MOBILE AUTOMATION

USER MANUAL

CONTROL PANEL

DUO2.CAN

This manual is an important part of your purchase. Please read it thoroughly before using your new equipment.

We recommend that you record details of your purchase here so that the information is readily available if you ever need to contact your supplier.

Serial number	
Date of purchase	
Purchased from	
Telephone	
Email	

Published by:

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MOBA MOBILE AUTOMATION

MCE Lasers was acquired by MOBA in 2018, bringing 40 years of Australian development and manufacturing together with MOBA's globally recognised and trusted expertise in mobile automation technology.

MCE LASERS

STATEMENT OF LIMITED WARRANTY

MOBA Mobile Automation Australia Pty Ltd (MOBA Australia) warrants all equipment it manufactures and sells to be free of defects in material and workmanship for a period specified below. This warranty period is from the date of sales invoice. All other components not manufactured by MOBA Australia and not specified below, such as hydraulic or electrical components, hoses, fittings and clamps, will carry the original manufacturer's warranty. The warranty covers only equipment sold by MOBA Australia and it's authorised dealers and does not cover parallel imports, which are also known as grey or direct imports. Proof of purchase will be required before claiming warranty.

The warranty does not cover normal wear and tear or deterioration. Any evidence of negligence or abnormal use, accident, improper installation or an attempt to repair equipment by anyone other than factory authorised personnel even when using MOBA Australia's certified or recommended parts, automatically voids the warranty.

The warranty shall only be in force for the benefit of the Purchaser, not any third parties, including without limitation the Purchaser's customers, unless warranty transfer has been approved by MOBA Australia in writing.

Warranty period:

Products	Warranty (months)
Laser receiving systems and components, visual guidance	12
All cords and cables	Dead on arrival only, must be returned within 7 days of receipt
Repairs and Replacements	
Repairs and replacements made under warranty	Warranty expires at the same time as original equipment warranty
Repairs made out of warranty	3

MOBA Australia or its authorised service centre will repair or replace, at its option, any defective part or component of which notice has been given during the warranty period. If service in the field is necessary to repair machine-mounted equipment under warranty, MOBA Australia may authorize on-site repairs at no charge for parts and labour. Travel time, accommodation and other expenses incurred to and from the place where repairs are made will be charged to the purchaser at the prevailing rates. If warranty service can be done at a factory authorised service centre, the customer will pay only one-way freight charges.

The foregoing states the entire liability of MOBA Australia regarding the purchase and use of its equipment. MOBA Australia will not be held responsible for any consequential loss or damage of any kind.

This warranty is in lieu of all other warranties, expressed or implied, except as set forth above, including any implied warranty of merchantability or fitness for a particular purpose which are hereby disclaimed.

SAFETY INFORMATION

Please become familiar with the important safety information in this section. Improper use or installation of the system may result in personal injury or damage to the system.

1 Read and become familiar with the manufacturer's operating manual for your machine, including safety information, before installing or using your Control Panel.

2 A construction site can be hazardous and working around heavy construction equipment can be dangerous. Always exercise extreme caution when on a construction site.

3 Do not let any part of the unit protrude into traffic or limit the visibility of the operator.

4 Always use eye protection when welding, cutting or grinding is being done on the machine.

5 Hydraulic lines can be under extreme pressure, even when the machine is not running. When working on or near hydraulic lines, protect yourself at all times and wear protective clothing.

Warning:
Do not weld near any hydraulic line or on any equipment while it is in operation. It is best to remove any electronic gear near a welding job.

7 Any external power supply must be rated between 12 and 24 Volts DC.

Caution:
Be sure your hands are dry before handling the machine battery terminals or power cables.

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1 PRODUCT OVERVIEW

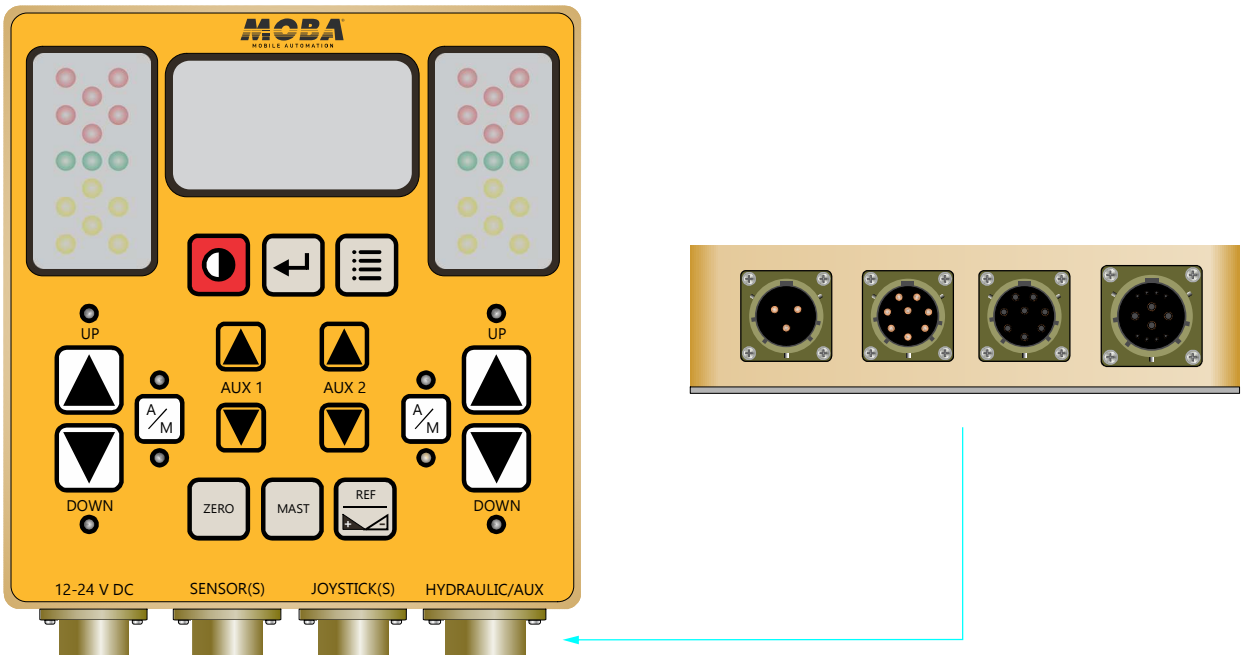


Figure 1.1

The DUO2 is a control panel design for dual machine control applications. The DUO2 has a dual control for valve actuation and dual control for auxiliary valves. The system provides the user with the flexibility to independently use single or multiple valve control.

Information provided by the sensor is intelligently processed and applied to the valve control. System control status and sensor readings are shown in bigger fonts for easy viewing.

A clearly structured configuration menu enables the operator to set all necessary settings, from accuracy selection for control to the selection of different valve types to be used.

In addition a three-coloured 5 channel LED clusters on each side of the unit provide an easily visible indication of the direction the hydraulics valves should be actuated to bring the blade to the set position.

The hydraulics valves can be actuated either automatically or manually, from the panel using keys or a joystick. The DUO2 can drive ON/OFF hydraulic valves along with PV and PI without need of any external accessory.

2 USER INTERFACE

2.1 GRAPHIC DISPLAY

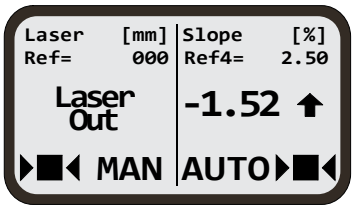


Figure 2.1.1

The graphic display indicates the panel status, sensor reading and sensor dead band accuracy setting. Menus, parameters, important information and various settings are displayed when menus are accessed.

2.2 KEY FUNCTIONS

Power Key - Turns the unit ON/OFF

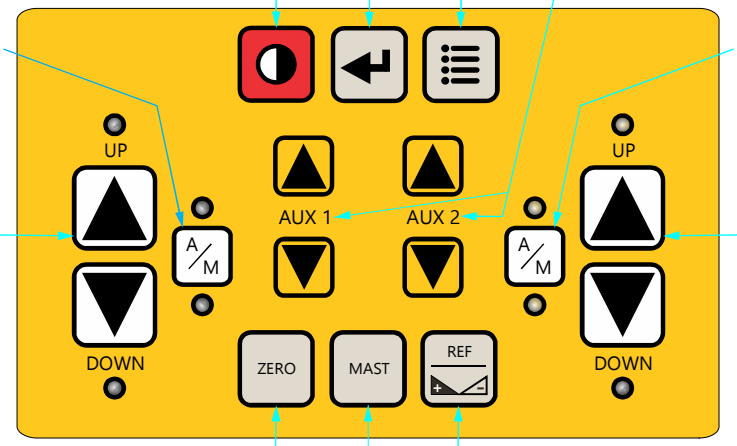
Enter Key - Confirms selection or setting changes in menus.

Menu Key - Accesses the main configuration menu.

Aux Up and Down Keys - Use to:
- scroll through menu options,
- increase or decrease the value of a menu setting,
- activate auxiliary 1 or auxiliary 2 hydraulics up or down (if connected),
- increase or decrease sensor Ref values (if available),
- move mast up or down (if connected).

A/M Key - Flips the main hydraulics valve control for left side between manual and automatic modes.

A/M Key - Flips the main hydraulics valve control for right side between manual and automatic modes.



Hyd Up and Down Keys- Manually activates main hydraulics in up or down direction for left side.

Hyd Up and Down Keys- Manually activates main hydraulics in up or down direction for right side.

Mast Key - Flips between mast screen and standard screen if mast is connected.

REF Key / Slope Reverse Key - Use to:
- Access the References menu for the connected mast or sensors (not available for all sensor types).
- Reverse the Polarity of the target slope when a slope sensor is connected.

Zero Key - sets the value of the connected mast or sensors to zero (not available for all sensor types).

Figure 2.2.1

2.3 KEY LEGEND

This manual uses key designators to represent each graphical key. Please refer to this section for the graphical key equivalents of each key designator.

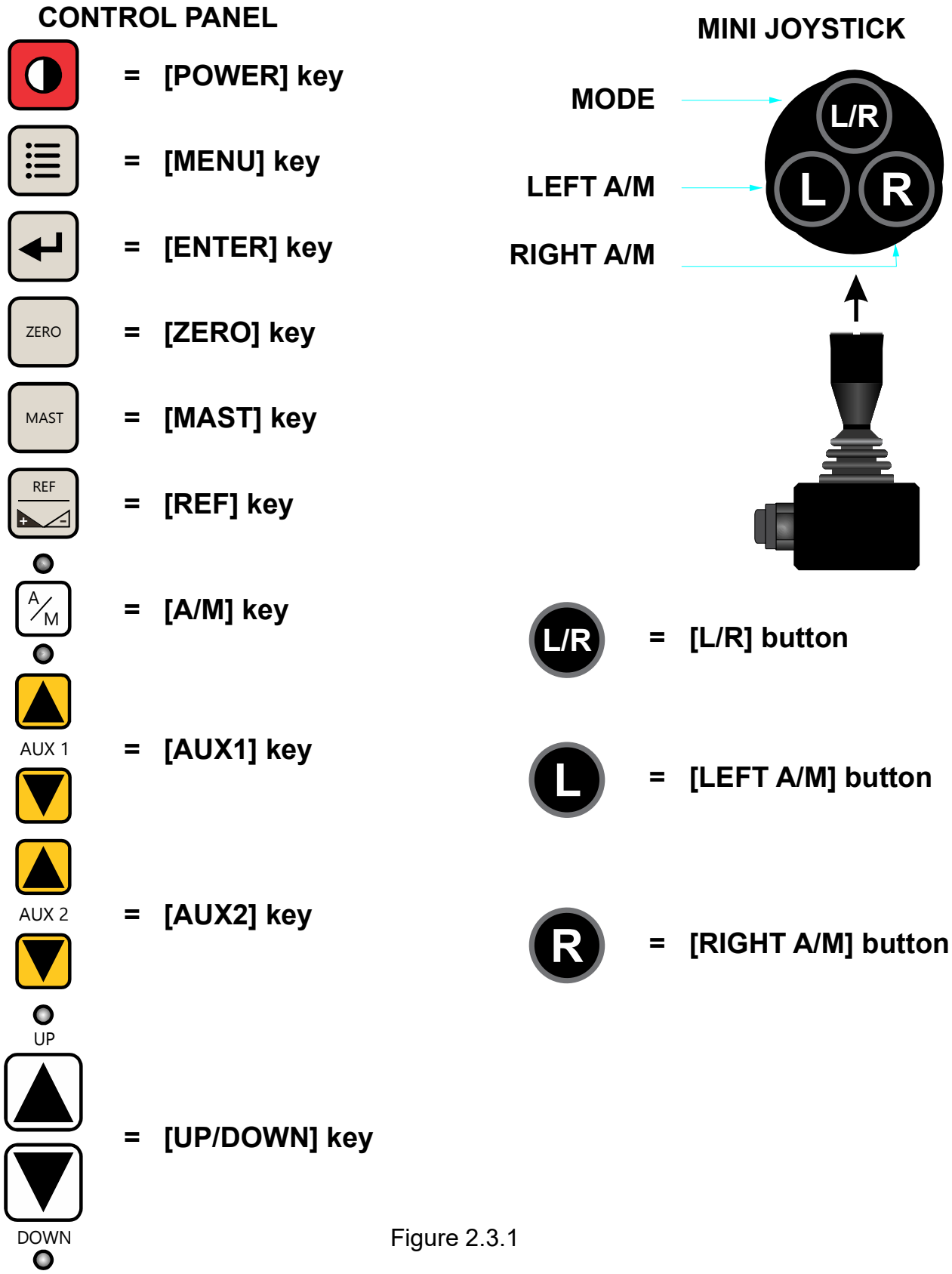
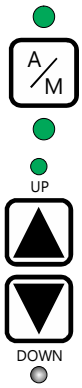


Figure 2.3.1

2.4 LED INDICATION



AUTO LEDs: ON when the hydraulic control for the side is in automatic mode.

MANUAL LEDs: ON when the hydraulic control for the side is in manual mode.

UP/DOWN LEDs: ON when the hydraulic valve for the side is activated up or down.

2.5 SENSOR LIGHTS

The sensor lights indicate the magnitude of the deviations from the centre or 'ON TARGET' and the required direction of the valve actuation to return to centre or 'ON TARGET'. Meaning of the different sensor light indications:

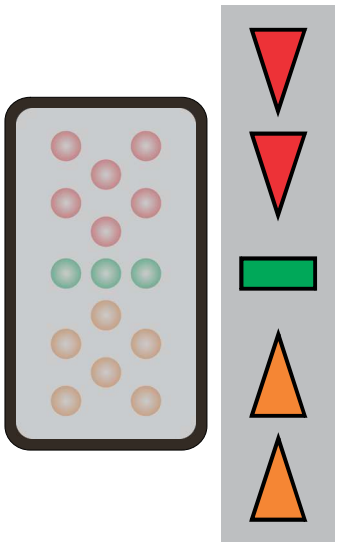


Figure 2.5.1

Top red arrow flashing = very large upward deviation.
Need to lower the bucket/blade by a lot.

Both red arrows flashing = large upward deviation.
Need to lower the bucket/blade.

Only inner red arrow flashing = small upward deviation.
Need to lower the bucket/blade by a little.

Inner red arrow & green bar flashing = very small upward deviation. Need to lower the bucket/blade by very little.

Green bar flashing = no deviation (centre or 'ON TARGET').

Inner orange arrow & green bar flashing = very small downward deviation. Need to raise the bucket/blade by very little.

Inner orange arrow flashing = small downward deviation.
Need to raise the bucket/blade by a little.

Both orange arrows flashing = large downward deviation.
Need to raise the bucket/blade.

Bottom orange arrow flashing = very large downward deviation.
Need to raise the bucket/blade by a lot.

Memory mode: If only top red or bottom orange arrows are flashing at slow rate it indicates the last direction of required correction before the laser beam went off the sensor receiving area.

No communication: If both top red and bottom orange arrows flash together it indicates that the panel has lost communication with the sensor. Please check the cable connection at this point.

2.6 CONFIGURATION MENU

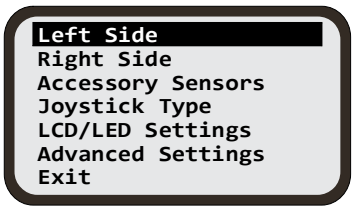


Figure 2.6.1

A variety of settings and features can be set or adjusted through the DUO2 configuration menu.

Settings include simple things like brightness of the panel LEDs to more advance settings like configuration of different hydraulic valve types.

From the working screen, press the [MENU] key to bring the configuration main menu screen.

As discussed before, the left side and right side submenu give access to settings related to hydraulics and sensor.

Using [AUX2] key, scroll down to select the side and then press the [ENTER] key. To bring the hydraulics and sensor setting menu for right side, follow the steps below.

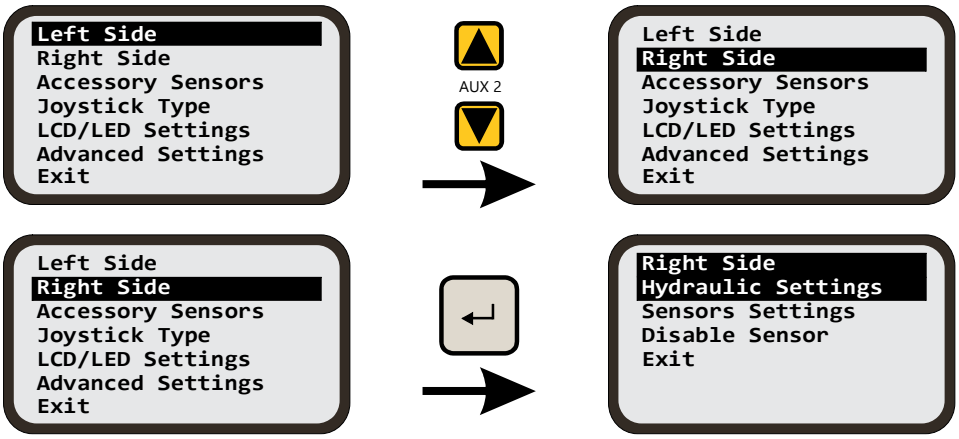


Figure 2.6.2

2.7 LOW BATTERY WARNING

If the battery voltage drops below the level required to operate the unit, a low battery symbol will appear on the LCD briefly before the unit automatically shuts down.

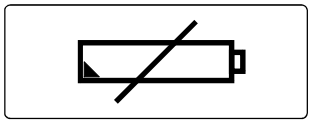


Figure 2.7.1

3 FIRST STEP

This chapter will provide you with information in connecting and setting up DUO2. In addition, a description of the symbols and displays used in the working window will be explained.

3.1 BASIC SETUP

The DUO2 control panel can be setup in multiple different configurations as illustrated below.

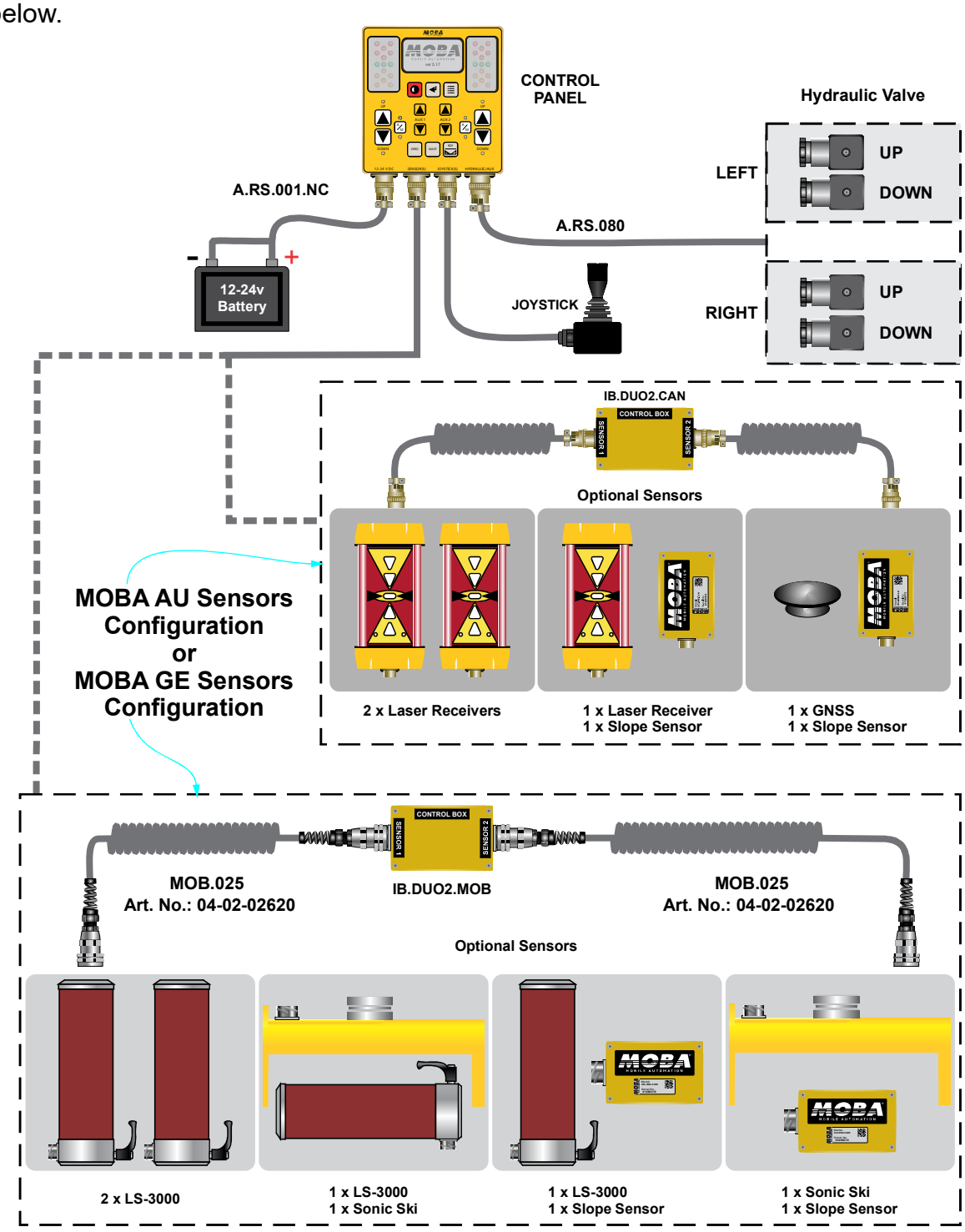


Figure 3.1.1

3.2 CABLE CONNECTIONS

	MOBA AU Configuration		MOBA GE Configuration
Connection	**Option 1 (RS232 Comm)**	**Option 2 (CAN Comm)**	
DUO2-POWER	A.R.S.001 or A.R.S.001.NC	A.R.S.001 or A.R.S.001.NC	A.R.S.001 or A.R.S.001.NC
DUO2-IB.DUO2 (Junction Box)	A.R.S.094	Straight CAN Cord Options	-----
IB.DUO2-SENSOR (Left Side)	A.R.S.074 or A.R.S.034	Straight and Curly CAN Cord Options	-----
IB.DUO2-SENSOR (Right Side)	A.R.S.074 or A.R.S.034	Straight and Curly CAN Cord Options	-----
DUO2-IB.DUO2.MOB (Junction Box)	-----	-----	Straight CAN Cord Options
IB.DUO2.MOB - SENSOR (Left Side)	-----	-----	MOB.025
IB.DUO2.MOB - SENSOR (Right Side)	-----	-----	MOB.025
DUO2-HYDRAULIC VALVES	A.RS..080	A.RS..080	A.RS..080
DUO2 - JOYSTICK/REMOTE	No cable required, connect the Joystick directly	No cable required, connect the Joystick directly	No cable required, connect the Joystick directly

Table 3.2.1

3.3 CONNECTING THE DUO2

1) Mount the DUO2 panel somewhere easily accessible by the operator and secure it properly.
2) Mount the IB.DUO2 or IB.DUO2.CAN or IB.DUO2.MOB (Junction Box) and connect it to the connector labelled SENSOR(S) on the DUO2 using appropriate cable listed in Table1.
3) Mount both sensors on posts or brackets mounted on the blade or bucket and connect them to the junction box using appropriate cable listed in Table 1.
4) Connect the joystick (optional) to the JOYSTICK connector on the DUO2.
5) Connect 12-24v DC (machine battery) to the connector labelled 12-24 V DC on DUO2 using appropriate cable listed in the table above.
6) Connect the hydraulic valves to the connector labelled ‘Hydraulics’ on the DUO2 using A.R.S.080 cable. The end of the cable with the bare wires should be connected to the valves as explained in the following section. Note that the hydraulic valves are normally part of the machine and are not supplied by MOBA Australia.

3.4 HYDRAULIC VALVES CONFIGURATION

The DUO2.CAN can manually and automatically drive most of the commercially available solenoid valves, including popular brands such as Danfoss, Eaton-Vickers, Rexroth and others. It has four different types of hydraulic output drive signal available, suitable for different types of valves as explained in the table below.

Hydraulic Output Types

Hydraulic Output Type	Output Drive	Solenoid Valves That Can Be Driven	Menu Selection	Description
Voltage Proportional	Voltage Signal	Danfoss PVG series with PVE actuator	V[O]	This output is a low current voltage signal, not intended to drive a solenoid directly. Mainly used with Danfoss Proportional Valves which have the PVE actuator incorporated, but other valves with similar actuator can also be driven. Valve spool stroke is proportional to the voltage signal.
Current Proportional	Current	1) Eaton-Vickers KDG4V series 2) Rexroth 4WRAB6	I[O]	This current output can be up to 3A and can directly drive a solenoid. Valve spool stroke is proportional to the current amplitude.
ON/OFF Low Side	Current	1) Eaton-Vickers KDG4V series 2) Rexroth 4WRAB6	ON/OFF (Low Side)	This current output can be up to 3A and can directly drive a solenoid. The 'Low Side' refers to the activation method which is done by switching to ground. Valve spool stroke is either maximum (solenoid active) or neutral (solenoid inactive).
ON/OFF High Side	Current	1) Danfoss ON/OFF with PVEO actuator 2) Eaton-Vickers KDG4V series 3) Rexroth 4WRAB6	ON/OFF (High Side)	This current output can be up to 3A and can directly drive a solenoid. The 'High Side' refers to the activation method which is done by switching the positive voltage supply. Valve spool stroke is either maximum (solenoid active) or neutral (solenoid inactive).

Table 3.4.1

The DUO2.CAN is normally supplied with hydraulic cable A.RS.080 which has colour-coded and labelled bare wires on one end allowing the user to connect their valve according to the particular hydraulic output type requirement for that valve.
Below are examples of how to connect the bare wires for each of the four hydraulic output types using as examples some common valve brands and assuming Hirschmann type connector (CETOP valves). Table 3 can be used as a guide for connecting other valve brands and models, once their hydraulic output requirement and pinout is known.

Typical Hydraulic Cable Connections

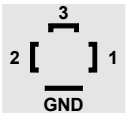
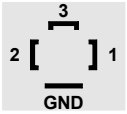
Hydraulic Output Type	Example Valves	Valve Pin Layout*	Connections of A.RS.080 Bare Wires (Wire Colour - Wire Label)
Voltage Proportional (V[O])	Danfoss PVG series with PVE actuator		PIN 1: Grey – VCC PIN 2: Yellow – SIG1/UP1 PIN 3: Not Connected GND: Pink - GND
Current Proportonal (I[O]) or On/Off Low Side	1) Eaton-Vickers KDG4V series (Current Proportional output) 2) Rexroth 4WE6 (On/Off Low Side output) 3) Eaton-Vickers DG4V series (On/Off Low Side output). *Note: The Rexroth 4WE6 and Eaton-Vickers DG4V can also be driven with On/Off High Side output if wired as shown in On/Off High Side below*	Up Coil 	PIN 1: Grey – VCC PIN 2: Yellow – SIG1/UP1 GND: Pink - GND (Optional)
		Down Coil 	PIN 1: Green – VCC PIN 2: Orange – DOWN1 GND: Not Connected
On/Off High Side	1) Danfoss On/Off with PVEO actuator		PIN 1: Orange – DOWN1 PIN 2: Yellow – SIG1/UP1 PIN 3: Not Connected GND – Pink - GND
	2) Rexroth 4WE6 series 3) Eaton - Vickers DG4V series *Note: The Rexroth 4WE6 and Eaton - Vickers DG4V can also be driven with On/Off Low Side output if wired as shown in On/Off Side row above.*	Up Coil 	PIN 1: Pink – GND PIN 2: Yellow – SIG1/UP1 GND - Pink-GND (Optional)
		Down Coil 	PIN 1: Pink – GND PIN 2: Orange – DOWN1 GND: Not Connected

Table 3.4.2

** In cases where valve pins are not numbered, use the position of the straight pin relative to the other pins as shown in the pin layout to determine which pin is which.*

The DUO2.CAN can optionally drive an additional On/Off type valve which can be used for auxiliary functions such as, for example, moving a wheel up and down on a skid steer machine. This hydraulic output can normally only be activated manually using the Aux Up and Down keys. In special cases, when selected through the Advanced Settings in the menu, the Aux Up can be activated automatically whenever the main hydraulic output (up or down) is activated.

Below is how to connect this valve using the bare wires of the A.RS.080 cable, assuming CETOP type valve (Hirschmann connector).

Typical Auxiliary Hydraulic Connections

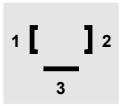
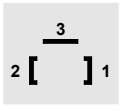
Valve Pin Layout	Connections of A.RS.080 Bare Wires (Wire colour- Wire Label)
Up Coil 	PIN 1: White - AUX1/ UP PIN 2: Pink – GND PIN 3: Not Connected
Down Coil 	PIN 1: Black - AUX1/DOWN PIN 2: Pink – GND PIN 3: Not Connected

Table 3.4.3

3.5 POWERING UP

Before powering up the DUO2 for the first time, a visual inspection is recommended to confirm everything is connected correctly and is well secured (refer to sections 3.1 - 3.4). Check and confirm especially that the type of hydraulic valves has been correctly determined and the wiring has been done as per section 3.4 for the particular type of valves. Check all system components for obvious damage, all cable connections for securely fitted connections and the sensor for secure and accurate mounting. When starting up the DUO2 ensure that no person or objects are located within range of the moving parts of the machine.

Press and hold the [POWER] key for 3 seconds to turn the unit on.
The DUO2 system will go through initialisation sequence and the working screen will come up.

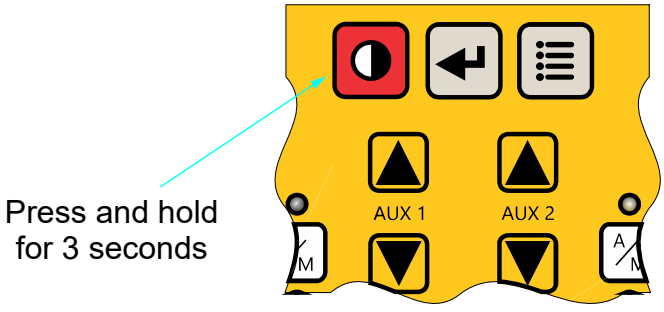


Figure 3.5.1

3.6 WORKING SCREEN

The working screen is divided into left and right side control. Information and settings related to individual side show separately on left or right side of the screen. See the typical example of working screen when laser beam is not hitting the laser sensor and system is connected with one Millimeter sensor on the left side and one Slope sensor on the right side.

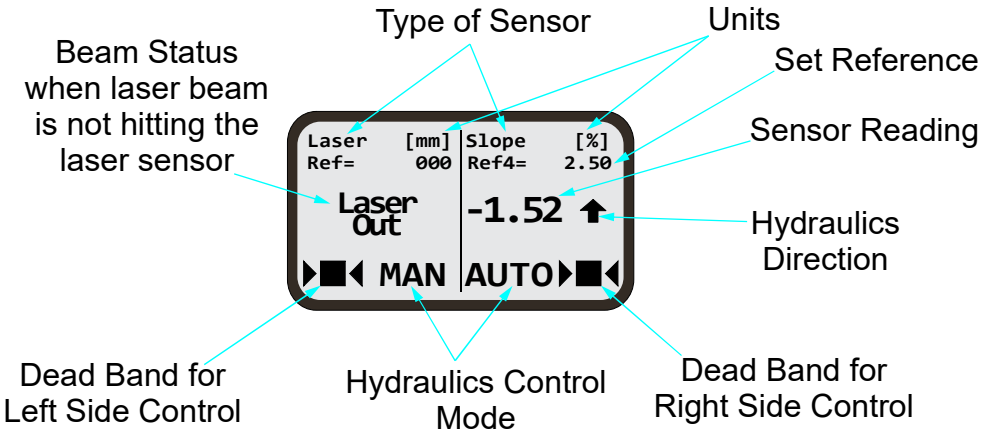


Figure 3.6.1

3.7 SETTING UP THE HYDRAULICS

As the DUO2 supports multiple types of hydraulic valves, it is very important to firstly select the correct type of valve operating on the machine.
From the Working screen, press the [MENU] key to bring up the configuration menu main screen.

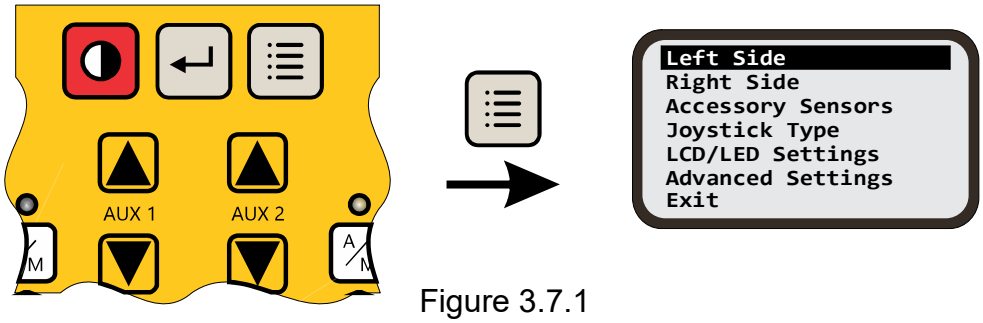


Figure 3.7.1

The settings for hydraulics are classified separately for left side and right side. Individually adjust the settings for left side control and right side control by going into submenu option “Left Side or “Right Side”.
Using [AUX2] key select the side and then press [ENTER] key.

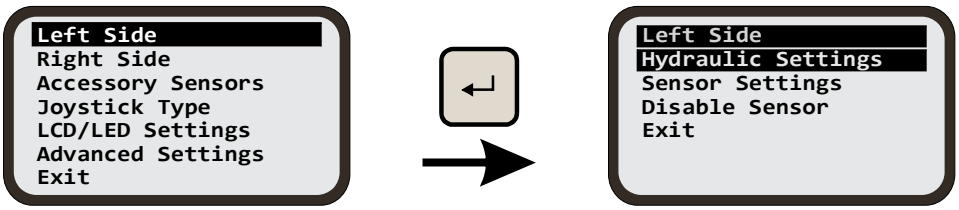


Figure 3.7.2

With Hydraulics Settings highlighted press the [ENTER] key to access Hydraulics settings submenu.

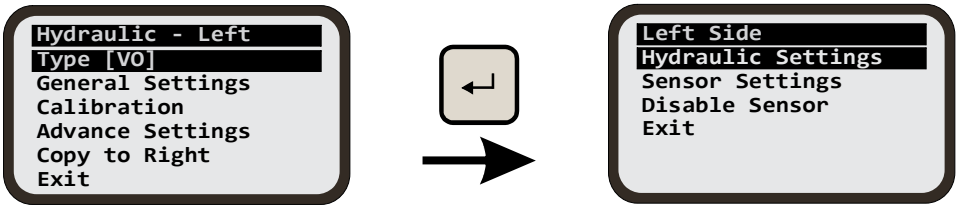


Figure 3.7.3

3.7.1 SELECTING TYPE OF HYDRAULICS

The currently selected hydraulics type is shown in [ ]. Press the [ENTER] key to access hydraulics type selection submenu.

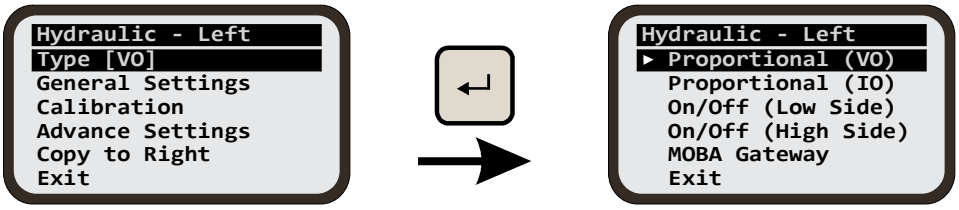


Figure 3.7.1.1

The DUO2 supports the following commercially available hydraulics valve types.

1. Proportional (VO) - Voltage controlled proportional hydraulics
2. Proportional (IO) - Current controlled proportional hydraulics
3. On/Off - Bang-Bang type. The DUO2 provides flexibility to activate on/off type valves via a low drive signal, option On/Off (low side), or via a high drive signal, option On/Off (high side).

Using [AUX2] key select the type of Hydraulics connected on the machine and then press [ENTER] key to set.

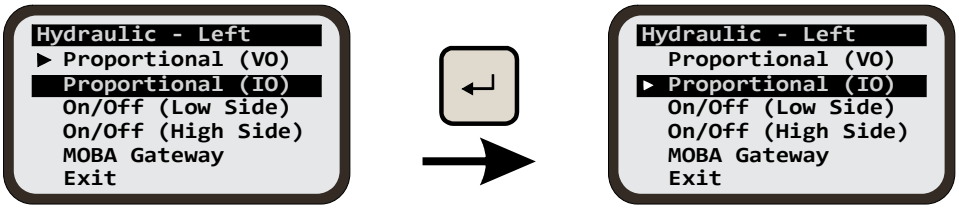


Figure 3.7.1.2

When finished, use [AUX2] key to select Exit and press [ENTER].

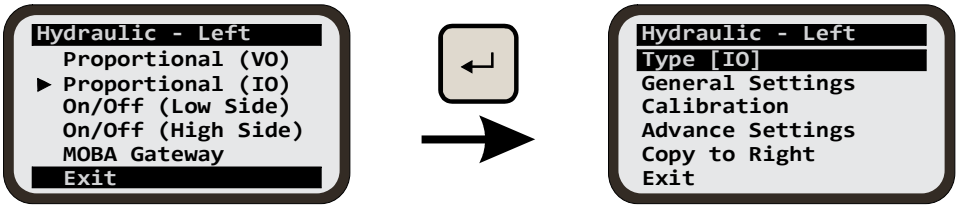


Figure 3.7.1.3

3.7.2 ADJUSTING THE SETTINGS FOR HYDRAULIC RESPONSE

Using [AUX2] key select ‘General Settings’ for hydraulics then press the [ENTER] key.

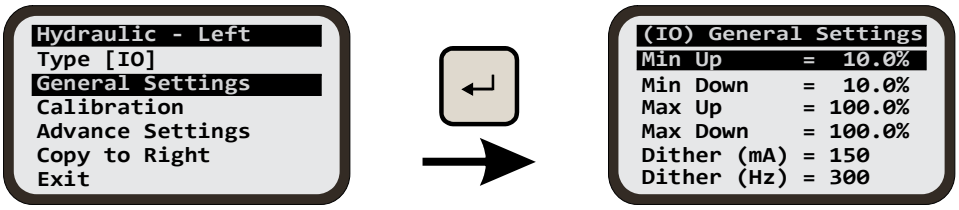


Figure 3.7.2.1

Different hydraulic types have different hydraulic settings which controls the behaviour of the hydraulic response during auto mode of operation. Select the hydraulic type as described in the previous section and then adjust the settings under ‘General Settings’ to optimise the hydraulic response .

To adjust these settings:

1. Use [AUX2] key to select a setting and then press the [ENTER] key.
2. The setting will start to flash indicating that the unit is in editing mode. Use [AUX2] key to adjust the value .
3. When finished adjusting, press [ENTER] key again to exit editing mode.
4. To exit the submenu, use [AUX2] key to select exit then press [ENTER].

The overall hydraulic response depends on many factors that differ from user to user. These include hydraulic oil pressure, size of the blade or bucket being moved, valve brand, sensor connected to the DUO2 and others. Because of this, there is not one set of correct settings to use. The following sections give an explanation of each of the settings to help the user optimise the overall hydraulic response.

3.7.2.1 GENERAL SETTINGS - VO HYDRAULICS

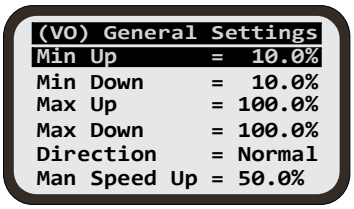


Figure 3.7.2.1.1

1. Min up: Minimum signal that is applied to move the blade or bucket in upward direction. This signal is applied when the signal from the connected sensor is just on the 'ON TARGET' (green) band. If set too high, the bucket or blade will overshoot the target going up. If set too low, the blade or bucket may not move up at all when only small upward adjustment is required.

2. Min Down: Minimum signal applied to move hydraulics in downward direction. This signal is applied when the signal from the connected sensor is just on the 'ON TARGET' (green) band. If set too high, the bucket or blade will overshoot the target going down. If set too low, the blade or bucket may not move up at all when only small downward adjustment is required.

3. MAX UP: Maximum signal that is applied to move hydraulics in upward direction. This signal is applied when the signal from the connected sensor is below the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

4. MAX Down: Maximum signal that is applied to move hydraulics in downward direction. This signal is applied when the signal from the connected sensor is below the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

5. Direction: Normal or Reverse direction for hydraulics movement. When Reverse direction is selected, the DUO2 will activate Down hydraulics when up control is applied and will activate UP hydraulics when down signal is applied.

6. Man Speed Up: In manual mode, this is the setting for rate of speed of the hydraulics in upward direction when up arrow, [UP/DOWN] key, is pressed (Maximum is 100%).

7. Man Speed Dn: In manual mode, this is the setting for rate of speed of the hydraulics in downward direction when down arrow, [UP/DOWN] key, is pressed (Maximum is 100%).

3.7.2.2 GENERAL SETTINGS - IO HYDRAULICS

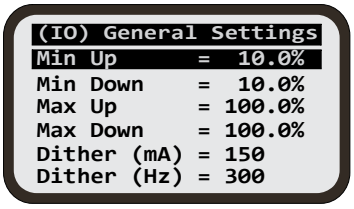


Figure 3.7.2.2.1

1. Min up: Minimum signal that is applied to move the blade or bucket in upward direction. This signal is applied when the signal from the connected sensor is just on the 'ON TARGET' (green) band. If set too high, the bucket or blade will overshoots the target going up. If set too low, the blade or bucket may not move up at all when only small upward adjustment is required.

2. Min Down: Minimum signal applied to move hydraulics in downward direction. This signal is applied when the signal from the connected sensor is just on the 'ON TARGET' (green) band. If set too high, the bucket or blade will overshoot the target going down. If set too low, the blade or bucket may not move up at all when only small downward adjustment is required.

3. MAX UP: Maximum signal that is applied to move hydraulics in upward direction. This signal is applied when the signal from the connected sensor is below the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

4. MAX Down: Maximum signal that is applied to move hydraulics in downward direction. This signal is applied when the signal from the connected sensor is below the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

5. Dither (Amp): adjusts the amplitude of the dither. This parameter should be set as per the recommendation given by the manufacturer of the hydraulic valve.

6. Dither (Hz): adjusts the frequency of the dither signal. Dither signal is superimposed with the control current for improvement of the response of the system. This parameter should be set as per the recommendation given by the manufacturer of the hydraulic valve.

7. Direction: Normal or Reverse direction for hydraulics movement. When Reverse direction is selected, the DUO2 will activate Down hydraulics when up control is applied and will activate UP hydraulics when down signal is applied.

8. Man speed up: Controls the movement speed of hydraulic up when using the buttons on the control panel.

9. Man speed down: Controls the movement speed of hydraulic down when using the buttons on the control panel.

3.7.2.3 GENERAL SETTINGS - ON/OFF HYDRAULICS

The On/Off hydraulic output can be made to pulse or to be solid.

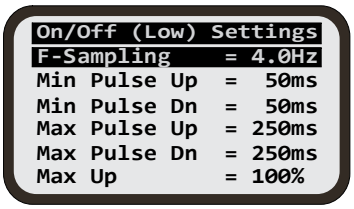


Figure 3.7.2.3.1

1. F-Sampling: frequency of the pulsing hydraulic signal. A higher number gives more rapid bursts of adjustment. A lower number gives slower bursts of adjustment. The adjustment range is from 1-16Hz.

2. Min Pulse Up: the duration of the up pulse when the signal from the sensor is just below the 'ON TARGET' (green) band. If set too low, the bucket or blade may not move at all when small adjustment is required. If set too high, the bucket or blade will overshoots the target.

3. Min Pulse Down: the duration of the down pulse when the signal from the sensor is just below the 'ON TARGET' (green) band. If set too low, the bucket or blade may not move at all when small adjustment is required. If set too high, the bucket or blade will overshoot the target.

4. Max Pulse Up: the duration of the up pulse when the signal from the sensor is below the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

5. Max Pulse Down: the duration of the up pulse when the signal from the sensor is above the 'ON TARGET' (green) band by an amount that is greater than or equal to the proportional range of the sensor. If set too high, the bucket or blade may move too fast and overshoots the target. If set too low, movement may be too slow.

6. MAX Up: Maximum signal current that is applied to move hydraulics in upward direction.

7. MAX Down: Maximum signal current that is applied to move hydraulics in downward direction.

8. Direction: Normal or Reverse direction for hydraulics movement. When Reverse direction is selected, the DUO2 will activate Down hydraulics when Up control is applied and will activate UP hydraulics when Down control is applied.

If constant (non-pulsing) hydraulic output is required, set Min Pulse Up, Min Pulse Down, Max Pulse Up and Max Pulse Down to be equal with a value of 1/Sampling x 1000. For example, if 'F-Sampling' is set to 4Hz, set all to 1/4 x 1000 = 250ms.

3.7.3 CALIBRATION - HYDRAULICS

The Minimum and Maximum hydraulic signal settings can be determined by selecting the option in the hydraulics menu.
In Hydraulics calibration menu, using [AUX2] key select ‘Calibration’, then press [ENTER].

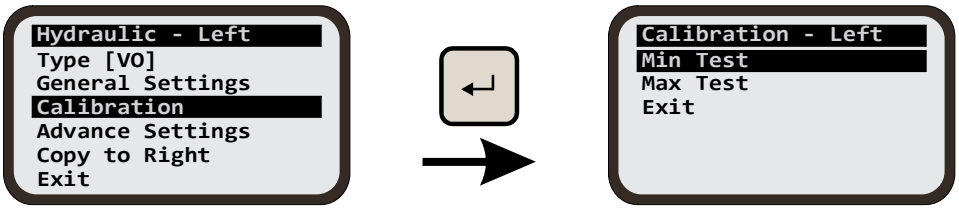


Figure 3.7.3.1

3.7.3.1 MIN PULSE CALIBRATION (HYDRAULICS)

The minimum settings required to move the blade or bucket up or down can be determined by selecting the ‘Min Test’ option.
In this test mode, the system automatically applies an up and down pulse alternately, allowing the user to see in real time the effect on the blade movement with each change in value for minimum up and minimum down settings.
Press [ENTER] key to begin the Min Pulse calibration.

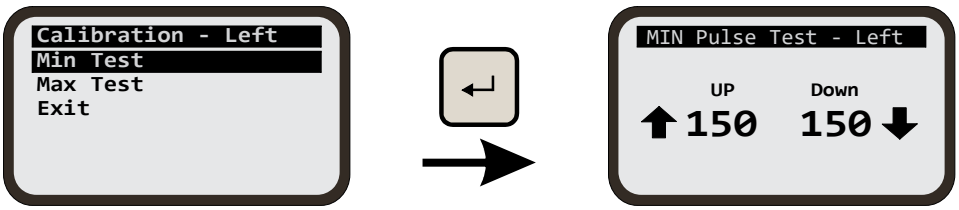


Figure 3.7.3.1.1

When doing Min Pulse Test, the aim is to find the minimum setting which will move the blade or bucket by the smallest amount in both upward and downward direction.
Use the [AUX1] key to adjust the value of Minimum for up.
Use the [AUX2] key to adjust the value of Minimum for down.

To determine the min settings:
1. Manually position the blade or bucket in the middle of the hydraulic cylinder’s working range.
2. Start with the minimum value of 100 for both up and down.
3. Slowly increase the value for Min Pulse Up. Stop when a small up movement is noticed on the blade or bucket.
4. Slowly increase the value for Min Pulse down, stop when a small movement is noticed on the blade or bucket.
5. Carefully adjust the Min Up and Down around these values to achieve a symmetrical response.
6. When a symmetrical response is achieved, the blade or bucket will oscillate above and below a fixed spot during the test and should not drift gradually up or down.
7. When finished, press the [MENU] key to return back to the Calibration menu.

Note: During the test, the hydraulic cylinder may end up moving to the limit in one direction. Manually move the cylinder back in the middle of its working range before continuing with the test.

3.7.3.2 MAX PULSE CALIBRATION (HYDRAULICS)

The maximum settings required to move the blade or bucket up or down can be determined by selecting the Max test option. In this test mode the system automatically applies an up and down pulse alternately, allowing the user to see in real time the effect on blade or bucket movement with each change in value for maximum up and maximum down settings. When doing calibration for maximum signal, the up and down pulses are spaced by a large time interval than for minimum calibration.

In hydraulics calibration menu, using [AUX1] key, select Max Test and press [ENTER] key to begin the Max Pulse calibration.

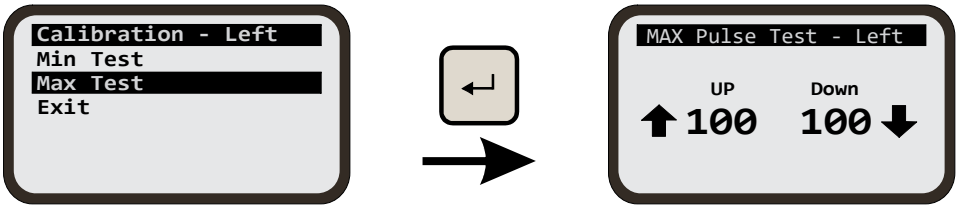


Figure 3.7.3.2.1

When doing the Max Pulse Test the aim is to find a setting which will move the blade or bucket to a satisfactory speed. Adjust the value for up and down to find the smallest acceptable value in both directions.

Use [AUX1] key to adjust the value of Maximum for up.
Use [AUX2] key to adjust the value of Maximum for down.

To determine the optimum Max settings:

1. Manually position the blade or bucket in the middle of the hydraulic cylinder working range.
2. Start with maximum value of 100 for both up and down.
3. Slowly decrease the value for Max Up to find the minimum value giving satisfactory speed.
4. Slowly decrease the value for Max Down to achieve a symmetrical response.
5. When finished, press [ENTER] key to return back to the Calibration menu and then the press [MENU] key to return to the working screen.

Note1: During the test the hydraulic cylinder may end up moving to the limit in one direction. Manually move the cylinder back in the middle of its working range before continuing with the test.
Usually more fine tuning of the Max and Min settings may be required after using Auto mode for the first time and observing dynamic behaviour in real working conditions. This can be done by adjusting the Min and Max settings through the menu without entering ‘Calibration’ mode.

Note2: Section 3.7.3.1 and section 3.7.3.2 are descriptions of the calibration procedure for the left side. A similar procedure should be followed for the right side.

3.7.4 ADVANCED SETTINGS (HYDRAULICS)

The ‘Advanced Settings’ for hydraulics can be used in special cases where hydraulic response remains unsatisfactory after careful adjustment of the General hydraulic settings. Currently, these settings are only available to MOBA Australia service technicians and distributors.

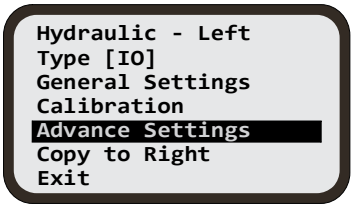


Figure 3.7.4.1

4 WORKING WITH PANEL

Please refer to section 2.2 for Key Functions and section 2.3 for Key Designators.

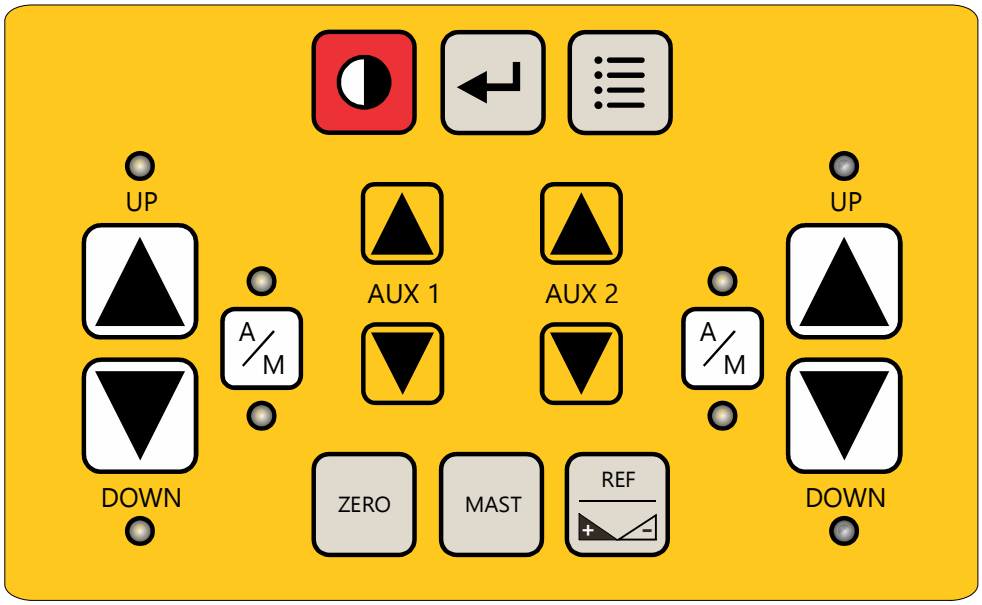


Figure 4.1

4.1 MANUALLY MOVING THE BLADE

From the panel, the left side up key can be used to manually activate the valves to move the left side of the blade up.

Similarly the left side down key can be used to manually activate the valves to move the left side of the blade down.

From the panel the right side up key can be used to manually activate the valves to move the right side of the blade up.

Similarly the right side down key can be used to manually activate the valves to move the right side of the blade down.

4.2 SETTING THE VALVE CONTROL MODE

From the panel, use the [A/M] key to switch between the two modes of control for the hydraulics valves.

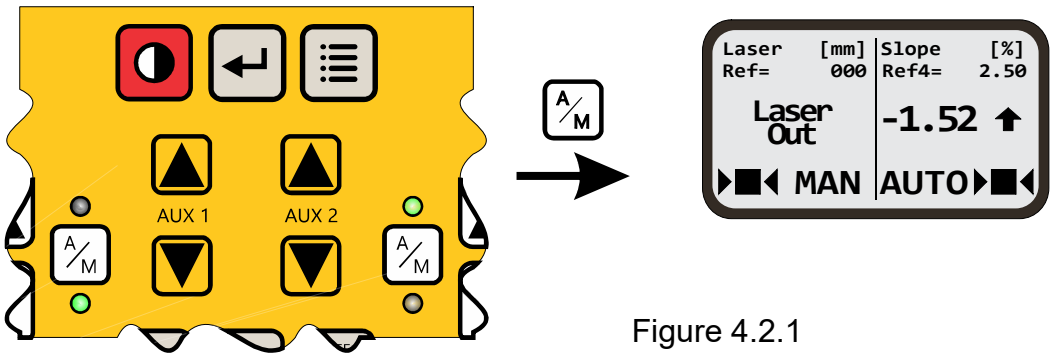


Figure 4.2.1

MANUAL MODE

When the unit is in manual mode, the panel LED MAN will be ON and the MAN will appear on the screen, as shown in the picture above for left side.
When unit is in this mode, blade movement is only controlled by the user. By pressing the [UP/DOWN] key or by using the joystick.

AUTO MODE

When unit is in automatic mode, the panel LED AUTO will be on and AUTO will appear on the screen as shown in the picture for right side.
In this mode, the panel automatically brings the blade to the centre position. The user can temporarily override automatic control at any time by pressing the [UP/DOWN] key or by using the joystick.
Automatic control returns upon release of the buttons or joystick handle.

WARNING: Extreme care should be exercised when switching the DUO2 to Auto for the first time in an unfamiliar setup. The mounting of the sensors might be such that, in attempting to achieve center, the blade forcefully digs into the ground; or the default hydraulic settings might cause the blade to oscillate and/or considerably overshoot the center position. The user should be on guard to immediately switch to Manual hydraulic control or switch the unit off.

4.3 SETTING THE AUXILIARY KEYS FUNCTION

From the standard screen, the Auxiliary Keys can be used to either activate the Auxiliary Hydraulics or to change the Ref (target) values of the connected sensors shown on the second line at the top of the screen (for sensors supporting this feature). To activate one of these two functions of the Aux Keys, press the menu key to access the main menu. Use [AUX] keys to scroll down to Advanced Settings, then press [ENTER] key to bring up the Advanced Settings submenu.
In the Advanced Settings submenu, use [AUX] keys to scroll down to the Aux Keys option. Press [ENTER] key to toggle between Auxiliary and Reference.
Press the [MENU] key from the submenu for quick exit back to the standard screen.

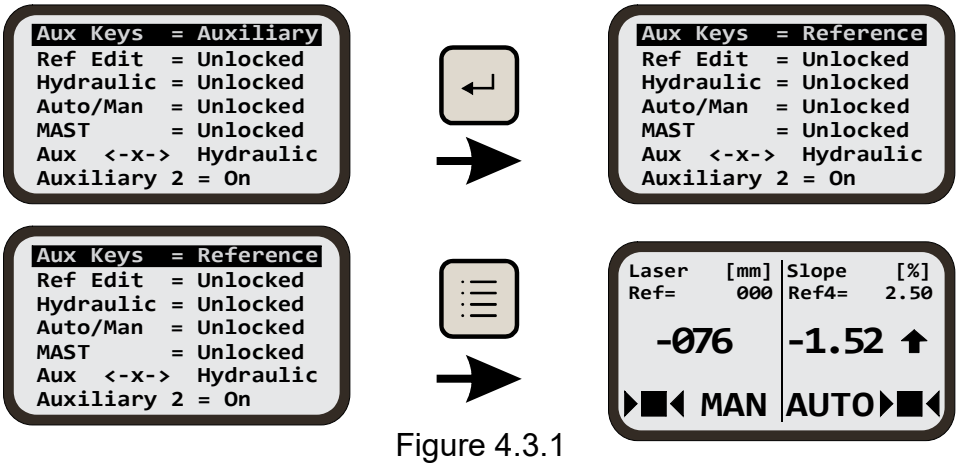


Figure 4.3.1

Shortcut: Pressing and holding [ENTER] key for 3 seconds from the standard screen acts as a shortcut to flipping the Aux Keys function. With Aux Keys = Auxiliary, the Keys activate auxiliary 1 and auxiliary 2 hydraulics up or down. With Aux Keys = Reference, the Keys increase or decrease the connected sensor Ref values.

Note: If in mast screen, The Aux Keys move the mast up or down.

4.4 AUXILIARY CONTROL

In addition to the left and right side hydraulic control, the DUO2 has the ability to control two auxiliary On/Off type valves which can be used for user defined applications such as smudge bar control. These can be operated manually using [AUX1] and [AUX2] Up/Down keys or by using certain optionally supplied joysticks (refer to section 8). To use the Aux keys for Auxiliary valve activation, this function must be allocated to the keys through the menu as explained in section 4.3.

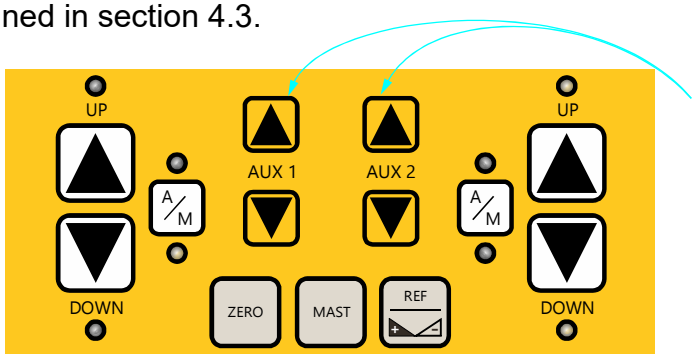


Figure 4.4.1

Additionally, for Auxiliary 2 to function, it must be switched on through the menu. To do this, press the [MENU] key to access the main menu. Select Advance Settings and press [ENTER]. Then select option Auxiliary 2 = Off and press [ENTER] to toggle it to On.

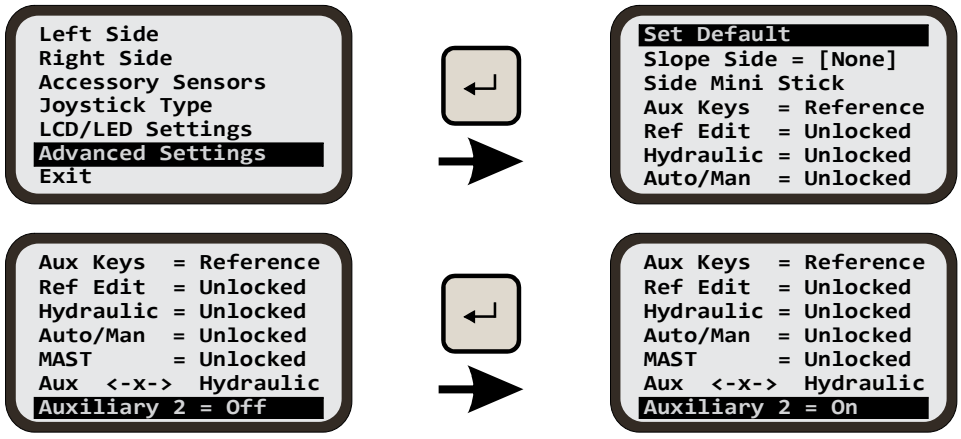


Figure 4.4.2

For some user specific applications, there is a requirement for auxiliary valve to be activating in parallel with the main up/down hydraulic valves in order to divert hydraulic oil to the main hydraulics to enable them to function. For such cases, a feature in the main menu can be switched on to automatically drive the auxiliary oil diversion valve whenever the main up/down hydraulics are activated.
To switch this feature on, press the [MENU] key to access the main menu. Use [AUX] key to scroll down to select the Advanced Settings, then press [ENTER] key to bring up the advanced settings. Scroll down to select 'Aux <-x-> Hydraulic' using [AUX] key. Press [ENTER] key to toggle to 'Aux <---> Hydraulic'.

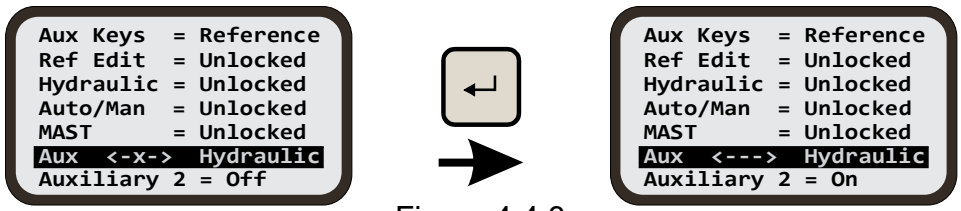


Figure 4.4.3

4.5 LCD/LED SETTINGS

From the main menu screen, use [AUX2] key to scroll down to ‘LCD/LED Settings’ and then press [ENTER] key to access the sub menu.

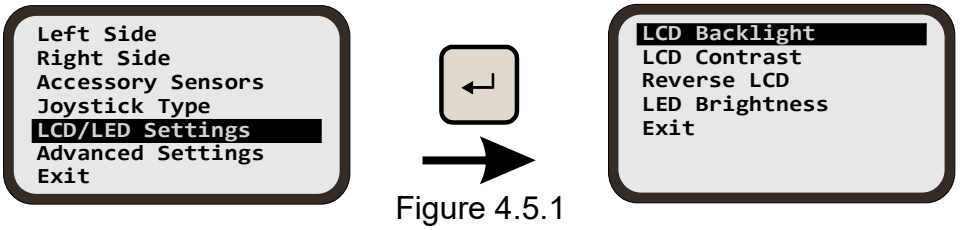


Figure 4.5.1

4.5.1 LCD BACKLIGHT SETTINGS

From the LCD menu screen, use [AUX2] key to scroll down to ‘LCD Backlight’ setting and then press [ENTER] key to access the sub menu.

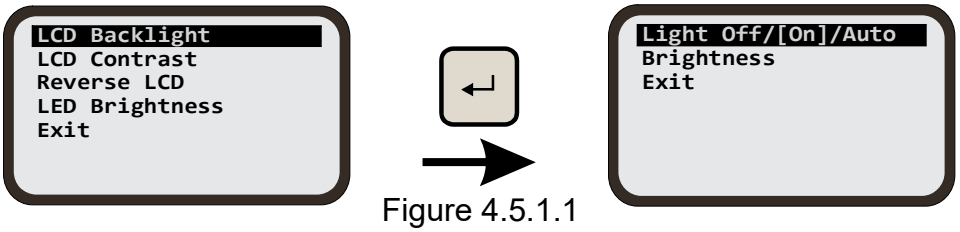


Figure 4.5.1.1

4.5.2 BACKLIGHT OFF/ON/AUTO SETTINGS

With the Light Off/On/Auto option highlighted, press [ENTER] key to select one of three power options for the backlight. The selected setting is shown enclosed in [ ]. The three settings work as below :

1. Off - If this option is selected the backlight will permanently stay off
2. On - If this option is selected the backlight will permanently stay On
3. Auto - If this option is selected the backlight will come on if a key is pressed and automatically switched off after 5 seconds of user inactivity.

Use [AUX2]key to select exit and press [ENTER] key to exit menu.

4.5.3 LCD BRIGHTNESS

Use [AUX2] key to highlight the Brightness setting and then press [ENTER] key to bring up the current brightness settings for LCD.

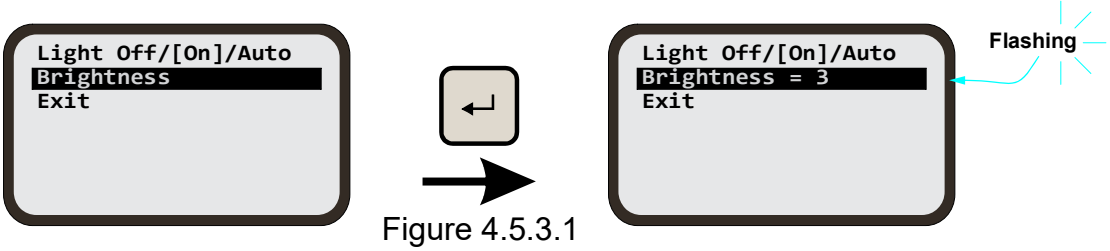


Figure 4.5.3.1

The setting will start to flash. Using [AUX2] key, adjust the brightness between four different levels. Adjust the brightness to suit your eyes and cabin light conditions. Press [ENTER] key when done.

4.5.4 LCD CONTRAST

Use [AUX2] key to highlight the ‘LCD Contrast’ setting and then press [ENTER] key to bring up the current setting.

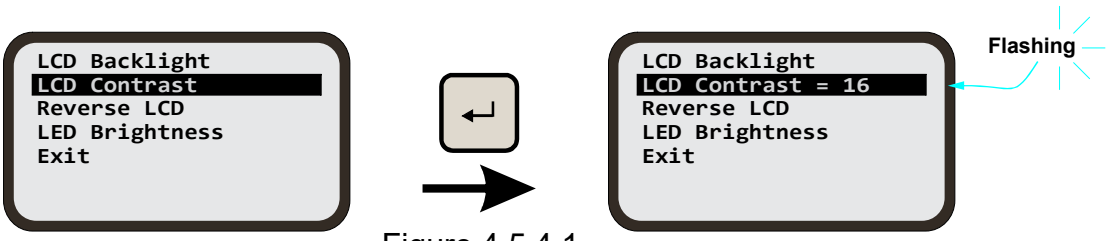


Figure 4.5.4.1

The setting will start to flash. Using [AUX2] key, adjust the contrast to suit your eyes and cabin light conditions. Press [ENTER] key when done.

4.5.5 REVERSE LCD

Use [AUX2] key to highlight the ‘Reverse LCD’ setting and then press [ENTER] key to reverse the default LCD colour settings.

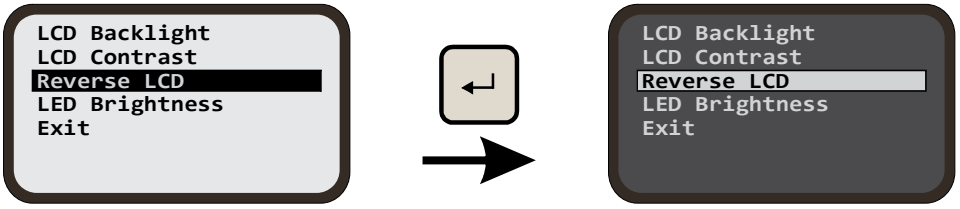


Figure 4.5.5.1

4.5.6 LED BRIGHTNESS

Using [AUX2] key to highlight the ‘LED Brightness’ setting and then press [ENTER] key to show the current ‘LED Brightness’ level.

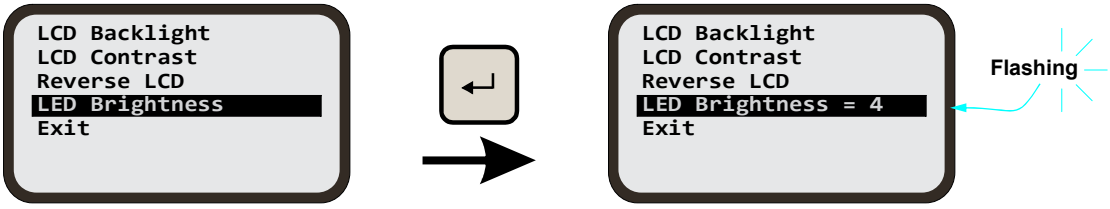


Figure 4.5.6.1

The ‘LED Brightness’ setting will start to flash. And the panel LEDs will turn on to show the brightness. Using [AUX2] key adjust the ‘LED Brightness’ to suit your eyes and cabin light conditions. Press [ENTER] key when done.

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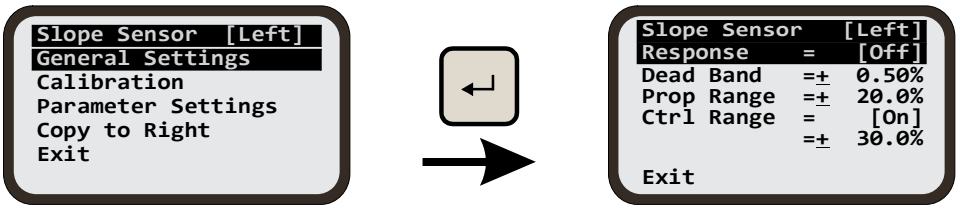
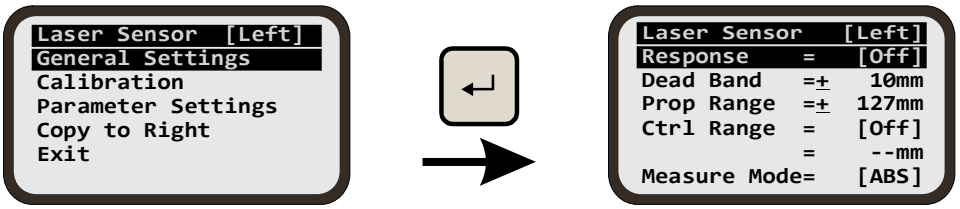
5 WORKING WITH SENSORS

In either ‘Left Side’ or ‘Right Side’ settings menu, using [AUX2] key, scroll down to select the ‘Sensor Settings’ then press [ENTER] key to bring up the ‘Sensor Setting’.
Based on the sensor connected, the settings could differ.

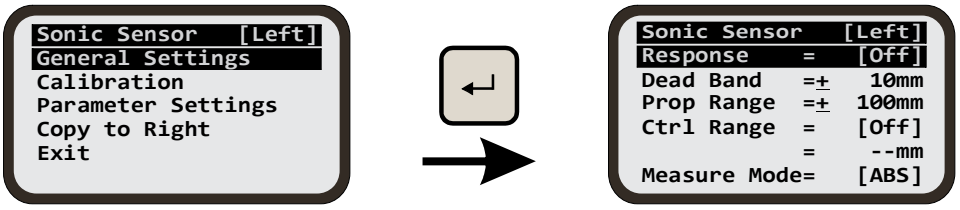
SLOPE SENSOR SETTINGS



LASER SENSOR SETTINGS



SONIC SENSOR SETTINGS



GNSS SENSOR SETTINGS

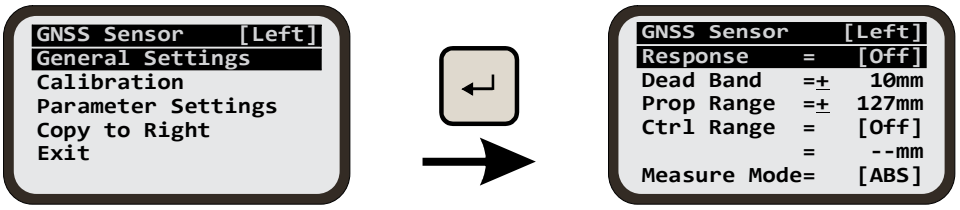


Figure 5.1

5.1 GENERAL SENSOR SETTINGS

5.1.1 RESPONSE ADJUSTMENT

When enabled, response lets you select between 90 predefined setting combinations of deadband and proportional range which directly affect the overall response of the system.

Response of 1.0 applies the slowest and most accurate response possible

Response of 10.0 applies the fastest and least accurate response possible

Example: SLOPE SENSOR RESPONSE ADJUSTMENT

Figure 5.1.1.1

5.1.2 DEAD BAND ADJUSTMENTS

This defines the accuracy of the system. The bigger the deadband, the less accurate the system is but the easier it is to achieve fast and stable hydraulic response. Conversely, the smaller the deadband the more accurate the system is but the harder it is to achieve fast and stable hydraulic response. The name deadband derives from the fact that once the sensor reading is within this band around the target (offset), it is considered 'ON TARGET' and stops (Kills off) hydraulic activation until the sensor reading goes outside this band again.

SENSOR TYPE	DEADBAND RANGE
Laser sensor - R.ULS.CAN	±2 mm to ±30 mm
Laser sensor - R.ULS.MM.CAN	±1 mm to ±30 mm
Slope sensor - UG.000.CAN	±0.2% to ±10% mm
Sonic sensor - SKIS-1500	±1.0 mm to ±100 mm
GPS sensor	±1.0 mm to ±50 mm

Table 5.1.2.1

Note: Deadband setting is not available when response is enabled.

From the working screen press [MENU] key to bring up the settings menu. Use [AUX2] key to select the 'Left Side' settings menu and press [ENTER]. On 'Left Side' settings menu, use [AUX2] key to select the 'Sensor Settings' menu and press [ENTER]. On 'Sensor Settings' menu, use [AUX2] key to select the 'General settings' and press [ENTER]. Select 'Dead Band' using [AUX2] key and press [ENTER]. The 'Dead Band' menu should be flashing which means it is ready for adjustment.

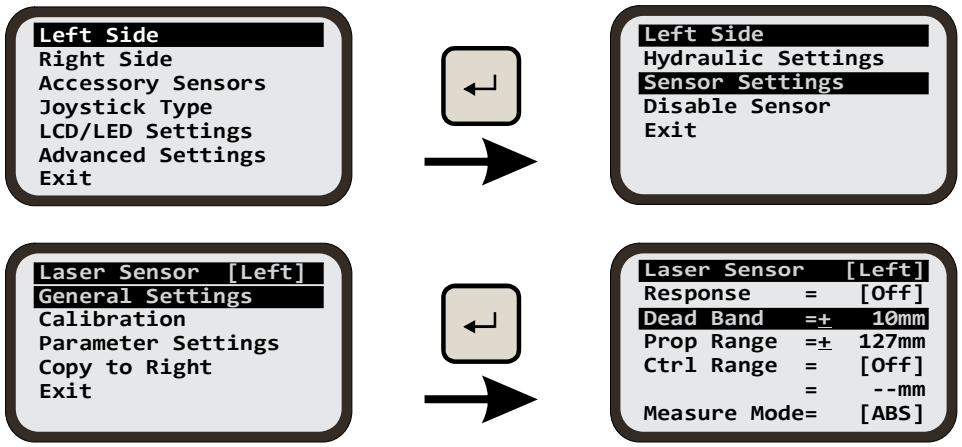


Figure 5.1.2.1

5.1.3 PROPORTIONAL RANGE ADJUSTMENT

The Proportional Range is the range of the sensor reading above and below the target over which the hydraulic output signal varies proportionally to the deviation of the sensor reading from the target.
The Min hydraulic output is applied when the sensor reading is just outside the deadband (beginning of the Proportional range) and the Max hydraulic out put is reached when the sensor reading deviates from the Target by an amount equal to or greater than the selected Proportional range. A smaller Proportional range means a faster hydraulic response.

SENSOR TYPE	SELECTABLE PROP. RANGE
Laser sensor - R.ULS.CAN	±6 mm to 98 mm
Laser sensor - R.ULS.MM.CAN	±10 mm to 128 mm
Slope sensor - UG.000.CAN	±10% to 30%
Sonic sensor - SKIS-1500	±100 mm to 1500 mm
GPS sensor	±50 mm to 300 mm

Table 5.1.3.1

Note: Proportional Range setting is not available when response is enabled.

5.1.4 CONTROL RANGE ADJUSTMENT

A selectable range above and below the deadband outside of which the automatic control of the valves is switched off .

SENSOR TYPE	SELECTABLE CONTROL RANGE
Laser sensor - R.ULS.CAN	±3 mm to 98 mm
Laser sensor - R.ULS.MM.CAN	±1 mm to 128 mm
Slope sensor - UG.000.CAN	±1% to 60%
Sonic sensor - SKIS-1500	±1.0 mm to 1500 mm
GPS sensor	±1.0 mm to 128 mm

Table 5.1.4.1

5.1.5 MEASUREMENT MODE

The measurement mode for sensors with ability to zero the reading can switch between Relative [REL] and Absolute [ABS]. Relative mode means that the sensor reading is relative to the position where the zeroing occurred. Absolute mode means the sensor reading is taken from the factory default. Zero position for example, for laser sensors this is the physical centre of the receiving area.
After executing a 'zeroing' using the zero button, the measure mode automatically becomes relative. To revert back to absolute, access sensor settings menu, select measure mode and press [ENTER]. ABS is then shown in the square brackets.

Note: On power down, the DUO2 retains the previously used measurement mode. It is important before starting a new job to ensure that the correct measurement mode is selected.

5.1.6 OFFSET

When system is used in Relative Mode this reading shows the offset of the relative 'zero' position from absolute position.

5.1.7 UNITS

Select between various units of measurement for different sensor. Different units available for different sensors are:

Slope Sensor :
1. Percentage [%]
2. Degree [°]

Laser Sensor :
1. Centimetre [cm]
2. Millimetre [mm]

5.2 SENSOR REFERENCES

During normal operation, the currently used Reference (Ref) value is displayed in the second line of the standard screen for all sensor types supporting this feature. This is the set target value for levelling or grading. From the standard screen, this value can be adjusted on the fly using the AUX Keys, provided the AUX Keys have been allocated this (refer to section 4.3).

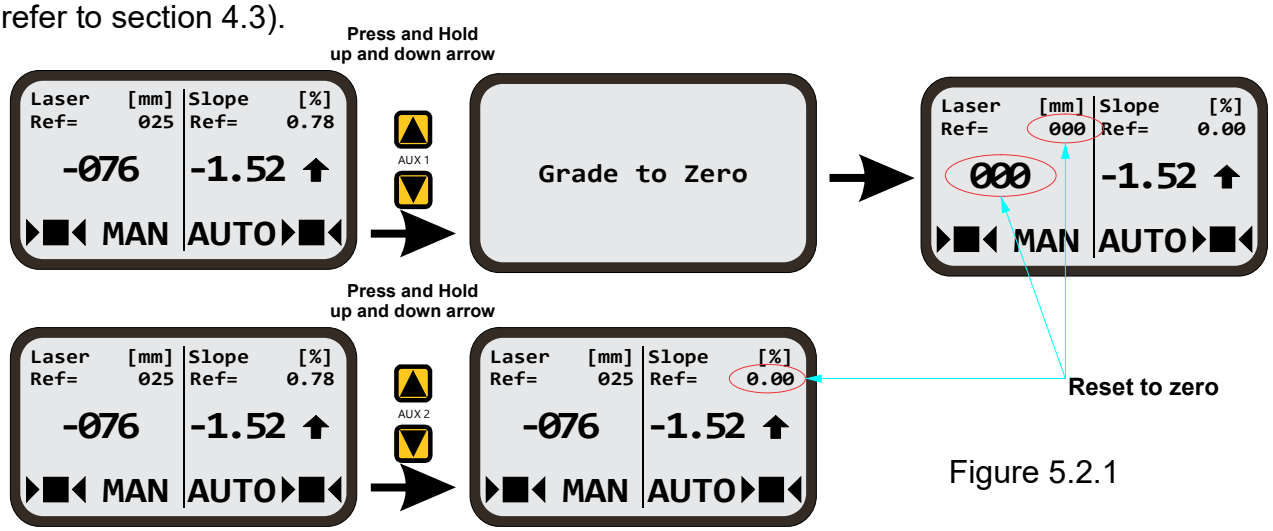
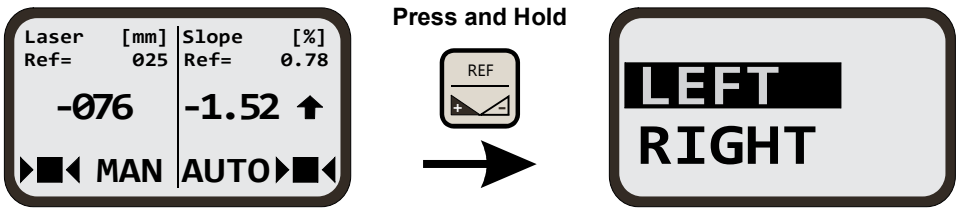


Figure 5.2.1

Slope and tracer sensors allow up to four preset Reference values (Ref1-Ref4) to be stored for quickly alternating the set target. These values are adjusted and invoked through the reference menu. At any given time, only one of the four References can be selected as the current levelling or grading target (Ref) shown on the standard screen. To access the stored References for a connected sensor, from the working screen, press and hold the [REF] key to bring up the References side selection screen.



Use the [AUX] keys to select the side/sensor to access, then press [ENTER] key to bring up the reference menu for that side/sensor.

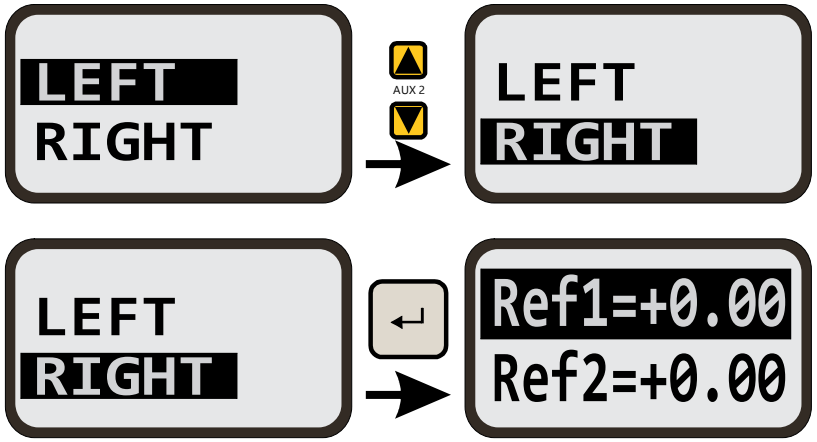


Figure 5.2.2

5.2.1 ADJUSTING STORED SENSOR REFERENCES

From the Reference menu screen, use [AUX] keys to highlight one of Ref1 - Ref4, then press [ENTER] key.
The value will start to flash to indicate edit mode. Use [AUX] keys to adjust the value. Pressing the AUX up and down keys simultaneously while in edit mode will zero the value. Press [ENTER] key when finished adjusting to exit edit mode.

5.2.2 INVOKING A STORED SENSOR REFERENCES

From the Reference menu screen, use [AUX] keys to highlight one of Ref1 - Ref4, then press the [MENU] key. The screen will return back to the standard screen and the Ref value on the second line of the screen will show the selected Reference as the new levelling target.

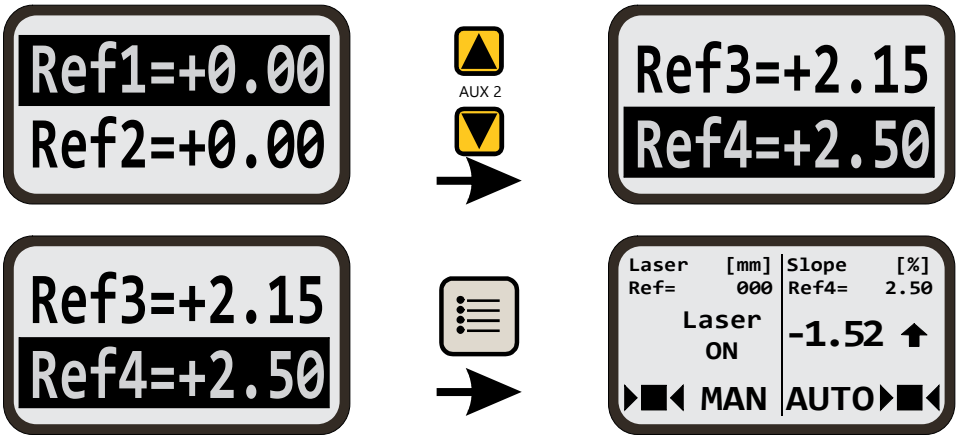


Figure 5.2.2.1

5.2.3 STORING THE CURRENT SENSOR VALUE

From the Reference menu screen, use [AUX] keys to highlight one of the Ref1 - Ref4, then press and hold the [ENTER] key until the current sensor value is transferred to the selected Ref.

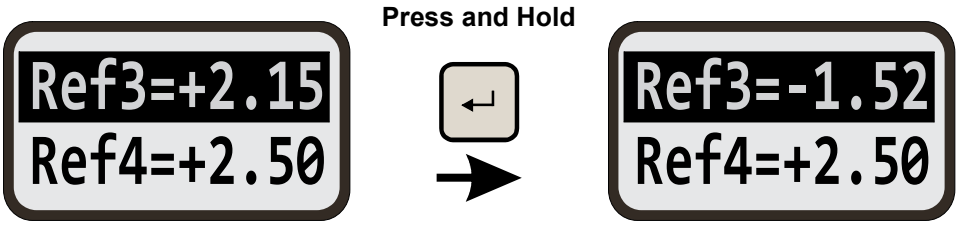


Figure 5.2.31

5.3 GRADE TO ZERO OPERATION

The current screen reading for certain models of laser sensor for GPS sensor and for masts can be zeroed at any time.
From the working screen press the [ZERO] key to bring up the side selection screen for zeroing.

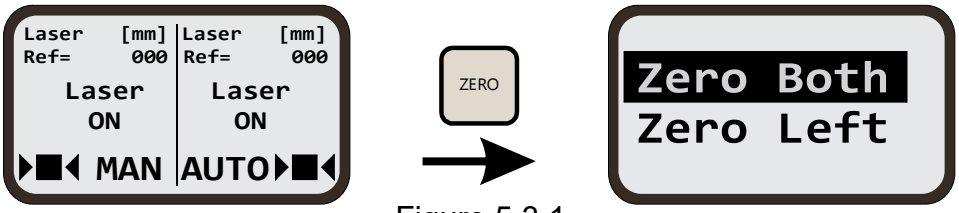


Figure 5.3.1

Use [AUX2] key to select the side/sensor for which grade is to be set to zero then press [ENTER] key.

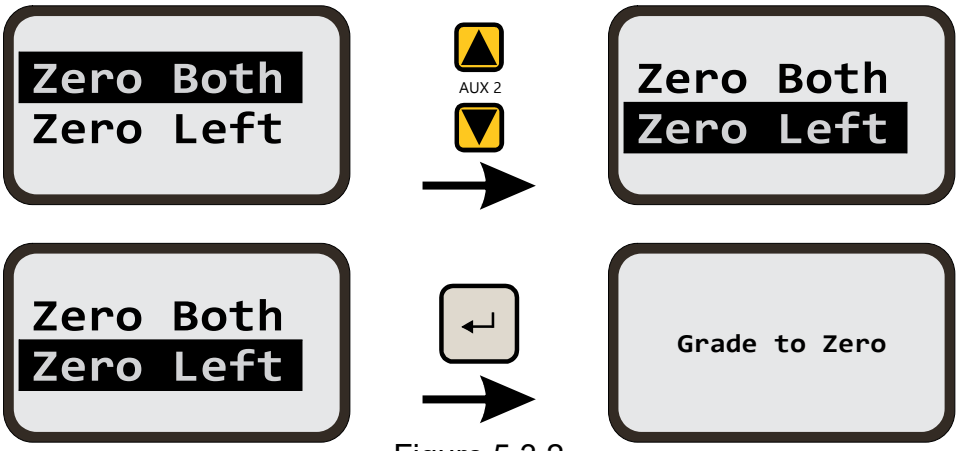


Figure 5.3.2

The current sensor value for that side will become zero.

Note:
1. Some sensor models do not support grade zero.
2. Grade to zero for laser sensors only works if beam is hitting the sensor.

5.4 SENSOR TYPES

1. Slope Sensor
2. Laser Sensor: R.ULS.CAN, R.ULS.MM.CAN and LS-3000
3. Sonic Ski
4. GNSS

5.4.1 SLOPE SENSOR

Using the slope sensor for the first time or after remounting, it is important that it is mounted and calibrated correctly. The mounting should be robust enough to guarantee that the sensor will not move while the blade is being used. Preferably the sensor should not be removed once mounted so as to avoid having to repeat the calibration procedure.

Checks should be done before starting a new job to ensure that calibration is maintained. This involves physically levelling the blade using a spirit level with sensitivity +/- 0.01% and confirming that the reading of the sensor grade on the screen is approximately zero.

5.4.1.1 MOUNTING THE SLOPE SENSOR

Ensure the following when mounting:
1) The arrow at the top of the sensor points towards the forward moving direction of the machine and is at the top.

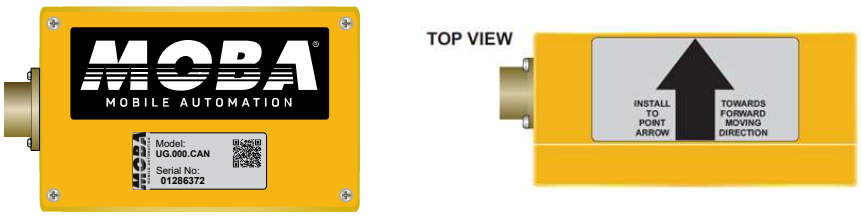


Figure 5.4.1.1.1

2) The long side of the sensor is parallel with the blade.
3) The blade is physically level. This can be checked using a spirit level with a levelling sensitivity of +/- 0.01%.
4) The sensor is approximately level with the blade.

With the above mounting, the sensor reading increases when raising right and decreases when lowering right. Conversely, it decreases when raising left and increases when lowering left. It is therefore more intuitive from the user perspective to have the sensor connected to the right side, however, auto hydraulic control will work correctly regardless of the side the sensor is connected. By default, the slope sensor connects to the right side when there is no other sensor connected on the right even if it is physically plugged on the left. It gets pushed to the left side only if another sensor is plugged on the right.

5.4.1.2 CALIBRATING THE SLOPE SENSOR

To execute calibration of the slope sensor, press [MENU] key from the working menu. Select the side to which the sensor is installed then select 'Sensor Settings'. Press [ENTER] key after selecting 'Calibration'. The next window will prompt you with 'Are you sure you want to do calibration?'. Simply select [YES] and hit [ENTER] key “Calibration Done” will be displayed.

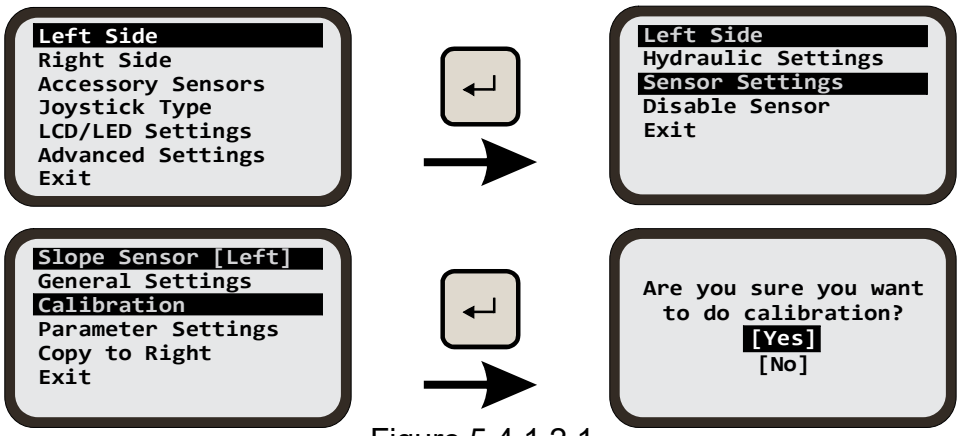


Figure 5.4.1.2.1

5.4.1.3 SLOPE SENSOR - SIDE SELECTION

When one side is controlling the slope of the blade and the other side is controlling the height of the blade, the levelling of the two sides can be done by adjusting one side at the time, rather than both sides at once. By adjusting in turns, the adjustment process is smoother but at the cost of being slower.

To select this method for levelling, go to the main menu and select ‘Advanced Settings’ option.

In the ‘Advanced Settings’ menu use [AUX2] key to scroll down to ‘Slope Side’.
Press [ENTER] key to toggle between ‘LEFT’, ‘RIGHT’ and ‘NONE’.
Use [AUX2] key to select ‘Exit’ and press [ENTER] key to exit the menu.

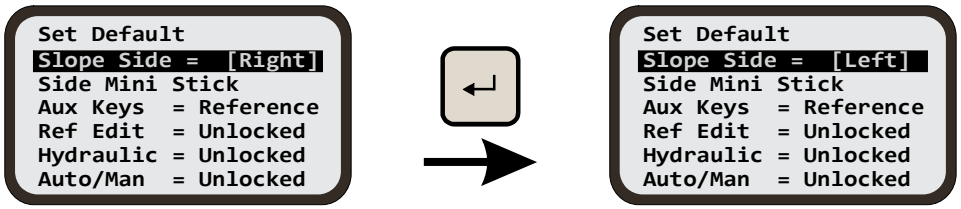


Figure 5.4.1.3.1

5.4.1.4 INVERTING THE GRADING TARGET FOR SLOPE SENSOR

To invert the sign of the current grade target from positive to negative or vice versa, press the [REF] key. The inverted offset target will be highlighted.
This feature is intended to allow the operator to continue grading the same slope seamlessly after doing a U-turn, with no other required adjustments. Available only for slope sensors.

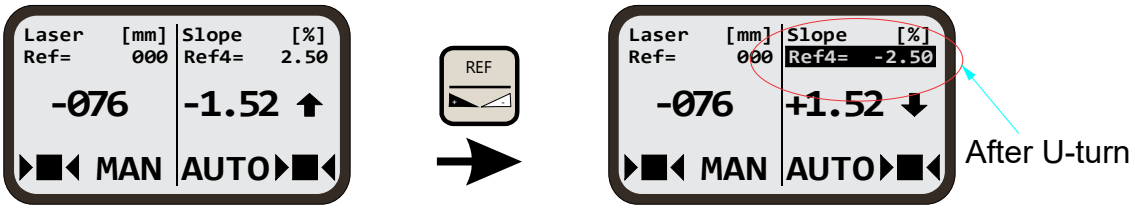


Figure 5.4.1.4.1

5.4.2 SONIC SKI

The Sonic Ski sensor is usually mounted using mast weld on bracket (A.ME.15), L-bracket and Sonic Ski bracket (MOB.236).
For parameter settings, refer to general sensor settings in section 5.1.

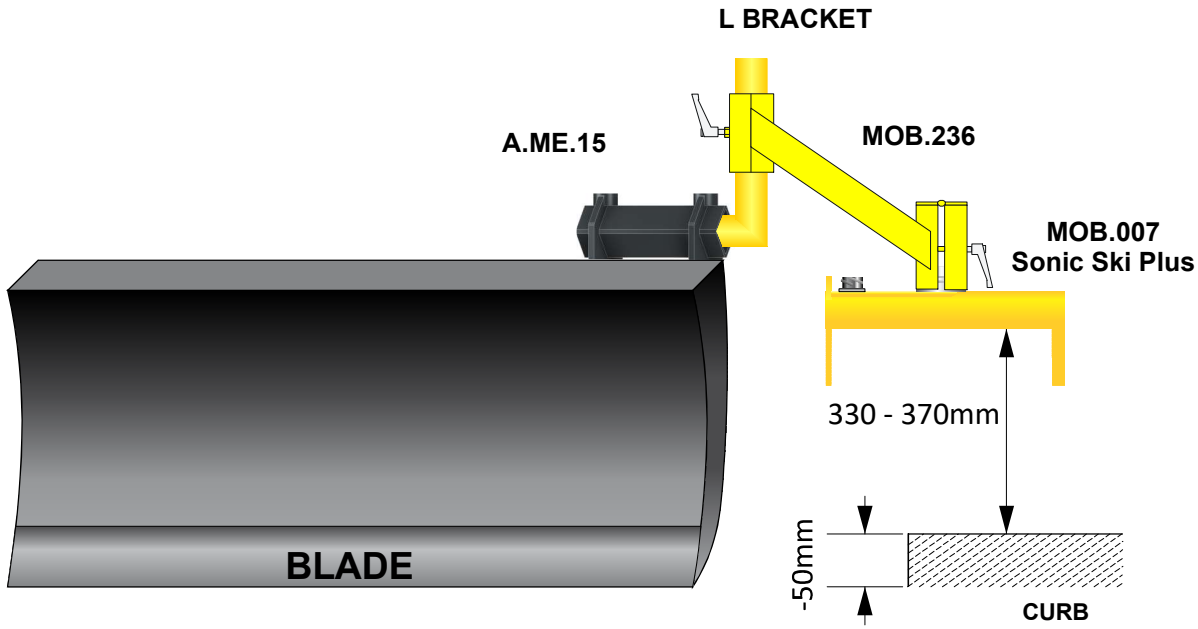


Figure 5.4.2.1

5.4.3 LASER SENSOR

Generally, the laser sensor is mounted on a pole or mast. See the practical example for reference. It is important that the laser sensor is mounted tight and secured to the mast. The mounting should be robust enough to guarantee that the sensor will not move while the blade is being used.
Ensure that the laser transmitter is stable and the beam is within the laser sensors upper and lower limits.
Refer to general sensor settings in section 5.1 for adjusting the laser sensor parameters.

LASER SENSOR TYPES

R.ULS.CAN and R.ULS.MM.CAN - Setup using IB.DUO2.CAN.
LS-3000 - Setup using IB.DUO2.MOBA.

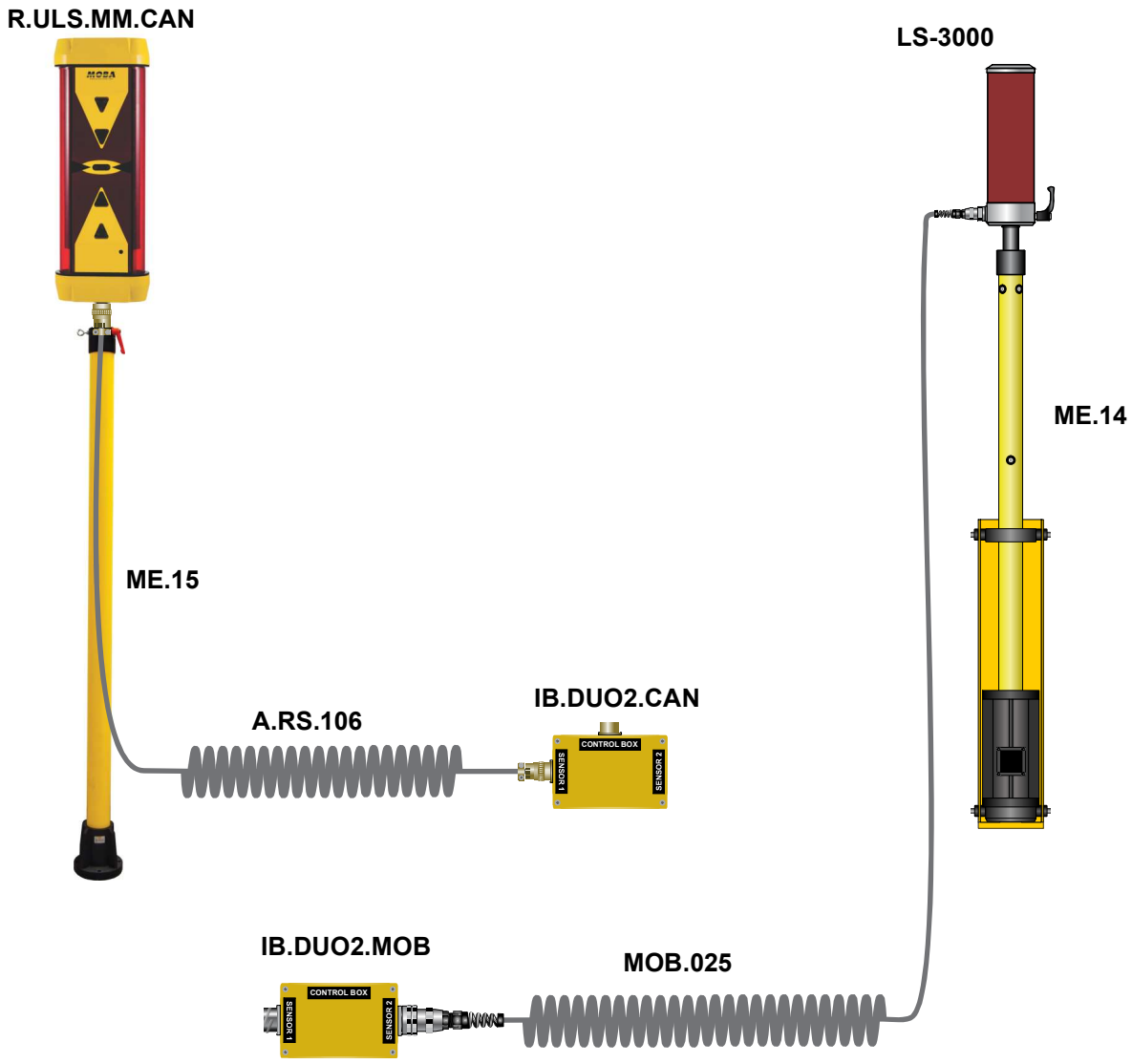


Figure 5.4.3.1

5.4.4 GNSS SENSOR

GNSS sensor enables user to perform land levelling and grading over large area with slightly less accuracy than levelling lasers. It can be used in conjunction with or as a replacement of level lasers.
It supports several job types, namely Flat Job, Single Slope Job and Dual Slope Job. With Single Slope Job and Dual Slope Job, user only needs to set up 2 height references by driving to the corresponding locations in the field. The required slopes will be calculated by the system automatically.
When installed with slope sensors, DUO2 allows for the target slope of the slope sensor to be automatically calculated based upon the direction in which the machine is traversing, avoiding the inconvenience of regularly changing target slopes when making U-turns during land grading.

5.4.4.1 GNSS WORKING SCREEN

The GNSS sensor is always shown on the left side of the working screen. All the information and settings related to GNSS are shown in the typical example below with the GNSS in a fixed state and control panel in manual mode of operation.

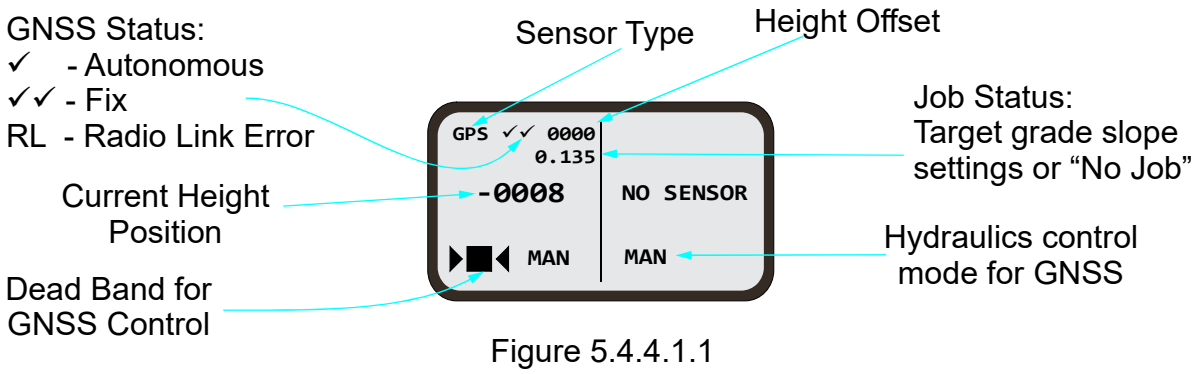


Figure 5.4.4.1.1

5.4.4.2 GNSS FUNCTION KEYS

- Job type selection
- Job target settings

AUX 1

- Move up and down to trim height offset
- Short press both keys to copy current height position to offset
- Long press both keys to reset height and offset to zero

- Zero left side GNSS height and offset

- Edit and select height reference memory settings

(Long press required in case slope sensor is active on right side of DOU2 to access memory reference settings)

5.4.4.3 GNSS JOB TYPE SELECTION AND SETUP

Press [ENTER] key to bring up the job selection menu. Select the job type and follow instructions to setup the job direction.

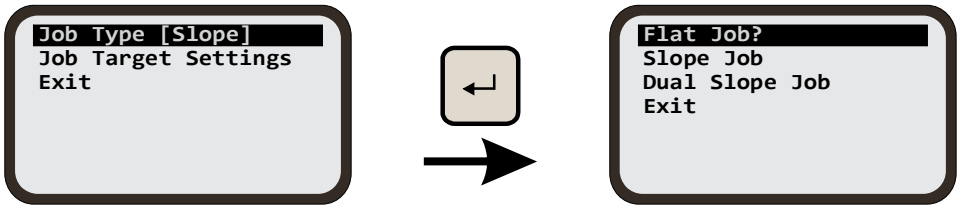


Figure 5.4.4.3.1

To set the job direction enter the position of the two reference points A & B using the following instructions.

Note: For the single & dual slopes provide a minimum distance of 10m between reference points A & B to define accurately the orientation of slope targets.

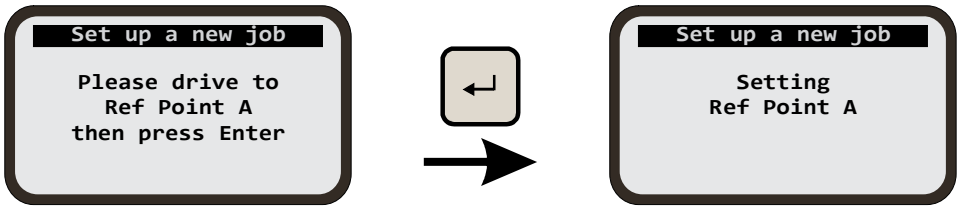


Figure 5.4.4.3.2

Continue with these same steps to set up reference point B.

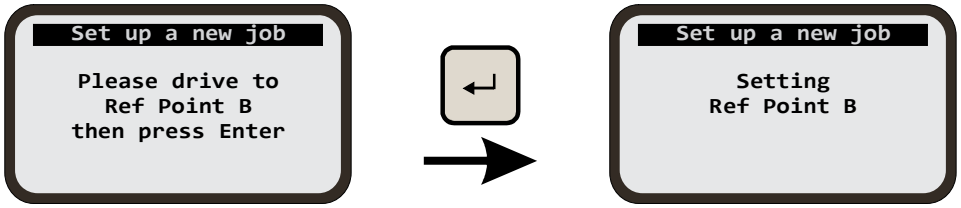


Figure 5.4.4.3.3

Confirm that the job setup has been completed successfully.

Figure 5.4.4.3.4

For Single Slope and Dual Slope go to the job target settings and use [AUX2] key to configure the required slope settings.

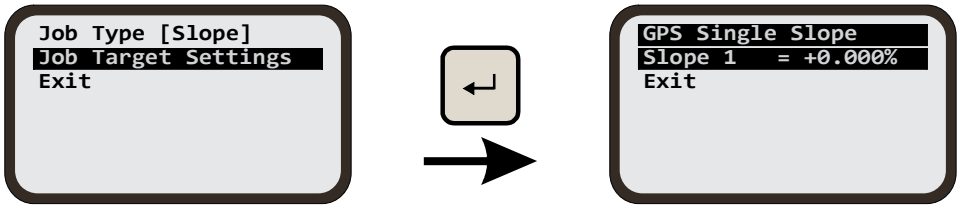


Figure 5.4.4.3.5

5.4.4.4 GNSS AUTO MODE

To enable GNSS Auto Mode, a Dual Slope Job has to be created and the Target Slopes have to be set beforehand. Please refer to section 5.4.4.3 for instructions.

MAKING AVAILABLE GNSS AUTOMATIC MODE
By default, GNSS automatic mode is disabled and not available from the panel. To make this option available, use [AUX2] key to scroll down to 'Advanced Settings' while in the main menu then pressed [ENTER] key to access the submenu.

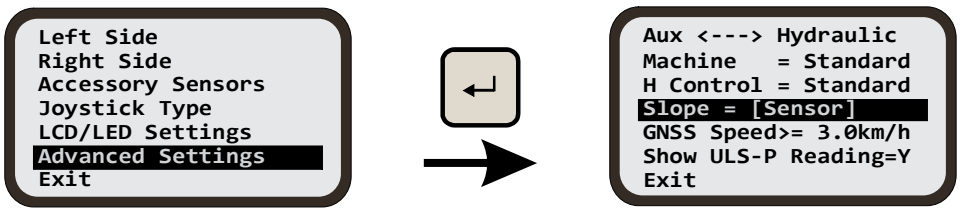


Figure 5.4.4.4.1

In the 'Advanced Settings' submenu, use [AUX2] key to scroll down to 'Slope' option. Press [ENTER] key to toggle between Sensor and GNSS slope.
To exit the submenu, use [AUX2] key to select Exit and press [ENTER] key to exit the submenu.

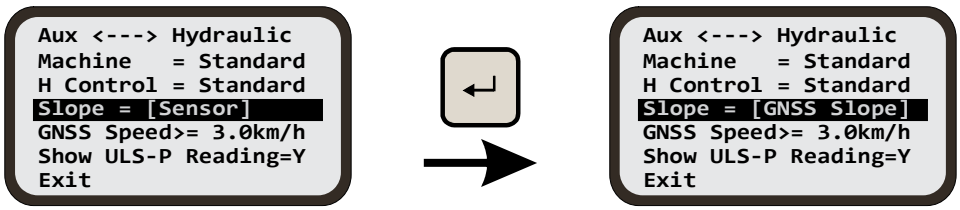


Figure 5.4.4.4.2

ENABLE GNSS AUTOMATIC MODE

After a Dual Slope Job and Target Slopes are set up on the GNSS sensor, press [A/M] key to toggle between manual (MAN) and automatic (AUTO) mode.

Once the GNSS automatic mode is activated, AUTO is highlighted on the slope sensor screen, with the slope sensor's target slope (Ref at the top of the screen) automatically set to GNSS cross slope (S2 at the bottom left of the screen).

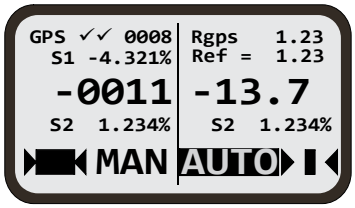


Figure 5.4.4.4.3

6 MAST MODE OF OPERATION

6.1 MAST WORKING SCREEN

From the main working screen, press [MAST] key to display the mast working screen. The image below shows the current position of the mast in millimetres. In case no mast is connected on either side of the DUO2, a message saying “No MAST” will be displayed.

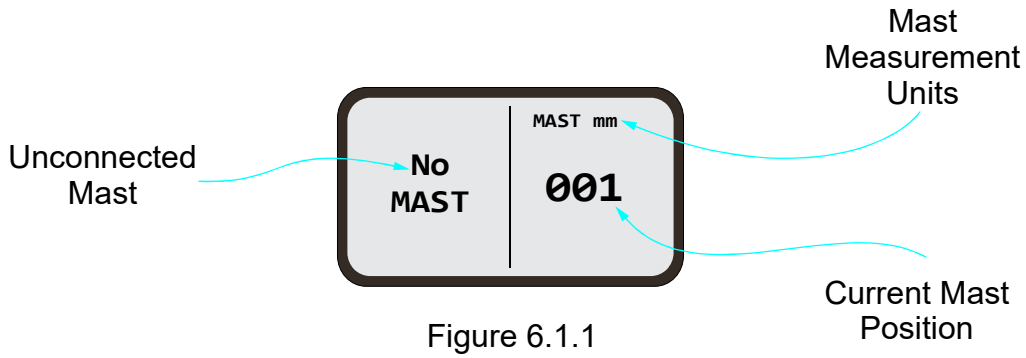


Figure 6.1.1

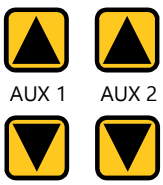
6.2 MAST FUNCTION KEYS

While in the mast working screen:

- Accesses the Reference menu.

- Sets current mast position to zero.

- Invokes a particular highlighted Reference value while in the Reference Menu.



- Move the mast up and down, Aux 1 Keys for left connected mast, Aux 2 Keys for right connected mast.

6.3 ADJUSTING MAST POSITION USING REFERENCES

Basic mast position adjustment is done with the [AUX] keys up and down. However, four preset References (R1 - R4) can be stored and invoke through the Reference menu for quick position change to frequently used positions.

To set the value of R1 - R4:

Access the reference menu by pressing the [REF] key from the mast working screen.

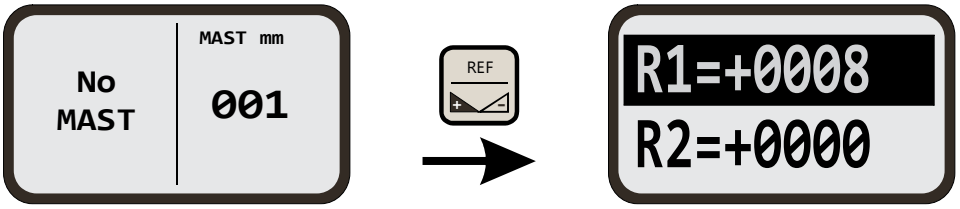


Figure 6.3.1

Using the Aux Keys, select one of the R1 - R4 and press [ENTER] key. The selection will flash to indicate edit mode.
Use [AUX] keys to adjust the reference value then press [ENTER] key to confirm the new adjust value and exit edit mode.

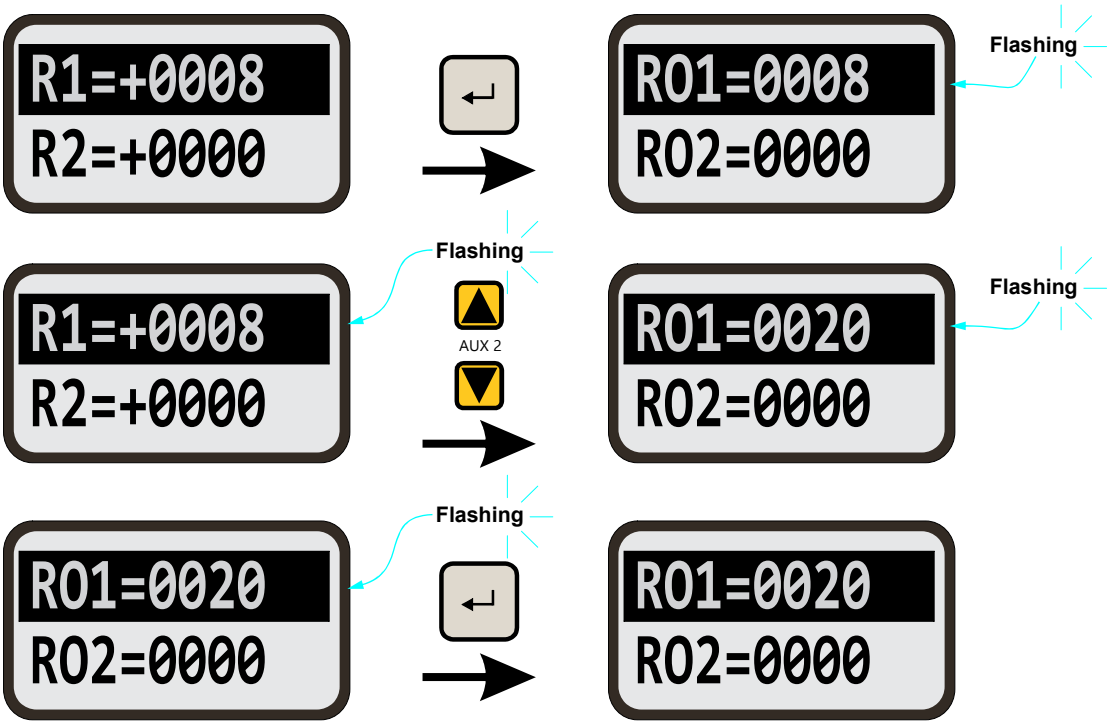


Figure 6.3.2

To invoke one of the R1 - R4, after exiting edit mode, use the Aux Keys to highlight one of R1 - R4 and then press [MENU] Key. The screen will revert to the standard mast screen and the mast will move to the selected position.

6.3.1 MAST SEARCH FUNCTION

The mast can automatically search for the laser beam using the sensor mounted on it.

To activate the search function for a right connected mast, from the mast screen, press and hold [AUX2] UP key and while the mast is moving, press [MAST] key once. The word ‘SEARCH’ will appear at the bottom of the screen to indicate activation of SEARCH mode..

press and hold [AUX2] UP key then press [MAST] key simultaneously

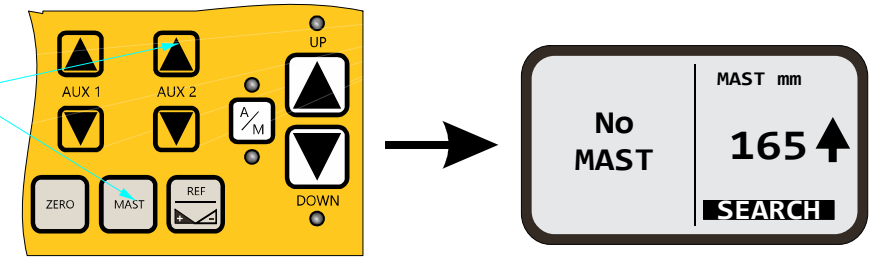


Figure 6.3.1.1

The mast will travel towards its top limit and then its bottom limit in search for the laser beam. It will automatically stop either when the laser hits the deadband of the receiver, (ie, sensor green LEDs are lit) or, having not found the beam, when it’s at the bottom limit.

If the beam is not found, the message ‘No Beam’ appears.

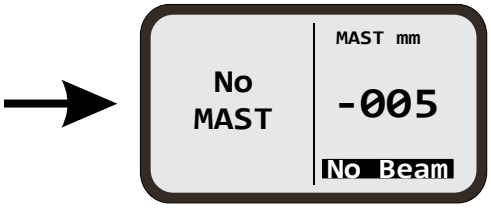


Figure 6.3.1.2

If mast is connected on the left, use AUX1 UP Key instead of AUX2 UP Key.

To stop the SEARCH function at any time, press the AUX Key (UP or DOWN) that opposes the current travelling direction of the mast (e.g. if mast is travelling up, press AUX DOWN Key. If mast is travelling down, press AUX UP Key).

Notes:

1) Search function will not work if ‘Please Zero MAST’ message appears on power up. Zero the mast position first.

2) Search function will not work without a laser sensor connected. The laser sensor must be mounted to the mast.

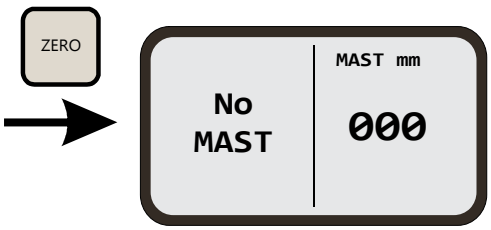


Figure 6.3.1.3

6.4 ADJUSTING MAST POSITION USING RELATIVE OFFSETS

Two Relative Offsets, RO1 and RO2, are available in the Reference Menu to enable easy mast position by preset discreet steps.
To set the values of RO1 and RO2, from the mast screen, enter the Reference menu and follow the same process described in section 6.3 to edit and confirm the values.

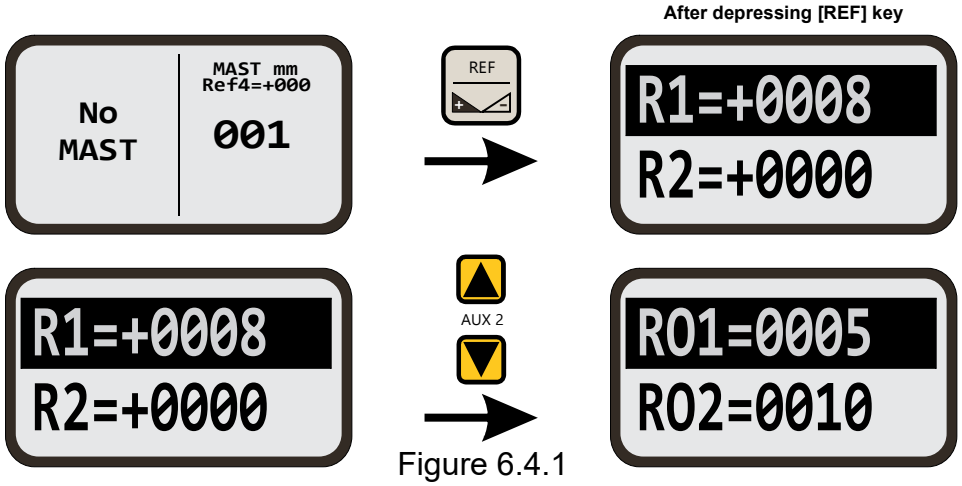


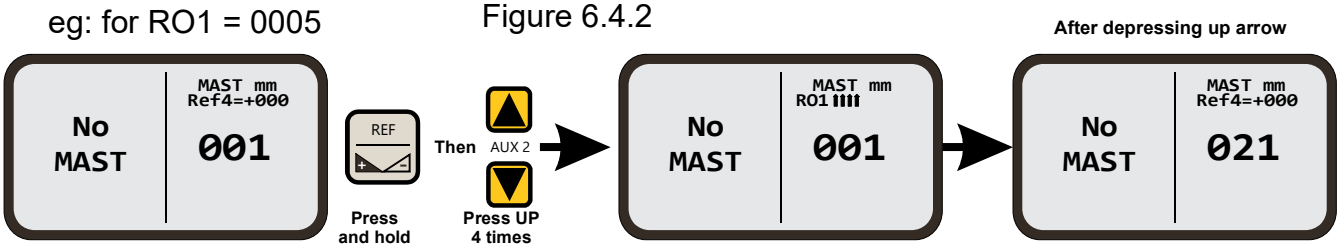
Figure 6.4.1

To adjust the mast height for right side by RO1 offset, from the mast screen:
1) Press and hold [REF] button then press the [AUX2] up or down keys once to increase or decrease the mast height.
2) Upon release of the [REF] button, the mast will move up or down by a value equal to RO1 offset.

To adjust the mast height by a multiple of RO1 offset (Right Hand Side):
1) Press and hold the [REF] button then press the [AUX2] up or down keys multiple times.
2) Upon release of the [REF] button, the mast will move up or down by a value equal to RO1 offset multiplied by the number of times the [AUX2] up or down keys was pressed. A maximum of 7 presses can be made and each press is indicated by small arrows on the screen.

eg: for RO1 = 0005

Figure 6.4.2



Note: If the mast is connected to the left hand side, use [AUX1] up and down keys instead of [AUX2] keys.
Adjusting the mast height by RO2 offset is the same procedure as with adjusting the mast height by RO1 offset except use hydraulic [UP/DOWN] keys (left or right depending on where the mast is connected) instead of [AUX2] keys.

Note: If RO1 or RO2 are set to a value of zero (default), mast position will not change.
To adjust the mast height by RO1 or RO2 using optionally supplied joystick, refer to section 8 explanation, for ‘Prop Mini Stick/Mast’ or ‘Mast Offset Stick’.

7 RESET TO SYSTEM DEFAULT

From the main menu screen use [AUX2] key to select the ‘Advanced Settings’ option then press [ENTER] key. The advanced settings parameters are shown on the right hand side of Figure 7.1.

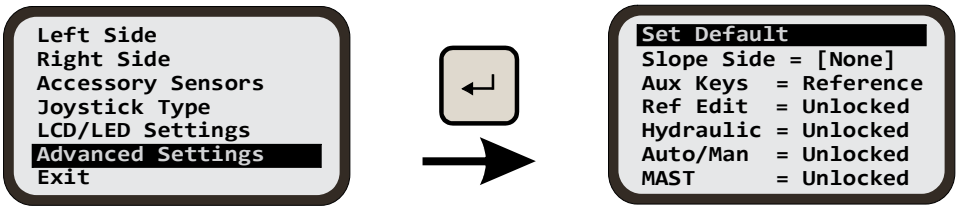


Figure 7.1

To avoid accidental resetting of the system to factory defaults, you will be asked to confirm your selection.
Select ‘[NO]’ using [AUX2] key if you do not want to proceed. Press [ENTER] key to exit.
Select ‘[YES]’ using [AUX2] key if you want to proceed with system default. Press [ENTER] key to execute.

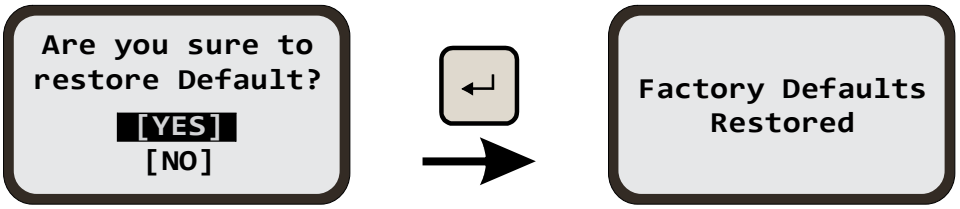
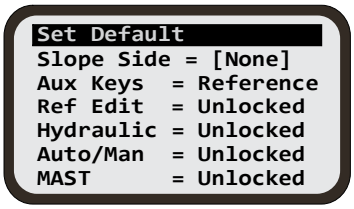


Figure 7.2

Screen will return to the ‘Advanced Settings’ menu after displaying ‘Factory Defaults Restored’ for five seconds.



8 JOYSTICK TYPE (optional)

DUO2 supports multiple types of joysticks, so it is very important to select the right type of joystick connected to the system.
From the main menu screen, use [AUX] key to scroll down to “Joystick Type” option then press the [ENTER] key. From the Joystick Type submenu, use [AUX] key to scroll down to select the type of joystick connected to the DUO2 panel.

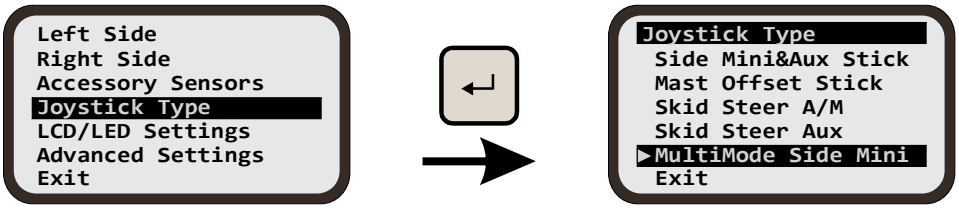
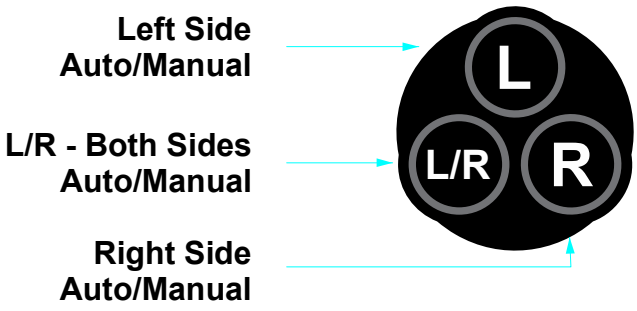


Figure 8.1

The different types of joystick supported are:

(a) Side Mini Stick (default) -

(I) Hydraulic up and down activations for a given side are located on an axis 90 degrees to each other on the joystick handle.
(ii) Hydraulic activation is proportional to handle position.
(iii) Includes 3 buttons on top for switching between Auto and Manual:



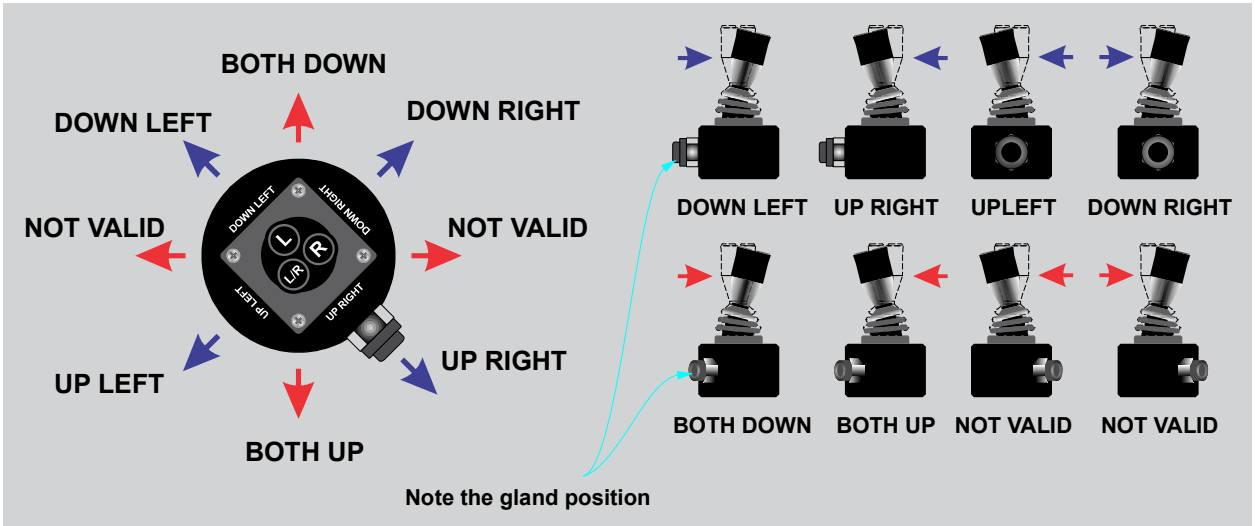


Figure 8.2

(b) Multi-Mode Side Mini - Has three operational modes for the handle: Standard, Auxiliary and Reference.

Standard Mode: Handle works in the same manner as “Side Mini Stick”, controlling the main Hydraulics (see section (8a)).
Auxiliary Mode: Handle controls the auxiliary hydraulics.
Reference Mode: Handle controls the Reference (target) values of the connected sensors. If the connected sensors do not support Reference values, this mode is omitted.

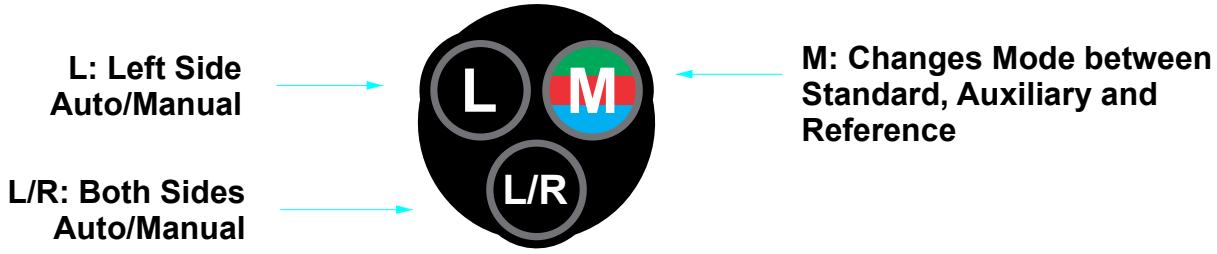


Figure 8.3

Changing Modes:

i) Pressing the M button toggles the joystick between Auxiliary and Standard Modes. In Auxiliary Mode, the word AUX appears on the screen and the handle controls Auxiliary 1 and Auxiliary 2 hydraulics with center arrows indicating direction of movement.

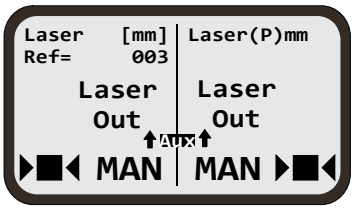


Figure 8.4

ii) Pressing and holding the M button for 3 seconds from either the Auxiliary or Standard Mode puts the joystick in Reference Mode. The handle now controls the left and right sensor References.

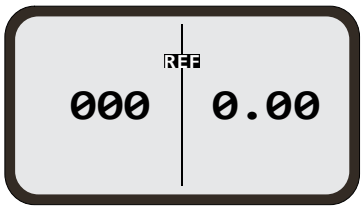


Figure 8.5

iii) Pressing the M button from the Reference Mode, puts the joystick and the screen back to the Standard Mode with the joystick handle controlling the main hydraulics.

Joystick handle movement in Auxiliary and Reference Modes relative to Standard Mode (refer to Figure 8.2):

- Down Right = Aux2 down/Ref2 decrement.
- Up Right = Aux2 up/Ref2 increment.
- Down Left = Aux1 down/Ref1 decrement.
- Up Left = Aux1 up/Ref1 increment.
- Both Down = Aux1 down/Ref1 decrement & Aux2 down/Ref2 decrement
- Both Up = Aux1 up/Ref1 increment & Aux2 up/Ref2 increment.

Ref1 refers to the left sensor Reference and Ref2 refers to the right sensor Reference.

Notes:
1) On power up, Mode always defaults to Standard Mode.
2) Selecting this joystick type automatically sets menu option Auxiliary 2 = OFF/ON to ON to enable control of Auxiliary 2.

When the Auto/Manual (A/M) button is held pressed for 3 seconds, it changes the joystick button function to Auxiliary mode.

Auxiliary mode is shown on the screen and the button function are as follows:

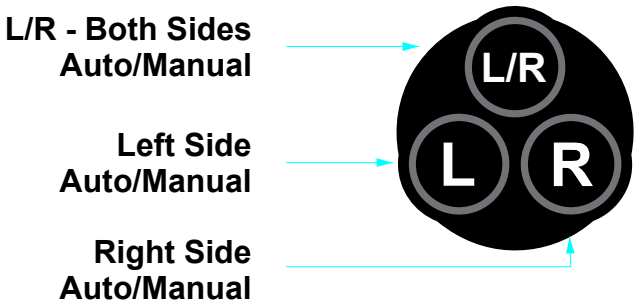
- Right Up becomes Aux 2 Up
- Right Down becomes Aux 2 Down
- Left Up becomes Aux 1 Up
- Left Down becomes Aux 1 Down

To change back to normal hydraulic mode, press and hold the Auto/Manual (A/M) button for 3 seconds.

(c) Side Mini & Aux Stick - as per 'Side Mini Stick' except the L/R button activates auxiliary 1 up which can be used to activate an oil diversion valve.

(d) Proportional Mini Stick -

(I) hydraulic up and down activations for a given side are located on the same axis on the joystick handle.
(ii) Hydraulic activation is proportional to handle position.
(iii) Includes 3 buttons for switching between Auto and Manual as per Side Mini Stick.



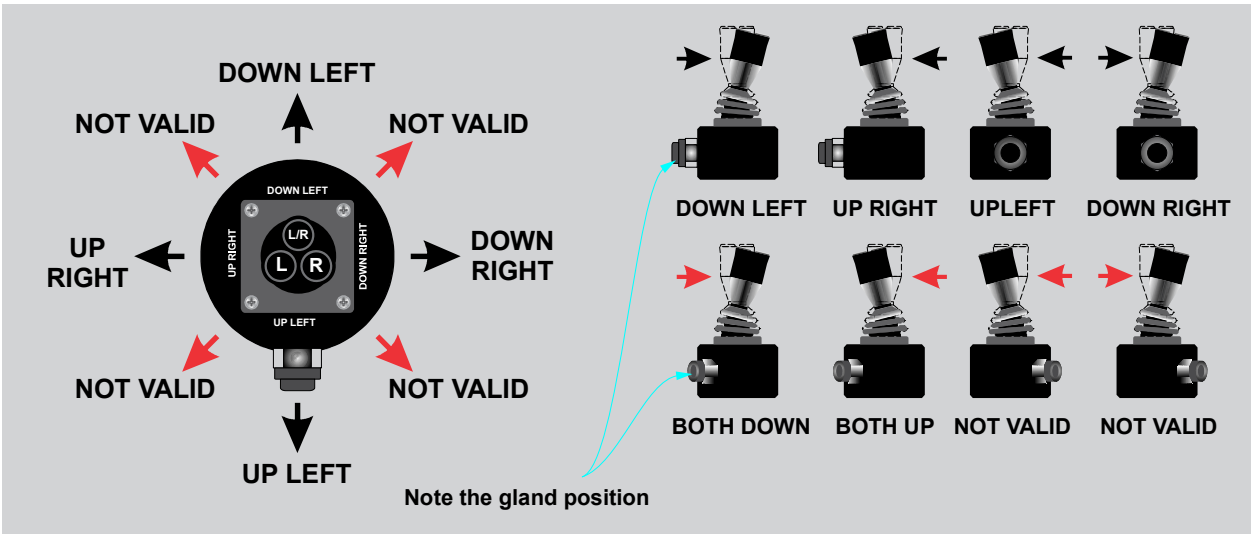


Figure 8.6

(e) On/Off Mini Stick -

(i) hydraulic up and down activations for a given side are located on the same axis on the joystick handle.
(ii) Hydraulic activation is not proportional to handle position. Simple ON/OFF activation.
(iii) Includes 3 buttons on top for switching between Auto and Manual as per Side Mini Stick.

(f) Proportional Toggle Stick - works in the same manner as 'Proportional Mini Stick', however power supply and signal out levels differ to accommodate DANFOSS type proportional joysticks (not limited to this brand).

(g) On/Off Toggle Stick - works in the same manner as 'On Off Mini Stick', however power supply and signal out levels differ to accommodate DANFOSS type ON/OFF joysticks (not limited to this brand).

(h) Auto/Man Stick - this joystick uses a toggle switch rather than a handle for hydraulic activation and another toggle switch for 'Auto/Manual' selection. Controls only left side up/down and auto/manual.

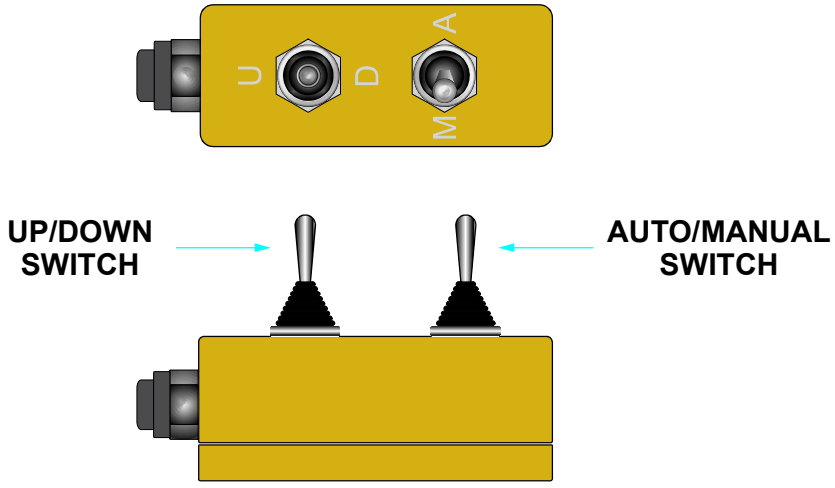


Figure 8.7

Note: With this option, the [A/M] key on the control panel will not work in the manner described in section 4.2 because the connected joystick will override this button. If no joystick is being used, select 'Side Mini Stick' (the default option).

(i) Mast Offset Stick - Used optionally with a mast and cable A.RS.118. Provides a means to move the mast by preset discreet step amounts RO1 or RO2 (refer to section 6.4 on setting the values of RO1 and RO2).

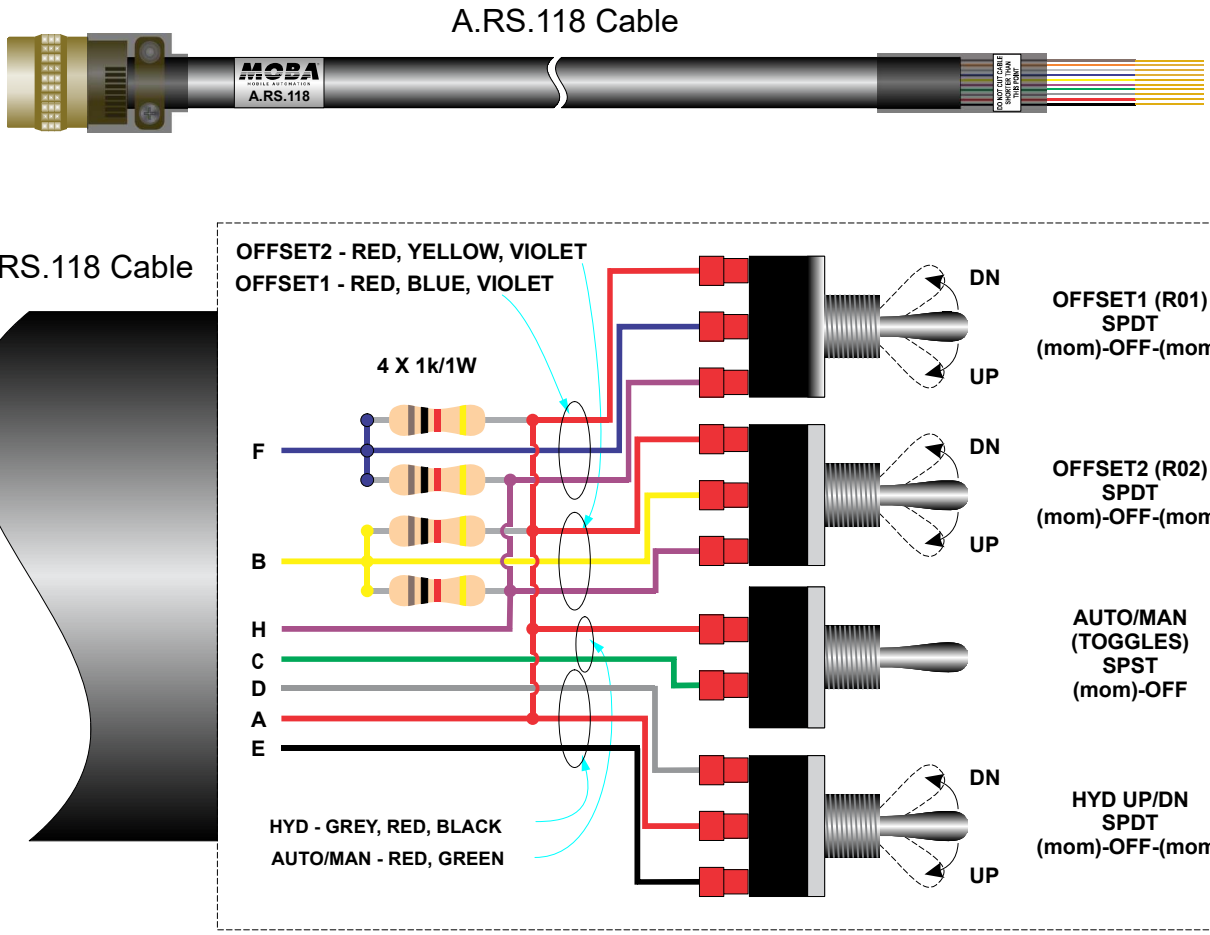


Figure 8.8

Offset1 (RO1) - Moves mast up or down by n x RO1 where n is the number of times the switch is toggled up or down in quick succession.

Offset2 (RO2) - Moves mast up or down by n x RO2 where n is the number of times the switch is toggled up or down in quick succession.

Auto/Man - Switches left hydraulic control between Auto and Manual.

HYD Up/Down - Activates left hydraulics up or down.

Note: Only cable A.RS.118 with unterminated wires is supplied. The switches can be supplied optionally or sourced by the user.

(j) Prop Mini Stick/Mast - Used optionally with a mast. As per ‘Proportional Mini Stick’ except L/R button changes handle function to move the mast by preset discreet step amounts RO1 or RO2 (refer to section 6.4 on setting the values of RO1 and RO2).

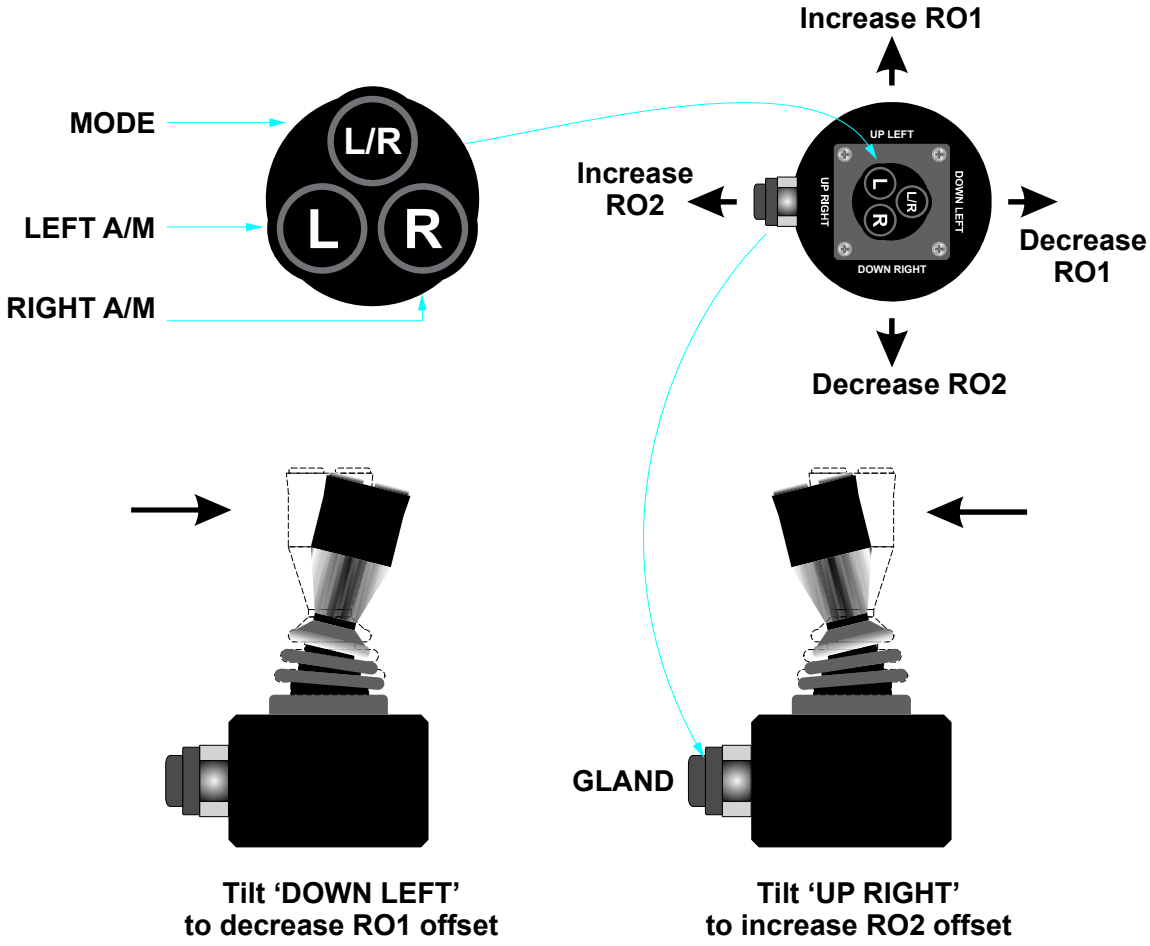


Figure 8.9

To increase the mast height by RO1 offset, press and hold [L/R] button then tilt the joystick towards ‘UP LEFT’ position. While holding the [L/R] button, go back to the neutral position and release the [L/R] button.
To decrease the mast height by RO1 offset, press and hold [L/R] button then tilt the joystick towards ‘DOWN LEFT’ position. While holding the [L/R] button, go back to the neutral position and release the [L/R] button.

To increase or decrease the mast height by a multiple of RO1 offset, press and hold [L/R] button then tilt the joystick towards ‘UP LEFT’ or ‘DOWN LEFT’ position and back to neutral position multiple times while holding the [L/R] button. In neutral position, release the [L/R] button to activate mast movement. A maximum multiple of 7 times can be applied.

Adjusting the mast height by RO2 offset is the same procedure as with adjusting the mast height by RO1 offset, the only difference is the joystick has to be tilted towards ‘UP RIGHT’ or ‘DOWN RIGHT’ position.

(k) Skid Steer A/M and **Skid Steer Aux** - Allows the DUO2 panel to connect to the buttons of a skid steer joystick via the 14 pin connector on the outside of the cab to control up/down and auto/manual. Cable A.RS.131 is supplied for this option but as wiring varies between skid steer machines, one end of the cable is left unterminated for the user to terminate.
The **Skid steer A/M** and **Skid steer Aux** are very similar, the differences are:
Skid steer A/M mode initially controls the hydraulics movements while **Skid steer Aux** mode initially controls the Auxiliary movements.

Switching modes:
In **Skid steer A/M** mode, when (A/M) button is held for 3 seconds, it changes the joystick button function to Auxiliary mode. In Auxiliary mode, “Aux” is shown on the screen (see below) and the button functions are as follows:

- Right Up becomes Aux 2 Up
- Right Down becomes Aux 2 Down
- Left Up becomes Aux 1 Up
- Left Down becomes Aux 1 Down

To change back to normal hydraulic mode, press and hold the A/M button for 3 seconds.
In **Skid steer AUX** mode, when (A/M) button is held for 3 seconds, it changes the button function to Auto/Manual mode. To change back to auxiliary mode, press and hold the (A/M) button for 3 seconds.

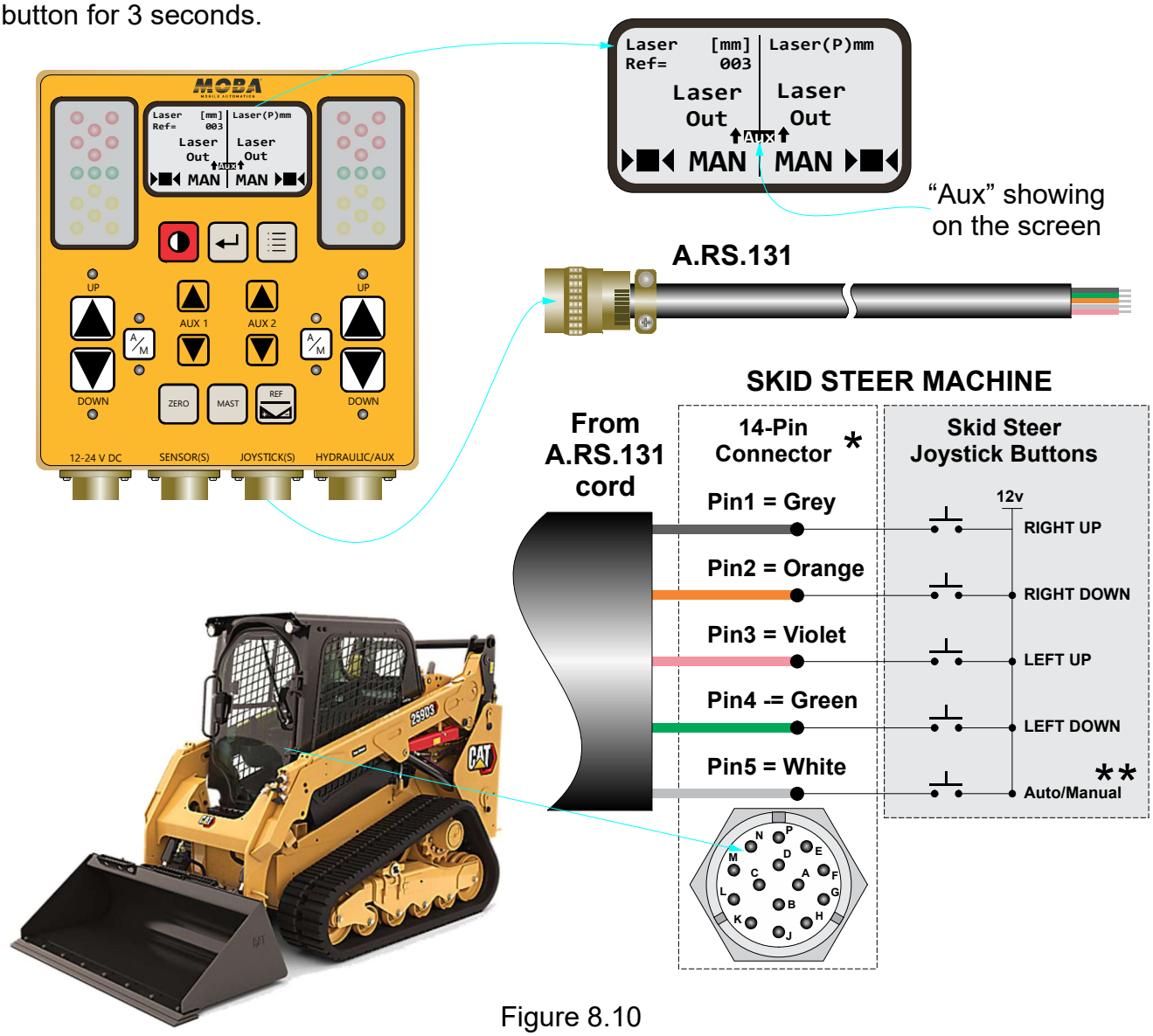


Figure 8.10

*(Pins 1 - 5 are labelled such for reference only. They correspond to pins on the skid steer 14 pin connector (pins A - P) which differ between skid steer machines. Refer to the skid steer manual for which pins to use. Once the correct pins are determined, slot the unterminated wires of the cable in the appropriate positions of the 14 socket cable connector supplied with the cable and secure the connector to the cable. The cable can then be plugged into the skid steer connector.

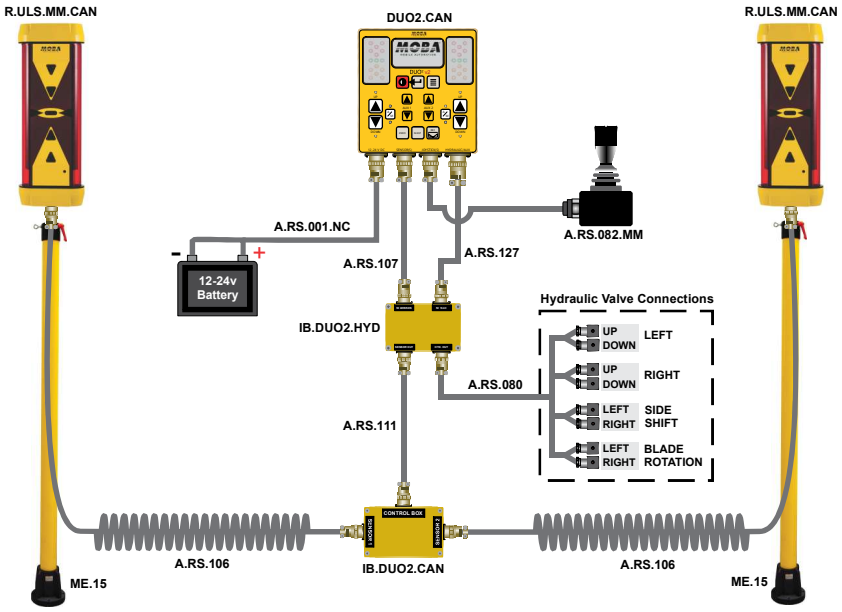
**Where skid steer joystick buttons are not enough for an Auto/Manual function, the following quick sequence can be used to switch between Auto and Manual:

1) Press LEFT DOWN button once.
2) Double click LEFT UP button.

9 PRACTICAL EXAMPLE

The following example is a basic setup for ground levelling and grading.
The diagram below is based on RS.037 setup.

Components:
1 x Dual Control Panel
2 x Laser Receiver MM CAN
1 x MultiMode Joystick
1 x Junction Box
1 x Breakaway Box
2 x Adjustable Mast ME.15
1 x A.RS.107 CAN Cable
2 x A.RS.106 CAN Cable Curly
1 x A.RS.111 CAN Cable
1 x A.RS.080 Hydraulic Cable
1 x A.RS.127 Hydraulic Cable
1 x A.RS.001.NC Power Cable



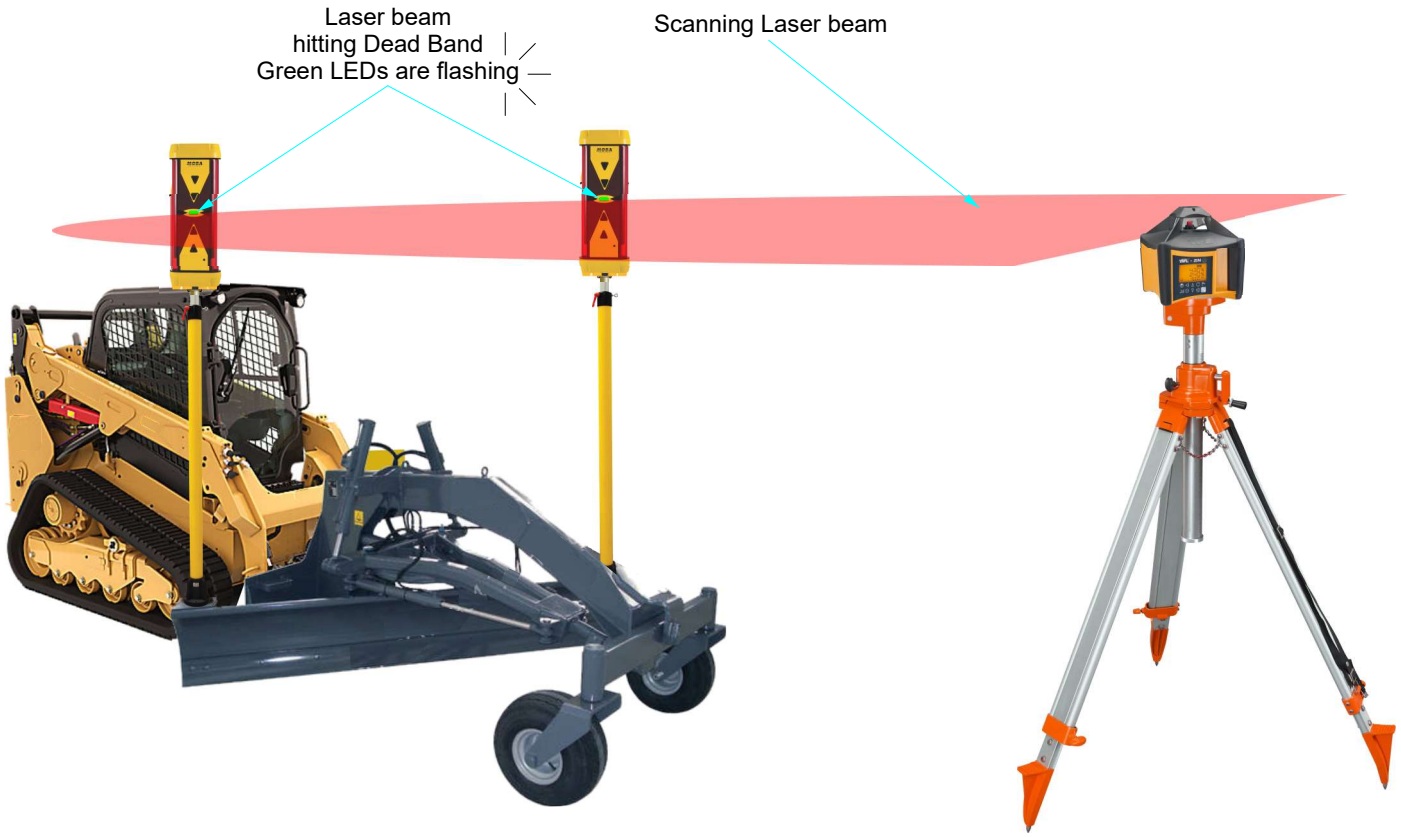


Figure 9.1

1. Start by setting up the laser on the tripod on a firm ground. Ensure the laser is stable. Adjust the laser position to a reference height. Turn the laser ON.
2. Adjust the cutting edge of the blade to the desired cut.
3. Adjust the laser receivers so that the laser beam hits dead band (ie: the green LEDs are flashing).
4. On the DUO2 panel, press and hold [AUX1] up and down arrow to set the current reading and reference for the left side of the blade to zero. Press and hold [AUX2] up and down arrow to set the current reading and reference for the right side of the blade to zero.
5. Press [A/M] button on both sides to set hydraulic control into automatic mode.

The laser receivers will automatically search for deadband, hence, maintaining the blade height for the duration of the job.

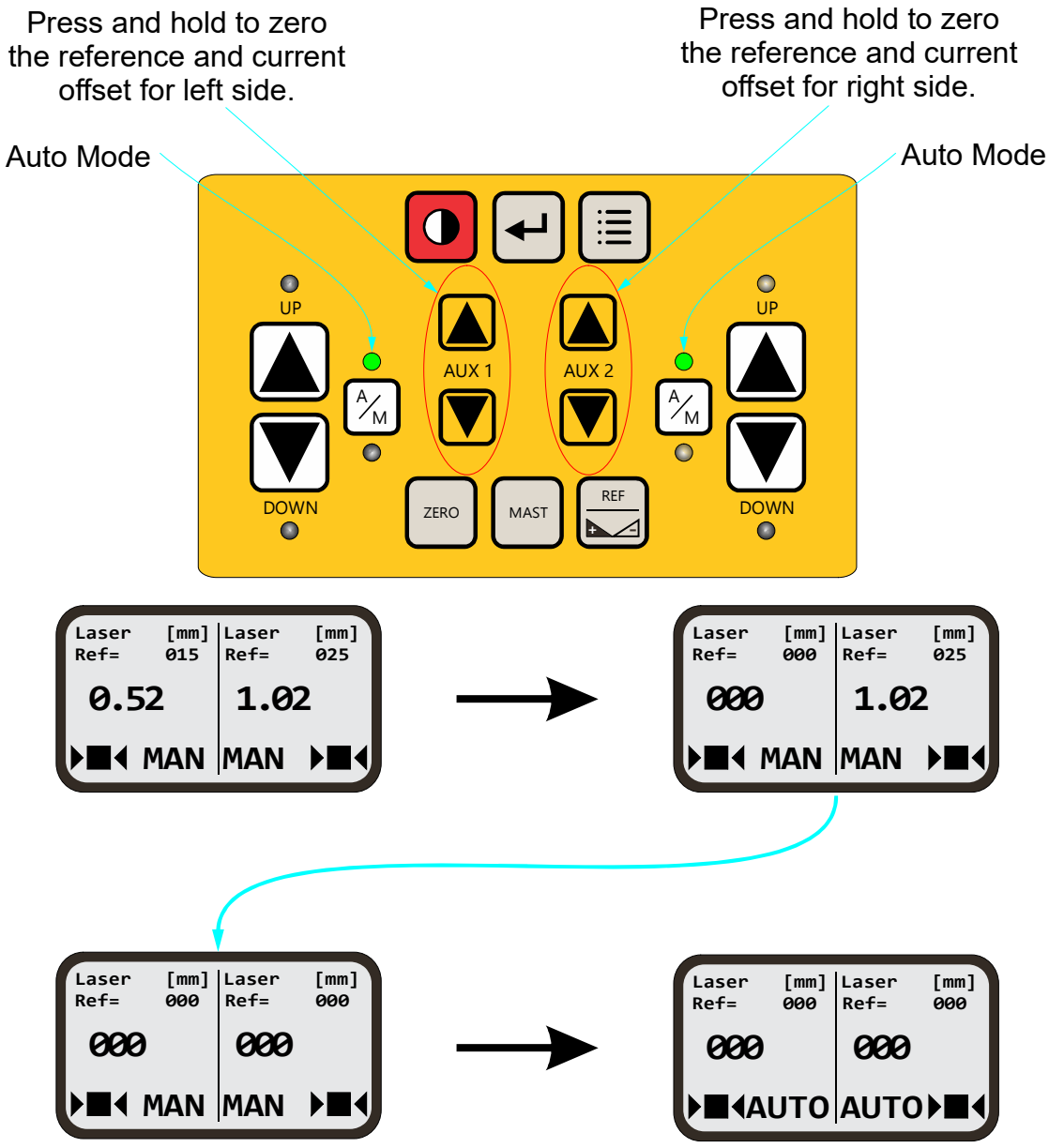


Figure 9.2

10 SPECIFICATIONS

Dimension	179 x 158 x 42 mm
Weight	1.6kg (panel only) 2.2kg (with Ram Mount attachment)
Operating voltage	12 - 24 V DC
Waterproof/Dustproof	Yes
LCD	• 128*64 dots • maximum number of characters is 21 • maximum number of lines is 7 • white colour LED backlight

* Specifications subject to change without notice.

Table 10.1