EMERGENCY STOP BUTTON ONLY IN POTENTIALLY DANGEROUS SITUATIONS.

6.1.2 Basket speed regulation

During the centrifuge operation it is possible to change the basket speed in manual, semiautomatic and automatic mode according to the following table

SEMIAUTOMATIC MODE	**AUTOMATIC MODE**
No active phase – Idle rotation	**Cycle not active – Idle rotation**
Push Acceleration button once and the setpoint is set to the maximum speed; when the basket is in rotation pushing the Acceleration button a second time sets the setpoint to the current basket rotation speed. Push Deceleration button once and the setpoint is set to the zero; when the basket is in rotation pushing the Deceleration button a second time sets the setpoint to the current basket rotation speed.	
Active phase	**Cycle active (phase active)**
Keeping Acceleration/Deceleration button pushed, the speed can vary ± 200 rpm with a step of 10rpm/s. When the basket is released , the setpoint remains at the set value. The setpoint can be varied only within the parameter range in order to respect the FDA and GAMP rules.	

6.1.3 Frame opening/closing.

The frame opening and access to the centrifuge process area i.e. for the filter cloth change, is possible only when all manual blockages and the pneumatic locking system is open.

NOTE

In order to open the pneumatic locking system, the following conditions must be verified:

- Centrifuge still (zero speed)
- Knife in rest position
- Cake detector in rest position

- The the locking system closes immediately, if one of the condition is missing.

6.1.4 Light lamp

The centrifuge light lamp should be used to illuminate the internal process area (basket) of the centrifuge. When the lamp is turned on, a timer is started that will switch it off automatically after three minutes. The operator can eventually switch it off manually with the function key.

6.1.5 Sightglass cleaning

The sightglass should be cleaned with washing liquid by opening the manual valve only with centrifuge close and basket in rotation.

6.1.6 Lip seal cleaning

When the centrifuge starts rotating, the time interval between cleanings (***P1_LIP*** parameter) is activated. When the time interval is elapsed the lip seal labyrinth cleaning valve (YV28) is opened for the lip cleaning time (***P2_LIP*** parameter) Then the lip seal labyrinth cleaning valve (YV28) is closed. The time interval between cleanings is reactivated.

6.1.7 Lip seal monitoring

When the centrifuge starts rotating, the nitrogen to lip seal valve (YY12) is opened in order to separate the internal product area from the bearings' housing. If the pressure (PSL12) becomes too low, no nitrogen grants the separation between product area and bearings housing, so relevant alarms *LOW NITROGEN PRESSURE TO BEARING SEAL* are generated after a delay. If there is a lack of power supply to the control system during operations then when the power is resumed, if the centrifuge is running, the nitrogen to lip seal valve (YY12) is reopened.

6.2 Semi-automatic mode

In semiautomatic mode the operator defines directly the sequence of phases with the start /stop phase pushbuttons. In example it is possible to start the loading phase and stop it when a certain amount of product has been loaded. The phase parameters are previously set into the recipe. At the phase start the basket is accelerated to the relevant phase parameter.

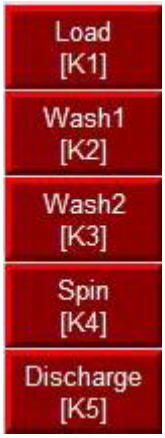


Fig. 5 Production phase buttons

When the basket speed setpoint is reached, the phase is active and the Phase active message is shown in the graphical display. The sequence of all phase steps are described in the following chapters for each phase. When the sequence is completed, the message Phase ended is displayed. The operator should exit the phase by pushing the phase stop button.

When a phase is active and the operator pushes the Standby button, the current phase is temporarily put in hold, the process valves close and the centrifuge continues to rotate at current speed. If the standby is activated during discharge phase, the knife movement is also stopped. The operator should disable the standby condition by pushing again the same button.

The following phases are foreseen for semiautomatic mode:
Production

- Loading
- Washing 1 & 2
- Centrifugation
- Discharge and heel cake removal

NOTE
An active phase can be disabled at any time even if the phase is not really completed. When a phase is active, all other phases buttons are disabled and it is not possible to activate any other phase.

6.3 Automatic mode

The following phases are foreseen for production automatic mode:

- ❑ Loading
- ❑ Washing 1 & 2
- ❑ Centrifugation
- ❑ Discharge and heel cake removal

When the automatic mode is selected, the phase that compose the cycle are activated in sequence according to the recipe phase parameters selected.
The automatic cycle can be actived only if the centrifuge is not in critical alarm.
The automatic cycle repeats the phases for a certain amount of cycles as defined in the loading phase parameter. When the number of cycles is reached, the centrifuge is stopped. If the insufficient load alarm is present, the loading reactor is empty and the current cycle is set as last cycle.
It is possible to stop the cycle at any time, even if the number of cycles is not reached. It is possible to stop the cycle with the button, the basket remains in rotation at current speed. Successively it is possible to switch in semiautomatic mode and complete the cycle with single phase start commands. The cycle can be restarted at any time, the cycle will prosecute from the last completely executed phase. In example a critical alarm (warning) disables the cycle. It is possible to switch to semiatomatic mode and re-execute the phase or skip another phase just by starting the next phase of the cycle. When this last phase is completed, the operator can switch back to automatic mode and restart the cycle from this last point.
In oder to reset the number of automatic cycles, the following conditions should be verified:

- Centrifuge open (frame).
- Switch in semiautomatic, zero speed and alarm reset button pushed.

7. Description of functional sequences

7.1 Loading

It is the phase of filling the basket with the product to be centrifuged, washed and discharged and it must be performed with the basket in rotation. An automatic valve is controlled by the cake thickness detector, to perform the basket loading according to the cake thickness parameter. The correct setting of the draining parameters allows more reloadings to take place and have more solid product inside the basket. The operator can regulate the flow of product with the manual valve in the loading pipe. The endphase can be selected on the effective reaching of the required cake thickness or simply on the expiry of total time. The phase development is indicated in the HMI in the relevant box for the phase steps.

7.1.1 Loading sequence

1) The basket rotation changes speed to filling speed set point (***P1_LOAD*** parameter). (indication “Waiting initial speed”).
2) When the basket rotation reaches ± 30 rpm of the desired filling speed set point, the phase starts (indication “Loading phase active”).
3) Loading valves control:
   3.1) The cake detector device (ZE17) starts the operation measuring the product thickness inside the basket. If the cake detector cannot reach the required position (***P3_LOAD*** parameter), a cake detector blocked alarm is generated.
   3.2) If the cake thickness signal (ZT17) is lower of the max set-point value, the loading valve (YV21) will open and product enters the basket.
   3.3) The total time parameter (***P2_LOAD*** parameter) starts counting. (indication “Loading”)

4) When the thickness set point limit (***P3_LOAD*** parameter) is reached, the loading valve (YV21) closes. The cake detector returns in rest position.
5) The speed changes to draining rotation speed (***P4_LOAD*** parameter). (indication “Waiting draining speed”) When the speed is reached, the draining time starts (***P5_LOAD*** parameter). (indication “Draining”) During the draining time the total time(***P2_LOAD*** parameter) is paused.
6) When the draining time expires, the speed is set back to feed speed (***P1_LOAD*** parameter).
7) When the loading speed is reached, the cake detector is actived. If the cake thickness signal (ZT17) is lower than the max set-point value (***P3_LOAD*** parameter), the loading valve (YV21) opens to reload the centrifuge. When the valve is in open position, than a fixed waiting time begins (10 sec). (indication “Waiting time”)
8) If the loading waiting time expires (10 sec) and max thickness set point (***P3_LOAD*** parameter) is not reached, then the loading sequence continues and goes back to step 3 (indication “Loading”)
9) If the thickness setpoint (***P3_LOAD*** parameter) is reached before the waiting time expires, no matter if the endphase selection (***P8_LOAD*** parameter) is by thickness or by time, the basket is full and the loading sequence goes on to step13
10) If the total time expires (***P2_LOAD*** parameter) and the endphase (***P8_LOAD*** parameter) is selected by time, the feeding step is completed and the loading sequence goes on to step13
11) If the total time expires (***P2_LOAD*** parameter) and the endphase (***P8_LOAD*** parameter) is selected by thickness, the basket is not full, an “insufficient load” alarm is displayed (see Message Alarm type). The loading sequence is paused.
12) The “insufficient load “ alarm performs following actions:
   12.1) The loading valve (YV21) closes. (indication “Insufficient load”) By resetting the alarm with the pushbutton the sequence proceeds.
   12.2) In automatic mode a memory of “ insufficient load alarm ” is set to stop the automatic cycle sequence at end of the discharge phase even if the total number of cycles has not been performed.
   12.3) The loading phase goes on to step13

13) The centrifuge basket will change speed to the spinning set point (***P6_LOAD*** parameter) (indication "Waiting spinning speed")
14) When the rotation speed reaches ± 30 rpm of the desired spin set point, the loading spin time starts (***P7_LOAD*** parameter). (indication "Final spinning")
15) When the spinning time elapses, the loading phase is finished (indication "Phase ended").

7.2 Washing

Once the basket is loaded, it is possible to wash the cake using the proper washing liquid (selection of washing tank upstream of washing valve). The automatic valve is controlled by the cake detector to avoid possible overflow or waves of liquid over the cake. The phase is controlled simply by time (no washing flow transmitter foreseen). The required washing total quantity can be split in several washing cycles (number of washings). After each cycle the speed is increased to spinning to drain the liquid.

NOTE
This sequence is equal for both WASHING 1 and WASHING 2 phases but with different parameters. Different washing liquid can be used for washing 1 and washing 2 with different quantities or speed. A washing phase can be skipped in the automatic cycle by setting the number of washings to zero.

7.2.1 Washing sequence

1) The basket rotation changes the speed to washing speed set point (***P1_WASH*** parameter). (indication "Waiting initial speed").
2) When the basket rotation reaches ± 30 rpm of the desired washing speed set point, the phase starts (indication "Washing phase active") and the number of required washings is set to (***P5_WASH*** parameter) value.
3) Washing valves control
   3.1) The cake detector device (ZE17) starts the operation measuring the product and liquid thickness inside the basket. If the cake detector cannot reach the required position (***P4_WASH*** parameter), a cake detector blocked alarm is generated.
   3.2) If the cake thickness signal (ZT17) is lower than the max set-point value (***P4_WASH*** parameter), the washing valve (YV20) opens. (indication "Washing")
   3.3) The washing total time starts (***P2_WASH*** parameter).
4) If the thickness set point limit (***P4_WASH*** parameter) is reached, then the washing valve (YV20) closes.
5) When the washing valve closes, the draining time starts (***P3_WASH*** parameter), during the draining time the total time is paused. The machine will continue to rotate at washing speed. (indication "Draining")
6) When the draining time expires, the cake detector verifies the thickness value and if it is lower than the max set-point value (***P4_WASH*** parameter), the washing valve (YV20) reopens and the total time continues.
7) When the washing total time elapses, the washing valve (YV20) closes, then the performed washings counter is increased by 1 (the indication of the required number of washings is reduced by 1).
8) The centrifuge basket will change speed to the spinning set point (***P6_WASH*** parameter). (indication "Waiting spinning speed")
9) When the rotation speed reaches ± 30 rpm of the desired spin set point, the spinning time starts (***P7_WASH*** parameter). (indication "Spinning after washing")
10) When the spinning time elapses, if the required number of washings (***P5_WASH*** parameter) is **not** reached, then the washing sequence starts again from step 3
11) When the spinning time elapses, if the required number of washings (***P5_WASH*** parameter) is reached, then the wash phase is finished (indication "Phase ended").

7.3 Centrifugation

It is the phase of final spinning of liquid through the cake. The product should be sufficiently dry before proceding with the discharge phase.

7.3.1 Centrifugation sequence

1) The basket rotation changes the speed to spin speed set point (***P1_SPIN*** parameter). (indication “Waiting initial speed”).
2) When the rotation reaches ± 30 rpm of the desired spin speed set point, the phase starts (indication “Spinning phase active”).
3) The total time begins (***P2_SPIN*** parameter). (indication “Spinning”)
4) When total time elapses, the centrifuge basket will change speed to the setpoint (***P3_SPIN*** parameter).
5) When the rotation speed reaches ± 30 rpm of the desired spin set point, the phase is finished (indication “Phase ended”)

7.4 Discharge

Discharge and heel cake removal phase is the unloading of the dry cake from the basket. When the phase starts the first step is cutting, where a knife scrapes the dry cake, the second step activated automatically during the cycle or manually by operator in semiautomatic mode is the heel cake removal with nitrogen, where it is possible to remove the residual heel cake left on the filter cloth after the cutting step.
The discharge sequence can be performed immediately after the spinning phase, if the relative phase parameter is set as "Without confirmation" or can proceed only after a confirmation of the operator, if the phase parameter is set as "With confirmation". The archimedean screw is activated in order to discharge the product in the solids chute.
The standby function can be used in order to stop temporarily the discharge phase and change the keg. When the standby is activated, the knife movement is stopped and after a short delay the archimedean screw is stopped.

7.4.1 Discharge sequence

1) The basket rotation changes speed to discharge speed set point (***P1_DISCH*** parameter). (indication “Waiting initial speed”).
2) When the basket rotation reaches ± 30 rpm of the desired discharge speed set point, the phase starts (indication “Discharge phase active”). If the basket speed decreases below the minimum discharge speed due to a too hard product, the relevant warning alarm is generated and the phase is aborted.
3) If the selected cutting sequence parameter is “*Without confirm*” (***P10_DISCH*** parameter), the sequence proceeds directly to step5.

4) If the selected cutting sequence parameter is “*With confirm*” (***P10_DISCH*** parameter), then:
   4.1) the discharge sequence is frozen and wait a confirm by operator on the centrifuge local panel (indication “Waiting operator confirm”)
   4.2) when the operator pushes the “Confirmation by operator " pushbutton, the sequence proceeds to step 5
5) The solids discharge archimedean screw is activated.
6) When the archimedean screw is in rotation, the knife ahead movement (YY02) is activated with the hydraulic piston, (indication “Cutting step active”). The knife cutting speed should be regulated on the hydraulic unit to avoid excessive resistance against the product. The Stand-by pushbutton can be used in order to freeze temporarily the discharge phase. The knife movement stops and after a short delay the archimedean screw stops. The operator can change the keg, if required. Push the Stand-by pushbutton again and the phase is reactivated.
7) When the knife is completely extracted (ZS06), the knife ahead movement is deactivated and the stopping time for discharging is activated (***P2_DISCH*** parameter).
8) When the stopping time is ended, the cutting step is finished (indication “cutting step ended”) and the phase proceeds according to operation mode selected.

9) With *AUTOMATIC MODE* selected:
   9.1) if the number of cycle for inserting heel cake removal phase is reached (***P11_DISCH*** parameter) the sequence proceeds to step 12.
   9.2) if the number of cycle is not reached the sequence proceeds to step 20.
10) With *SEMIAUTOMATIC MODE* selected:
   10.1) if nitrogen heel cake removal is required, the operator should start the nitrogen heel cake removal step with the relative pushbutton on the local panel and the sequence proceeds to step12.
   10.2) If nitrogen heel cake removal is not required, the operator should stop the discharge phase by pushing the relative pushbutton on local panel. The sequence proceeds to step 20.
11) The basket rotation changes the speed to heel cake removal initial speed set point (***P3_DISCH*** parameter) (indication " heel cake removal step active"). The knife moves back for few seconds to avoid possible contacts with the filter cloth during the heel cake removal.
12) When the basket rotation reaches the desired set point, the nitrogen heel cake removal valve1 (YV24) opens with intermittent function depending on the opening/closing time parameters (***P7_DISCH*** and ***P8_DISCH*** parameters).
13) The heel cake removal total time 1 starts (***P5_DISCH*** parameter).
14) When heel cake removal total time 1 is elapsed, the nitrogen heel cake removal valve1 (YV24) closes and the sequence is repeated with the nitrogen heel cake removal valve2 (YV25) for the heel cake removal total time 2 (***P6_DISCH*** parameter).
15) When the heel cake removal total time 2 is elapsed, the basket rotation speed changes to the heel cake removal final speed value (***P4_DISCH*** parameter).
16) When the set speed is reached, the nitrogen heel cake removal valve1 (YV24) and valve 2 (YV25) open and the heel cake removal basket cleaning time (***P9_DISCH*** parameter) is activated.
17) When the heel cake removal basket cleaning time is ended, the nitrogen heel cake removal valves (YV24-YV25) close, the heel cake removal step ends and the indication "heel cake removal step ended" is displayed.
18) With *AUTOMATIC MODE* selected:
   18.1) the sequence proceeds to step 20.
19) With *SEMIAUTOMATIC MODE* selected:
   19.1) if nitrogen heel cake removal is required again, the operator should start the nitrogen heel cake removal step with the relative pushbutton on the local panel and the sequence returns back to step 12.
   19.2) If nitrogen heel cake removal is no more required, the operator should stop the discharge phase with the relative pushbutton on the local panel and the sequence proceeds to step 20.
20) The discharge phase is finished, the knife back movement (YY03) is activated to allow the knife return in initial position (ZS05). (Indication "Knife back to rest position")
21) When the knife initial position is reached, the knife back movement is deactivated and the archimedean screw is stopped.
22) The discharging phase is ended and the indication "Phase ended" is displayed.

7.5 Maintenance mode

It is possible to perform the maintenance operations and verification tests by selecting the appropriate maintenance mode.
The following different operations appear on the screen depending on the user level of access:

- ✓ Operative working hours visualization and reset for basket bearings, motor bearings, lip seal, calibration of devices. Level Engineer.
- ✓ Visualization of status and output forcing for the Input/Output of the centrifuge PLC (digital and analog). The selection of the PLC pages disables all phases and alarms. Level Engineer.
- ✓ Centrifuge Runtime program disactivation to access the operator terminal (PC) operating system. Level Administrator.

ATTENTION !
IN MAINTENANCE MODE, IMPROPER USE MAY CAUSE DAMAGES TO THE CENTRIFUGE AND LEAD TO A SERIOUS FAULT CONDITION, PHYSICAL INJURY OR DEATH.
ONLY AUTHORIZED AND TRAINED PERSONNEL CAN OPERATE IN MAINTENANCE MODE.
COMI CONDOR S.P.A. IS NOT RESPONSIBLE FOR ANY SORT OF DAMAGE ARISING FROM IMPROPER USE OF THE MAINTENANCE MODE BY THE CLIENT.

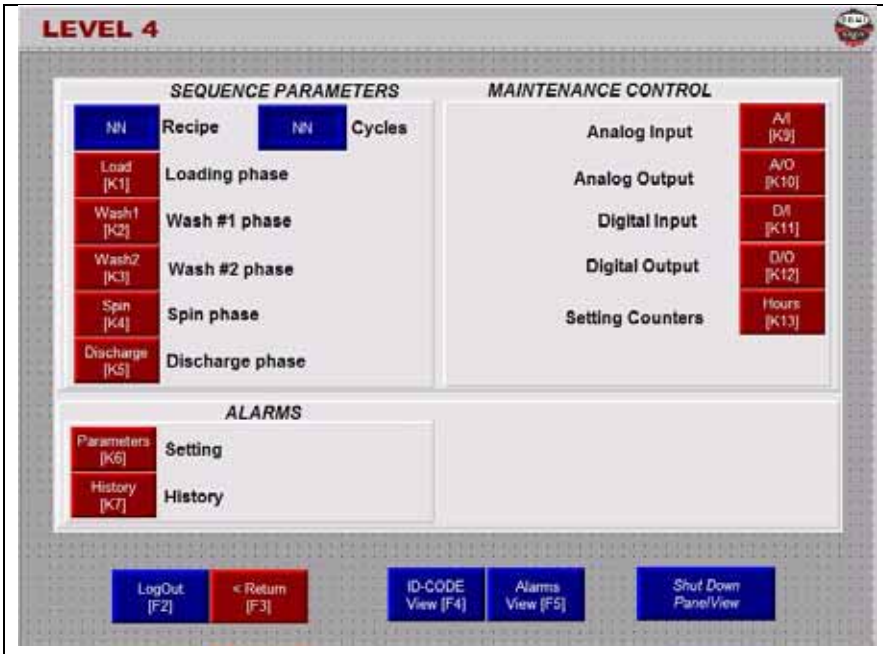


Fig.29 *Maintenance mode selection*

Key	Function
A/I [K9]	Analog inputs status
A/O [K10]	Analog outputs control
D/I [K11]	Digital inputs status
D/O [K12]	Digital outputs control
Hours [K13]	Operative working hours
Shut Down PanelView	Shutdown runtime
< Return [F1]	Push the Back button to return to the previous page

7.5.1 Operative working hours

In this page it is possible to visualize the operative working hours of main centrifuge components and the validity of the calibration of critical instruments.
The relevant alarm setpoint are also visualised but their value can be changed only in the alarm setpoint page. If the setpoint is reached, a message alarm is generated. This alarm will not stop the centrifuge, it is only an indication to the maintenance engineer that has to perform the activity or perform a control. The message alarm can be reset with the normal alarm reset button. If the maintenance operation is performed before the alarm is activated, the maintenance engineer can access this page and reset the relative counter.

Fig.30 *Centrifuge operative hours page*

Key	Function
Reset [K1]	Reset the relative hour counter
< Return [F1]	Push the Back button to return to the previous page

7.5.2 PLC Input / Output control

In maintenance mode it is possible to access a digital or analog output page and force the status of one or more outputs. After forcing the outputs, it is possible to select the digital or analog inputs page and verify the reaction to the setted outputs. The outputs remain active untill the maintenance engineer leaves the PLC input / output selection page.
In example it is possible to activate the command of a single process valve from the digital output page, then recall the digital input page and verify the variation of the digital input that is connected to the valve position sensor.

7.5.2.1 Digital inputs

The digital input page can be activated to verify the actual readings of the connected devices. Every input is defined by its logical address and its description. The actual status is indicated with green box if active and grey box if zero.

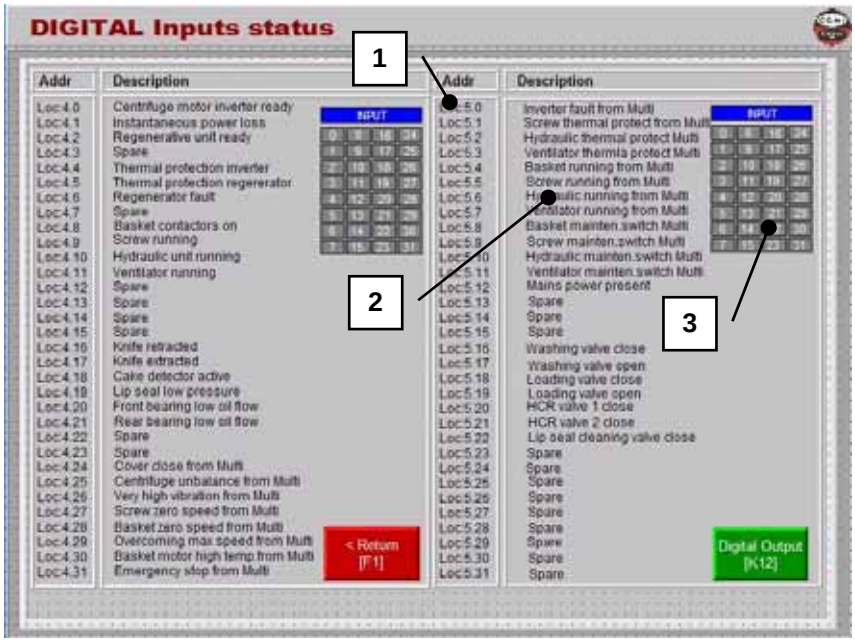


Fig.31 *Digital inputs page*

Keys	Function
	1. PLC logic address 2. Input description 3. Status (grey=false green=true)
Digital Output [K12]	Proceed to the digital output page
< Return [F1]	Push the Back button to return to the previous page

7.5.2.2 Digital outputs

The digital output page can be activated to force the actual status of the connected devices. Every output is defined by its logical address, description and a number ID of associated actuator. The actual status is indicated with green box if active and grey box if zero.

In order to activate the output, digit the ID number and confirm with ↵ Enter. Use fuction ON [K9] key to set the selected output and OFF [K10] key to reset. It is possible to open a process valve or to start a motor without generating alarms.

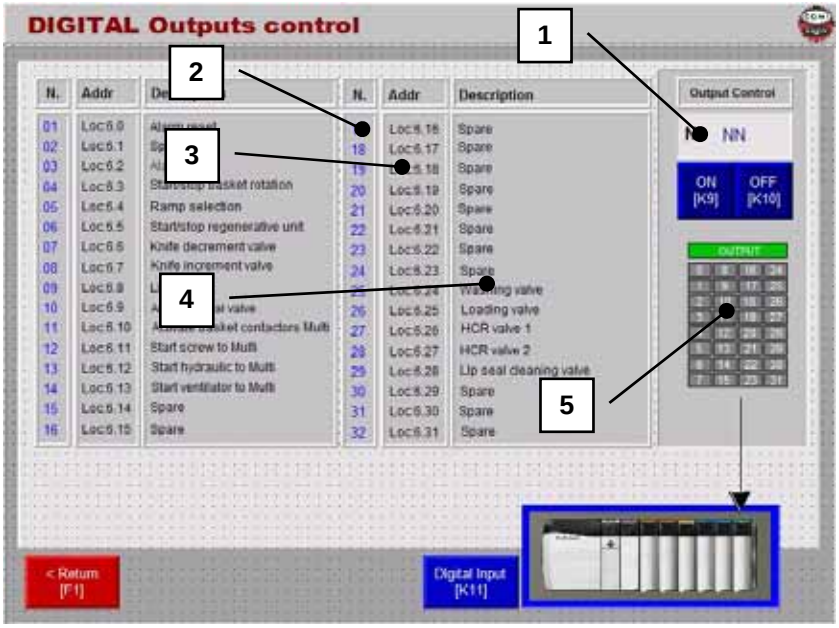


Fig.32 *Digital output page*

Keys	Function
1. ID selection for the output that has to be forced. 2. Output ID number 3. PLC logic address 4. Output description 5. Status of comand (grey=false green=true)	
ON [K9]	Activate the output
OFF [K10]	Reset the output
Digital Input [K11]	Proceed to the digital input page
< Return [F1]	Push the Back button to return to the previous page

DANGER !
IN MAINTENANCE MODE, IMPROPER USE MAY CAUSE DAMAGES TO THE CENTRIFUGE AND LEAD TO A SERIOUS FAULT CONDITION, PHYSICAL INJURY OR DEATH.
ONLY AUTHORIZED AND TRAINED PERSONNEL CAN OPERATE IN MAINTENANCE MODE.
VERIFY ACCURATELY THE POSSIBLE CONSEQUENCES PRIOR TO PROCEED WITH THE COMMAND OF THE OUTPUT.
COMI CONDOR S.P.A. IS NOT RESPONSIBLE FOR ANY SORT OF DAMAGE ARISING FROM IMPROPER USE OF THE MAINTENANCE MODE BY THE CLIENT.

NOTE

THE GREEN COLOR IDENTIFIES THE ACTIVE DIGITAL OUTPUT.
MULTIPLE SELECTION CAN BE PERFORMED TO ACTIVATE MORE OUTPUTS. THE DIGITAL OUTPUTS REMAIN ACTIVE WHILE VISUALIZING THE PLC PAGES. IN EXAMPLE A VALVE CAN BE ACTIVATED AND THEN THE DIGITAL INPUT PAGE CAN BE SELECTED TO VERIFY THE FEEDBACK POSITION SENSOR STATUS.
WHEN THE PLC MAINTENANCE PAGE IS NO MORE VISUALIZED, ALL DIGITAL OUTPUTS ARE RESET AND THE CENTRIFUGE NORMAL CONTROL LOGIC IS ACTIVATED.

7.5.2.3 Analog inputs

The analog input page can be activated to verify the actual readings of the connected devices. Every input is defined by its logical address and description. The actual value is indicated in the correspondent unit.

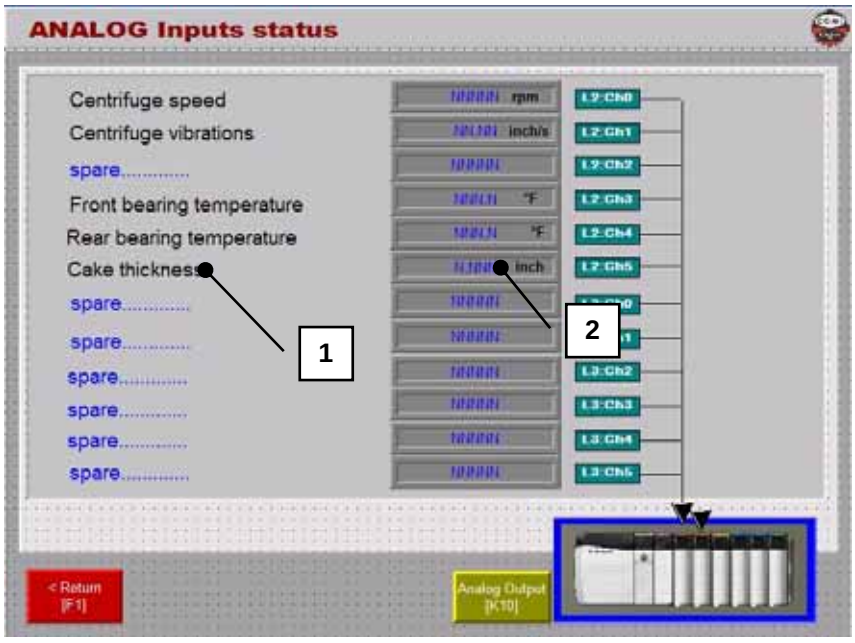


Fig.33 *Analogic inputs page*

Keys	Function
	1. Analog input description 2. Actual value of analog input It is possible to verify the variation of the analog variables of the centrifuge.
Analog Output [K10]	Proceed to the analogue output page
< Return [F1]	Push the Back button to return to the previous page

7.5.2.4 Analog outputs

The analogic output page can be activated to set the actual commands to the connected devices. Every output is defined by its logical address and tag number. The actual value can be set in the correspondent unit with the numeric keys and confirm with enter.

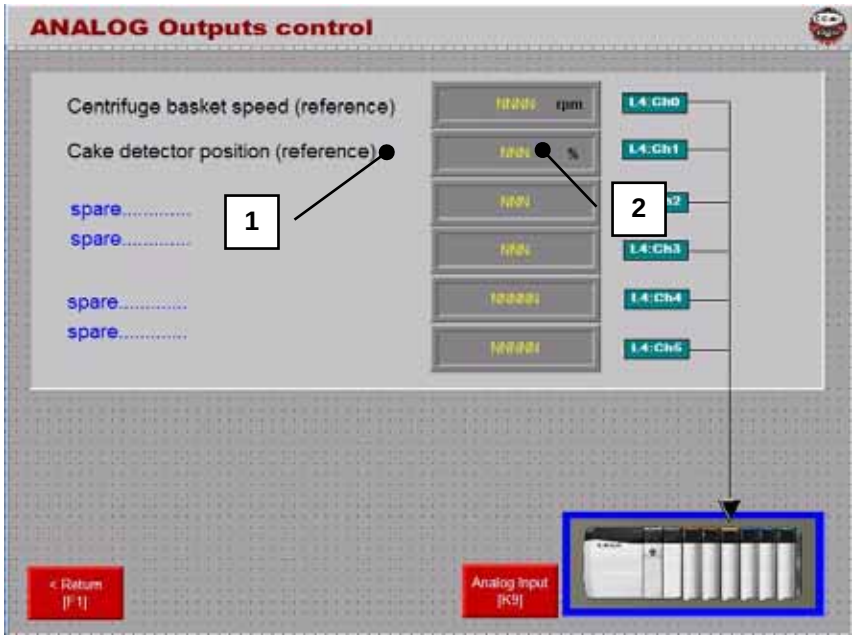


Fig.34 *Analog outputs page*

Keys	Function
	1. Analog output description 2. Actual setpoint of analog output It is possible to force the analog output variables of the centrifuge control.
Analog Input [K9]	Proceed to the analogue input page
< Return [F1]	Push the Back button to return to the previous page

DANGER !
IN MAINTENANCE MODE, IMPROPER USE MAY CAUSE DAMAGES TO THE CENTRIFUGE AND LEAD TO A SERIOUS FAULT CONDITION, PHYSICAL INJURY OR DEATH.
ONLY AUTHORIZED AND TRAINED PERSONNEL CAN OPERATE IN MAINTENANCE MODE.
VERIFY ACCURATELY THE POSSIBLE CONSEQUENCES PRIOR TO PROCEED WITH THE COMMAND OF THE OUTPUT.
COMI CONDOR S.P.A. IS NOT RESPONSIBLE FOR ANY SORT OF DAMAGE ARISING FROM IMPROPER USE OF THE MAINTENANCE MODE BY THE CLIENT.

7.5.3 HMI disable

In the administrator level page it is possible to stop the centrifuge Runtime program to access the PC operating system.

DANGER !
THE DISACTIVATION OF THE CENTRIFUGE RUNTIME PROGRAM DISABLES THE POSSIBILITY TO COMMAND THE CENTRIFUGE. THEREFORE IT IS STRICTLY FORBIDDEN TO STOP THE RUNTIME PROGRAM WITH ANY CENTRIFUGE PHASE ACTIVE OR WITH BASKET IN ROTATION.
IMPROPER USE MAY CAUSE DAMAGES TO THE CENTRIFUGE AND LEAD TO A SERIOUS FAULT CONDITION, PHYSICAL INJURY OR DEATH.
ONLY AUTHORIZED AND TRAINED PERSONNEL (ADMINISTRATOR) CAN DISABLE THE RUNTIME PROGRAM UNDER THEIR DIRECT RESPONSIBILITY.

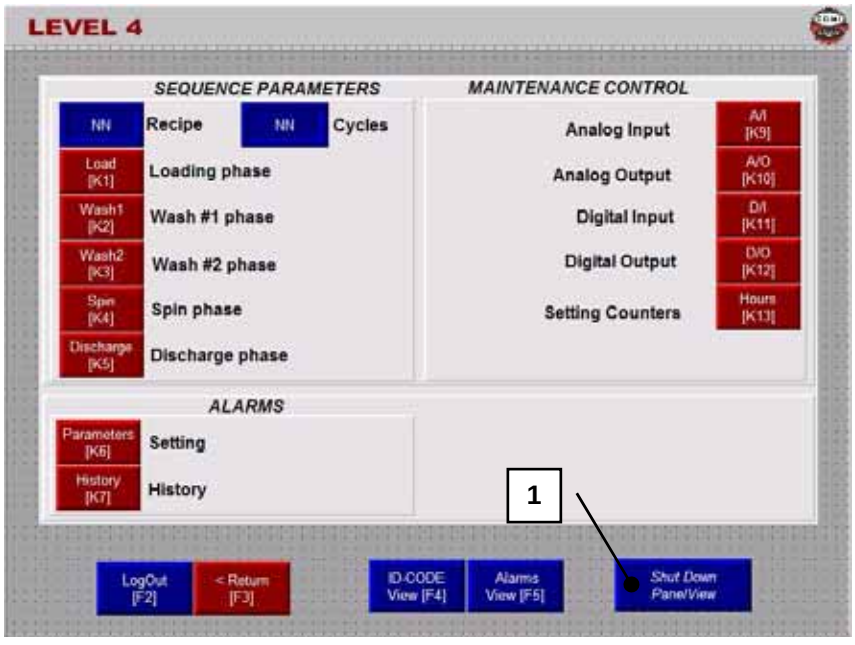


Fig.35 *Hmi disable*

Keys	Function
1. Runtime stop command	
Shut Down PanelView	Stops the runtime program
< Return [F1]	Push the Back button to return to the previous page

Use the stop button to end the runtime program and have access the PC operating system.

8. Alarm diagnostic

8.1 Diagnostics of the alarms with indication only (MESSAGE)

Centrifuge functionality	***Acknowledge***	***Reset***
• The active phase remains completely operative	• Push the Alarms View [F13] key to display the alarm page • Select desired alarm • Push the "Help" button Help [F5] to display the alarm diagnostic page • Select desired alarm using the "Up- Down" button Move Up [F1] Move Down [F2]	▪ Once the cause is eliminated, push the Reset Alarm [F3] function key on the local terminal to delete the alarm

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_001_01	*FRONT BEARING HIGH TEMPERATURE*	▪ Lubrication problem on front bearings ▪ Overheating caused by lack of lubrication	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check oil lubrication
ALM_002_01	*REAR BEARING HIGH TEMPERATURE*	▪ Lubrication problem on rear bearings ▪ Overheating caused by lack of lubrication	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check oil lubrication
ALM_003_01	*HIGH VIBRATIONS*	▪ Unbalanced basket due to unbalanced load ▪ Bad product draining	▪ Possible bearings damage	▪ Decrease slurry feeding flow or washing liquid
ALM_004_01	*BASKET SPEED SIGNAL FAULT*	▪ Speed control device, speed sensors, control system malfunction ▪ Failure of the barrier or of the transmitter connected to PLC analogue input module	▪ Basket in rotation with a reading value error ▪ Deceleration of the basket speed until zero rpm	▪ Check speed sensors positions and functionality ▪ Check control system
ALM_005_01	*Spare*		▪	
ALM_006_01	*VIBRATIONS SIGNAL FAULT*	▪ Vibration control system malfunction ▪ Analog input fault	▪ Possible damage of basket, shaft ▪ Centrifuge unbalancing ▪ Possible pipes disconnection	▪ Check vibration control system ▪ Verify analog input

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_007_01	*CAKE DETECTOR SIGNAL FAULT*	▪ Cake detector control system malfunction ▪ Analog input fault	▪ Possible damage of basket, shaft ▪ Centrifuge unbalancing ▪ Possible pipes disconnection	▪ Check cake detector control system ▪ Verify analog input
ALM_008_01	*CAKE DETECTOR BLOCKED OR NOT OPERATIVE*	▪ Air loose on pneumatic circuit ▪ Mechanical blockage ▪ Control system fault	▪ Low "slurry" feeding ▪ Loading / washing impossible ▪ Frame damage if opened	▪ Check the detector device functioning ▪ Check the position and the correct functioning of sensors or connection wiring ▪ Check the air pipes of the cylinder and the inlet air system
ALM_009_01	*INSUFFICIENT LOAD*	▪ Incorrect loading valve opening ▪ Loading time set is too short ▪ Loading valve sensors out of position	▪ Low "slurry" feeding	▪ Increase slurry flow ▪ Increase loading time ▪ Check loading line (valves, reactor) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_010_01	*LOW NITROGEN PRESSURE TO THE BEARING SEAL*	▪ Imperfect lip seal sealing on the shaft ▪ Nitrogen feeding line lip seal damage ▪ Possible lip seal damage ▪ Nitrogen leakage	▪ Possible product contamination ▪ Lip seal damage	▪ Increase the nitrogen flow to the lip seal ▪ Check the lip seal damaging ▪ Check the feeding line
ALM_011_01	*LOAD VALVE CLOSED*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Insufficient loading ▪	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_012_01	*LOAD VALVE OPEN*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Centrifuge overfilling	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_013_01	*WASHING VALVE CLOSE*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Insufficient washing	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_014_01	*WASHING VALVE OPEN*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Centrifuge overfilling	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_015_01	*NITROGEN HEEL CAKE REMOVAL VALVE 1 CLOSE*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Impossible to remove product from filter cloth	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_016_01	*NITROGEN HEEL CAKE REMOVAL VALVE 1 OPEN*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Centrifuge overpressure	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_017_01	*NITROGEN HEEL CAKE REMOVAL VALVE 2 CLOSE*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Impossible to remove product from filter cloth	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_018_01	*NITROGEN HEEL CAKE REMOVAL VALVE 2 OPEN*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Centrifuge overpressure	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_019_01	*LIP SEAL CLEANING VALVE CLOSE*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Insufficient cleaning	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_020_01	*LIP SEAL CLEANING VALVE OPEN*	▪ Valve malfunctioning ▪ Proximity switch not operating or out of position	▪ Centrifuge overfilling ▪ Product contamination	▪ Replace the proximity switch position ▪ Check the valve functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_021_01	*ATTENTION CENTRIFUGE BEARINGS WORKING HOURS REACHED*	▪ Counter hours setpoint reached	▪ Bearing overheating ▪ Bearing damage	▪ Check or replace the bearings ▪ Verify the alarm setpoint
ALM_022_01	*ATTENTION LIP SEAL WORKING HOURS REACHED*	▪ Counter hours setpoint reached	▪ Possible product contamination	▪ Check or replace the lip seal ▪ Verify the alarm setpoint
ALM_023_01	*ATTENTION MOTOR BEARINGS WORKING HOURS REACHED*	▪ Counter hours setpoint reached	▪ Bearing overheating ▪ Bearing damage	▪ Check or replace the bearings ▪ Verify the alarm setpoint

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_024_01	*ATTENTION VIBRATION TRANSMITTERS CALIBRATION REQUIRED*	▪ Counter hours setpoint reached	▪ Incorrect vibration reading ▪ Incorrect inertisation	▪ Calibrate transmitter ▪ Verify the alarm setpoint
ALM_025_01	*ATTENTION BELTS WORKING HOURS REACHED*	▪ Counter hours setpoint reached	▪ Centrifuge vibrations ▪ belts damage	▪ Check or replace the belts ▪ Verify the alarm setpoint
ALM_026_01	*PLC - DCS COMMUNICATION BROKEN*	▪ Communication watchdog time elapsed	▪ Impossible to perform sterilization	▪ Verify communication
ALM_027_01	*Spare*	▪	▪	▪
ALM_028_01	*Spare*	▪	▪	▪
ALM_029_01	*Spare*	▪	▪	
ALM_030_01	*Spare*	▪	▪	▪
ALM_031_01	*Spare*	▪	▪	▪
ALM_032_01	*Spare*	▪	▪	▪

8.2 Diagnostics of the alarms with partial block (WARNING)

Centrifuge functionality	*Acknowledge*	*Reset*
▪ The active phase both in semi-automatic or automatic mode, is disabled. All process valves return to rest position: centrifuge is in "safety" conditions. ▪ Basket speed is reduced to safety speed if higher; remains the same value if lower.	• Push the Alarms View [F12] key to display the alarm page • Select desired alarm • Push the "Help" button Help [F5] to display the alarm diagnostic page • Select desired alarm using the "Up- Down" button Move Up [F1] Move Down [F2]	▪ The alarm reset is executed only when centrifuge has reached the safety speed. ▪ Once the cause is eliminated, push the Reset Alarm [F3] function key on the local terminal to delete the alarm

Identification	*Description*	*Cause*	*Effect*	*Remedy*
ALM_001_02	*VERY HIGH VIBRATIONS*	▪ Vibration control system malfunction ▪ Basket unbalancing due to uneven load ▪ Low drainage of the cake ▪ Visco dampers failure	▪ Possible damage of basket, shaft ▪ Centrifuge unbalancing ▪ Possible pipes disconnection ▪ Stopping of all sequences and block of the automatic cycle start-up ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging, etc. valves	▪ Check vibration control system ▪ Reduce slurry feeding capacity or washing liquid ▪ Verify visco dampers
ALM_002_02	*CENTRIFUGE UNBALANCE*	▪ Unbalance switch malfunction ▪ Basket unbalancing due to uneven load ▪ Low drainage of the cake ▪ Visco dampers failure	▪ Possible damage of basket, shaft ▪ Centrifuge unbalancing ▪ Possible pipes disconnection ▪ Stopping of all sequences and block of the automatic cycle start-up ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging, etc. valves	▪ Check unbalance switch ▪ Reduce slurry feeding capacity or washing liquid ▪ Verify visco dampers
ALM_003_02	*TOO LOW DISCHARGE SPEED*	▪ Product is too hard ▪ Too high knife movement speed ▪ Frequency converter fault	▪ Possible knife damage ▪ knife movement stop ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging, etc. valves	▪ Decrease the knife speed movement ▪ Verify parameters, frequency converter

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_004_02	*KNIFE OUT OF POSITION*	▪ Position sensors broken or knife incorrect position ▪ Hydraulic unit fault ▪ Knife movement valve fault	▪ Possible knife damage due to incorrect action from the operator during centrifuge opening ▪ Stopping of all sequences and block of the automatic cycle start-up, frame opening disabled ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging, etc. valves	▪ Check the position and the correct functioning of sensors or connection wiring ▪ Check the hydraulic unit
ALM_005_02	*KNIFE TOO LONG COMMAND – SENSOR BROKEN*	▪ Position sensors broken or knife incorrect position ▪ Hydraulic unit fault ▪ Knife movement valve fault ▪ Too short timeout for knife movement	▪ Knife stopped ▪ Stopping of all sequences and block of the automatic cycle start-up, frame opening disabled ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging, etc. valves	▪ Check the position and the correct functioning of sensors or connection wiring ▪ Check the hydraulic unit ▪ Increase timeout for knife movement
ALM_006_02	*OVERLOAD LUBRICATION OIL PUMP MOTOR*	▪ Hydraulic unit failure ▪ Motor damaged ▪ Failure of a phase	▪ Bearing temperature increase ▪ Bearing damage ▪ Load, wash, cleaning valves closing	▪ Check oil hydraulic unit ▪ Replace the motor ▪ Check the motor thermal switch
ALM_007_02	*LOW OIL FLOW TO FRONT BEARING*	▪ Low oil level ▪ Hydraulic unit failure ▪ Failure of flow switch sensor ▪ Failure of barrier ▪ Pipe blockage	▪ Bearing temperature increase ▪ Bearing damage ▪ Load, wash, cleaning valves closing	▪ Check oil level and hydraulic unit ▪ Replace the flow switch ▪ Check the oil pipe functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_008_02	*LOW OIL FLOW TO REAR BEARING*	▪ Low oil level ▪ Hydraulic unit failure ▪ Failure of flow switch sensor ▪ Failure of barrier ▪ Pipe blockage	▪ Bearing temperature increase ▪ Bearing damage ▪ Load, wash, cleaning valves closing	▪ Check oil level and hydraulic unit ▪ Replace the flow switch ▪ Check the oil pipe functioning (obstruction) ▪ Check the position and the correct functioning of sensors or connection wiring
ALM_009_02	*LOW NITROGEN PRESSURE TO THE BEARING SEAL*	▪ Imperfect lip seal sealing on the shaft ▪ Nitrogen feeding line lip seal damage ▪ Possible lip seal damage ▪ Nitrogen leakage	▪ Possible product contamination ▪ Stopping of all sequences ▪ Deceleration of the basket speed to safety speed ▪ Closing of the loading, washing, discharging valves	▪ Increase the nitrogen flow to the lip seal ▪ Check the lip seal damaging ▪ Check the feeding line

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_010_02	*POWER FAILURE*	▪ No power supply to the centrifuge ▪ Power failure of mains electrical line	▪ Centrifuge stop if continues ▪ Possible product loss o r contamination ▪ Stopping of all sequences and block of the automatic cycle start-up ▪ Deceleration of the basket speed to safety speed (if higher than 100 rpm); otherwise the centrifuge is stopped ▪ Closing of the loading, washing, discharging valves	▪ Check the power supply
ALM_011_02	*OVERLOAD ARCHIMEDEAN SCREW MOTOR*	▪ Screw failure ▪ Motor damaged ▪ Failure of a phase	▪ Impossibe to discharge ▪ Screw damage ▪ Load, wash, cleaning valves closing	▪ Check archimedean screw ▪ Replace the motor ▪ Check the motor thermal switch
ALM_012_02	*ARCHIMEDEAN SCREW MAINTENANCE SWITCH OPEN*	▪ Maintenance switch open	▪ Stopping of the screw ▪ Impossible to discharge ▪ Stopping of all sequences ▪ Deceleration of the basket speed to the safety speed ▪ Closing of the loading, washing valves	▪ Check the maintenance switch ▪ Verify connection wiring
ALM_013_02	*HYDRAULIC UNIT MAINTENANCE SWITCH OPEN*	▪ Maintenance switch open	▪ Stopping of the hydraulic unit ▪ Insufficient bearing lubrication ▪ Impossible to discharge ▪ Stopping of all sequences ▪ Deceleration of the basket speed to the safety speed ▪ Closing of the loading, washing valves	▪ Check the maintenance switch ▪ Verify connection wiring
ALM_014_02		▪	▪	
ALM_015_02		▪	▪	▪
ALM_016_02		▪	▪	▪

8.3 Diagnostics of the alarms with total block (SHUTDOWN)

Centrifuge functionality	***Acknowledge***	***Reset***
▪ The active phase both in semi-automatic or automatic mode, is disabled. All process valves return to rest position: centrifuge is in "safety" conditions. ▪ Basket speed goes to zero rpm	• Push the Alarms View [F11] key to display the alarm page • Select desired alarm • Push the "Help" button Help [F5] to display the alarm diagnostic page • Select desired alarm using the "Up- Down" button Move Up [F1] Move Down [F2]	▪ The alarm reset is executed only when centrifuge has reached zero speed. ▪ Once the cause is eliminated, push the Reset Alarm [F3] function key on the local terminal to delete the alarm

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_001_03	*BASKET ROTATION MOTOR FREQUENCY CONVERTER FAULT*	▪ Failure or intervention of one of the frequency converter protection	▪ Stopping of the knife movement ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the alarms of the frequency converter
ALM_002_03	*FRONT BEARING VERY HIGH TEMPERATURE*	▪ Lubrication problem on front bearings ▪ Overheating caused by lack of lubrication	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check oil lubrication
ALM_003_03	*REAR BEARING VERY HIGH TEMPERATURE*	▪ Lubrication problem on front bearings ▪ Overheating caused by lack of lubrication	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check oil lubrication
ALM_004_03	*FRONT BEARING TEMPERATURE SIGNAL FAULT*	▪ Failure of the barrier or of the transmitter connected to PLC analogue input module ▪ Temperature transmitter fault	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check temperature transmitter, connection and barrier
ALM_005_03	*REAR BEARING TEMPERATURE SIGNAL FAULT*	▪ Failure of the barrier or of the transmitter connected to PLC analogue input module ▪ Temperature transmitter fault	▪ Possible bearings damage ▪ Temperature increase within centrifuge operation area	▪ Check temperature transmitter, connection and barrier
ALM_006_03	*LOW NITROGEN PRESSURE TO THE BEARING SEAL*	▪ Imperfect lip seal sealing on the shaft ▪ Nitrogen feeding line lip seal damage ▪ Possible lip seal damage ▪ Nitrogen leakage	▪ Possible product contamination ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Increase the nitrogen flow to the lip seal ▪ Check the lip seal damaging ▪ Check the feeding line

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_007_03	*VENTILATOR MOTOR THERMAL PROTECTION*	▪ Failure or intervention of the ventilator motor protection	▪ Stopping of the ventilator motor ▪ Main motor overheating ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing valves	▪ Check the thermal protection ▪ Verify motor consumption
ALM_008_03	*VENTILATOR MOTOR MAINTENANCE SWITCH OPEN*	▪ Maintenance switch open	▪ Stopping of the ventilator motor ▪ Increasing temperature of basket motor ▪ Stopping of all sequences and automatic cycle ▪ Deceleration of the basket speed to zero speed ▪ Closing of the loading, washing valves	▪ Check the maintenance switch ▪ Verify connection wiring
ALM_009_03	*REGENERATIVE UNIT FAULT*	▪ Failure of regenerative unit	▪ Impossible to decelerate ▪ Impossible to regenerate current into the line ▪ Stopping of all sequences and automatic cycle ▪ Deceleration of the basket speed to zero speed ▪ Closing of the loading, washing valves	▪ Check the regenerative unit ▪ Verify connection wiring
ALM_010_03	*REGENERATIVE UNIT THERMAL PROTECTION*	▪ Failure or intervention of the regenerative unit protection	▪ Impossible to decelerate ▪ Impossible to regenerate current into the line ▪ Stopping of all sequences and automatic cycle ▪ Deceleration of the basket speed to zero speed ▪ Closing of the loading, washing valves	▪ Check the thermal protection ▪ Check the regenerative unit ▪ Verify main motor consumption ▪ Verify connection wiring
ALM_011_03	*BASKET MOTOR MAINTENANCE SWITCH OPEN*	▪ Maintenance switch open	▪ Stopping of the basket motor ▪ Stopping of all sequences and automatic cycle ▪ Deceleration of the basket speed to zero speed ▪ Closing of the loading, washing valves	▪ Check the maintenance switch ▪ Verify connection wiring

8.4 Diagnostics of the alarms with Safety interlock (SAFETY INTERLOCK)

Centrifuge functionality	***Acknowledge***	***Reset***
▪ The safety interlock conditions do not allow centrifuge start and process phases. ▪ In case they intervene with basket in motion, the following will occur: the basket speed goes to zero rpm	• Push the Alarms View [F11] key to display the alarm page • Select desired alarm • Push the "Help" button Help [F5] to display the alarm diagnostic page • Select desired alarm using the "Up- Down" button Move Up [F1] Move Down [F2]	▪ The alarm reset is executed only when centrifuge has reached zero speed. ▪ Once the cause is eliminated, push the Reset Alarm [F3] function key on the local terminal to delete the alarm

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_001_04	*FRAME OPEN*	▪ Sensors out of position / fault	▪ Frame open ▪ Stopping of all sequences ▪ Disconnection of the power supply to the basket rotation frequency converter ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Position sensors ▪ Close frame
ALM_002_04	*BASKET ROTATION MOTOR HIGH TEMPERATURE*	▪ Main motor overheating ▪ Overcurrent to the motor ▪ Motor malfunctioning ▪ Thermal shot on the motor relay.	▪ Main motor damage ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the main motor ▪ Check the basket rotating motor
ALM_003_04	*OVERCOMING OF THE BASKET MAXIMUM SPEED*	▪ Speed reading device, speed sensors, speed control system malfunction	▪ Possible damage of basket, shaft ▪ Stopping of all sequences ▪ Disconnection of the power supply to the basket rotation frequency converter ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the frequency converter ▪ Check the speed control system; position and functioning of speed sensors
ALM_004_04	*ZERO BASKET SPEED SURVEYING NOT ACTIVE OR FAULT*	▪ Zero rpm speed surveying device damaged or not correctly calibrated	▪ Basket in rotation ▪ Disconnection of the power supply to the locking ring opening device ▪ Stopping of all sequences	▪ Check sensors and speed control system

Identification	***Description***	***Cause***	***Effect***	***Remedy***
ALM_005_04	*EMERGENCY STOP*	▪ Emergency pushbutton activated	▪ Centrifuge blockage ▪ Stopping of all sequences ▪ Disconnection of the power supply to the basket rotation frequency converter ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Release the emergency pushbutton after checking the cause of the intervention
ALM_006_04	*BASKET ROTATION MOTOR CONTACTORS FAULT*	▪ Failure of the contactors feedback ▪ Failure of safety system output ▪ Rupture of contactor	▪ Stopping of the drum movement ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the contactors of the frequency converter
ALM_007_04	*HYDRAULIC UNIT MOTOR CONTACTORS FAULT*	▪ Failure of the contactors feedback ▪ Failure of safety system output ▪ Rupture of contactor	▪ Possible overheating of bearings ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the contactors
ALM_008_04	*ARCHIMEDEAN SCREW MOTOR CONTACTORS FAILURE*	▪ Failure of the contactors feedback ▪ Failure of safety system output ▪ Rupture of contactor	▪ Impossible to discharge ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing, discharging valves	▪ Check the contactors
ALM_009_04	*VENTILATOR MOTOR CONTACTORS FAILURE*	▪ Failure of the contactors feedback ▪ Failure of safety system output ▪ Rupture of contactor	▪ Stopping of the ventilator motor ▪ Main motor overheating ▪ Stopping of the rotation motor ▪ Stopping of all sequences ▪ Deceleration of the basket speed to zero rpm ▪ Closing of the loading, washing valves	▪ Check the contactors
ALM_010_04			▪	
ALM_011_04			▪	