



# Heightmaster Tool Low

## Operators Guide





This guide describes operation of the  
**PROLEC HEIGHTMASTER TOOL LOW**

Model covered :	MODEL NAME	HEIGHTMASTER TOOL LOW
	INTRODUCED	September 2011
	PART No	002146-000

Prolec supports a nationwide network of fully trained service engineers. Warranty claims, service work, technical information and spare parts are available by contacting :

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

This product is not a height limiting device.

Prolec Ltd must be informed of any Prolec system component failure. Be it directly or via the machine convertor/service agreement holder. Manufacturers original instructions.

<b>Section</b>	<b>Subject</b>	<b>Page</b>
<b>1.0</b>	System Description	<b>6</b>
1.1	Applications	<b>6</b>
1.2	Tool Low Limiting	<b>7</b>
1.3	MIN Radius Limit (Cab Protection)	<b>8</b>
1.4	MAX Radius Limit	<b>9</b>
<b>2.0</b>	System Components	<b>10</b>
2.1	Mono boom and triple articulations	<b>10</b>
2.2	System Component Descriptions	<b>11</b>
<b>3.0</b>	System Operation	<b>12</b>
3.1	Power On	<b>12</b>
3.2	Initialisation	<b>12</b>
3.3	Time and Date	<b>12</b>
3.4	Mode Sequence	<b>13</b>
<b>4.0</b>	Height Indication Mode	<b>14</b>
4.1	Setting the height limit at an operator derived equipment position	<b>15</b>
4.2	Setting the height limit to a known height	<b>17</b>
4.3	Switching OFF the Height Monitoring	<b>18</b>
4.4	Height Alarm Conditions	<b>19</b>

<b>Section</b>	<b>Subject</b>	<b>Page</b>
<b>5.0</b>	MIN Radius Limit (Cab Protection) Mode	<b>20</b>
5.1	Setting the MIN Radius limit at an operator derived equipment position (Cab Protection)	<b>20</b>
5.2	Setting the MIN Radius limit to a known Radius (Cab Protection)	<b>22</b>
5.3	Switching OFF the MIN Radius Limit Monitoring	<b>23</b>
<b>6.0</b>	MAX Radius Limit (Cab Protection) Mode	<b>24</b>
6.1	Setting the MAX Radius limit at an operator derived equipment position	<b>24</b>
6.2	Setting the MAX Radius limit to a known Radius	<b>26</b>
6.3	Switching OFF the MAX Radius Limit Monitoring	<b>27</b>
<b>7.0</b>	Duty Selection Mode	<b>28</b>
<b>8.0</b>	System Test	<b>30</b>
<b>9.0</b>	Setting the Clock	<b>33</b>
<b>10.0</b>	Setting Screen Contrast	<b>34</b>
<b>11.0</b>	Error Conditions	<b>35</b>

## 1.0 System Description

### 1.1 Applications

Heightmaster Tool Low can be deployed to a variety of heavy plant including excavators, backhoes and flails for monitoring the equipment position and preventing set limits from being exceeded.

Heightmaster Tool Low uses a sensor on each articulation to monitor the position of the machine, allowing single boom and triple articulation machines to be easily equipped.

Using Heightmaster Tool Low ensures both plant and operator can work safely in confined spaces by restricting specific machine movement.



## 1.2 Tool Low Limiting

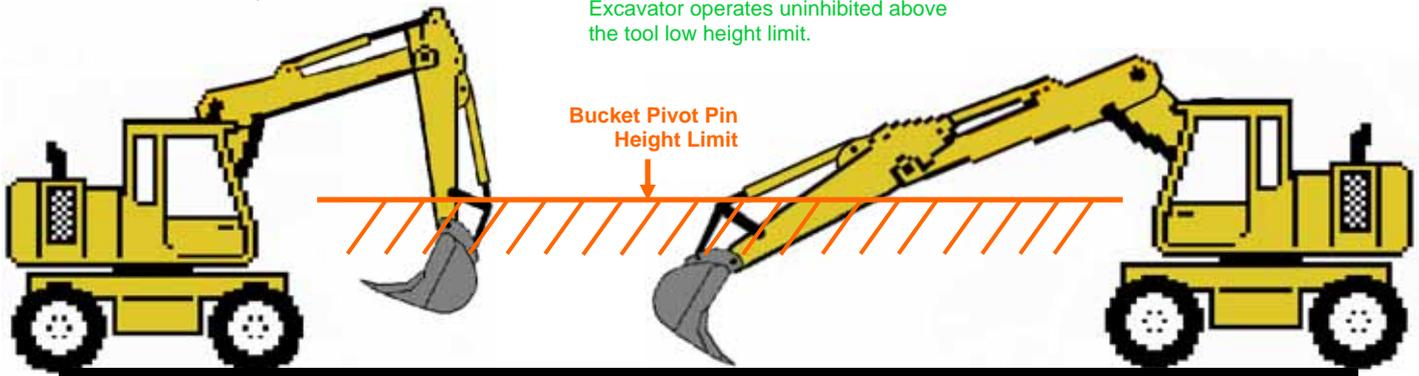
The Heightmaster Tool Low provides accurate monitoring of the bucket pivot pin height and will alarm and control motion at a user selectable limit.

The Heightmaster Tool Low :

1. Allows the machine to work above restricted areas.
2. Can control the machine equipment motion to prevent access into the restricted area.
3. Provides the user with a clear display of the Bucket pivot pin height and of alarm conditions.
4. Allows the height limit to be set from the safety of the cab.

When the bucket pivot pin drops below set height limit the visual and audible alarm will activate and the corresponding equipment motion will be controlled (if fitted).

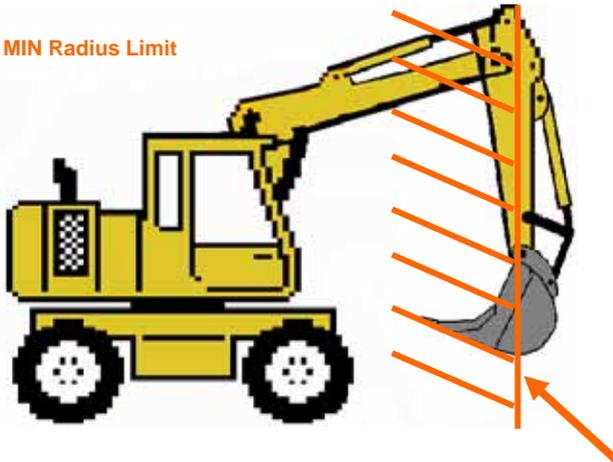
Excavator operates uninhibited above the tool low height limit.



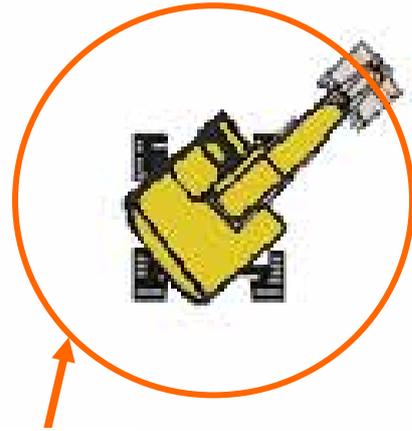
### 1.3 MIN Radius Limit (Cab Protection)

The Min Radius Limit mode allows either the adjustment of the minimum permissible operating radius. The basic Heightmaster Tool Low system features a 'warning only' radius indicator. The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions. The addition of a COMBI BOX (see Heightmaster Tool Low System Components) allows the system to interface with hydraulic solenoid valves on the pilot control circuits to physically prevent a Min Radius Limit from being exceeded. The Min Radius Limit is stored in the memory each time it is set. When the system is switched on, the last Min Radius Limit value stored will become operative.

#### MIN Radius Limit



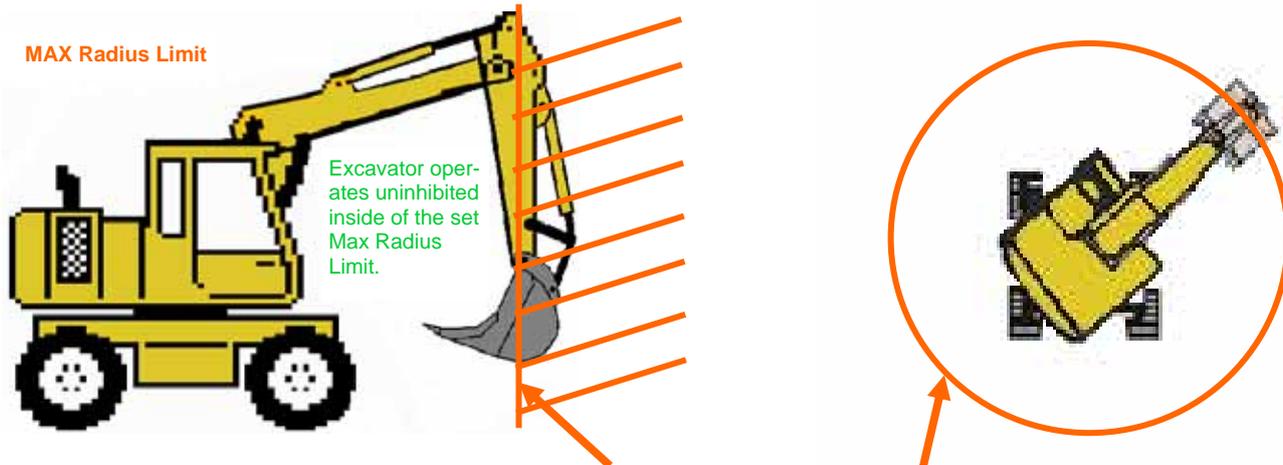
Excavator operates uninhibited outside of the set Min Radius Limit.



When the bucket pivot pin reaches the set radius limit, the visual and audible alarms will activate and the corresponding equipment motion will be cut (If fitted), halting further movement into the radius limit.

#### 1.4 MAX Radius Limit

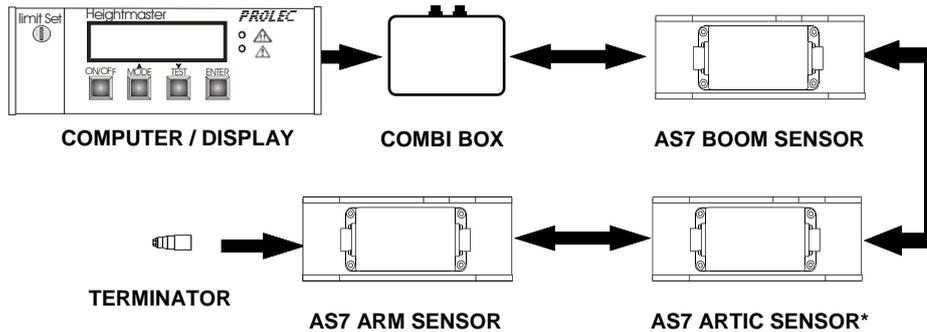
The Max Radius Limit mode allows either the adjustment of the maximum permissible operating radius. The basic Heightmaster Tool Low system features a 'warning only' radius indicator. The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions. The addition of a COMBI BOX (see Heightmaster Tool Low System Components) allows the system to interface with hydraulic solenoid valves on the pilot control circuits to physically prevent a Max Radius Limit from being exceeded. The Max Radius Limit is stored in the memory each time it is set. When the system is switched on, the last Max Radius Limit value stored will become operative.



When the bucket pivot pin reaches the set radius limit, the visual and audible alarms will activate and the corresponding equipment motion will be cut (If fitted), halting further movement into the radius limit.

## 2.0 System Components

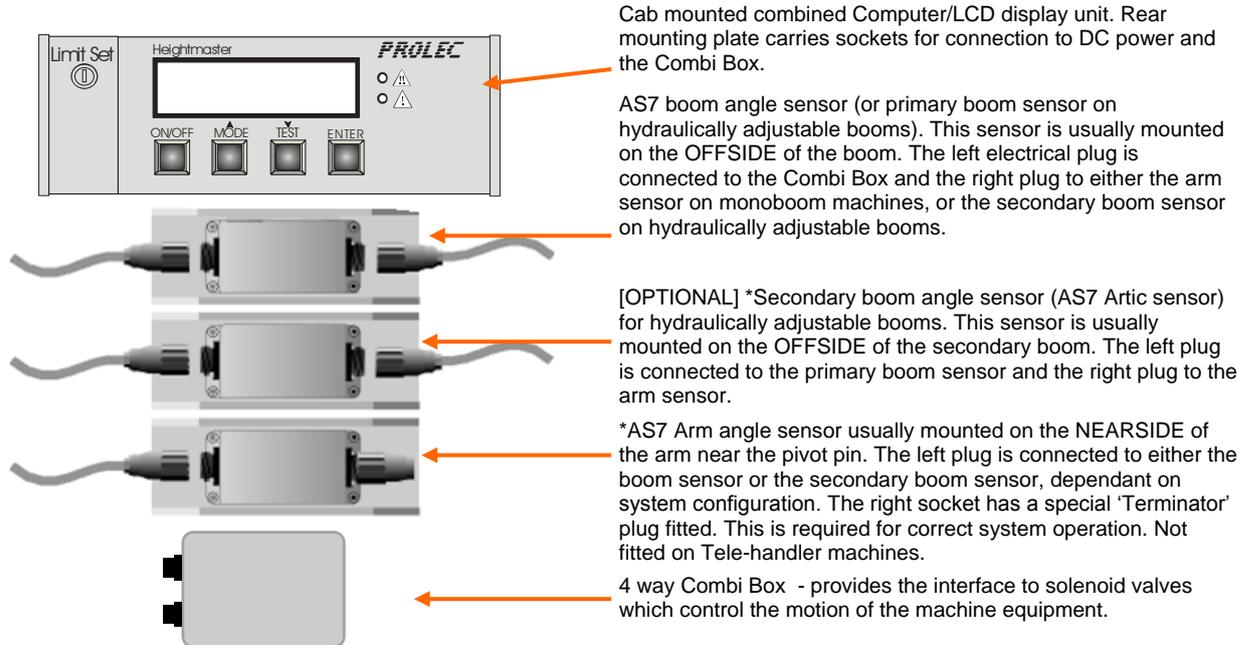
### 2.1 Mono boom and triple articulations



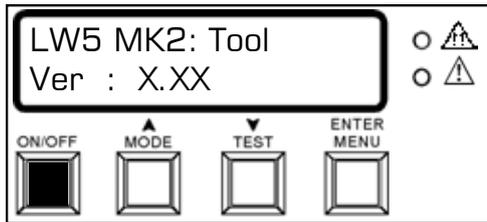
The Heightmaster Tool Low uses CAN2.0B communication technology. A single cable run connects all the system components. Power from an ignition switched source is connected to the LCD/Computer. All the cables have 6-way screw type connectors. These have a common pin-out, and are polarised, allowing any cable to be plugged into any device or sensor without causing damage.

\*Triple articulation machines only

## 2.2 System Component Descriptions



### 3.0 System Operation



#### 3.1 Power On

Heightmaster Tool Low will only operate when it is switched on.

To activate the Heightmaster Tool Low press the ON button. The System title and software version will be momentarily displayed before proceeding to the operational display.

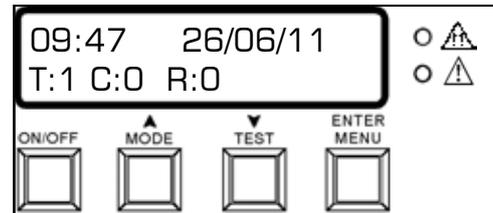
#### 3.2 Initialisation

Once activated, Heightmaster Tool Low will perform an initialisation procedure. This will take three to four seconds, during which time all sensors and auxiliary components are checked for correct operation. The external alarm, if fitted, will sound for approximately 3 seconds. If all checks are successfully completed, operation will resume as normal. If problems are detected during initialisation a relevant warning message will be issued. The Time and Date mode will then be displayed. Refer to section 11 for further information on error conditions.

#### 3.3 Time and Date mode

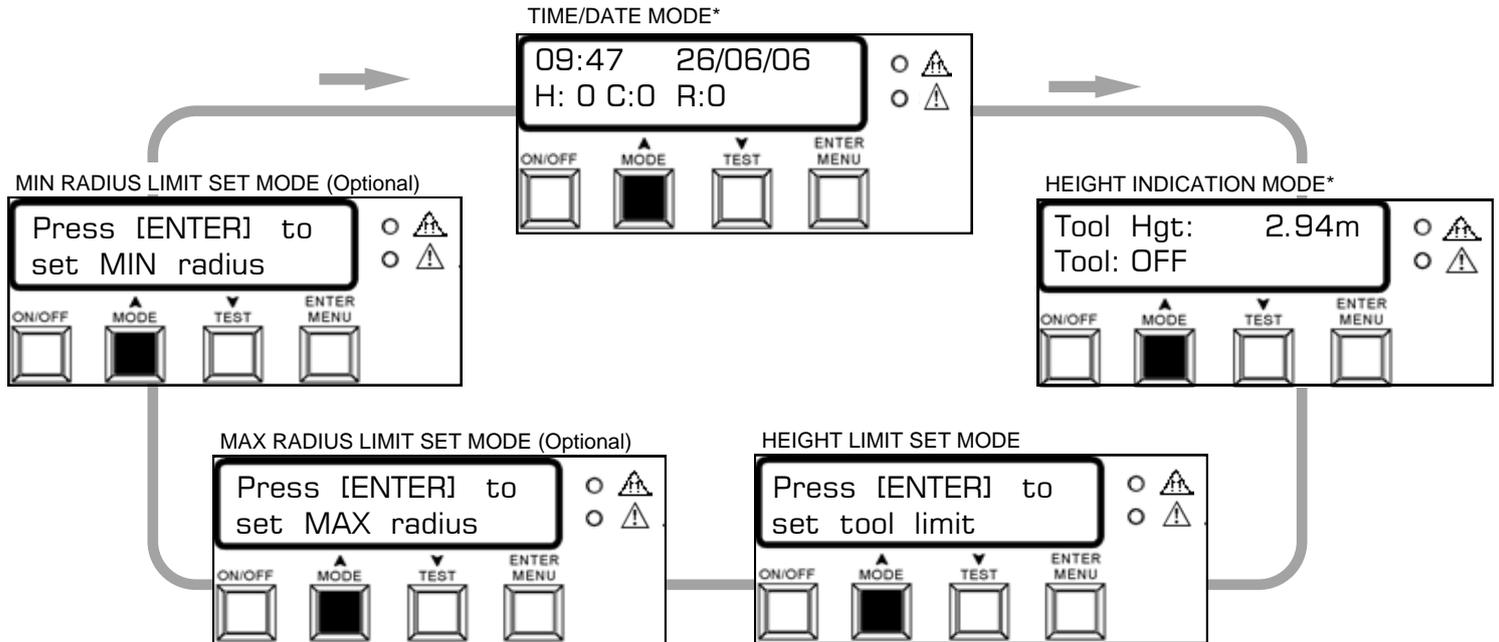
Current time and date are shown on the top line and the status of tool low limiting are displayed on the bottom line.

Tool Low limiting	T = n
Min radius limiting (Cab Protection)	C = n
Max radius Limiting	R = n
n =1 (ON) and n = 0 (OFF).	



### 3.4 Mode Sequence

Pressing the MODE button will cycle the Heightmaster Tool Low through the four available operational modes as shown below with the key in the set position. Max radius limit and Cab limit must be activated at calibration of system.

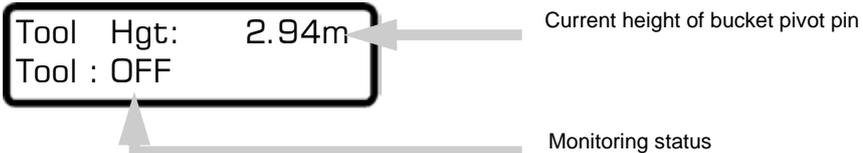


\*With the key in the Limit position, only the Time/Date and Height Indication modes are shown.

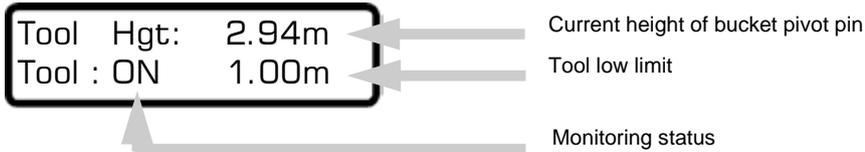
#### 4.0 Low Height Indication Mode

This provides the following information dependant upon the Low height limiting being on or Off. When the system is switched on, the last limit state will become operative.

##### Tool LOW INDICATION MODE – LIMIT OFF



##### Tool LOW INDICATION MODE – LIMIT ON



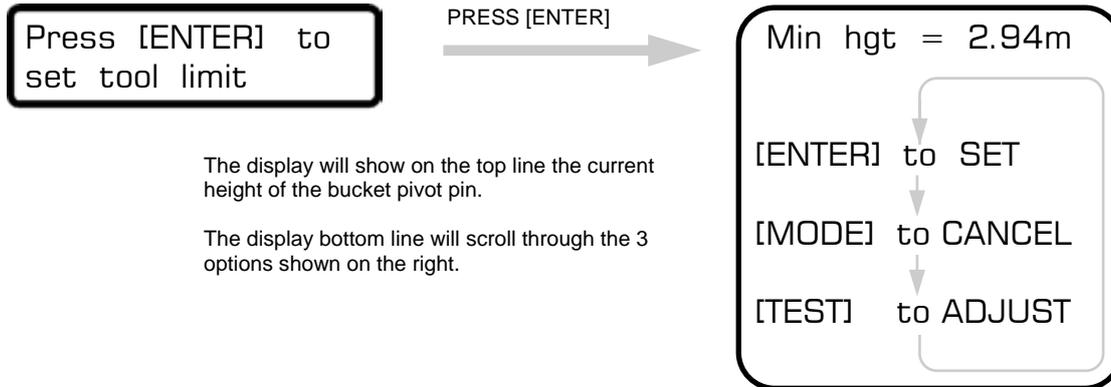
#### 4.0 Height Indication Mode – continued

There are two different methods for setting the tool low height limit with the key in the set position :

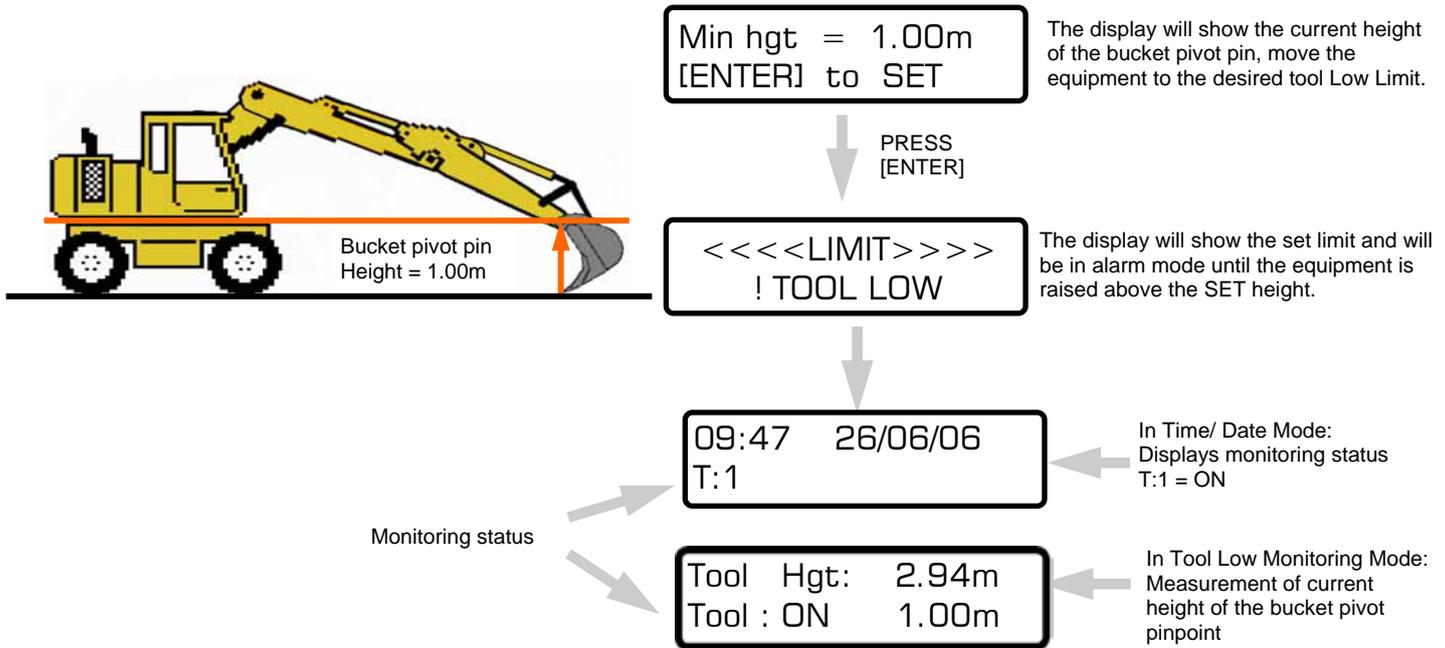
- 1) Setting the height limit at an operator derived equipment position
- 2) Setting the height limit to a known height.

#### 4.1 Setting the height limit at an operator derived equipment position

Press [MODE] to access the set tool limit display.



#### 4.1 Setting the Bucket Low limit at an operator derived equipment position – continued



The Tool Low limit monitoring mode is now active, if the bucket pivot pin intrudes into the set Limit will cause the relevant alarm and control motion (If fitted) to occur. See section 1.2 for further details.

#### 4.2 Setting the Tool Low Limit to a known height

Press [MODE] to access the set LOW Limit display with the key in the set position.

Press [ENTER] to set tool limit

PRESS [ENTER]

Hgt MIN = 1.00  
[ADJ<>] [ENTER]

PRESS [TEST]

THE display will show the current height of the bucket pivot pin. Use the ▲ (MODE) and ▼ (TEST) buttons to adjust the set height to the required value.

PRESS [TEST]

Min hgt = 2.94m  
[ENTER] to SET  
[MODE] to CANCEL  
[TEST] to ADJUST

The display will show on the top line the current height of the bucket pivot pin.

The display bottom line will scroll through the 3 options shown on the left.

09:47 26/06/06  
T: 1

In Time/ Date Mode: Displays Tool Low monitoring status T:1 = ON

Tool Hgt: 2.94m  
Tool : ON 1.00m

In Tool Low Limit Monitoring Mode: Measurement of current height of the bucket pivot pin.

Height monitoring status

The display will show the Time/ Date mode and may be in alarm mode until the equipment is raised from the SET height.

The Tool Low limit monitoring mode is now active, if the bucket pivot pin intrudes into the set Limit will cause the relevant alarm and motion control condition (If fitted) to occur.

### 4.3 Switching OFF the Bucket Low Limit

Press [MODE] to access the set Tool low Limit display with key in the set position.

Press [ENTER] to set tool limit

PRESS [ENTER]

Min hgt = 2.94m  
 [ENTER] to SET  
 [MODE] to CANCEL  
 [TEST] to ADJUST

The display will show on the top line the current height of the highest piece of equipment.

The display bottom line will scroll through the 3 options shown on the left.

PRESS [MODE]

Tool Low Limit Monitoring is OFF until a new height limit is set.

Tool Hgt: 2.94m  
 Tool: OFF

In Height Monitoring Mode: Measurement of current height of the bucket pivot pinpoint

In the Time/ Date Mode, 'T' will equal 0 to indicate Tool Low Limiting is not set.

09:47 26/06/06  
 T: 0

#### 4.4 Low Alarm Conditions

When the machine equipment intrudes into the tool low height limit the Heightmaster Tool Low will go into alarm mode. The operator will be alerted visually, audibly and motion control will occur (if fitted).



The display will inform the user which piece of equipment is too high. The RED LED will illuminate. The internal alarm will sound every 10 seconds.

If the bucket pivot pin intrudes into the set Limit this will cause the relevant alarm and motion control (If fitted) to occur.

The alarm condition will be cleared on raising the bucket pivot pin above the limit.

## 5.0 MIN Radius Limit (Cab Protection) Mode

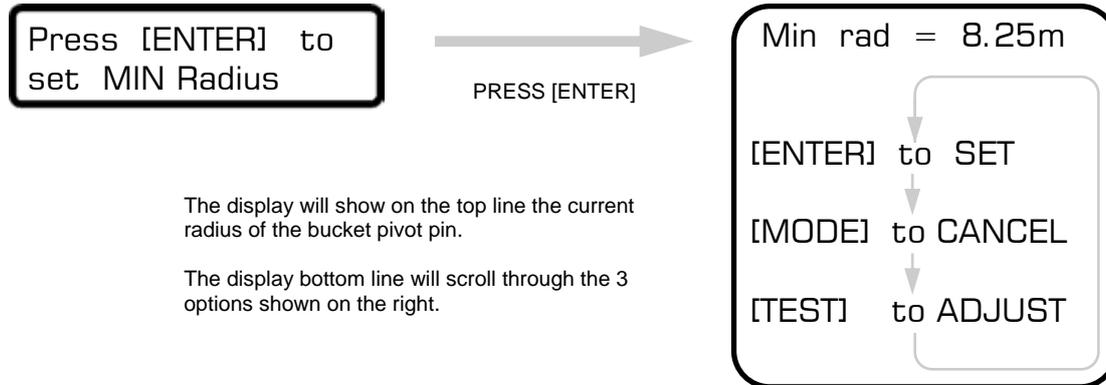
The min Radius Limit does not have its own screen to view the set limit. The only information available is located in the Time/ Date Mode which shows a C:0 or C:1. C:0 indicates the Min Radius Limit is turned Off and C:1 indicated the Min Radius Limit is turned On. To view the set limit, enter the Set MIN Radius function. Note: The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions.

There are two different methods for setting the MIN Radius Limit with the key in the set position :

- 1) Setting the MIN Radius Limit at an operator derived equipment position
- 2) Setting the MIN Radius Limit to a known Radius

### 5.1 Setting the MIN Radius limit at an operator derived equipment position (Cab Protection)

Press [MODE] to access the set MIN Radius Limit



### 5.1 Setting the MIN Radius limit at an operator derived equipment position (Cab Protection) – continued

Move the equipment to the desired new minimum radius and press ENTER. The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions.

Min rad = 8.25m  
[ENTER] to SET



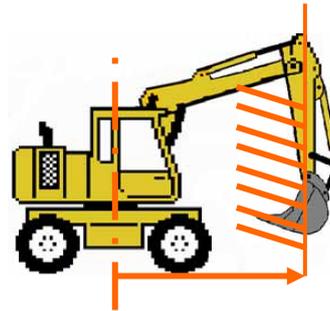
<<<<LIMIT>>>>  
MIN RADIUS LIMIT



The display will show the alarm mode, the Amber LED will illuminate.  
The internal and \*external alarms will sound.

09.47 26/6/06  
T: 1 C: 1

In the Time/ Date Mode, 'C' will equal 1 to show a MIN Radius Limit is set.



Minimum radius = 8.25m

\*External alarm will sound if fitted

### 5.2 Setting the MIN Radius limit to a known Radius (Cab Protection)

Press [MODE] to access the set MIN Radius Limit display with the key in the set position.

Press [ENTER] to set Min radius

PRESS [ENTER]

Min rad = 8.25m

[ENTER] to SET

[MODE] to CANCEL

[TEST] to ADJUST

The display will show on the top line the current radius of the bucket pivot pin.

The display bottom line will scroll through the 3 options shown on the left.

Rad Min = 0.00m  
[ADJ<>] [ENTER]

PRESS [TEST]

The radius displayed on the screen represents the bucket pin position and does not take into account bucket or load dimensions.

THE display will show 0.00m.  
Use the ▲ (MODE) and ▼ (TEST) buttons to adjust the set radius to the required value.

PRESS [ENTER]

<<<<LIMIT>>>>  
MIN RADIUS LIMIT



09:47 26/06/06  
T:0 C: 1

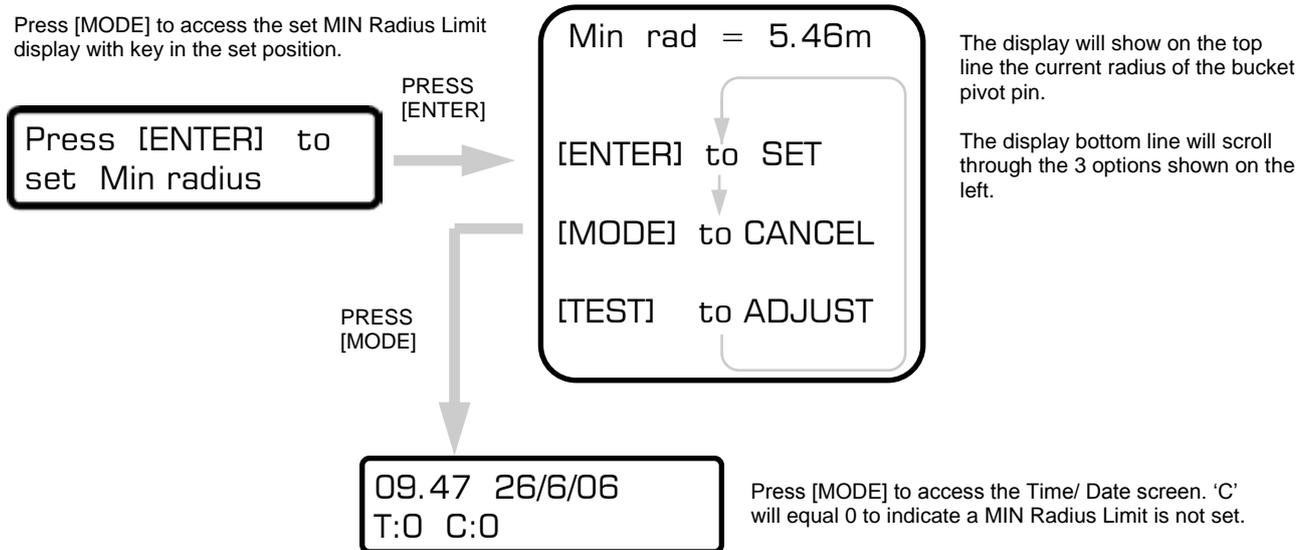
In the Time/ Date Mode, 'C' will equal 1 to indicate a MIN Radius Limit is set.

The display will show the MIN Radius alarm if the equipment is on or inside the new set limit.

The MIN Radius monitoring mode is now active, if the bucket pivot pin intrudes into the MIN Radius Limit will cause the relevant alarm and motion cut condition (If fitted) to occur. See section 1.3 for further details.

### 5.3 Switching OFF the MIN Radius Limit Monitoring

Press [MODE] to access the set MIN Radius Limit display with key in the set position.



## 6.0 MAX Radius Limit Mode

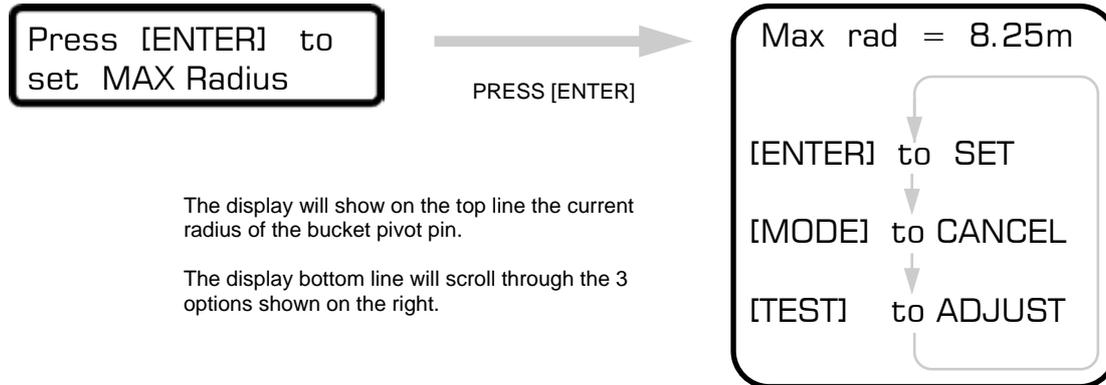
The max Radius Limit does not have its own screen to view the set limit. The only information available is located in the Time/ Date Mode which shows a R:0 or R:1. R:0 indicates the Max Radius Limit is turned Off and R:1 indicated the Max Radius Limit is turned On. To view the set limit, enter the Set MAX Radius function. Note: The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions.

There are two different methods for setting the MAX Radius Limit with the key in the set position :

- 1) Setting the MAX Radius Limit at an operator derived equipment position
- 2) Setting the MAX Radius Limit to a known Radius

### 6.1 Setting the MAX Radius limit at an operator derived equipment position

Press [MODE] to access the set MAX Radius Limit



### 6.1 Setting the MAX Radius limit at an operator derived equipment position – continued

Move the equipment to the desired new maximum radius and press ENTER. The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions.

Max rad = 8.25m  
[ENTER] to SET

↓  
PRESS  
[ENTER]

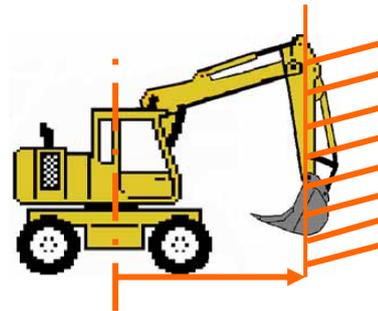
<<<<LIMIT>>>>  
MAX RADIUS LIMIT



The display will show the alarm mode, the Amber LED will illuminate.  
The internal and \*external alarms will sound.

09.47 26/6/06  
T:0 R: 1

In the Time/ Date Mode, 'R' will equal 1 to show a MAX Radius Limit is set.



Maximum radius = 8.25m

\*External alarm will sound if fitted

## 6.2 Setting the MAX Radius limit to a known Radius

Press [MODE] to access the set MAX Radius Limit display with the key in the set position.

Press [ENTER] to set Max radius

PRESS [ENTER]

Rad Max = 0.00m  
[ADJ<>] [ENTER]

PRESS [TEST]

Max rad = 8.25m

[ENTER] to SET

[MODE] to CANCEL

[TEST] to ADJUST

The display will show on the top line the current radius of the bucket pivot pin.

The display bottom line will scroll through the 3 options shown on the left.

The radius displayed on the screen represents the bucket pin position and does not take into account bucket or load dimensions.

THE display will show 0.00m.

Use the ▲ (MODE) and ▼ (TEST) buttons to adjust the set radius to the required value.

PRESS [ENTER]

<<<<LIMIT>>>>  
MAX RADIUS LIMIT



09:47 26/06/06  
T:0 R: 1

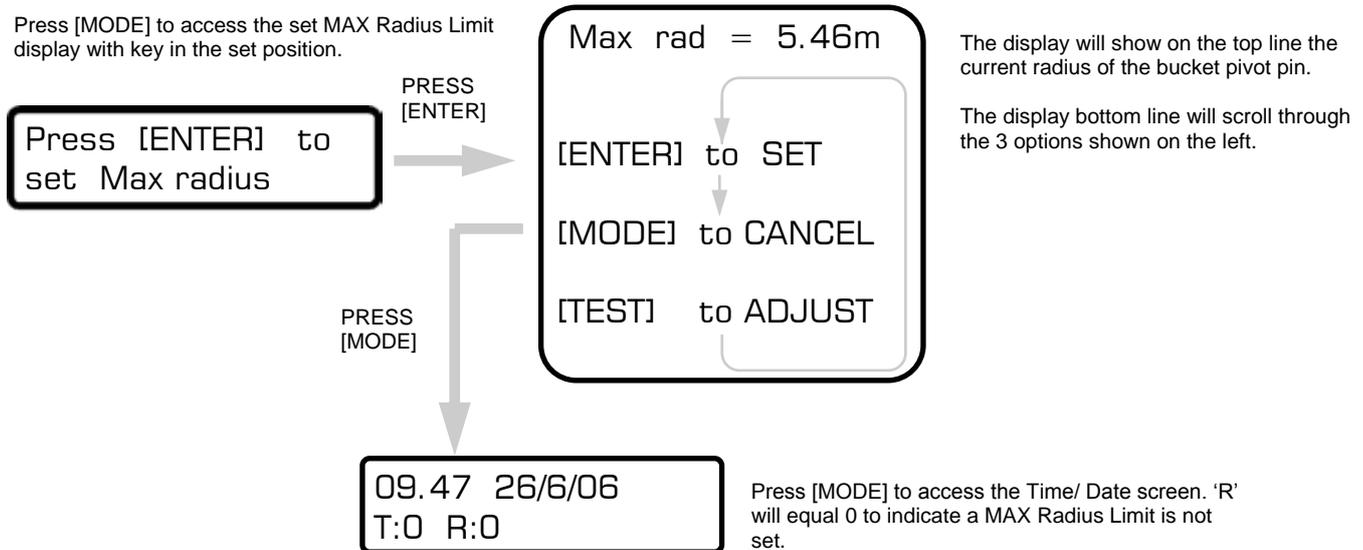
In the Time/ Date Mode, 'R' will equal 1 to indicate a MAX Radius Limit is set.

The display will show the MAX Radius alarm if the equipment is on or inside the new set limit.

The MAX Radius monitoring mode is now active, if the bucket pivot pin intrudes into the MAX Radius Limit will cause the relevant alarm and motion cut condition (if fitted) to occur. See section 1.4 for further details.

### 6.3 Switching OFF the MAX Radius Limit Monitoring

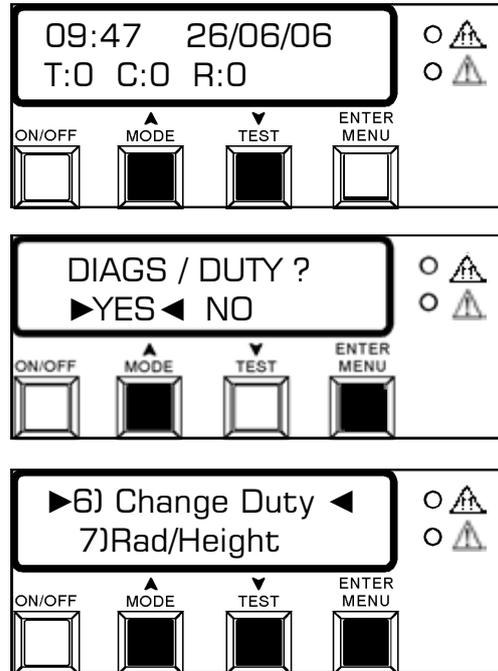
Press [MODE] to access the set MAX Radius Limit display with key in the set position.



## 7.0 Duty Selection Mode

Multiple duties are only available if the enabled at calibration of the system. The Duty Selection mode is only accessible with the key in the set position in the time and date screen. Multiple duties will be setup to allow for different machine dimensions to be used, so can take into account stabilisers, removable extensions and secondary equipment.

The system can automatically change duty if enabled at calibration of the system.

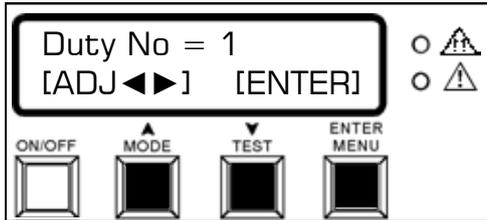


PRESS MODE and TEST together

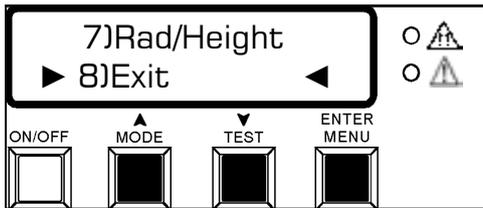
PRESS MODE to select YES and PRESS ENTER

PRESS MODE or TEST to scroll to Change Duty and PRESS ENTER

## 7.0 Duty Selection Mode – continued



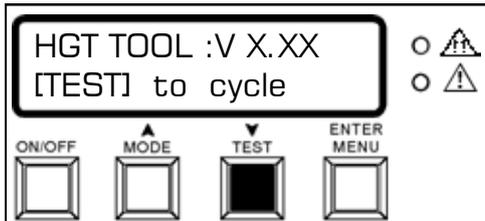
Use the MODE and TEST keys to select the required duty number. There is a maximum of 8 possible duty selections. Press ENTER to confirm the selection. After duty changes are made, test equipment to ensure correct operation. The test function can be used to check current duty and current equipment lengths, see section 8.0.



PRESS MODE or TEST  
to scroll to Exit and  
PRESS ENTER

## 8.0 System Test

The Heightmaster Tool Low has a comprehensive built-in test function that allows the operator to check all aspects of the system and its set-up. To enter the test function, put the key switch in the SET position, enter the Time & Date screen and press the TEST button. Once this mode is accessed, pressing TEST will cycle the options available and pressing MODE will cancel the function and return to the previous operational mode.



The initial test display is shown here. All information is displayed on the upper line. The lower line contains a scrolling message that says '[TEST] to cycle [MODE] to exit'. This will be present throughout the test procedure.

Current duty = 1

### Current duty number

This displays the current operational duty selected.

Boom len = 5.20

### Boom length

This is the straight line distance between the boom pivot pin and arm pivot pin, and is given in metres.

Artic len = 3.70

### Artic length

This is the length of the secondary boom section on an hydraulically adjustable boom. If the system is configured for monoboam equipment, this display will not appear. The length is the straight line distance between the secondary boom pivot pin and the arm pivot pin, and is given in metres.

## 8.0 System Test - continued

Arm len = 2.80

### **Arm length**

This is the straight line distance between the arm pivot pin and bucket pivot pin, and is given in metres.

Alarm ON check

### **External alarm check**

If the system has a Combi Box with external alarm this test will activate the external alarm.

Buzzer ON check

### **Internal alarm check**

This test will activate the internal alarm which is mounted on the rear of the display housing (and externally mounted alarm if fitted).

Amber LED check

### **Amber LED alarm check**

This test will activate the lower amber LED on the display front.

Red LED check

### **Red LED alarm check**

This test will activate the upper red LED on the display front.

## 8.0 System Test – continued

Boom Ang= 12°

### Boom angle check

This test displays the current boom angle on monoboam machines, or the first boom section angle on hydraulically adjustable boom machines. The angle given is for the imaginary line connecting the two pivot pins. As the boom moves up the value should increase: as the boom moves down the value should decrease. When the two pins are in the same horizontal plane, the value should be zero.

Arm Ang= 90°

### Arm angle check

This test displays the current arm angle in degrees. The angle given is for the imaginary line connecting the two pivot pins. As the arm moves out the value should decrease: as the arm moves in the value should increase. When the two pins are in same vertical plane, the value should be 90.

Artic Ang= 12°

### Artic angle check

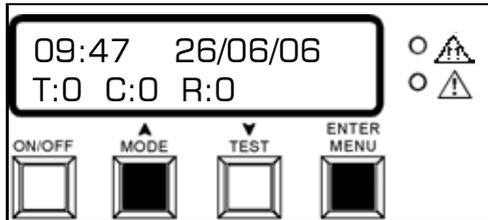
This test displays the current secondary boom angle on hydraulically adjustable boom machines. The angle given is for the imaginary line connecting the two pivot pins. As the secondary boom moves up the value should increase: as the secondary boom moves down the value should decrease. When the two pins are in same horizontal plane, the value should be zero. This option will not appear on monoboam machines.

15:53 26/06/08  
T:0 C:0 R:0

### Calibration time and date

The final test option displays the calibration time and date. This value is updated when the passcode protected Calibration menu is accessed.

## 9.0 Setting the Clock



To adjust the time and date, press the MODE and ENTER together in the time and date screen with the keyswitch in the SET position.

The display will now enter the clock set function as described below.

As each parameter is offered, use the UP and DOWN keys to adjust the displayed number to the correct value, and press ENTER to confirm. At the end of the procedure control will return to the normal Time & Date mode.

Hours = 9  
[ADJ<>] [ENTER]

HOURS range = 0 to 23

Minutes = 34  
[ADJ<>] [ENTER]

MINUTES range = 0 to 59

Date = 26  
[ADJ<>] [ENTER]

DATE range = 1 to 31 (Note : it is possible to set a date beyond the maximum—for example 31 February. If this is attempted the system will set itself to the next valid date and month).

Month = 6  
[ADJ<>] [ENTER]

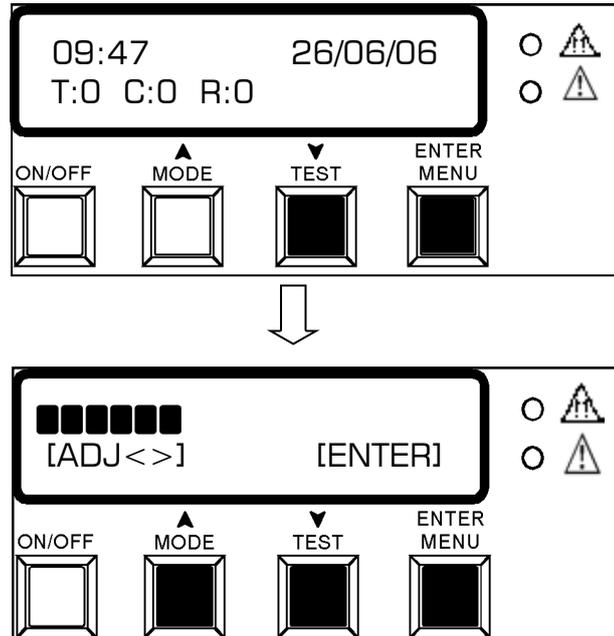
MONTH range = 1 to 12 (1 = January, 12 = December)

Year = 08  
[ADJ<>] [ENTER]

YEAR range = 00 to 99 (00 = 2000)

## 10.0 Setting Screen Contrast

To adjust the contrast on the Heightmaster Tool Low screen, press the TEST and ENTER together in the time and date screen with the keyswitch in the SET position. Use the UP/DOWN buttons to adjust. Press ENTER to save the desired contrast.



## 11.0 Error Conditions

Heightmaster Tool Low software constantly checks for the presence of all attached sensors and if they are not detected then the display indicates the problem component. This will indicate if the sensor is missing, damaged, or that there is a fault with interconnecting CAN bus cable. If an error condition is displayed halt any operation, seek service immediately and do not continue operation until the fault has been remedied. The failure message is shown on the lower line of the current active display. If more than one sensor fails then the Fail messages will scroll.

Height = 6.07m  
!BOOM FAILED

Boom sensor not detected.

Height = 6.07m  
!ARTIC FAILED

Artic sensor not detected.

Height = 6.07m  
!ARM FAILED

Arm sensor not detected.

Height = 6.07m  
!COMBI FAILED

Combi Box not detected.

Height = 6.07m  
!RELAY SUPPLY

Power not detected to Combi Box relays.







PROLEC LTD  
25 BENSON ROAD  
NUFFIELD INDUSTRIAL ESTATE  
POOLE, DORSET  
ENGLAND, BH17 0GB

560383-003 Issue 1.0



+44 (0)1202 681190



+44 (0)1202 677909



[service@prolec.co.uk](mailto:service@prolec.co.uk)