

SERIES 1|H

HEIGHT LIMITER



INSTALLATION MANUAL

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1 OVERVIEW

The Series 1-H is a height limiting system intended for use on excavators, loaders, teletrucks or similar type machines.

The system monitors the angle of the primary boom or arm and compares this angle against a previously stored limit, set by the machine operator. When the boom is lifted to the point where the boom angle approaches the stored “limit” angle, an internal relay is switched within the display and the state of the relay output from the display switches. If this output is connected to an external sounder, the sounder will alarm at the height limit. If this output is connected to a solenoid valve controlling the boom lift function the boom lift function will be cut, preventing movement beyond the height limit. The boom lower function is still active, allowing boom movement back to a safe position.

Because the Series 1-H system references the boom position against gravity rather than against the machine base, machine base gradient is automatically compensated for in operation.

2 MAIN SYSTEM COMPONENTS

2.1 Display

The display is mounted in the machine cab at the operator station, in a position easily accessible by the machine operator. The display has a flying lead, which supplies power to the system and includes the

relay outputs used to activate an external sounder and / or a motion cut valve. The display also has a 12mm CAN bus connection, which is connected to the angle sensor mounted on the machine boom.

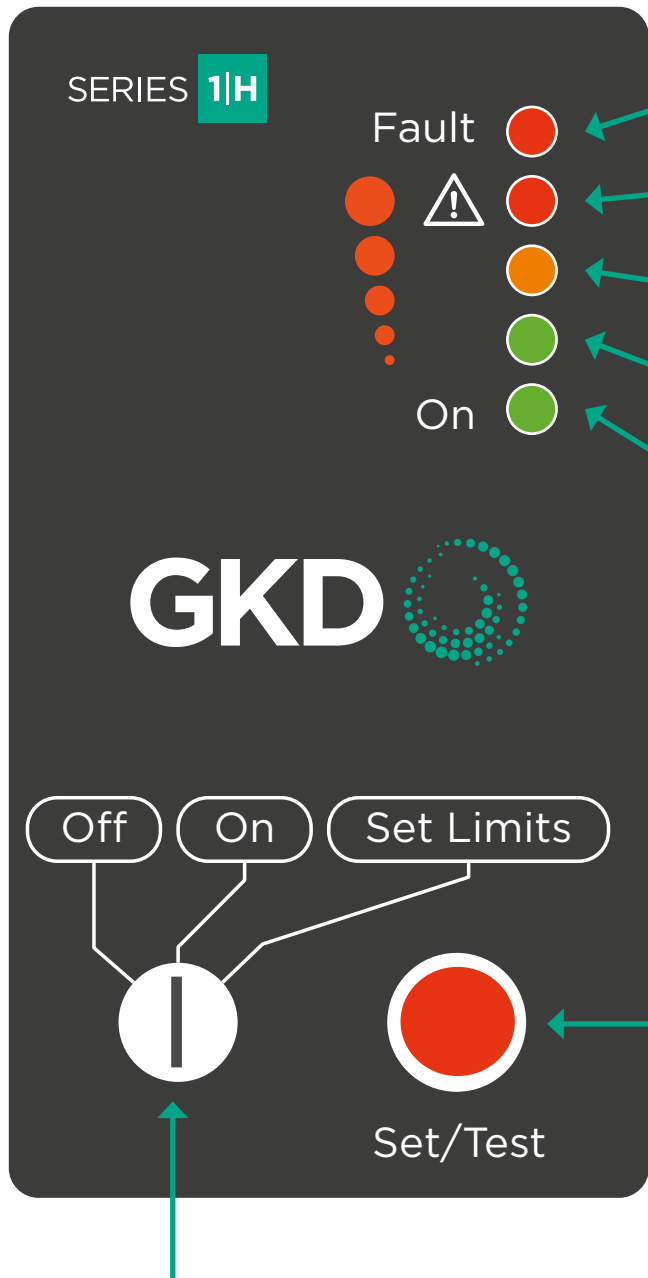
2.2 Angle Sensor

The angle sensor used in this system is a gravity referenced angle sensor, called a GRAVITY V.

In all installations, the angle sensor should be mounted on the first Boom of the machine.

For more information, please see page 8.

3 SERIES 1-H INDICATORS AND CONTROLS



Indicator LEDs in ACTIVE mode:
(see detailed notes in sections below)

Indicates fault with the Series 1-H system or configuration

Indicates System has reached 95% of maximum height limit.

Indicates System has reached 75% of maximum height limit.

Indicates System is below 75% of the maximum height limit

Indicates System Power is ON

Set/Test Button:

= SET when Key Switch at Set Limit

= TEST when Key Switch at On

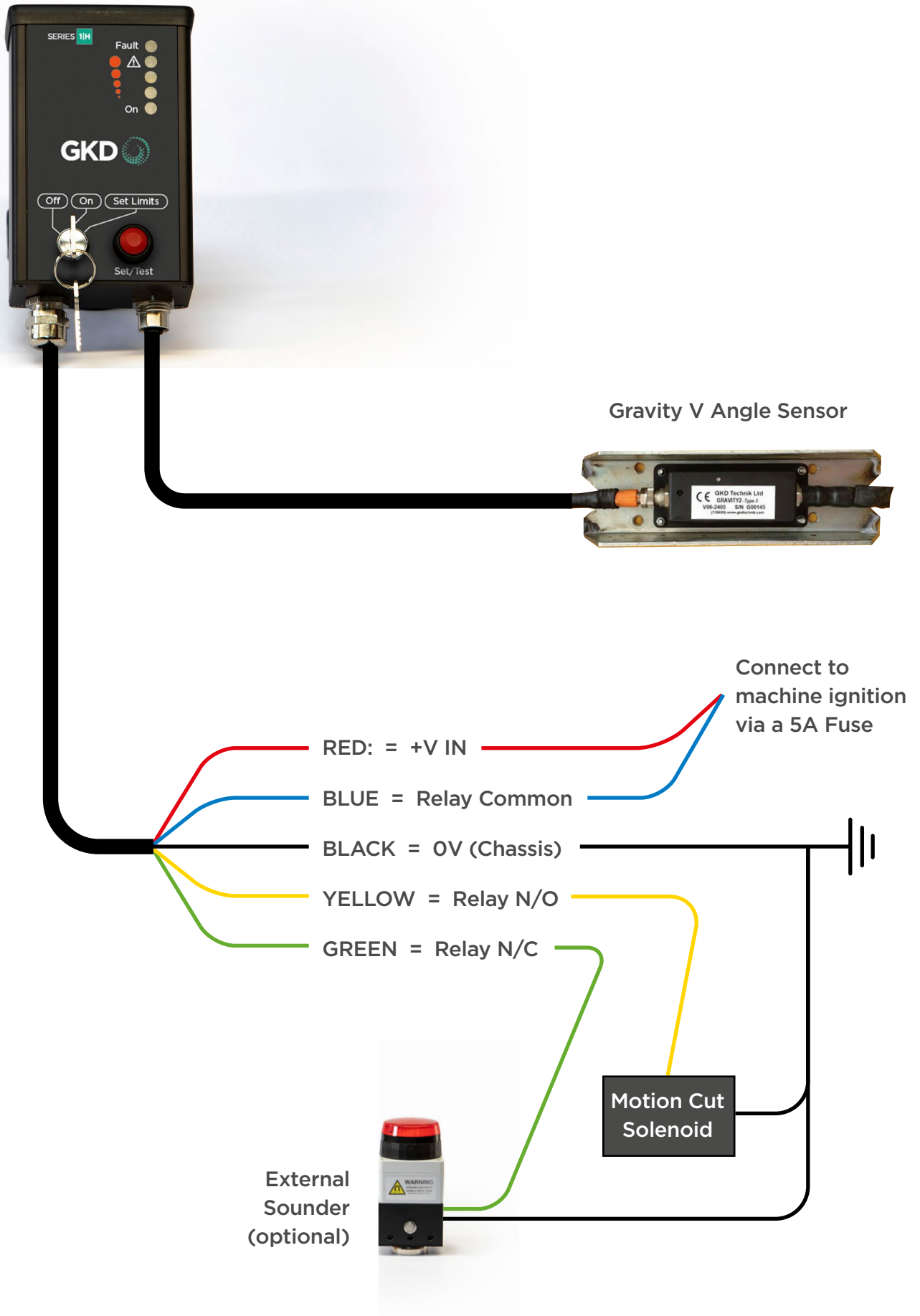
Key Switch:

Off = System in Inactive Mode

On = System in Height Limit Active Mode

Set Limits = System in Setup Mode

4 SYSTEM LAYOUT



5 DISPLAY INSTALLATION

The display should be installed in the machine cab at the operator station, in a position where it can easily be seen and accessed by the operator. Normally this will be on the operator's right side, near the front of the cab.

The display is mounted using a RAM bracket, which will enable the display to be positioned facing the operator. Mount the RAM bracket to a solid surface that is capable of supporting the weight of the display.

Do not modify the frame of the machine by drilling or welding as this will compromise the ROPS / FOPS integrity of the structure.

Ensure that machine controls, operator view of indicator lamps and gauges, and window / door operation are not obstructed.

5.1 Electrical Connections

The display has a flying lead through which all electrical connections are made. A suitable power supply should be identified, this should be ignition switched and capable of supplying **5A** to the system.

The Series 1-H system should be protected by a **5A** fuse on the ignition power supply.

Connect both the **RED** and **BLUE** wires to the **+V** power supply, with the fuse protecting both.

Connect the **BLACK** wire to a good **0V** connection, preferably directly to the vehicle chassis.

5.2 Relay Outputs

The Series 1-H outputs are through the **GREEN** and **YELLOW** wires. Note that these will be **+V** outputs, if either are not used they should be insulated and protected from the possibility of short circuit against a **0V** chassis component or connection.

- The **GREEN** wire will be live when the height limit is reached, and is therefore suited to driving a sounder or lamp indicating that the limit has been reached.
- The **YELLOW** wire will be live when working, and will switch off when the height limit is reached. It is suited to driving a solenoid valve controlling the boom lift function, and will motion cut the hydraulic function at height limit.

5.3 CAN Bus Connection

The 12mm connector on the base of the display is the CAN bus connection to the angle sensor, and should be connected to the angle sensor using the supplied cable.

6 ANGLE SENSOR INSTALLATION

6.1 GRAVITY V angle sensor option

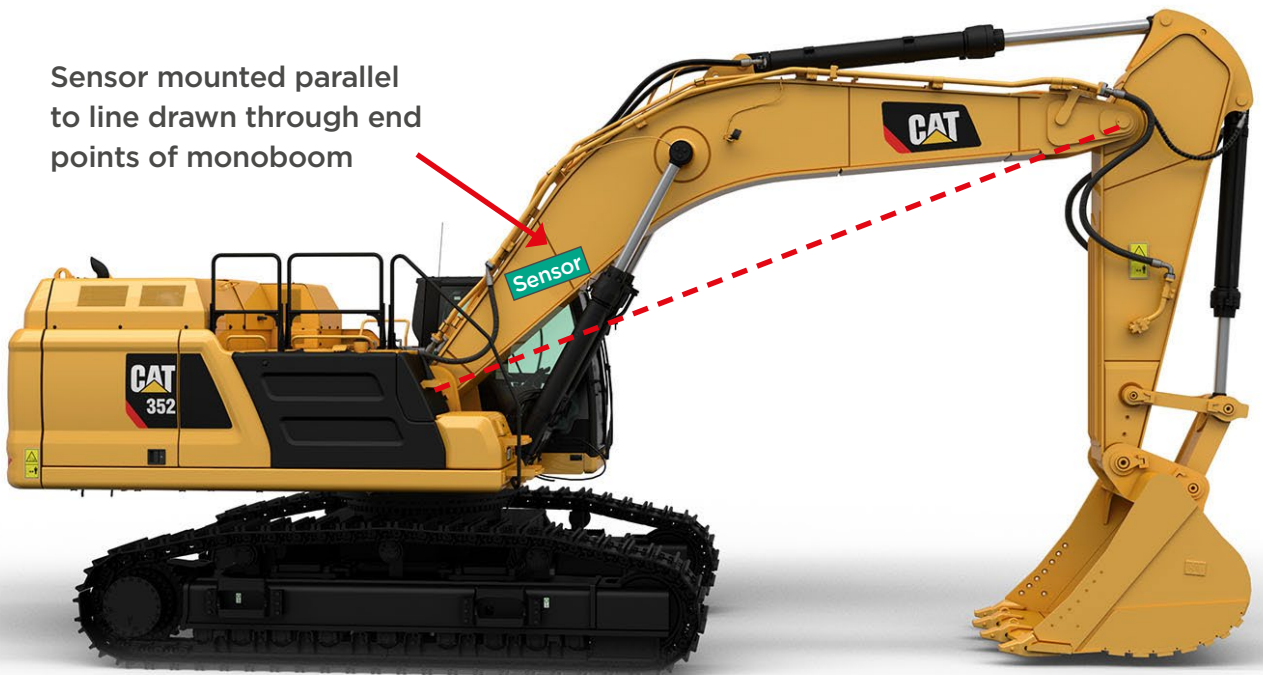
The GRAVITY V angle sensor is installed onto the boom to be monitored.

Identify a position for the sensor on the side of the boom, where it is not likely to be damaged by machine components or to catch moving cables or hydraulic hoses as machine components articulate.

It is preferable that the sensor should be installed as close to the boom base pin as is practical, to minimize acceleration and deceleration forces imposed on the sensor as the boom moves up or down.

The sensor should be orientated so that the long edge is parallel with the boom being monitored.

Sensor mounted parallel to line drawn through end points of monoboom



Sensor mounted parallel to the extending boom. The sensor can be installed on either side of the equipment, but this will depend on what access is available.



Once a suitable position has been identified, remove a small area of paint from the install site at each end of the angle sensor mounting shoe, and weld the mounting shoe to the arm using the V shaped cutout at each end of the mounting shoe.



Treat the area of the weld with anti rust compound and paint to prevent rust forming.

Install the angle sensor onto the mounting plate using the four nuts provided in the kit, and connect the angle sensor to the display using the 12mm CAN cable provided.

Ensure that the CAN bus cable between the angle sensor and the display is routed back into the cab in such a way that it will not be damaged by moving machine components or external forces such as trees or bushes when working in overgrown areas. Provide sufficient free cable at boom or machine articulation points to allow full movement of the booms or equipment without straining the cables.



6.2 Terminating Resistor

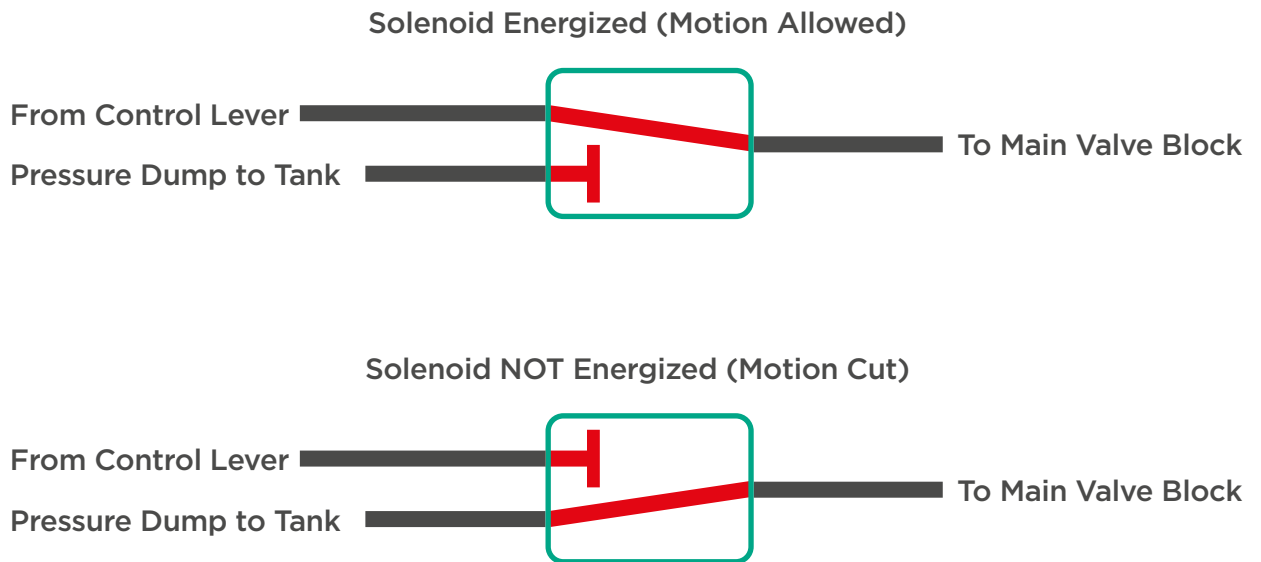
A terminating resistor is provided, this should be fitted to the free 12mm connector on the other end of the angle sensor. The terminating resistor is required to be fitted at the end of any CAN bus line to maintain an efficient CAN bus loop.

7 MOTION CUT SOLENOID VALVE INSTALLATION

If motion cut on height limit is required, a three port solenoid valve should be installed in the low pressure Pilot hydraulic line between the machine control lever and the high pressure valve block.

Identify the pilot line controlling the boom lift hydraulic function.

With the boom fully lowered and the engine off, remove the pilot line hydraulic fitting from the valve block, and route it through the three port solenoid valve as per the diagram below.



7.1 Operating Principle - motion cut valve

When working below the set height limit, boom up motion is allowed and the solenoid valve will be powered. Hydraulic oil can flow freely between the machine control lever and the high pressure valve block. The tank dump line from the solenoid valve is blocked in this valve state.

When the height limit is reached, the power supply from the Series 1-H display to the solenoid valve is cut and the valve closes. The pilot line from the machine control lever is now blocked, and the pilot line to the high pressure valve block is connected to the tank dump port within the solenoid valve to allow any residual pressure in the pilot line to be dumped to tank, thus preventing further upward motion and causing immediate motion cut. When the boom is dropped back below the height limit, power to the solenoid valve is restored and normal operation is resumed automatically.

8 CALIBRATION

Once installation has been completed, set the Series 1-H display key switch to “On” mode and switch on the ignition, causing the Series 1-H system to power up.

At power up, all 5 LEDs will come on and the internal sounder bleeps as a self-test. The LEDs will then go off in turn.

When powered up with no Horizontal reference or Height Limit set, the red “Fault” and “!” LEDs flash alternately to show the system is in an undefined fault state. This is normal on initial power up.

8.1 Horizontal Position Setting

The Horizontal Position is usually set once, when the Series 1-H system is first installed. The Horizontal Position should be set again if the Series 1-H control unit or the boom angle sensor are modified, moved or replaced.

Setting the horizontal position is important because the Series 1-H system does not know which side of the boom the angle sensor is fitted, and the direction of “Up” is reversed if the sensor is fitted to the opposite side of the boom. Setting the Horizontal position provides a “low boom” reference to the Series 1-H, and as long as the height limit is set ABOVE the Horizontal position, the Series 1-H sensor knows which way is “Up”.

Park the machine on level ground and set the boom as near to Horizontal as practical (or, set the boom to it’s lowest practical position).

Set the Key switch to the Height Limit Inactive position (a special case for initial Horizontal setting).

Press and hold the Set / Test button for 10 seconds, initially the Yellow LED flashes. Continue to hold the Set button On and after 10 seconds the Yellow LED stays permanently On to indicate that the Series 1-H is ready to accept the Horizontal setting.

While still holding the Set button ON, turn the key switch to Set Limit & then release the button.

The yellow LED goes Off and the Green LED comes On for 3 seconds. After 3 seconds the red !! LED comes on to demonstrate that the Horizontal setting has been accepted.

The Horizontal Position has now been set. Set the key switch to Active mode. The red !! LED flashes fast as no Height Limit is set.

(The Horizontal setting can be reset at any time by following the procedure above. Any Height Limit setting is cleared if the Horizontal setting is changed.)

Once the Horizontal position has been set, set a height limit to activate the system.

9 SETTING A HEIGHT LIMIT

To set a height limit, turn the key switch to the “**SET**” position and raise the boom of the machine to the desired maximum height position.

Note: the configuration of the machine equipment will depend on how it is positioned when setting a height limit. See below for how to achieve this.

- **Mono-boom or machines with a hydraulic adjustable boom.** Set the equipment in the worst case, i.e. with the dipper and/or fore boom at full reach, then position at the required height.
- **Teletruks or machines with extending booms.** Extend the boom to its maximum extended length, then position at the required height.

Press the “**SET / TEST**” button. The current boom angle will be stored as the maximum allowed boom angle.

Turn the key switch back to the “**ACTIVE**” position and lower the boom.

If desired, the key can be removed from the Series 1-H in the “**Active**” position to prevent tampering with the stored height limit.

Normal operation is now possible whilst the boom angle is below the stored height limit.

As the boom is lifted towards the stored height limit, The **AMBER** LED on the Series 1-H display will light up as the boom moves through 75% of the available height range, and at 95% of the available height range a **RED** LED will light up on the display, the display internal alarm will sound, and the internal relay within the display will switch state.

Where an external sounder or lamp is installed and powered from the **GREEN** wire from the Series 1-H, power will be provided to the connected device.

Where a hydraulic solenoid valve has been connected to the **YELLOW** wire from the Series 1-H display, power is cut off and motion is cut on the boom raise circuit.

For convenience, the installer username and password are printed onto a label on the unit, which should be removed following installation.

10 FAULT FINDING

10.1 Fault LED

If the “**Fault**” LED is lit, a connection error is present between the Series 1-H display and the angle sensor. Check the CAN bus cable between the display and the angle sensor for damage or incorrect connection. **NOTE:** On first switch on, before the Horizontal boom position has been learned, it is normal for the fault light to flash.

10.2 Angle sensor, no LED

The angle sensor LED should be flashing **GREEN** whilst the system is powered.

No LED showing on the angle sensor may be caused by angle sensor failure, but is more likely to indicate that no power is being supplied to the sensor through the CAN bus cable.

10.3 Angle sensor, red LED

Should the angle sensor LED be **RED**, an angle sensor internal fault has occurred.

10.4 No motion cut or external alarm

Check to make sure that the display internal relay connection (**BLUE** wire) is connected to a +V ignition switched source, as the power to the green and yellow output wires is derived from the blue power input wire.

10.5 Motion cut not working

Ensure that the Horizontal boom position has been learned by the system (see page 14) and that a valid height limit ABOVE the horizontal position has been set, and that the key switch is in the ACTIVE position. If still not working, check the **YELLOW** wire output to the solenoid valve for power, and that the solenoid has a good chassis earth to the 0V connection.

DISCLAIMER

Incorrect installation of any part and or incomplete calibration will affect the correct operation of the Series 1-H.

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If in doubt contact GKD Technologies.

GKD Technologies reserve the right to change these instructions in line with the policy of continuous improvement.

