



Heightwatch 6 user manual

Document reference: 560368-000

V1.1



This guide describes operation installation and calibration of the
PROLEC HEIGHTWATCH 6 INDICATOR FOR EXCAVATORS

| | | |
|-----------------|------------------|----------------|
| Model covered : | MODEL REF | HEIGHTWATCH 6 |
| | SOFTWARE VERSION | 1.05 |
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THIS 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.

! WARNING !

Avoid accidents involving product installation, calibration, operation, maintenance and repair by observing basic safety rules and precautions.

Only personnel with the necessary training, skills and tools should perform installation and calibration of the Heightwatch 6 system.

Be alert to the potential hazards listed below :

- Always disconnect the battery/ ECU's prior to welding or during electrical installation.
- Do not drill ROPS and FOPS cabs. Suitable mounting equipment is supplied with the installation kit.
- Do not site components where they will obstruct emergency exits
- Do not work on the machine with the bucket/arm raised unless supported.
- Do not work on the hydraulic system with the bucket/arm raised unless supported.

The warnings listed above are by no means exhaustive. Therefore the installation engineer must satisfy himself that any operating technique not specifically recommended is safe to use and that the product/machine will not be damaged or made unsafe by procedures that are chosen by the installation engineer.

Note:

Prolec Ltd. reserves the right to amend specifications, information and designs without notice. Prolec Ltd. cannot anticipate every possible circumstance that might involve a potential hazard and the warnings given in this manual are not all inclusive. The correct functioning of this equipment is dependant upon correct installation and calibration.

CONTENTS

| Section | Subject | Page |
|----------------|-------------------------------|-------------|
| | OPERATION | 5 |
| 1 | Function | 5 |
| 2 | Description | 5 |
| 3 | System Components | 6 |
| 4 | Operation | 7 |
| | INSTALLATION | 9 |
| 5 | Specification | 9 |
| 6 | Installation of components | 10 |
| 7 | System Wiring Details | 11 |
| 8 | Parameter Adjustment | 12 |
| 9 | Fault Finding and Maintenance | 15 |

OPERATION

1.0 Function

Heightwatch 6 – HW6 – is designed for the positional sensing of the height of a single articulation and may be used with 360° machines, wheeled loaders and lorry mounted cranes. The positional sensing is determined by monitoring the angle of the equipment. The system provides audible and visual alarm indication and offers optional motion inhibit. This allows safer operation of the machine in restricted applications. Heightwatch 6 is key operated and can be locked on / off by the operator or site safety officer. This gives the system the added advantage of providing machine immobility by allowing the equipment to be locked at a secure position, requiring the adjustment of the height setting before the machine can be moved.

2.0 Description

The Heightwatch 6 system consists of the following main components :

- 1 Sensor Unit – the sensor is boom mounted inside the protective mounting cradle.
- 2 Display Unit – usually mounted inside the machine cab.
- 3 Hydraulic motion cut – optional – mounted externally, dependant upon machine and hydraulic types.
- 4 System cable
- 5 Power / motion cut cable
- 6 Optional Beacon showing HW6 in active mode

The HW6 is a microprocessor-controlled system that functions in a fail-to-safe mode of operation i.e. if the computer fails, or the system cable breaks, then the alarms indicate the failure occurrence to alert the operator and operate the motion cut (If fitted). This is achieved by activating the motion cut relay during safe operating modes and de activating the motion cut relay during alarm modes.

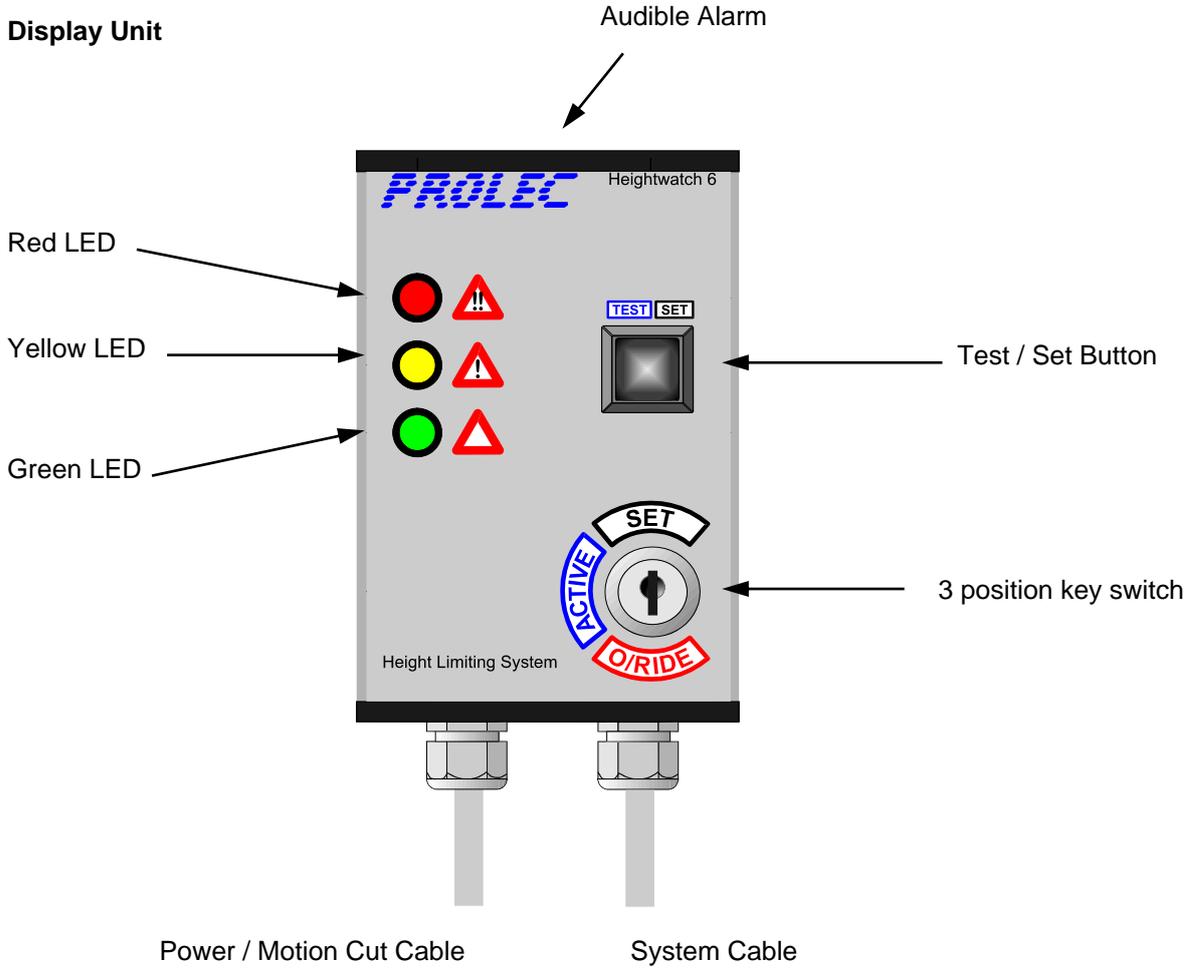
The microprocessor circuit, angle sensing device and display control circuit are contained within the Sensor unit. The sensor is an extremely rugged device and is fully potted giving it an IP67 water resistant rating when correctly mated with the system cable connector.

A cab mounted display provides the operator with the ability to set a height limit without having to manually adjust any external mechanical components. This is achieved by the use of the display key switch and the pushbutton. The display provides the operator with a warning during the approach to the set limit as well as the alarm condition when the set limit is reached. The alarm is mounted in the top plate of the display enclosure. When the set height is reached the display alarm will sound and a single relay which may be used to control a solenoid valve is activated inside the display. The set limits are stored in non volatile memory of the computer / sensor. On power up the system will automatically use the last set limits unless new limits are set.

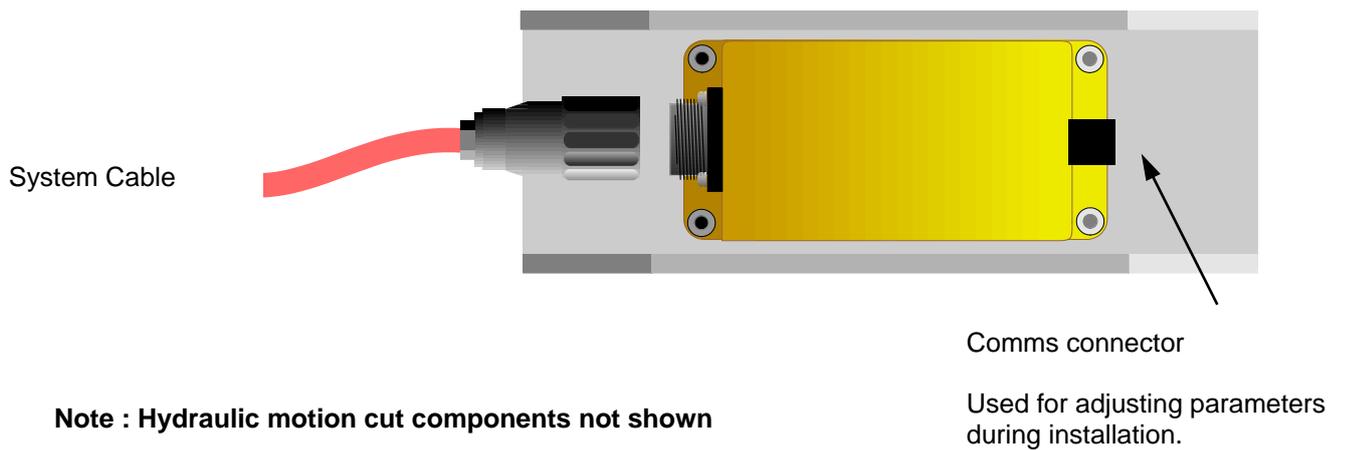
A dual function push button allows for a self test routine to be performed and / or the setting of a height limit dependant on the key switch position.

The key switch over ride position (O/RIDE) will stop the HW6 computer from operating and over ride the motion cut relay contacts allowing the machine to be used without the HW6 system from interfering in the normal operation of the machine.

3.0 System Components



Sensor Unit and Mounting Channel



4.0 Operation

BEFORE OPERATION ALWAYS CHECK THE VALIDITY OF THE ALARM HEIGHT AND THE RELAY / SOLENOID ACTIVATION BEFORE PROCEEDING

4.1 Key Switch Active

With the key switch in the ACTIVE position the following will occur :

- 1 **Equipment below height limit** – Safe condition – Green LED illuminated. Motion cut relay activated. Motion cut solenoid operational.
- 2 **Approach to height limit** – Warning condition – Green LED illuminated. Yellow LED pulses. Alarm pulses in sequence with the Yellow LED. Motion cut relay activated. Motion cut solenoid operational.
- 3 **Equipment at height limit** – Alarm Condition – Green, Yellow and RED LEDs illuminated. Alarm permanently sounding. Motion Cut relay de activated. Motion cut solenoid de activated.

The alarm condition will activate for a minimum period of 3 seconds, even if the equipment is lowered below the height limit within the 3 second period.

The alarm condition will remain activated until the equipment is lowered below the height limit.

Optional beacon will be active when the key is in the Active position..

4.2 Setting the Height Limit

- 1 Turn the key switch to the SET position. The Yellow and Red LEDs will alternate.
- 2 Move the machine equipment to the required maximum height.

Important : Place the arm at maximum extension before setting the height. See figure 1.0

- 3 Press and hold the SET / TEST button until the Yellow LED illuminates.
- 4 Return the key switch to the ACTIVE position.
- 5 Verify the operation by lowering and raising the equipment through the new alarm position.
- 6 Re adjust alarm position if necessary.

4.3 Test Procedure

The operation of the Heightwatch 6 system can be verified at any time the key switch is in the ACTIVE position, by pressing the SET / TEST button. Pressing SET / TEST will cause the internal alarm to sound, all the LEDs to illuminate and any optional equipment connected to the system to activate (e.g. solenoid operated lock out valve).

4.4 Key Switch Override

With the key switch in the OVERRIDE position the Heightwatch 6 computer / sensor unit will be inactive. None of the display LEDs will illuminate and the alarm will not sound. The solenoid relay will be over ridden and will have no effect on the operation of the machine.

Height Limit Operation

Important :

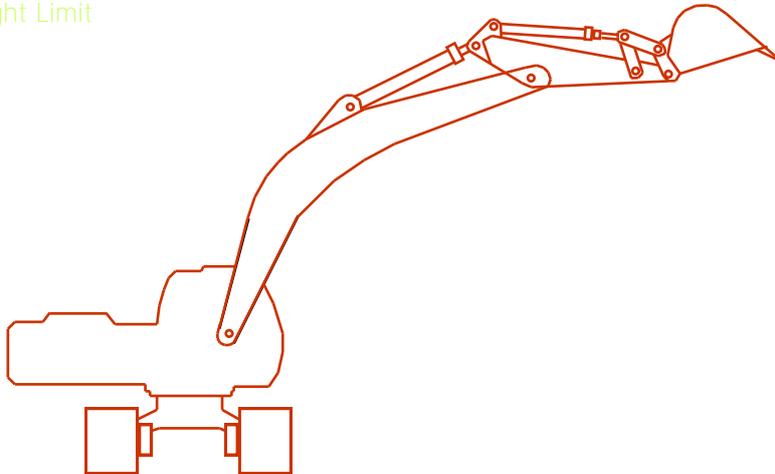
This Prolec system is fitted with motion cut operation on the Boom only. The Dipper will not stop movement at the alarm limit.

When setting the height limit ensure that the Dipper is fully extended and the bucket moved back to its worst case position before moving the boom to the required height limit.

When the height limit is reached the boom up motion will stop and the in cab display will enter its alarm conditions.

Example :

Height Limit



This notice applies to the following Prolec products :

- 1 HW6
- 2 LW5 with single motion cut option installed

If in doubt read the operator manual or contact Prolec Service.

Cab Sticker
Part No : 560343-001 Issue 2



Figure 1.0

INSTALLATION

5.0 Specification

Electrical

+10V to +30V to accommodate both 12V and 24V machine types.
System protected with in line fuse.
Sensor protected with resettable fuse.
Reverse connection protected.
Protected against overvoltage and machine transients.

Environmental

Storage Temperature : -40°C to +76°C

Operating Temperature : -20°C to +60°C

Sensor enclosure protected against dust and water ingress to IP67.

Display enclosure suitable for all types of cab mounting.

Sensor

Solid state sensing device.

+/- 90° sensing range

Impact resistance of sensing device – 20000g

Display

3 x High Intensity LEDs for status indication

1 x push button

1 x 3 position key switch

Alarm – 85dB at 1m

EMC

Meets Directive 89/336/EEC.

6.0 Installation of Components

6.1 Heightwatch 6 Display

The Heightwatch 6 Display can be fitted to any convenient surface inside the machine cab ensuring that the operator has convenient access to the key switch and Test / Set switch.

The mounting is achieved via the ball joint adaptor fitted to the bottom plate of the display housing.

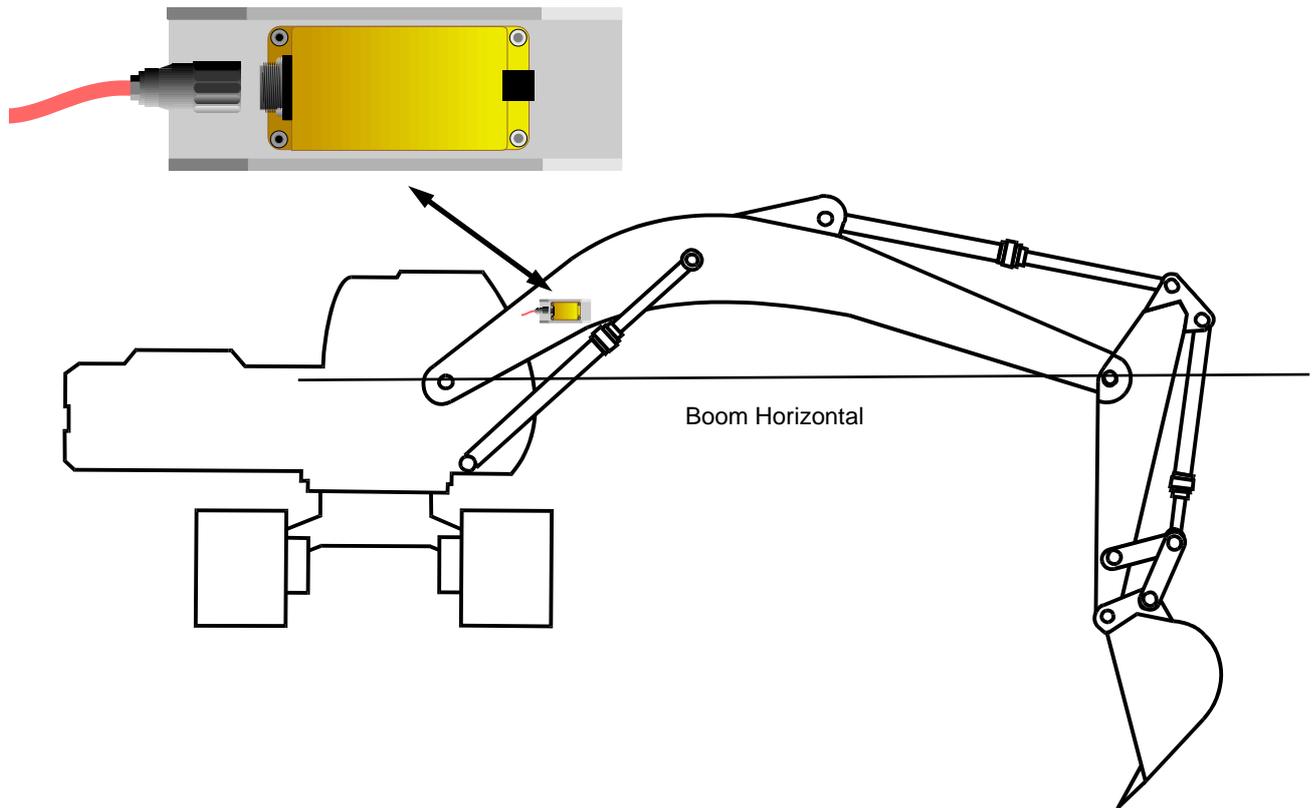
Try to mount the unit in a position that provides easy sight of the LEDs and access to the Key switch and test / set button. The mounting must make the display accessible, but not obtrusive in any way that could cause harm to the operator or the equipment. Avoid vulnerable long cable runs inside the cab. When routing the cable to the controller try to use existing cable looms, and make sure any holes drilled for routing purposes are properly deburred and grommeted.

6.2 Heightwatch 6 Sensor

The sensor is mounted on the side of the equipment to be monitored. The sensor should be mounted away as far as possible from moving parts like rams or hoses, and away from any potential danger caused by the material being handled.

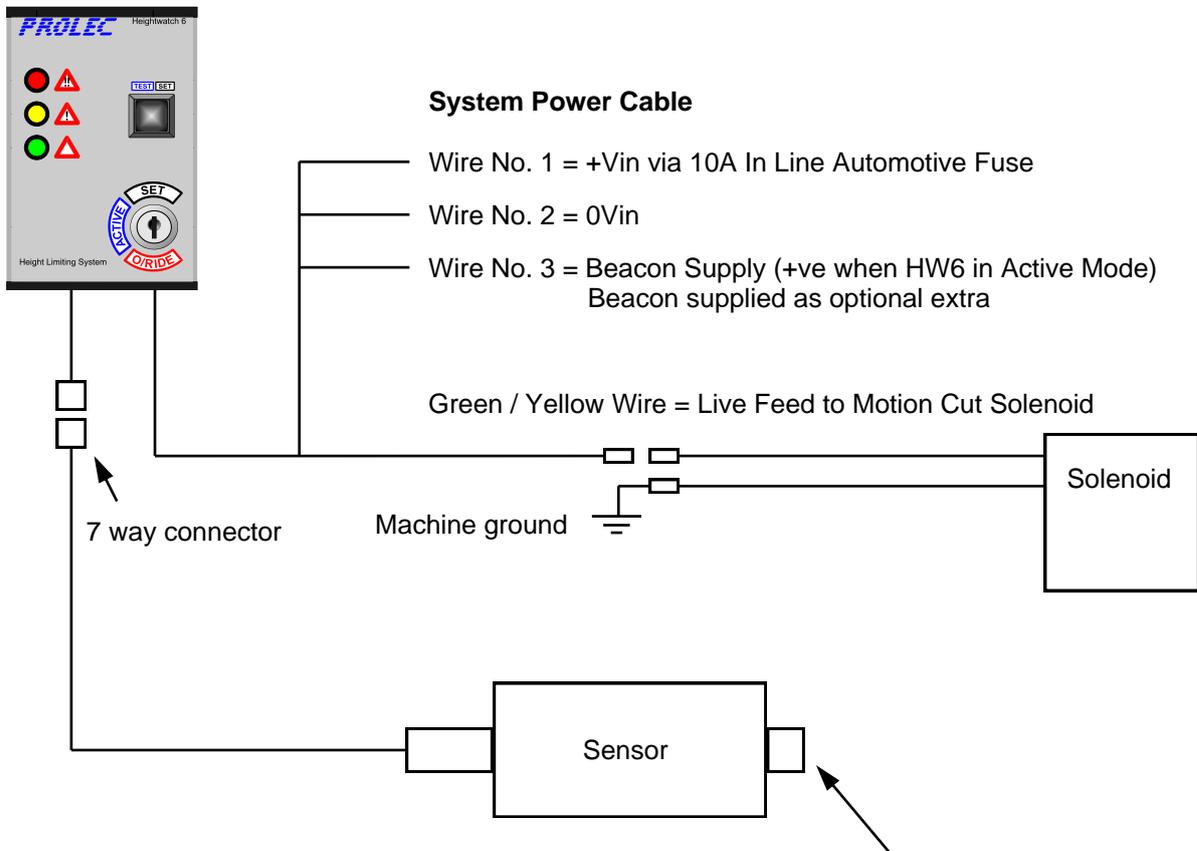
The sensor is mounted via the mounting bracket provided. The bracket is welded to the equipment and should be positioned such that it is approximately horizontal when the equipment is horizontal e.g. in the case of a 360° machine or back hoe loader this is when the boom pivot pin and the dipper pivot pin are at the same height. The sensor can be mounted either way up on either side of the equipment to be monitored, however the cable must be on the boom pivot side.

See Below for horizontal mounting position :



7.0 System Wiring Details

General wiring layout of the Heightwatch 6



Note : The comms connector must have the cap tightly fitted as this provides environmental sealing.

The comms connector is only used if parameter adjustment is required.

- 1 Ensure that the system cable sensor connector is correctly located and tightly fastened to the sensor connector, to provide environmental sealing.
- 2 The power cable must be connected via an in line 10A fuse to protect the equipment and the machine electrics. When selecting a power take off point ensure that it is ignition switched and that it has the ability to provide 10A without damaging the machine wiring. Avoid noisy power points such as those that supply wiper motors etc.
- 3 All cables must be fastened with cable ties and not be run where they can be damaged or cause a hazard.

8 Parameter Adjustment

The default parameters of the HW6 as supplied from the factory are adequate for most installations. However there is a selection of operating parameters that can be adjusted to obtain optimum performance from an installed HW6 system.

A portable PC or serial terminal is required to communicate with the HW6.

HW6 comms cable is required to interface between the HW6 and a PC serial comms port.

The serial port must be set up for : Baud rate = 19200, No parity, 8 data bits, 1 stop bit.

8.1 Set Up Page

With the serial interface installed, apply power to the HW6. Press **S** on the keyboard. This will access the Set Up page and the display will now show the adjustable parameters and the HW6 sensor status. See below.

```

Heightwatch 6 V1.02                                     (c)Prolec Ltd 22/01/02

[1] Toggle RED           A2D Chan 0 : 2024
[2] Toggle AMBER         Chan 1 : 4094 (ACTIVE)
[3] Toggle GREEN         Temperature : 0.0
[4] Toggle ALARM         Half second : 89
[5] Toggle MOTION        Limit angle : 2049 ( )
[C] Clear memory         Approach ang: 1949 (*)
[W] Write e2prom         Angular hyst: 50
[R] Read e2prom          Alm persist : 2
[P] +persistence         Speed adjst : 1.00
[p] -persistence         Change rate : 0
[A] +speed               Direction  : Normal
[a] -speed
[H] Angular hyst+

```

The left half of the display shows which key controls which function. The right half of the display

8.2 Exit the Set Up Page

To exit the Set up page press **N**. This can be done at any time and will not affect any parameters that have been adjusted. Adjusted parameters are only affected if the power is lost, see Memory Options on page 13.

8.3 Display Control

Keys **1, 2, 3, 4, 5** control the HW6 display and can be used for test and fault finding purposes.

- | | | |
|----------|---------------|--|
| 1 | Toggle RED | switches Red LED on / off |
| 2 | Toggle AMBER | switches Amber LED on / off |
| 3 | Toggle GREEN | not used as Green LED is permanently on when power is applied |
| 4 | Toggle ALARM | switches Alarm on / off |
| 5 | Toggle MOTION | switches motion cut relay on / off. Note : this will also switch Red LED and Alarm on / off. |

8.4 Memory Options

- | | | |
|----------|--------------|---|
| C | Clear memory | Clears the HW6 e2prom memory and loads default parameters (shown in above display example). |
| W | Write e2prom | Stores displayed parameters in e2prom. Important Note : Any parameters that are adjusted including the memory clear option are not stored in the memory until W is pressed. If the system is switched off without storing , then on power up the previously stored parameters are used. |
| R | Read e2prom | Performs an e2prom read test. Factory use only. |

8.5 Persistence

The alarm persistence is the minimum time that the alarm condition will stay active when the height limit is reached. The alarm persistence value is shown on the display as Alm persist, the indicated value is the persistence time

- | | | |
|----------|--------------|---|
| P | +persistence | Increase alarm persistence |
| p | -persistence | Decrease alarm persistence in 0.5 second increments i.e. 2 = persistence of 1 second. |

8.6 Speed Compensation

The speed compensation compensates for any delays in the activation of the motion cut system during high speed angle changes. The speed value is adjusted such that the angle (or height) at which the alarm has been set is not affected by the speed of lift of the equipment. This can only be obtained by testing the HW6 at slow and high speeds of lift and adjusting the speed value accordingly. Increasing the value increases the sensitivity of the sensor.

- | | | |
|----------|--------|-----------------------------|
| A | +speed | Increase speed compensation |
| a | -speed | Decrease speed compensation |

8.7 Hysteresis

This sets the amount of hysteresis in the sensor, i.e. the angle the sensor has to be lowered to exit an alarm condition. The angular hyst value is displayed in 'bits' where 20 bits is approximately equal to 1°.

- | | |
|----------|---------------|
| H | Angular hyst+ |
| h | Angular hyst- |

8.8 Operating Direction

This sets the direction of the sensor operation.

Normal is used for standard height limit operation.

Reverse is used for special cases which require an alarm limit to be approached from above its set point.

- | | |
|----------|-------------------|
| D | Direction Normal |
| d | Direction Reverse |

8.9 Sensor status

The right half of the display shows the status of the sensor and the set parameter values. See the summary below :

| | | |
|---------------|---------------|--|
| A2D Chan 0 : | 2024 | The output from the angle sensor. Will be in the range of 0 to 4095 dependant upon angle. Will be approx. 2048 with sensor horizontal. |
| Chan 1 : | 4094 (ACTIVE) | The key switch and test button status. |
| Temperature : | 0.0 | Temperature of sensor. |
| Half second : | 89 | A half second timer (diagnostic factory use only) |
| Limit angle : | 2049 () | The angle sensor output at which the alarm limit was set via the HW6 display SET option. |
| Approach ang: | 1949 (*) | The angle sensor output at which the approach warning will operate (Note : This is always 100 counts below the set limit). |
| Angular hyst: | 50 | Hysteresis value (20 counts = 1° approx.) |
| Alm persist : | 2 | Alarm persistence (0.5 second increments) |
| Speed adjst : | 1.00 | Speed compensation value |
| Change rate : | 0 | The count by which the limits are compensated due to angular rate. Value will vary depending on rate of change and speed adjust value. With sensor stable = 0. |

9.0 Fault Finding and Maintenance

Due to the simplicity of the display there is only a limited amount of diagnostic information that can be displayed to the operator. Most common faults are attributable to cable faults. A regular maintenance regime will identify the occurrence of any cable problems.

If all the display lamps are illuminated and / or the alarm continually sounds then the problem will be due to a faulty system cable or a computer failure. The computer sensor has no user serviceable parts and will require replacing if at fault. Contact Prolec for guidance if this condition occurs.

If the system does not operate e.g. Green LED not illuminated no alarm conditions etc. then check the inline fuse as described below.

9.1 Maintenance

The Heightwatch 6 system has been designed with ease of maintenance in mind. HW6 has no moving parts. Maintenance is restricted to periodical checking of cable routing / chafing and general fixing / sealing verification.

The sensor element inside the computer / sensor unit is a solid state device and thus is very rugged and extremely reliable. Many sensor installations are by their nature in exposed positions so checks for damaged cable runs and physical sensor damage are important.

The unit is protected by an internal re-settable fuse mounted on the computer board. The system power is protected by an in line automotive fuse. This fuse will blow if a malfunction occurs in the power cable to the Display and / or the cable to the solenoid (or the solenoid itself) and can be replaced by the user. Always confirm and rectify the reason for the fuse failure before replacing with a new fuse.

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