



Heightmaster

Operators Guide



This guide describes operation of the
PROLEC HEIGHTMASTER

Model covered :	MODEL NAME	HEIGHTMASTER
	INTRODUCED	SEPTEMBER 2011
	PART No	002146-000

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1.0 System Description

1.1 Applications

Heightmaster can be deployed to a variety of heavy plant including excavators, telehandlers wheeled loaders, backhoes, flails and telescopic cranes for monitoring the equipment position and preventing the maximum safe working height and or minimum radius from being exceeded. Heightmaster uses a sensor on each articulation to monitor the position of the machine, allowing single boom and triple articulation machines to be easily equipped. Telescopic sections are catered for via a reeling drum sensor. Using Heightmaster ensures both plant and operator can work safely in height limited environments.



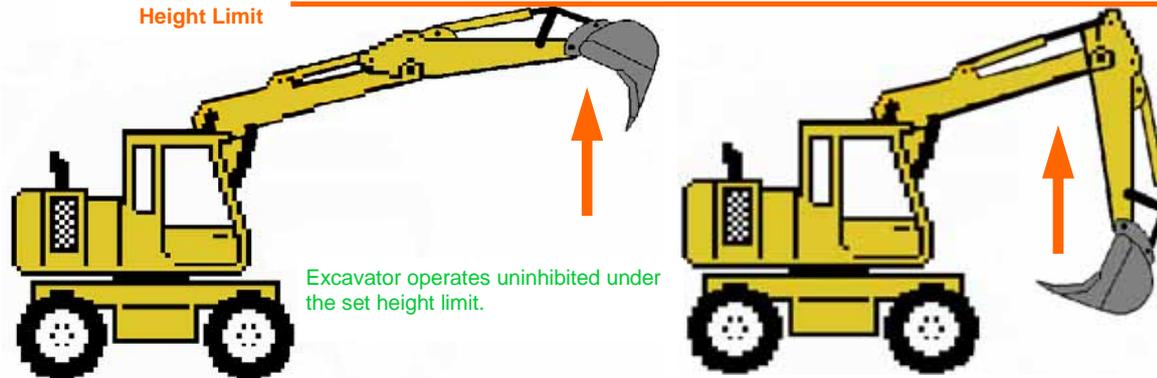
1.2 Height Limit

The Heightmaster provides accurate monitoring of the equipment height and will alarm and motion control (if fitted) at a user selectable height.

The Heightmaster :

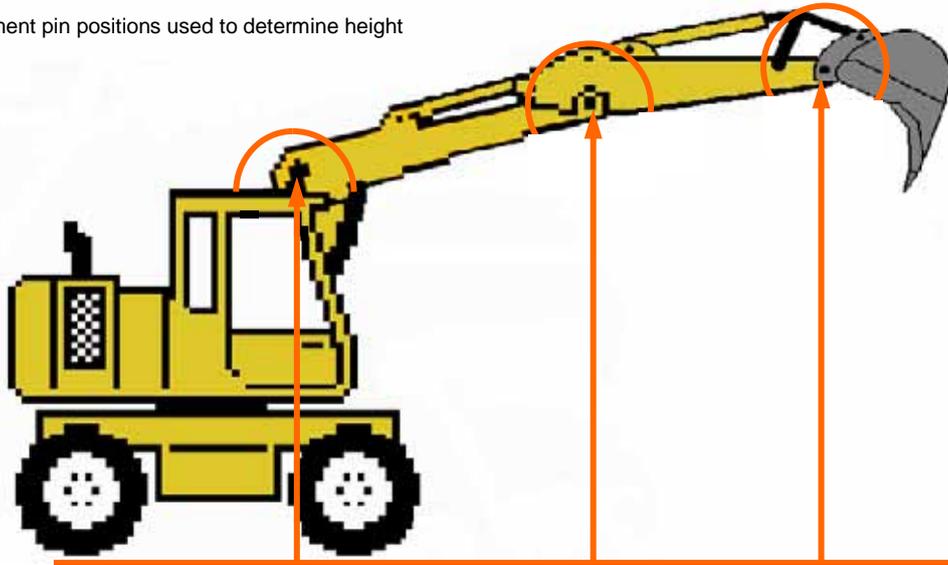
1. Allows the machine to work under restricted areas.
2. Can control the machine equipment motion to prevent access into the restricted area.
3. Provides the user with a clear display of the equipment height and of alarm conditions.
4. Allows the height limit to be set from the safety of the cab.

When the excavator equipment reaches the set height limit the visual and audible alarms will activate and motion control will activate.



1.2 Height Limit - continued

Guide to equipment pin positions used to determine height



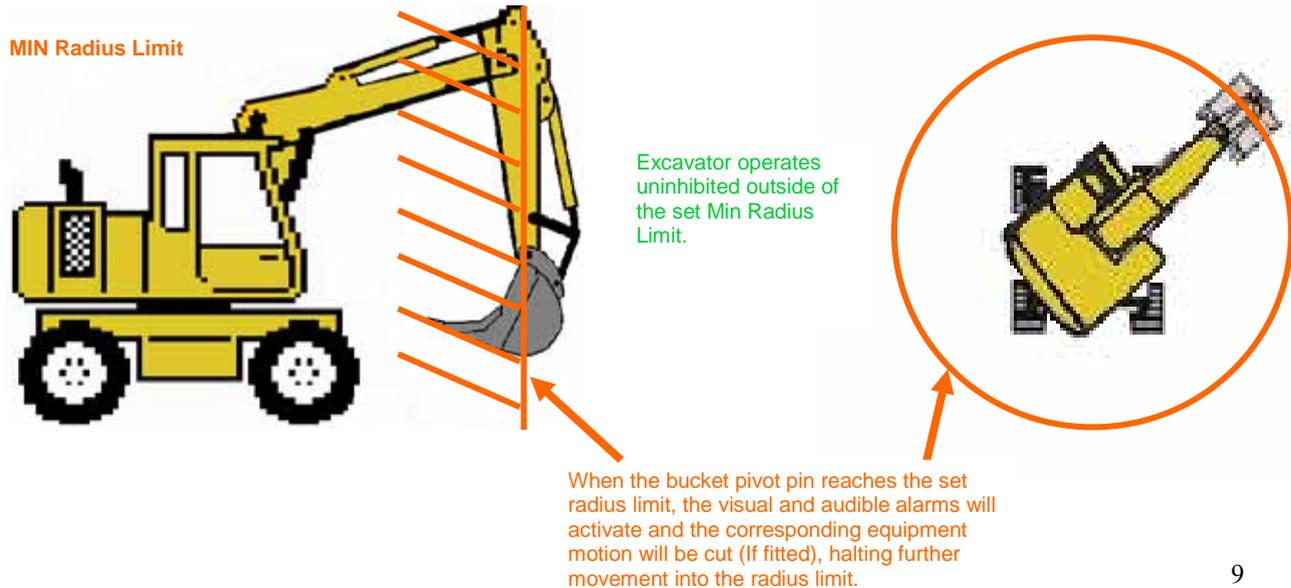
Residual value will automatically be added to any height limit to take into account any part of the artic, arm and bucket above the pivot pin



*All heights are referred to equipment pivot pins - triple articulation machine shown in example

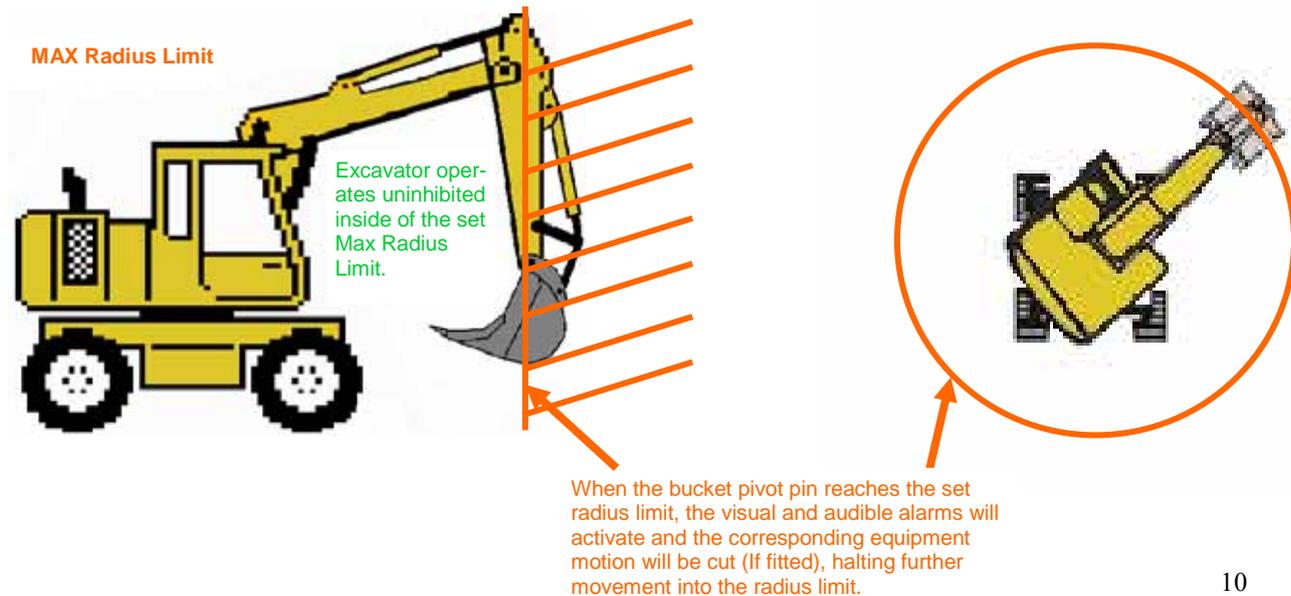
1.3 MIN Radius Limit (Cab Protection)

The Min Radius Limit mode allows either the adjustment of the minimum permissible operating radius. The basic Heightmaster 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 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.



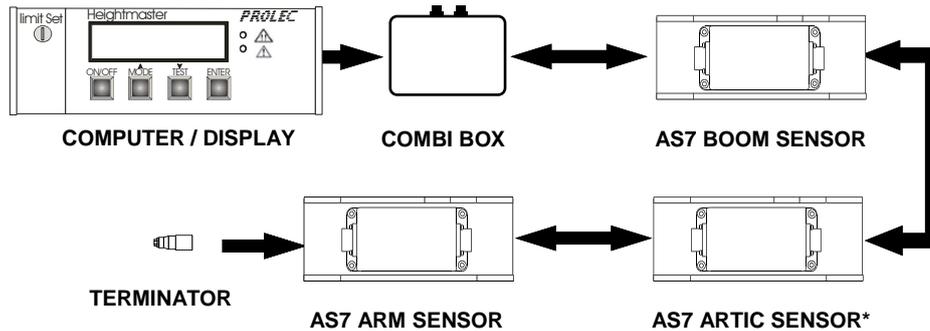
1.4 MAX Radius Limit

The Max Radius Limit mode allows either the adjustment of the maximum permissible operating radius. The basic Heightmaster 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 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.



2.0 System Components

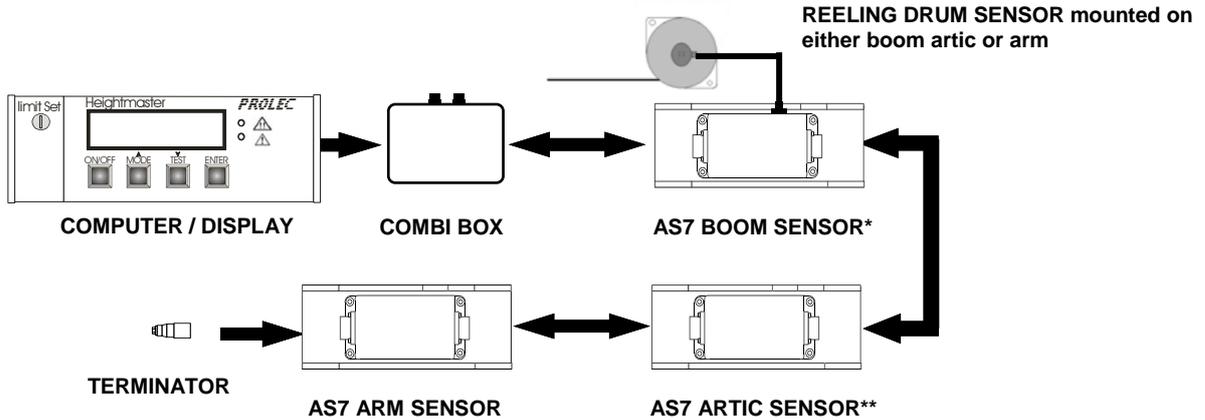
2.1 Mono boom and triple articulations



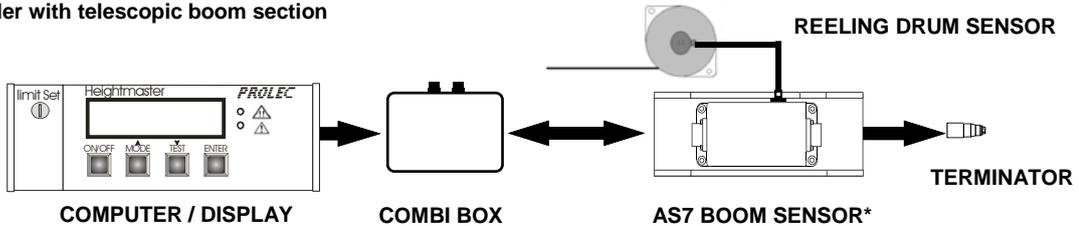
The Heightmaster uses CAN2.0B communication technology. A single cable run connects all the system components. Power from an ignition switched source is connected to the LCD/Computer. All the cables have 6-way screw type connectors. These have a common pin-out, and are polarised, allowing any cable to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

*Triple articulation machines only

2.2 Mono Boom or triple articulation with single telescopic section

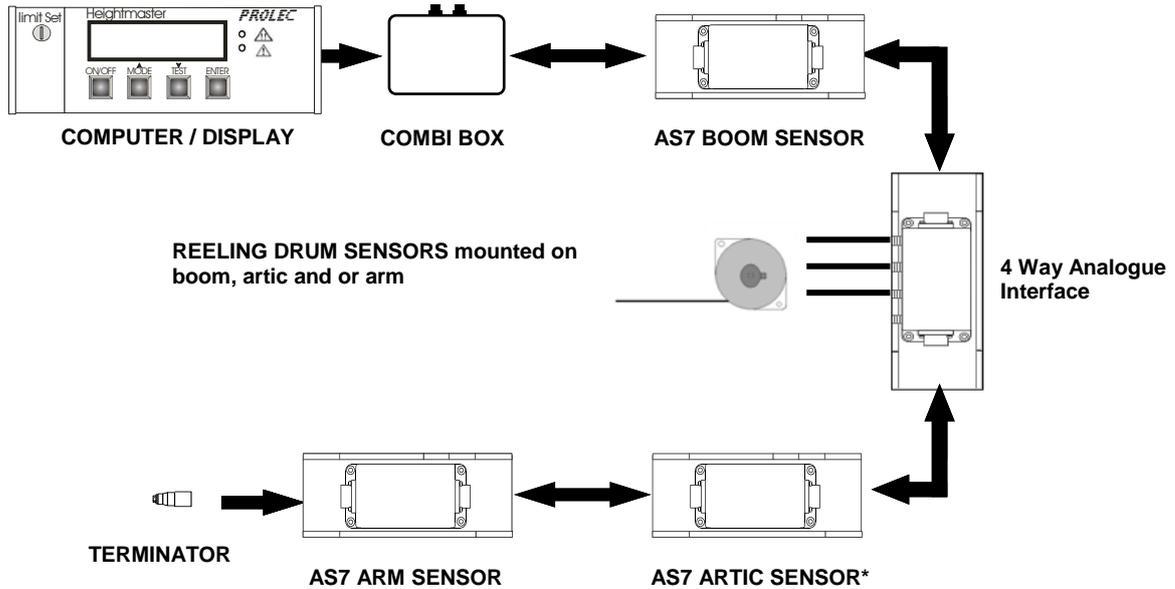


2.3 Telehandler with telescopic boom section



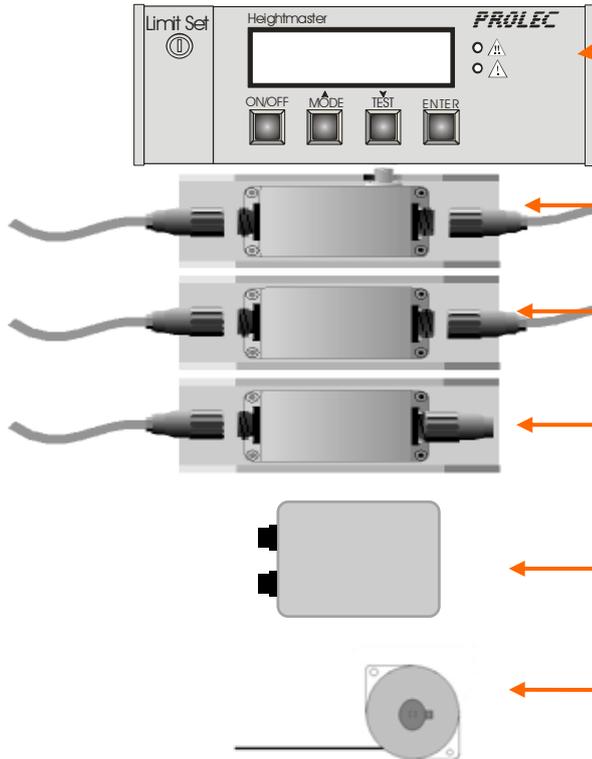
*Boom sensor with reeling drum input **Triple articulation machines only

2.4 Mono Boom or triple articulations with multiple telescopic sections



*Triple articulation machines only

2.5 System Component Descriptions



Cab mounted combined Computer/LCD display unit. Rear mounting plate carries sockets for connection to DC power and the Combi Box.

AS7 boom angle sensor (or primary boom sensor on hydraulically adjustable booms). This sensor is usually mounted on the OFFSIDE of the boom. The left electrical plug is connected to the Combi Box and the right plug to either the arm sensor on monoboam machines, or the secondary boom sensor on hydraulically adjustable booms. Reeling drum connection mounted on top of sensor if applicable.

[OPTIONAL] *Secondary boom angle sensor (AS7 Artic sensor) for hydraulically adjustable booms. This sensor is usually mounted on the OFFSIDE of the secondary boom. The left plug is connected to the primary boom sensor and the right plug to the arm sensor.

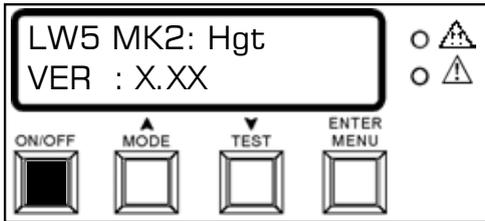
*AS7 Arm angle sensor usually mounted on the NEARSIDE of the arm near the pivot pin. The left plug is connected to either the boom sensor or the secondary boom sensor, dependant on system configuration. The right socket has a special 'Terminator' plug fitted. This is required for correct system operation. Not fitted on Tele-handler machines.

4 way Combi Box - provides the interface to solenoid valves which control the motion of the machine equipment.

[OPTIONAL] Reeling drum only fitted to telescopic sections. This can be mounted on the side or top at the base of the section and will extend and retract with that section.

*Not fitted on telehandler machines

3.0 System Operation



3.1 Power On

Heightmaster will only operate when it is switched on.

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

3.2 Initialisation

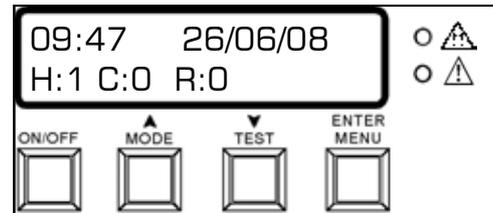
Once activated, Heightmaster will perform an initialisation procedure. This will take three to four seconds, during which time all sensors and auxiliary components are checked for correct operation. The external alarm, if fitted, will sound for approximately 3 seconds. If all checks are successfully 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

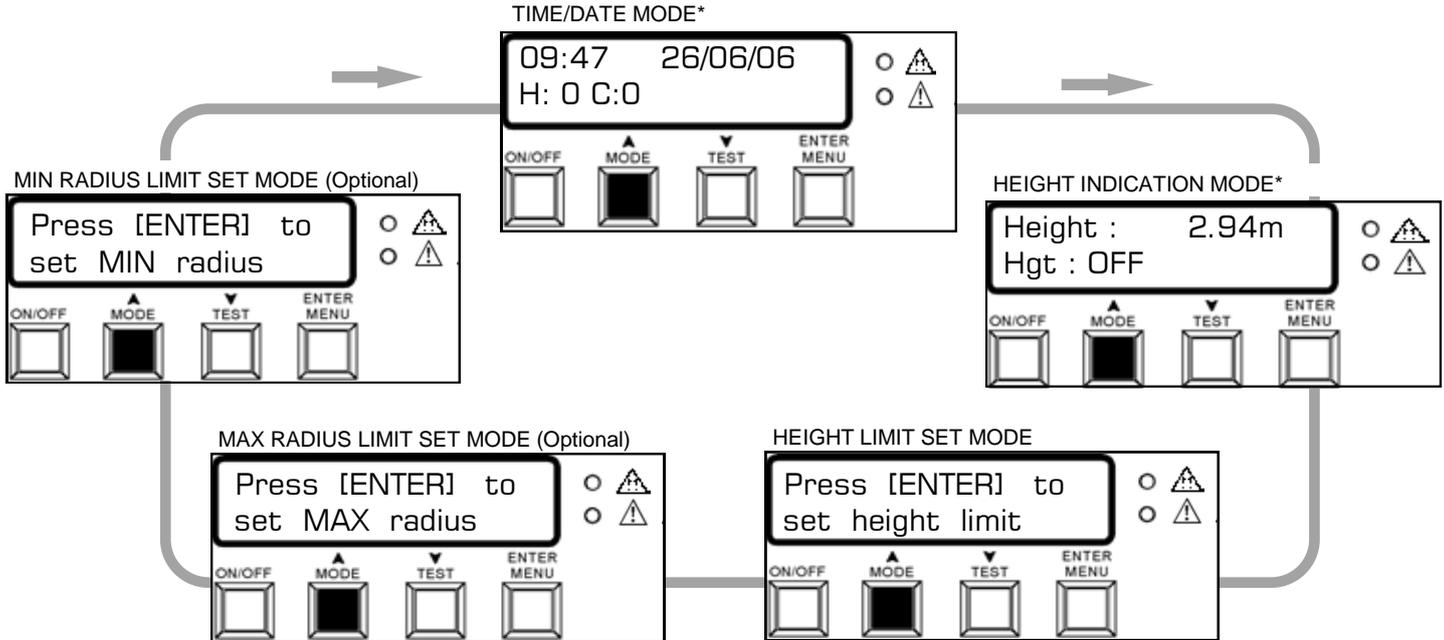
Current time and date are shown on the top line, the status of Height limiting and Cab Protection (Min Radius limiting) are displayed on the bottom line. If a mode has not been activated at calibration, its mode character will not be displayed.

Height limiting	H = 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 through the four available operational modes as shown below with the key in the set position. Maximum Radius and Minimum radius limit (Cab protection) must be activated at calibration of system.

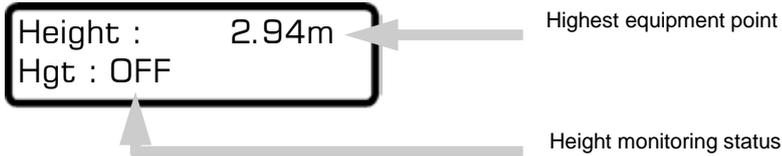


*With the key in the Limit position, only the Time/Date and Height Indication modes are shown.

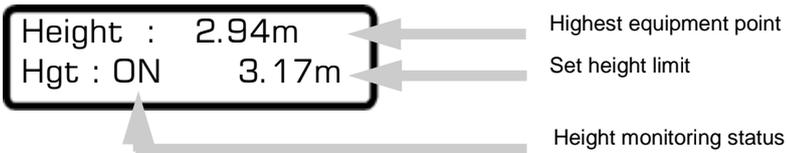
4.0 Height Indication Mode

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

HEIGHT INDICATION MODE – HEIGHT OFF



HEIGHT INDICATION MODE – HEIGHT ON



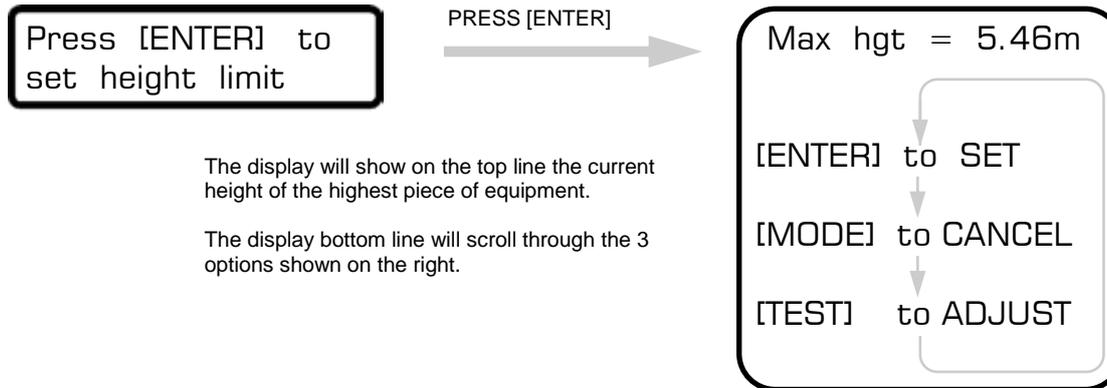
4.0 Height Indication Mode – continued

There are two different methods for setting the 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 height limit display.



4.1 Setting the height limit at an operator derived equipment position – continued



In this example the maximum equipment height is referred to the bucket pin.

Max hgt = 5.46m
[ENTER] to SET

The display will show the current height, move the equipment to the desired new maximum height.

↓
PRESS
[ENTER]

<<<<LIMIT>>>>
! ARM TOO HIGH

The display will show the set height and will be in alarm mode until the equipment is lowered from the SET height.

↓

09:47 26/06/06
H: 1

← In Time/ Date Mode:
Displays Height monitoring status H:1 = ON

Height monitoring status



Height : 2.94m
Hgt : ON 5.46m

← In Height Monitoring Mode:
Measurement of current highest equipment point

The Height monitoring mode is now active, any piece of equipment which intrudes into the set Height Limit will cause the relevant alarm and motion cut condition (If fitted) to occur. See section 1.2 for further details.

4.2 Setting the height limit to a known height

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

Press [ENTER] to set height limit

PRESS [ENTER]

Max hgt = 5.46m

[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.

Hgt MAX = 5.46
[ADJ<>] [ENTER]

PRESS [TEST]

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

PRESS [TEST]

09:47 26/06/06
H: 1

In Time/ Date Mode:
Displays Height monitoring status H:1 = ON

Height monitoring status

Height : 2.94m
Hgt : ON 5.46m

In Height Monitoring Mode:
Measurement of current highest equipment point

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

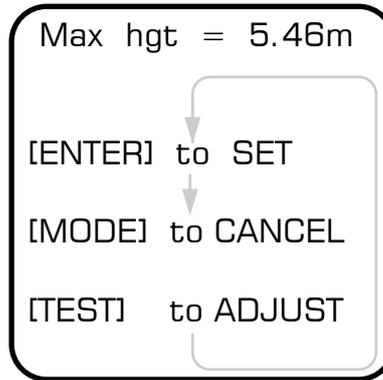
The Height monitoring mode is now active, any piece of equipment which intrudes into the set height limit will cause the relevant alarm and motion cut condition (If fitted) to occur.

4.3 Switching OFF the Height Monitoring

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

Press [ENTER] to set height limit

PRESS [ENTER]



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]

Height Monitoring is OFF until a new height limit is set.



In Height Monitoring Mode: Measurement of highest equipment point

In the Time/ Date Mode, 'H' will equal 0 to indicate height Limiting is not set.



4.4 Height Alarm Conditions

When the machine equipment reaches a set height limit the Heightmaster will go into alarm mode. The operator will be alerted visually, audibly and operationally of the condition.

Height: 7.30m
! BOOM TOO HIGH

Height: 7.30m
! ARTIC TOO HIGH

Height: 7.30m
! ARM TOO HIGH

The display will inform the user which piece of equipment is too high. The RED LED will illuminate. The internal and *external alarms will sound.

Whichever piece of equipment is causing the alarm condition will have its motion cut such that it cannot intrude into the set height limit any further.

In the case of triple articulation machines both base boom and secondary boom (boom and artic) will be restricted from raising should either a "BOOM TOO HIGH" or "ARTIC TOO HIGH" condition occur.

The alarm condition will be cleared on lowering the equipment from the set height limit.

*External alarm will sound if fitted

5.0 MIN Radius Limit (Cab Protection) Mode

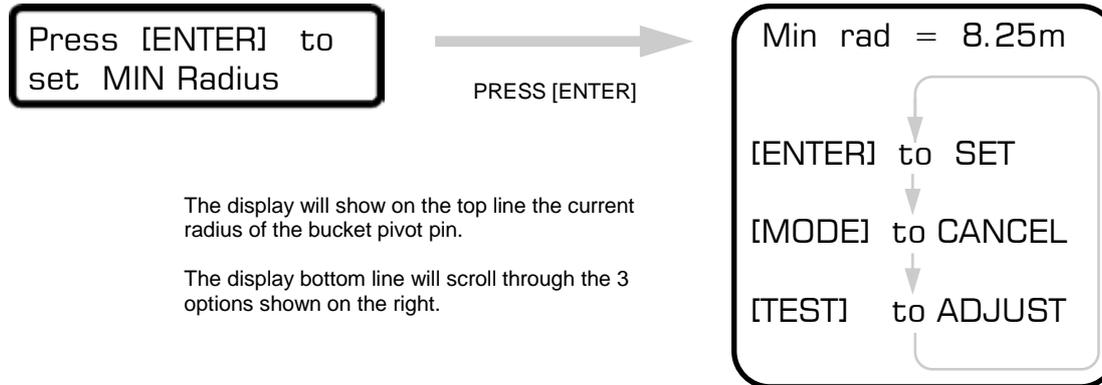
The min Radius Limit does not have its own screen to view the set limit. The only information available is located in the Time/ Date Mode which shows a C:0 or C:1. C:0 indicates the Min Radius Limit is turned Off and C:1 indicated the Min Radius Limit is turned On. To view the set limit, enter the Set 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

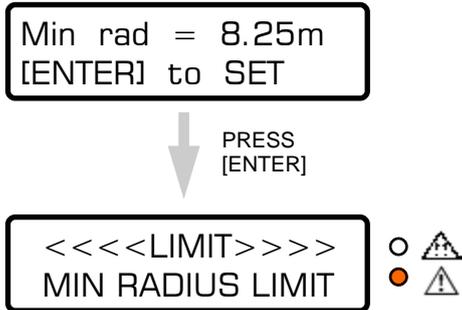
5.1 Setting the MIN Radius limit at an operator derived equipment position (Cab Protection)

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

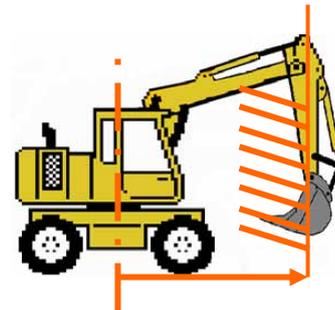
Move the equipment to the desired new minimum radius and press ENTER. The radius displayed on the screen represents the current bucket pin position and does not take into account bucket or load dimensions.



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



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]

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

PRESS [TEST]

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.

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
H: 1 C: 1

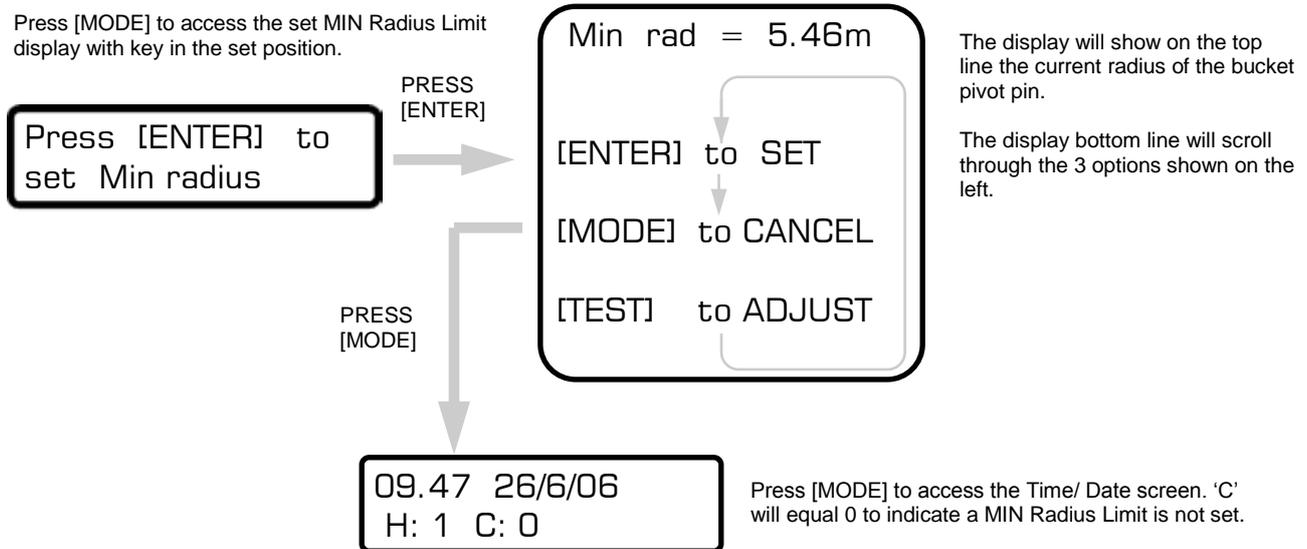
In the Time/ Date Mode, 'C' will equal 1 to indicate a MIN Radius Limit is set.

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

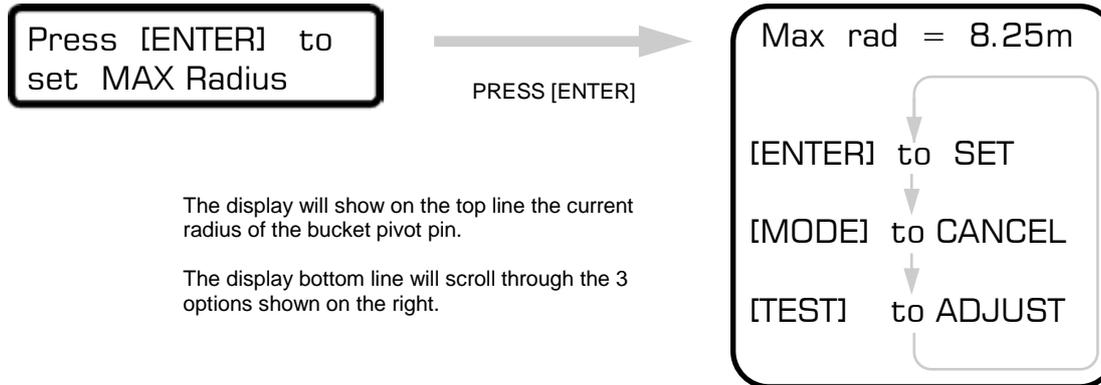
The max Radius Limit does not have its own screen to view the set limit. The only information available is located in the Time/ Date Mode which shows a R:0 or R:1. R:0 indicates the Max Radius Limit is turned Off and R:1 indicated the Max Radius Limit is turned On. To view the set limit, enter the Set 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

5.1 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

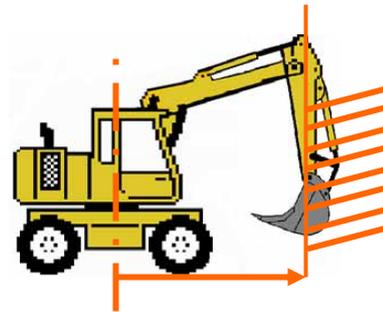


PRESS
[ENTER]

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



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



Maximum radius = 8.25m

09.47 26/6/06
H: 1 R: 1

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

*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
H: 1 R: 1

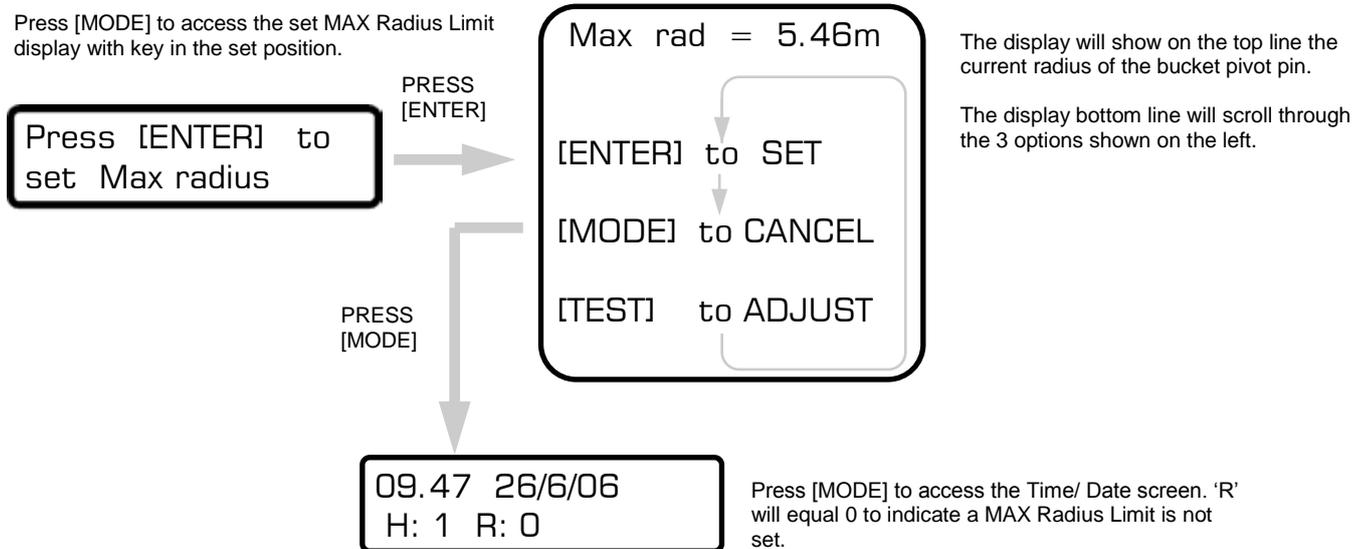
In the Time/ Date Mode, 'R' will equal 1 to indicate a MAX Radius Limit is set.

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.

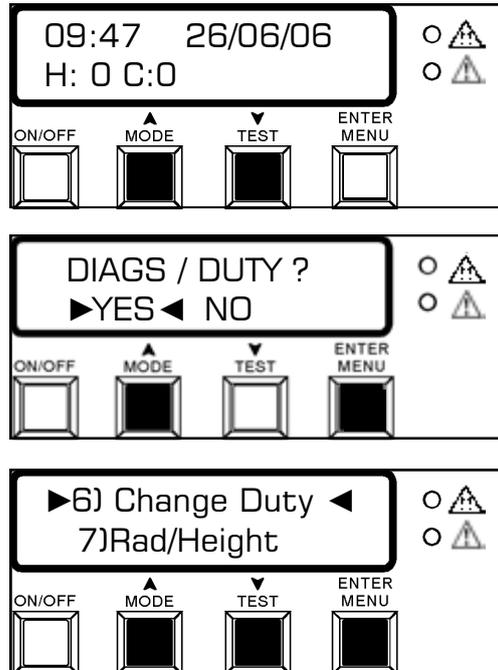


7.0 Duty Selection Mode

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.

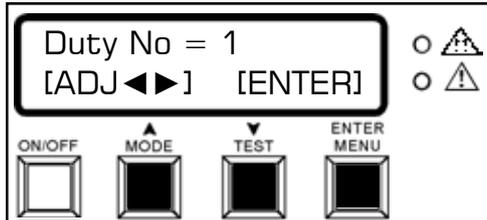


PRESS MODE and TEST together

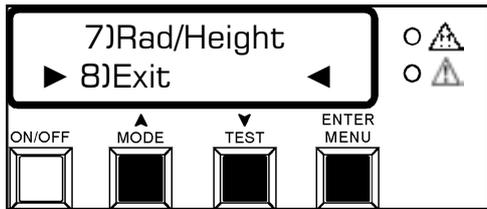
PRESS MODE to select YES and PRESS ENTER

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

7.0 Duty Selection Mode – continued



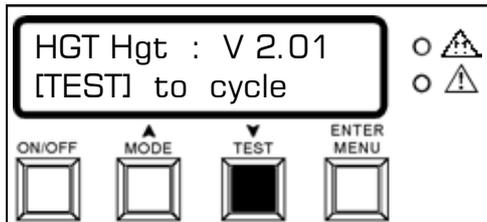
Use the MODE and TEST keys to select the required duty number. There is a maximum of 8 possible duty selections. Press ENTER to confirm the selection. After duty changes are made, test equipment to ensure correct operation. The test function can be used to check current duty and current equipment lengths,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



PRESS MODE or TEST
to scroll to Exit and
PRESS ENTER

8.0 System Test

The Heightmaster 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 monoboom 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

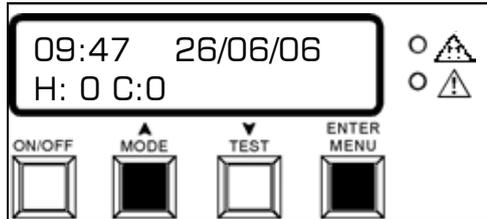
This test displays the current secondary boom angle on hydraulically adjustable boom machines. The angle given is for the imaginary line connecting the two pivot pins. As the secondary boom moves up the value should increase: as the secondary boom moves down the value should decrease. When the two pins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

15:53 26/06/08
H:1

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]

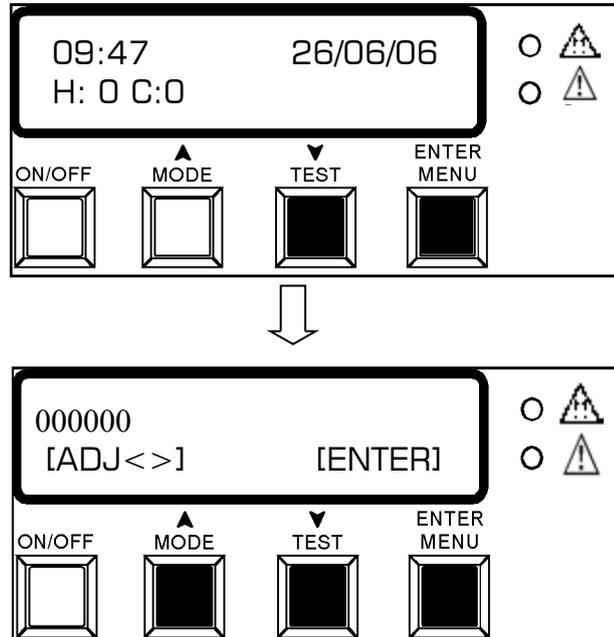
MONTH range = 1 to 12 (1 = January, 12 = December)

Year = 08
[ADJ<>] [ENTER]

YEAR range = 00 to 99 (00 = 2000)

10.0 Setting Screen Contrast

To adjust the contrast on the Heightmaster 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 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.



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