

PME 100

Machine Envelope Indicator Machine Envelope Controller

Operators Manual



Your safety, your profit, our commitment

This guide describes operation of the

PROLEC PME ENVELOPE SAFETY SYSTEM FOR CONSTRUCTION PLANT

Model covered :	PART No.	MODEL Ref
	PME100	PME100 - MEI SYSTEM
	PME100H//E/C	PME100 - MEC SYSTEM

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THIS ENVELOPE SAFETY SYSTEM IS NOT SUITABLE FOR USE IN EXPLOSIVE ATMOSPHERES. ADJUSTMENT BY UNAUTHORISED PERSONS WILL INVALIDATE ANY WARRANTY OR CERTIFICATION SUPPLIED. IF A PROBLEM ARISES WHICH CANNOT BE RECTIFIED USING THIS GUIDE, AUTHORISED SERVICE SHOULD BE SOUGHT.

Any alterations or modifications to machine components which affect this system and any system component failure must be reported to Prolec Ltd or via the machine convertor/service agreement holder. This manual must be kept with the product and be passed on to any subsequent user of the product.

Whilst every effort has been made to ensure the accuracy of the information supplied in this manual, Prolec Ltd cannot be held responsible for any errors or omissions.

Manufacturers original instructions.

Table of contents

1	Use of this Document	8
2	Notices	8
3	System Identification	9
4	Operating and Limit Situation Recommendations	10
5	Operating Instructions	11
5.1	Power Up	11
5.2	Using the Display	12
5.3	Editing Values using Arrow Buttons	13
5.4	Selecting from a list using Arrow Buttons	13
5.5	User Login	14
5.6	Current User	15
5.7	User Logout	15

Table of contents (continued)

6	Top Menu	16
7	Tool Selection	17
8	Envelope Monitoring	18
8.1	Height Limit	19
8.1.1	Height Limits Menu	19
8.1.2	Height Limit Setting - Known Height	20
8.1.3	Height Limit Setting - Using Current Highest Point	21
8.1.4	Machine Envelope Indicator (MEI) - Height	22
8.1.5	Machine Envelope Controller (MEC) - Height	23
9	Warning Messages	24
9.1	On Screen Messages	24
9.2	LED and Internal Alarm Warnings	25
10	Daily checks	26

Table of contents (continued)

11	Test / Diagnostics	27
11.1	Relay Function Test	28
11.2	Beacon, LED Alarm Function Test	28
12	Display Settings	29
12.1	Day / Night Mode	29
12.2	Select Display Machine	30
12.3	Select Language	30
13	System Information	31
14	Error Messages	31
15	Taking Product out of Operation	31

Table of contents - continued

16	Service and Repair	32
	16.1 Maintenance Review	32
	16.3 Radius / Height	33
17	User Login	33
	17.1 User Login Setup	33
	17.2 Add New User to Login	34
	17.3 Edit User Details	35
	17.4 Select User to Delete	36
	17.5 Edit User Access Code	36
	17.6 Enable / Disable Users	37
18	Repair	38
19	Definitions / Glossary	39

1 Use of this Document

This user guide is intended for persons familiar with the use of construction plant undertaking lifting operations.



WARNING denotes information about particular risks which may be generated by certain applications, by using certain fittings, and about additional protective measures which are necessary for such applications.

Caution, care, risk situation



HAZARD Actions that can lead to serious injury or death

2 Notices



Adjustment by unauthorised persons will invalidate any warranty or certification supplied. If an error condition is displayed which cannot be rectified using this guide, halt any operation, seek authorised service immediately and do not continue operation until the fault has been remedied.

3 System Identification



The PME system provides an envelope safety function

This safety function is achieved through real time monitoring of the machine's moving parts (booms, other articulations, turret etc) and its environment (ground pitch and inclination) and actively determining the safety of the current operation where appropriate limits have been set.

The Machine Envelope function also is divided into two sub classes



- Machine envelope indicators (MEI) warn of movements that would bring parts of the machine into hazardous areas, most notably height restrictions when working under overhead wires. Any motion which exceeds the set limit will not be inhibited at any time.



- Machine envelope controllers (MEC) prevent movements that would bring parts of the machine into hazardous areas, most notably height restrictions when working under overhead wires.

•



During operation the indicators shown here on the left are displayed on the screen to clearly identify the function supported by your PME 100. Functions may not be available i.e. when envelope monitoring is switched off, if this is the case a cross will be painted over the relevant function icon.

4 Operating and Hazard Situation Recommendations



Operating Recommendations

When using envelope monitoring:

- When setting a height limit, make sure any implement attached is in its least favourable position
- Check for correct operation once the limit or limits have been set
- Reduce operating speed
- Do not raise the equipment quickly when close to a limit
- Do not operate the machine in a reckless manner
- Do not travel over rough terrain when at or near a limit

Hazard Situation Recommendations

In a limit hazard state:

Return the control levers to neutral once a limit has been reached if appropriate

Operate the machine at a slow speed

4.1 MEC Override



The system can optionally be fitted with a key operated master override switch. Turning the switch to the override position will allow normal operation of any of the hydraulic services regardless of safety status. When the unit is in override the external alarms will stay active, and the beacon (if fitted) will indicate that the machine is overridden, the red LED will flash and an 'In Override' message will appear on the display.

The override key switch should only be used if the safety system is not operational due to a fault and the machine needs to be moved due to its location presenting a hazard.

The override status shall be recorded in the system data log. To access the override key switch, the seal must be broken.

5 Operating Instructions

5.1 Power Up

The PME system automatically powers up when the machines ignition is switched on. The in-cab unit incorporates a 4.3" high resolution LCD display and is controlled with three buttons at each side. Three status LEDs and an internal alarm provide further information.

The system will perform a self check at start up:

1. All LEDs will flash, the internal display alarm and the external alarm will sound.
2. The RED LED will light indicating the system is starting and performing a self test.
3. Once the self test is complete, the GREEN LED will light and the system will become active. A safety warning message is displayed, pressing any button activates Lifting Mode. Any previous limits set will be enabled. The system is now ready for use.
4. The system can be configured to require a user login - if this is enabled, see section 5.5.



If the RED LED remains lit, a fault has been detected, halt any operation, seek authorised service immediately and do not continue operation until the fault has been remedied.

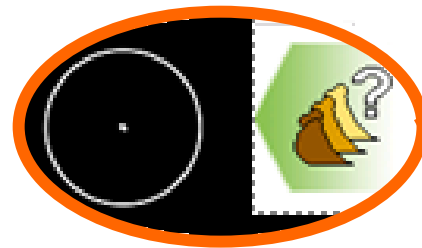


The display is secured to the machine using a flexible ball mounting allowing easy adjustment for personal viewing preference.

5.2 Using the Display

The display is operated by using the buttons adjacent to a function icon. The buttons can open a sub menu, turn a function ON or OFF, set a value, toggle through multiple screens, no one button has a single function. The button icon will turn black/purple when the button has been activated. Note that the image of the machine is fixed and does not follow the movement of the machine.

Multifunction buttons:
The action of the button is indicated by the adjacent icon.



A secondary symbol can appear in the top left corner of an icon, these mean :



The plus symbol indicates a sub menu will be opened if selected.

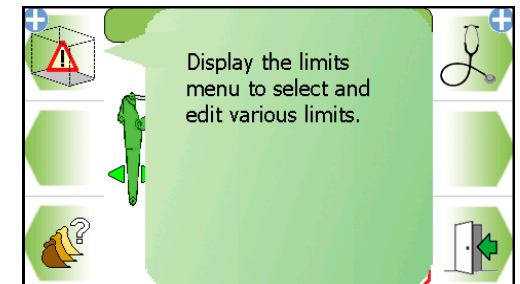


The cycle symbol indicates that multiple features are available.



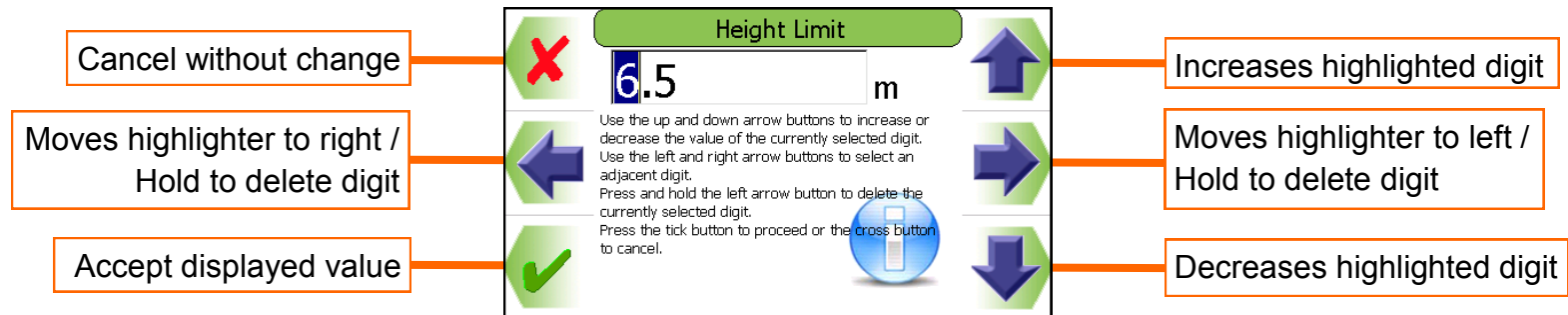
The on / off symbols indicate if a feature is ON or OFF. Red is ON and grey is OFF.

Help is available for each button. To access the help, push and hold the button for three seconds. The help screen can be cleared by pressing any of the six buttons. PME is still active when displaying help messages, if the Lifting Mode is active and or a height limit is set any alarm or warning condition will be indicated.



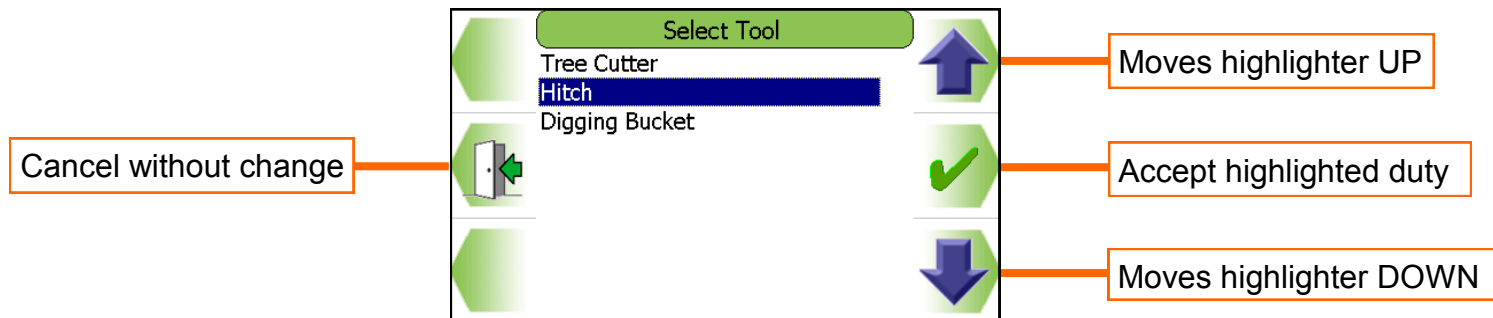
5.3 Editing Values using the Arrow Buttons

Editing values such as login codes or a height limit is easily achieved using the number editor screen. The digit highlighted in blue is increased or decreased between 0 and 9 by pressing the UP and DOWN buttons - use the LEFT and RIGHT buttons to move the highlighter to the left and to the right. Press the tick button to apply the value displayed.



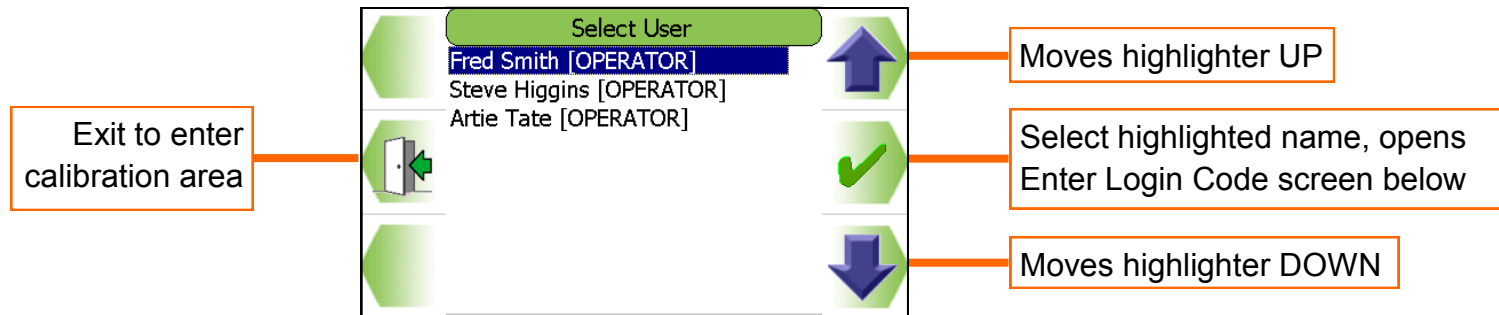
5.4 Selecting from a list using the Arrow Buttons

To make a selection from a list such as Users or tools, use the UP and DOWN buttons to move the highlighter up and down. Press the TICK button to select the highlighted entry. Press the CROSS button to exit without making a change.

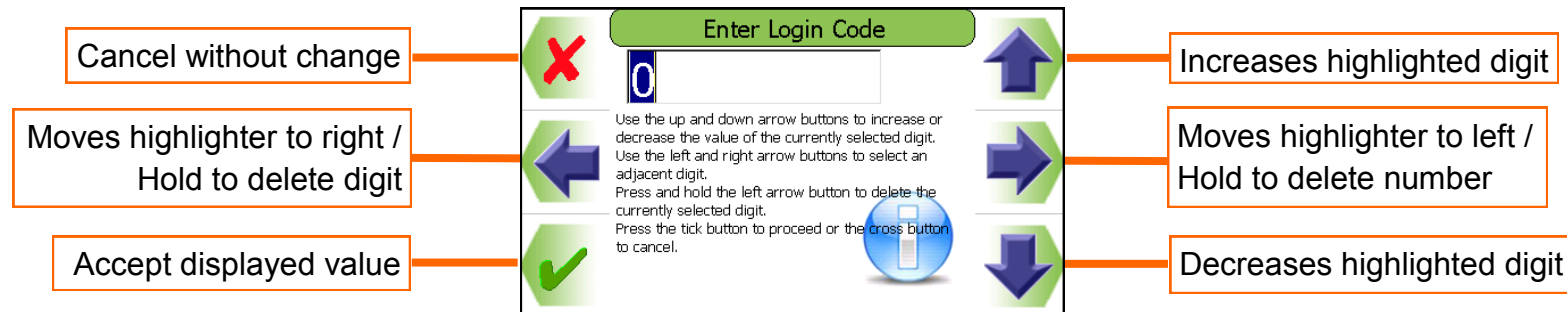


5.5 User Login

If PME has been configured to work with the built-in user list, the system will prompt for a user login pass code. Select the user name required and the login code screen will appear.



Using the arrow buttons to enter a valid pass code. The previous number will be replaced with a star as the code is entered. Press the TICK button to confirm the login pass code. If a valid pass code is entered the system will commence normal operation.

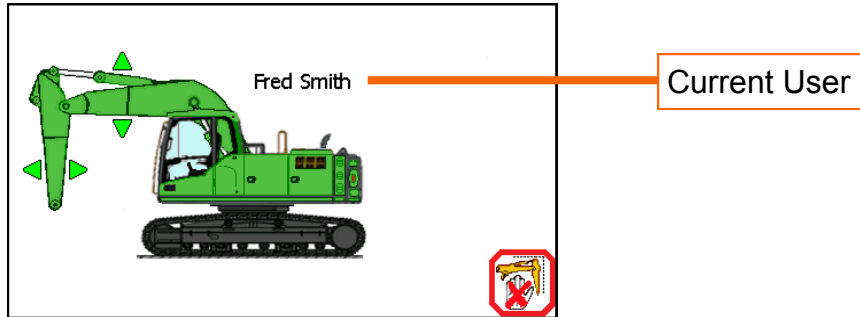


If an incorrect login code is entered, a failure screen will be displayed. Press the TICK button to return to the Select User screen.



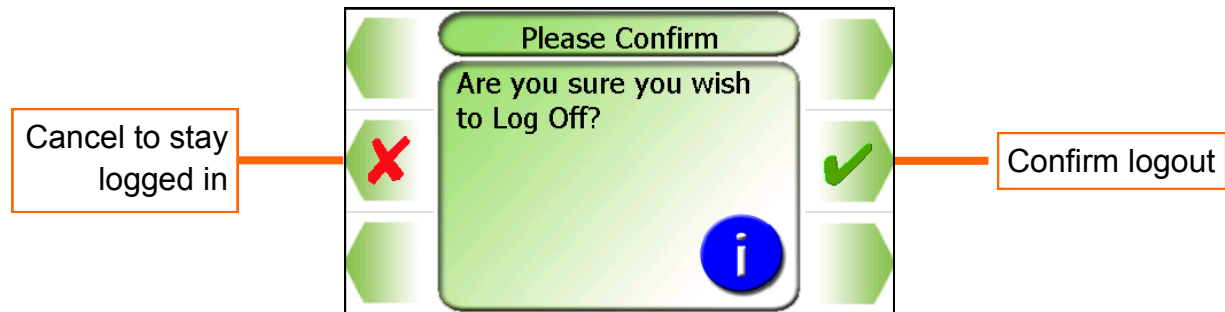
5.6 Current User

Once logged in, the current user details can be found on the main screen.



5.7 User Logout

If a user is logged in as the current user, they can select the logout screen by holding an exit key down for three seconds.



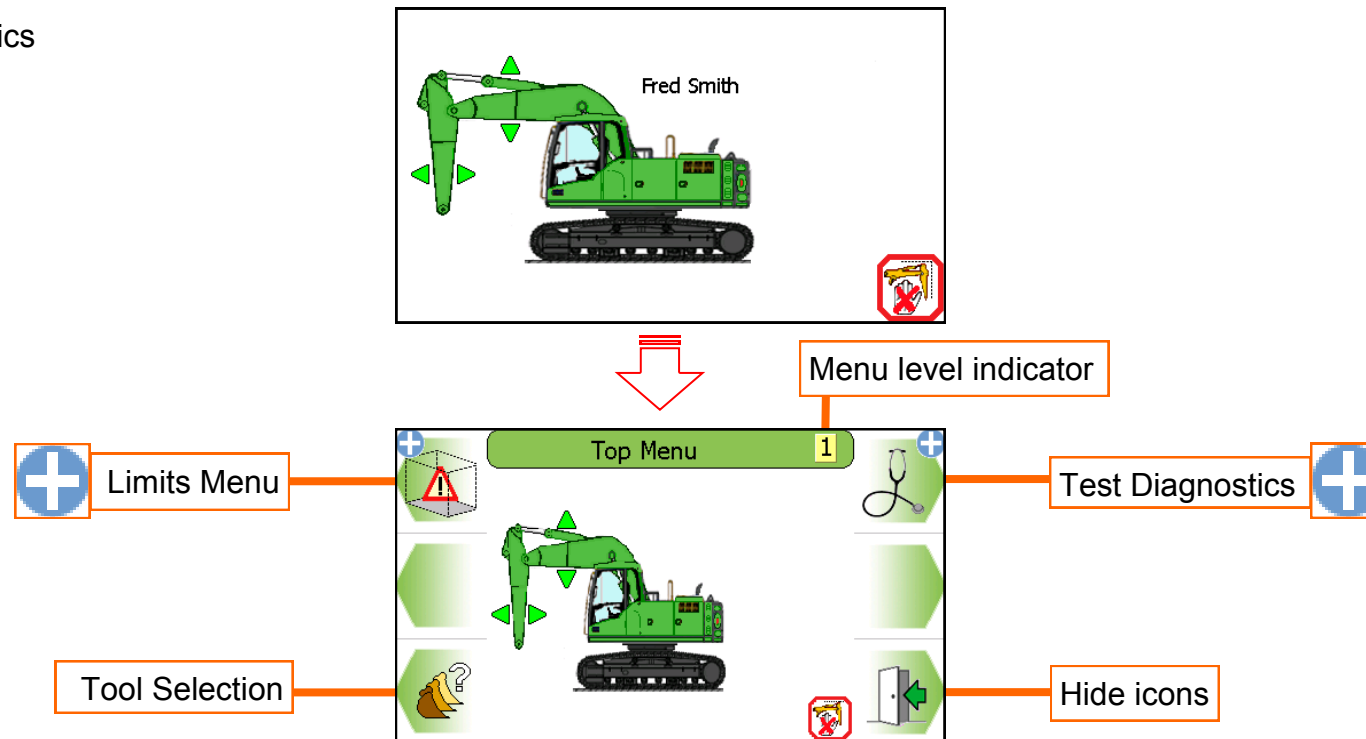
Once logout has been confirmed the login screen will be automatically displayed.
Press the CROSS button to stay logged in, the screen will return to that previously shown.

6 Top Menu

The Top Menu screen allows access to all the system functions. To reveal the icons, if hidden, press any button. To return to the Top Menu from a sub menu press the EXIT button until the Top Menu is displayed. To hide the icons when at the Top Menu, press the EXIT button once more.

Top Menu button functions:

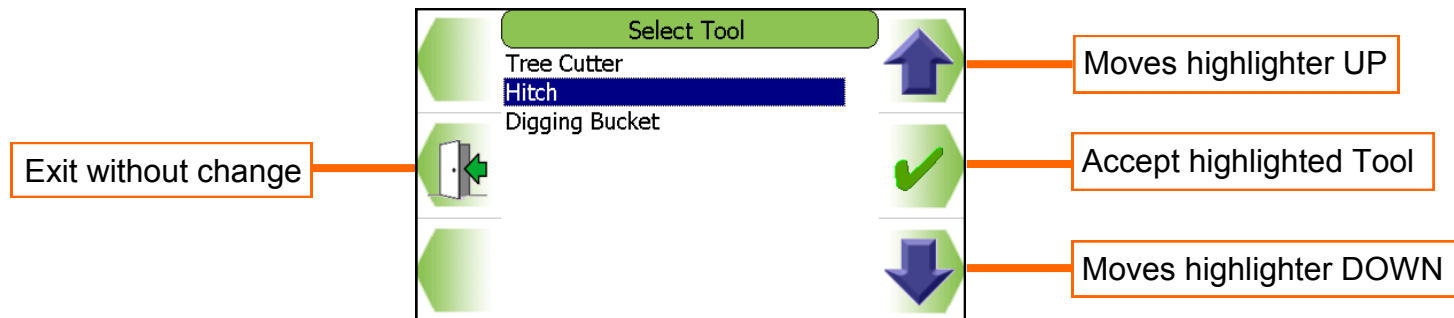
- Limits menu
- Tool Selection
- Test / Diagnostics
- Hide icons



7 Tool Selection



The system can be calibrated with or without tools. If a tool or tools have been calibrated, they will be manually selected via the select tool screen shown below. Use the arrow buttons to select the required tool and confirm using the TICK button. Example tools are shown in the listing.



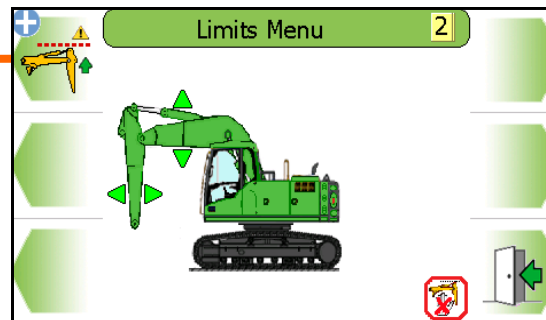
If no tool or tools have been calibrated this screen will not be accessible.

8 Envelope Monitoring



PME can be configured to monitor for Machine Envelope Indication (MEI) or Machine Envelope Control (MEC). MEI will give a warning only, MEC will warn and prevent equipment motion. MEC is achieved by interacting with the machines hydraulics, this allows motion to be cut to any section of equipment that has reached a limit but allow other sections to operate unhindered unless they too reach the set limit. PME can monitor the highest, furthest, nearest and or lowest part of the machine but is unaware of any implement fitted. When setting a limit, make sure any implement attached is in its least favourable position.

Height Limiting



Exit to previous screen

MEC



MEI



OFF: when operating with an inactive limit the indicator will have a cross painted on it.



ON: when operating with an active limit the indicator will not have a painted on cross on it.

Care should be taken to test that the limit is set correctly:

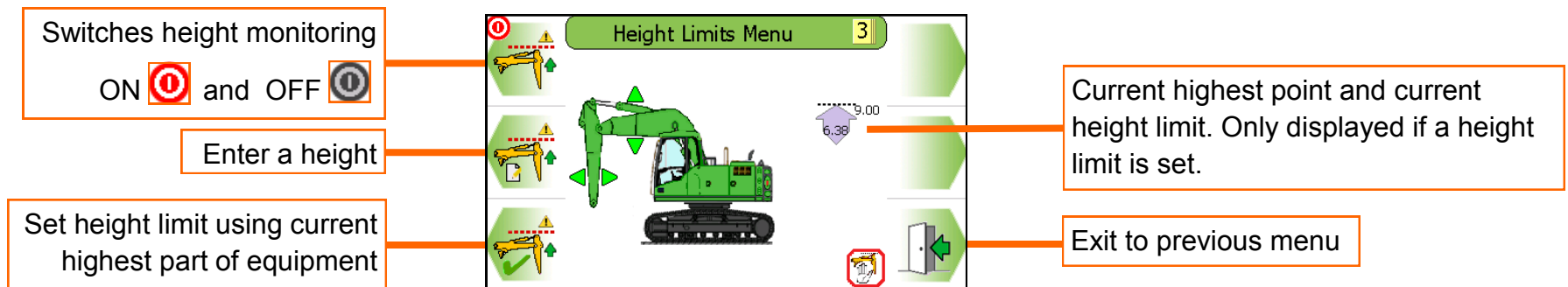
- Check that the limit is set to the required height
- Reduce operating speed
- PME will warn when approaching the set limit, the display alarm will beep and a message 'Approaching max height' will be displayed
- If the limit is reached, the display alarm will sound with a continuous tone and a message 'Max height exceeded' will be displayed

8.1 Height Limit

8.1.1 Height Limits Menu



A height limit can be set by entering a known height on the keypad or by manually moving the machine to the desired limit.



Using the Height Limits Menu, the height limit can be switched ON and OFF, a height limit can be set to a known value, or the height limit can be set to the current highest point.

See sections 8.1.2 to enter a known height and section 8.1.3 for setting the limit by moving the machine.



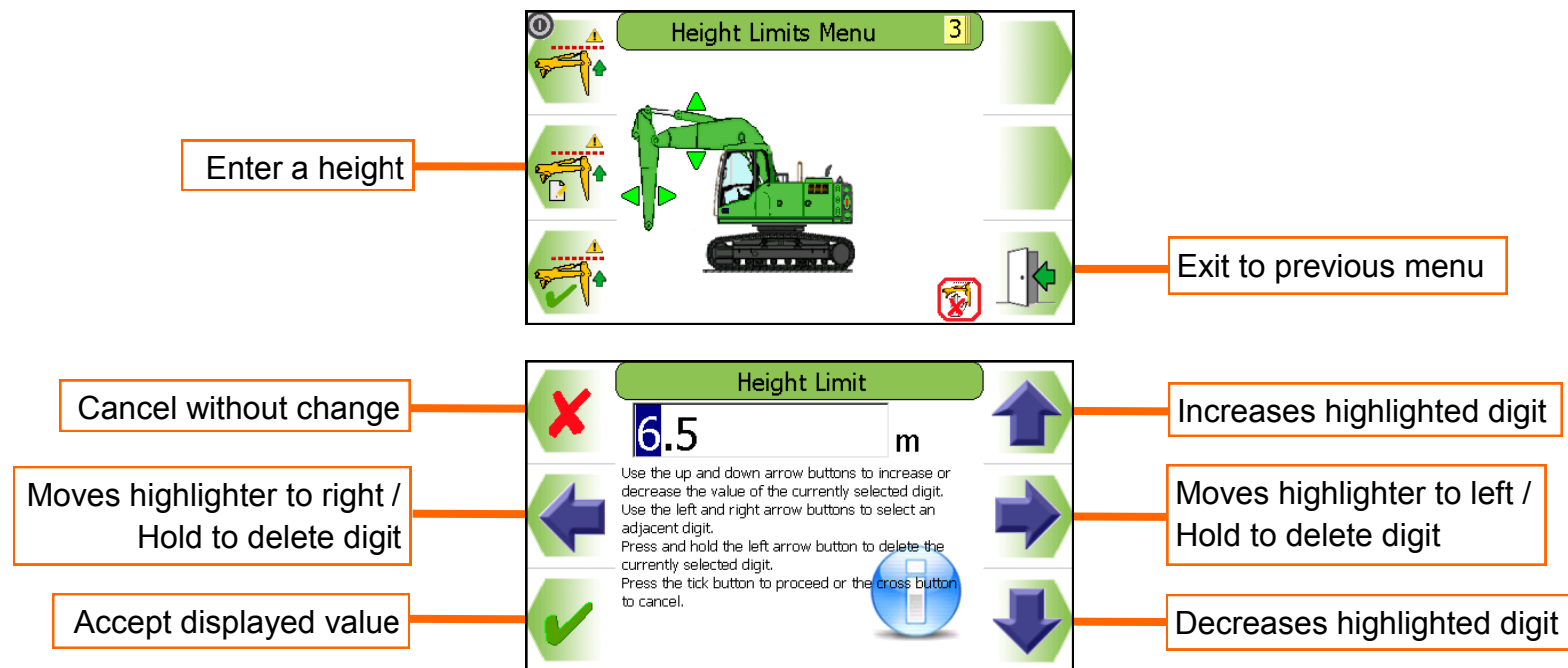
Once a height limit is set, the internal alarm will sound and the RED LED will light if the highest point of the equipment exceeds the current limit. Always check that the height limit activates at the set point. The limit cannot be deactivated if in the alarm state. Observe the operational limitations given in section 4.

8.1.2 Height Limit Setting - Known Height



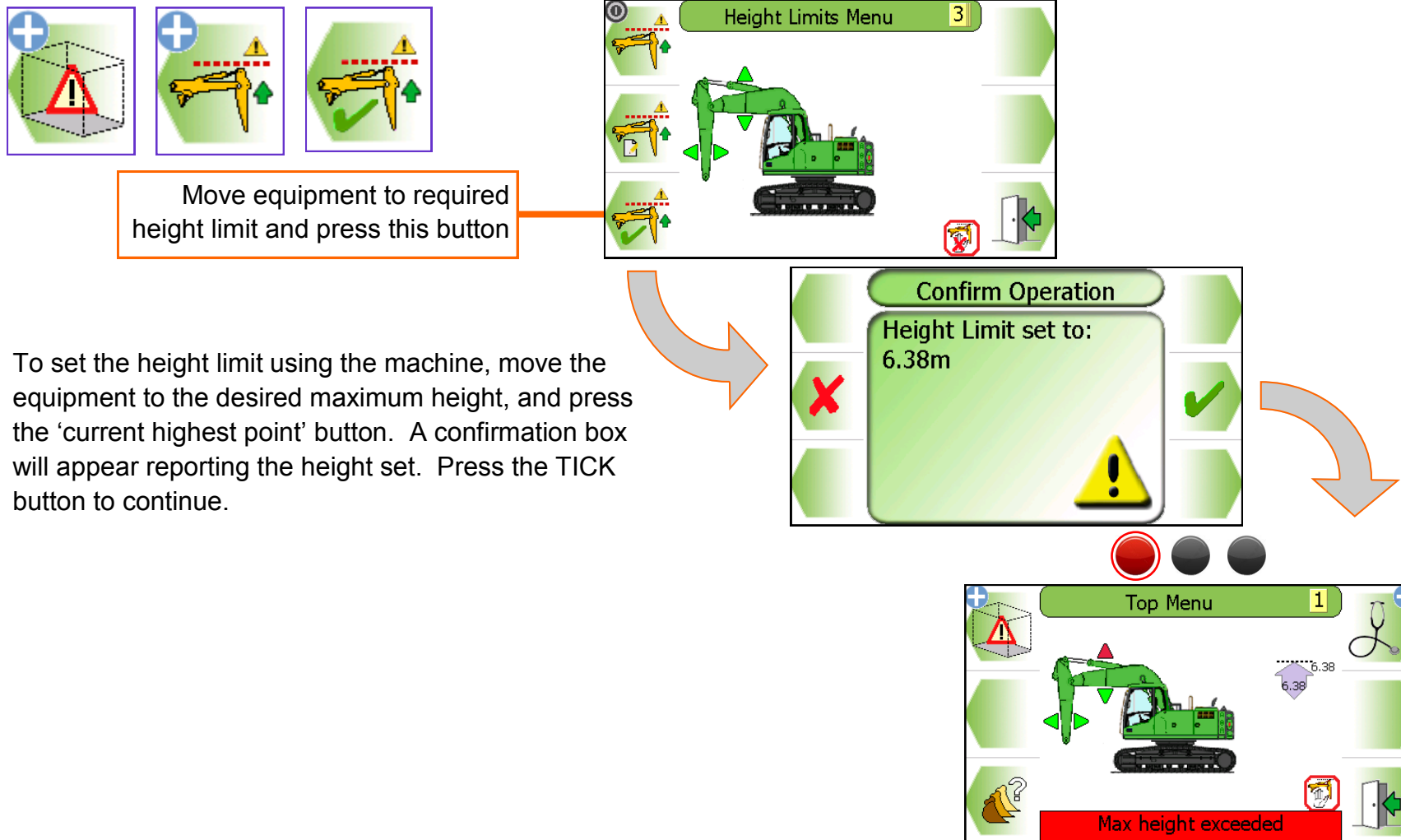
To enter a limit at a known height, use the UP and DOWN arrows to increase and decrease the highlighted number.

Use the LEFT and RIGHT arrows to move the highlighter to the left and to the right. The height limit is measured from the base of the machine tracks/wheels. The height limit is stored internally, and if enabled, will remain active whenever the system is switched on.



Once a height limit is set, the internal alarm will sound and the RED LED will light if the highest point of the equipment exceeds the current limit. Always check that the height limit activates at the set point. The limit cannot be deactivated if in the alarm state. Observe the operational limitations given in section 4.

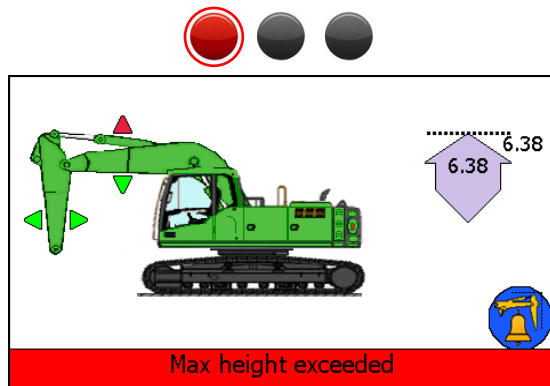
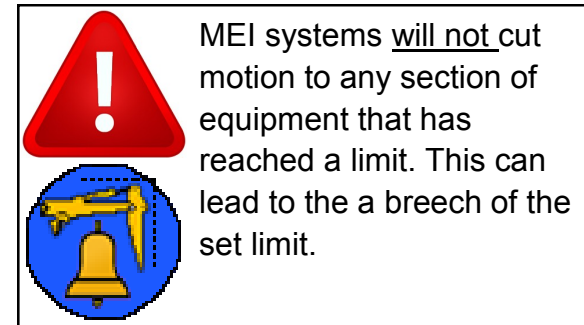
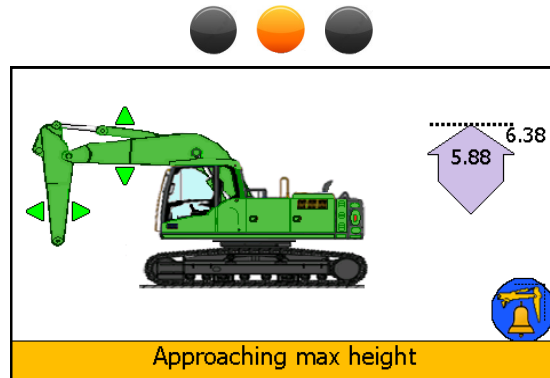
8.1.3 Height Limit Setting - using Current Highest Point



Once a height limit is set, the internal alarm will sound and the RED LED will light if the highest point of the equipment exceeds the current limit. Always check that the height limit activates at the set point. The limit cannot be deactivated if in the alarm state. Observe the operational limitations given in section 4.

8.1.4 Machine Envelope Indicator (MEI) - Height

If any of the equipment enters the approach limit* an 'Approaching max height' message will appear, the internal alarm will sound and the amber LED will be lit.



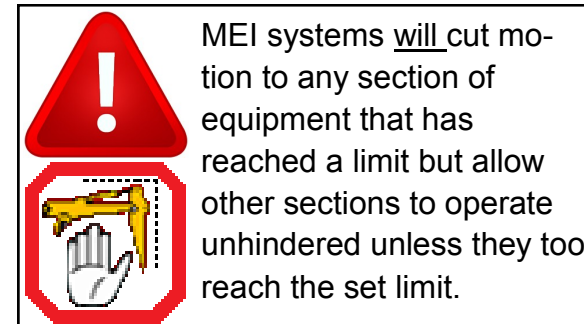
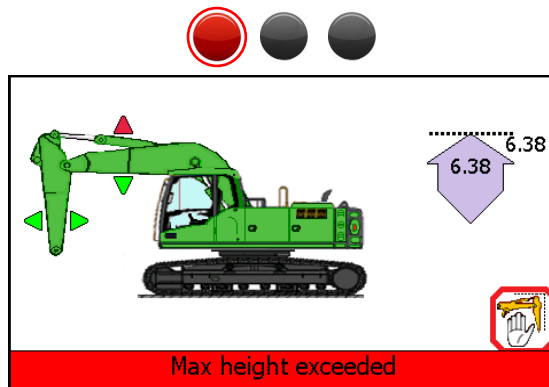
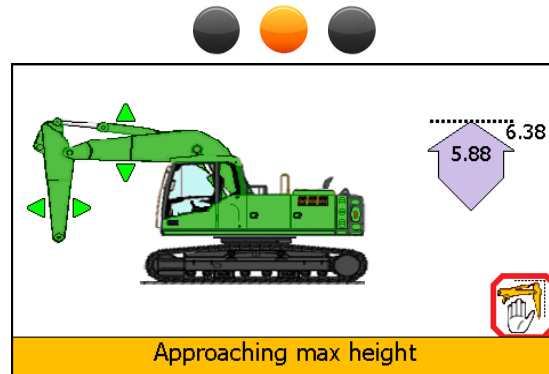
*The approach limit is configurable at point of calibration, check system operation before commencing work.



If any of the equipment exceeds the set limit a 'Max height exceeded' message will appear, the internal alarm will sound and the red LED will be lit. The limit cannot be deactivated if in the alarm state. Observe the operational limitations given in section 4.

8.1.5 Machine Envelope Controller (MEC) - Height

If any of the equipment enters the approach limit* an 'Approaching max height' message will appear, the internal alarm will beep and the amber LED will be lit. If any of the equipment reaches the height limit, the appropriate motions will be controlled.



*The approach limit is configurable at point of calibration, check system operation before commencing work. See sections 4.1 for hydraulic override details.



If any of the equipment exceeds the set limit a 'Max height exceeded' message will appear, the internal alarm will sound and the red LED will be lit. The limit cannot be deactivated if in the alarm state. Observe the operational limitations given in section 4.

9 Warning Messages

9.1 On Screen Messages

Approaching max height	Highest point of equipment within *0.5m of set limit
Maximum height exceeded	Highest point of equipment has reached/exceeded set limit

*The approach limit is configurable at point of calibration, check system operation before commencing work.

9.2 LED and Internal Alarm Warnings

The table below shows the state of the three LEDs on the display and the internal alarm with respect to system status.

LED and Internal Alarm status	System status
	Off
	Start up, Power Down
	Operational System OK, no warnings, hazards, or errors
 1 Hz	Warning Approach to overload or envelope limit
 Continuous	Hazard Overload or breach of an envelope limit
	Maintenance Engineering access active
 8 Hz	Error PME hardware/software error, or sensor failure

10 Daily Checks

- Display - check for damage and correct operational
- Safety Controller - check for damage and correct operational
- Sensors and sensor cabling - check for damage
- Connectors - check for damage
- Alarm / beacon functionality

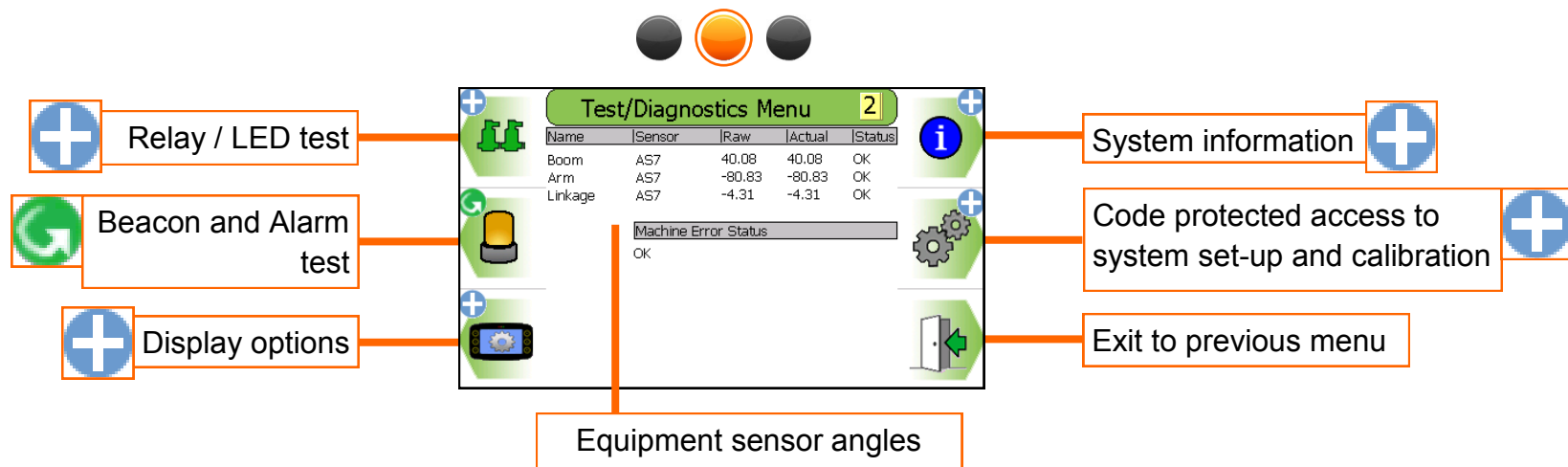
See section 11 for test / diagnosis features.

If an issue is discovered which cannot be rectified using this guide, halt any operation, seek authorised service immediately and do not continue operation until the fault has been remedied.

11 Test / Diagnostics



The system test function is available from the main operating screen. This option allows the functionality of the system to be verified, and basic trouble-shooting to be performed. In this mode, the amber LED will flash to indicate that the system is in maintenance mode. The system will continue to monitor any limits that are active and the Lifting Mode (if active) will continue to monitor machine safety status. Alarm conditions and warnings / controls will be issued as normal.



The image shown is an example only. The exact contents of the sensor list will depend on machine type and PME specification.

11.1 Relay Function Test



Operate show status of feature

Exit to previous menu

11.2 Beacon, LED Alarm Function Test



Press the Beacon
button to activate
the alarm



Press the Alarm
button to activate the
LEDs



Press the Alarm
button to activate the
beacon



12 Display Settings



The display brightness, button click volume, and the displayed machine colour and type can be adjusted from this menu.



Adjust button click volume

Select day / night mode

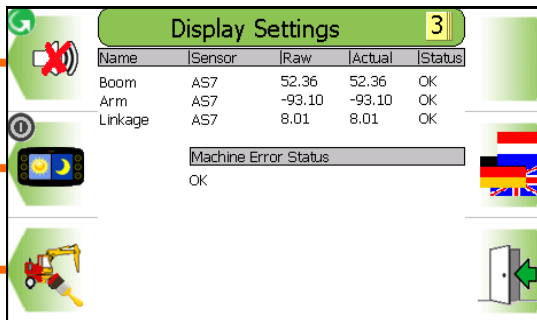
ON



OFF



Select machine colour / type



Language selection

Exit to previous menu

12.1 Day / Night Mode



To make viewing the display more comfortable at night, the display brightness can be switched to a preset 'night mode'. The system will default to day mode on power up.

Select day / night mode:

Day mode ON
Full display brightness



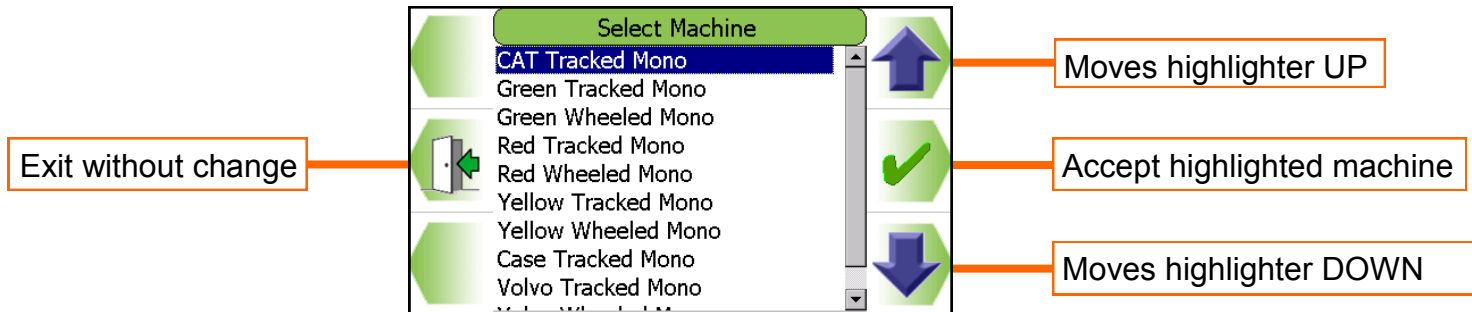
Night mode ON
Reduced display
brightness



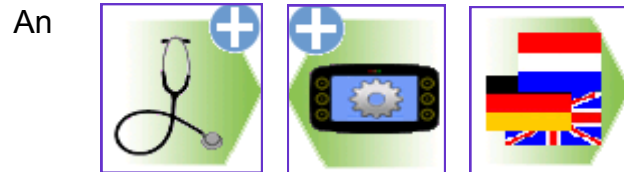
12.2 Select Display Machine



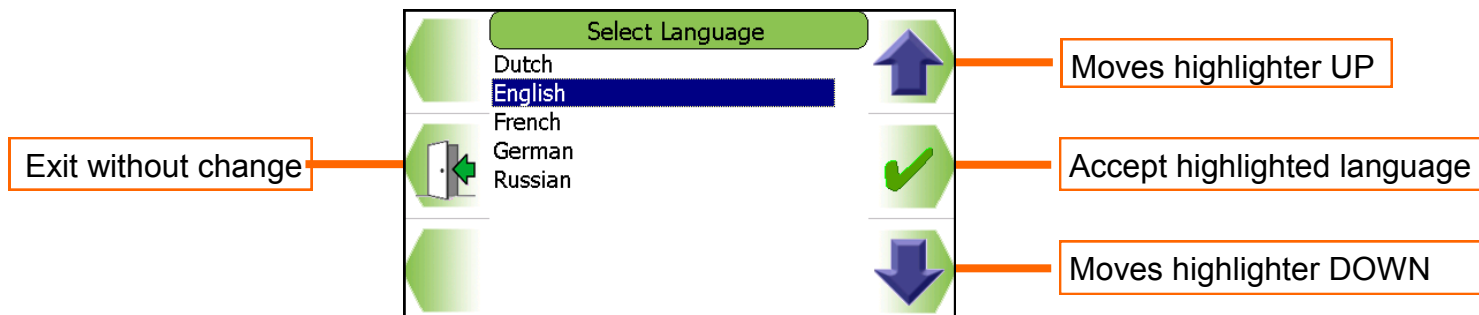
An appropriate machine type for the display can be selected from this list.



12.3 Select Language



appropriate machine type for the display can be selected from this list.



13 System Information

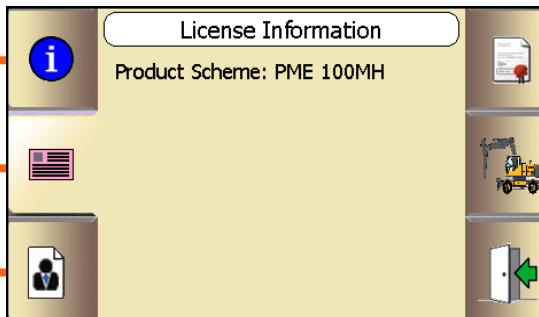


Information regarding the system can be found from this menu.

Software Version information

License information

Distributor information



Not applicable

Machine information

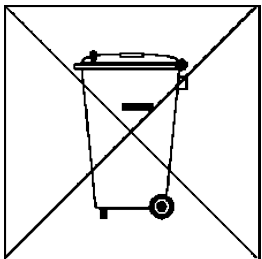
Exit to previous menu

14 Error Messages

PME continuously monitors the presence and condition of the safety controller and sensors. If the safety controller or any sensor fails an error message box will appear at the bottom of the display. In the event of a failure, the cab mounted beacon will indicate that the Lifting Mode is NOT active, the display red LED will flash and the internal and external alarms will sound.

If the system indicates a fault, do not use the system, halt any operation, seek authorised service immediately, and do not continue operation until the fault has been remedied.

15 Taking Product out of Operation



Prolec Limited is committed to complying with the upcoming European Directive of RoHS (Restriction of Certain Hazardous Substances) and WEEE (Waste from Electrical and Electronic Equipment). PME is subject to the WEEE directive, therefore PME or any component must be returned to Prolec Ltd for correct disposal or recycling.

The display and safety controller are fitted with internal batteries and must not be disposed of in landfill.

16 Service and Repair

PME has very few user serviceable parts. The safety controller has internal fuses that, in the event of a blown fuse, can be replaced. The service section describes daily, monthly and yearly checks that must be carried out to ensure safe operation of the system.

16.1 Maintenance Review

Due to nature of the PME system operating environment, changes in usage can occur. Prolec Ltd must be notified of any changes in the pattern of use of the system for consideration.

Any alterations or modifications to machine components which affect the system must be reported to Prolec Ltd or via the service agreement holder.

To aid in the use of PME, all appropriate technical bulletins relating to PME are to be assessed and implemented as appropriate. This information is available from Prolec Ltd.

Prolec Ltd must be informed of any Prolec system component failure. Be it directly or via the service agreement holder.

Technical consultation is available to the user, contact Prolec Ltd or the service agreement holder.

Prolec Ltd	Telephone	+44 (0) 1202 681190
25 Benson Road	Fax	+44 (0) 1202 677909
Nuffield Industrial Estate	Email	service@prolec.co.uk
Poole Dorset BH17 0GB		

16.2 Radius / Height



Requires supervisor access rights.

Lever 1 = Boom pivot pin
 Lever 2 = Arm or hydraulically adjustable boom pivot pin
 Lever 3 = Arm pivot pin
 Tool Pin = Used if tool is selected
 Tool Point = Used if tool is selected
 Lift Point = Current lifting point

Additional Settings 4		
	Radius	Height
Lever 1	0.090	1.869
Lever 2	3.571	6.383
Tool Pin	3.415	3.462
Tool Point	3.515	3.457
Lift Point	3.415	3.462

Machine Error Status
OK

Exit to previous menu

17 User Login



17.1 User Login Setup

Requires supervisor access rights.

Add new user

Select user to edit

Select user to delete

User Settings Menu 4	

[Supervisor]

Edit user login code

Select user(s) to be displayed on login screen

Exit to previous menu

17.2 Add New User to Login



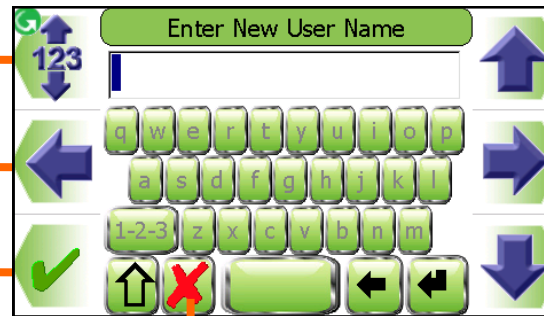
Requires supervisor access code

Toggle to / from keyboard

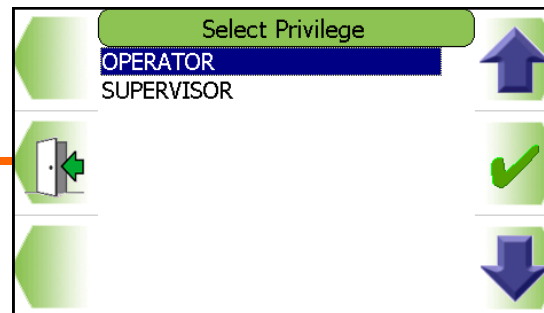
Moves highlighter to right

Accept displayed name

Highlight cross and press tick to cancel without

Increases highlighted number /
Scroll up though digits/ letters

Moves highlighter to left

Decreases highlighted number /
Scroll down though digits/ letters

Exit without change

Moves highlighter UP

Select highlighted Privilege

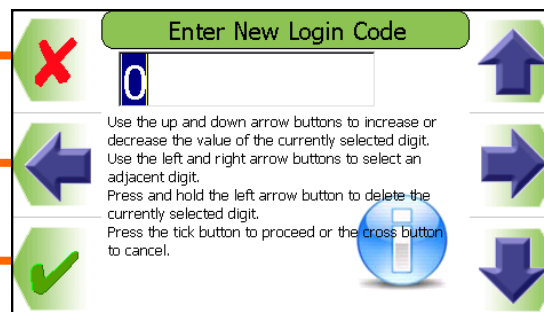
Moves highlighter DOWN



Cancel without change

Moves highlighter to right /
Hold to delete digit

Accept displayed value



Increases highlighted digit

Moves highlighter to left /
Hold to delete number

Decreases highlighted digit

17.3 Edit User Details



Requires supervisor access rights.

Cancel without change

Moves highlighter UP

Select highlighted user

Moves highlighter DOWN

Toggle to / from keyboard

Moves highlighter to right

Accept displayed name

Highlight cross and press tick to exit without change

Increases highlighted number /
Scroll up though digits/ letters

Moves highlighter to left

Decreases highlighted number /
Scroll down though digits/ letters

Return to previous screen

Moves highlighter UP

Select highlighted Privilege

Moves highlighter DOWN

Cancel without change

Moves highlighter to right /
Hold to delete digit

Accept displayed value

Increases highlighted digit

Moves highlighter to left /
Hold to delete digit

Decreases highlighted digit

17.4 Select User to Delete



Requires supervisor access rights.

Exit without change

Moves highlighter UP

Delete highlighted

Moves highlighter DOWN

17.5 Edit User Access Code



Requires supervisor access rights.

Exit without change

Moves highlighter UP

Accept highlighted user

Moves highlighter DOWN

Cancel without change

Moves highlighter to right /
Hold to delete digit

Accept displayed value

Increases highlighted digit

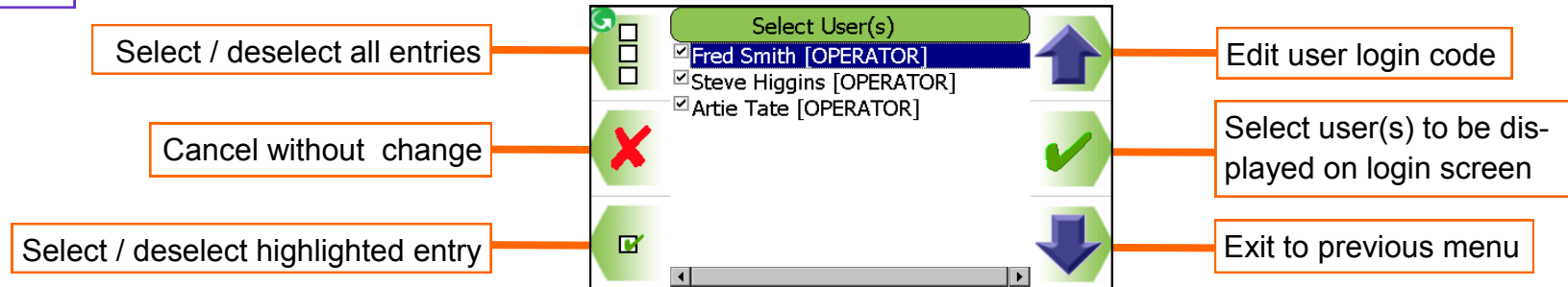
Moves highlighter to left /
Hold to delete number

Decreases highlighted digit

17.6 Enable / Disable Users



Requires supervisor access rights



18 Repair

Once a repair has been carried out and tested, the following must be checked:

<u>Required Checks</u>	<u>Section</u>
Height and radius check	16.2
Relay Check	11.1
Alarm, LED and beacon Check	11.2
Maintenance review	16.1

19 Definitions / Glossary

Definitions of words used to ensure understanding

P/N	Part Number
Boom	First articulation connected to turret
Arm	Second articulation
Artic	Second articulation of a hydraulically adjustable boom (luffing boom, knuckle boom, two piece boom)
Turret	Section of machine above the undercarriage
Undercarriage	Section which the tracks/wheels attach too
Track	continuous band of treads, metal or rubber covered
Wheeled excavator	An excavator fitted with wheels
Tracked excavator	An excavator fitted with tracks, also known as
Bucket	Digging attachment
Attachment	Tool fixed to the dipper other than a bucket
SC	Safety Controller
MMI	Pretentious Man Machine Interface (i.e. Display)
CAN cable	Cable connecting system components
Angle sensor	Sensor detecting current equipment angle
Pitch	Longitudinal base machine angle (fore / aft)
Roll	Lateral base machine angle (side to side)
Motion Cut	Direct control of component hydraulic service
Power Supply	DC supply voltage
Ram	Hydraulic Cylinder
Blade	heavy metal plate on the front of the machine, used for stability and moving material
Stabiliser	Hydraulically powered arms that can be lowered and raised to increase the Stability of the machine
Counterweight	Weight attached to the rear of an excavator to increase digging force and lifting capacity
Pivot pin	Point at which the articulations rotate about
Relay	Electronic device to operate motion cut valve

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