

# INSTRUCTION MANUAL

## ***SULTAN*** **DUAL**



A higher level of performance



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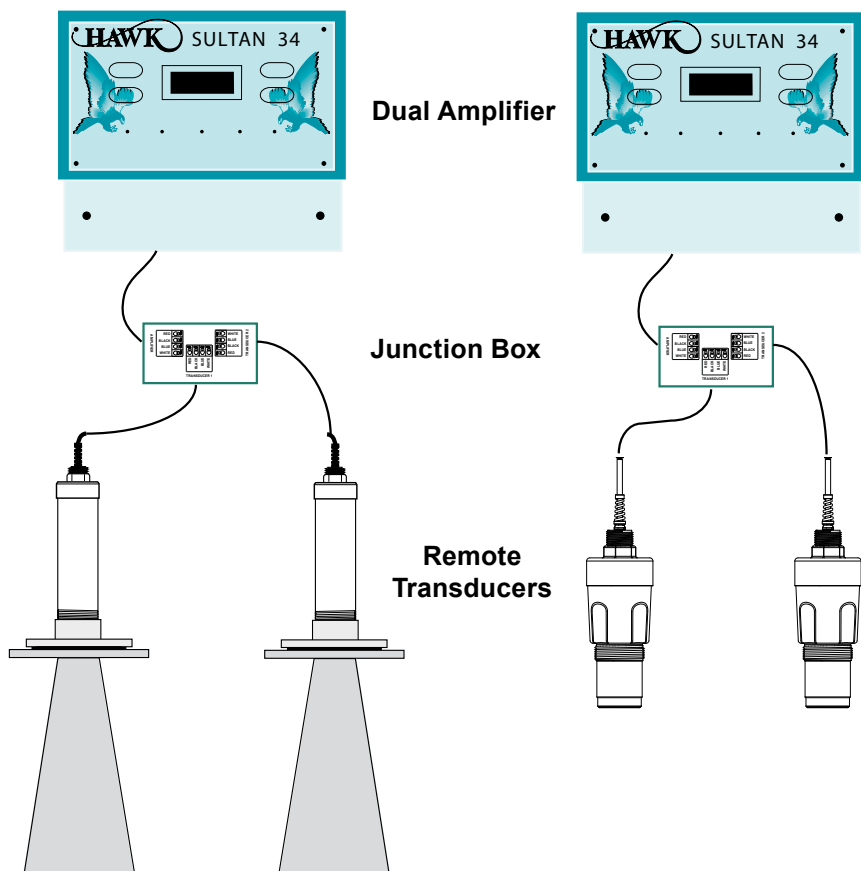
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## SYSTEM COMPONENTS

The Sultan Dual units consist of one AWRD34 Amplifier, two AWRT transducers and a junction box



# WIRING THE UNIT

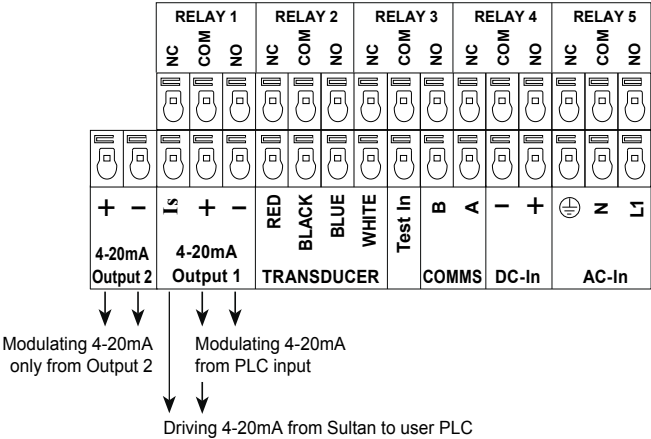
## Sultan Dual

The Sultan Remote amplifier has wiring information printed inside the flip lid of the unit.

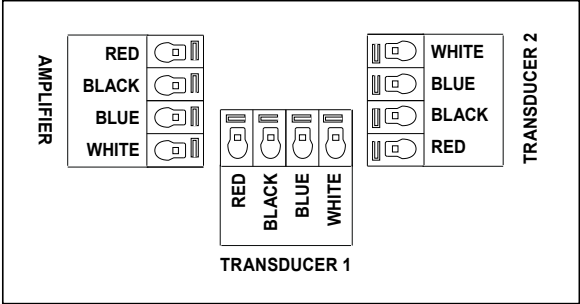
Ensure your power source is deactivated before handling the exposed power wires. To place a wire in the terminals use a small flat head screwdriver to push down on the bevelled button above the terminal and place the wire in the terminal.

The transducer terminals are labeled by colour on the PCB matching each wire for both the Amplifier and Junction Box. If you are connecting a HawkLink USB unit connect the blue wire to B and the white wire to A. The black wire can be connected to the DC- terminal next to A.

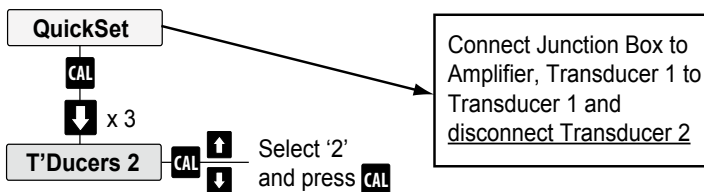
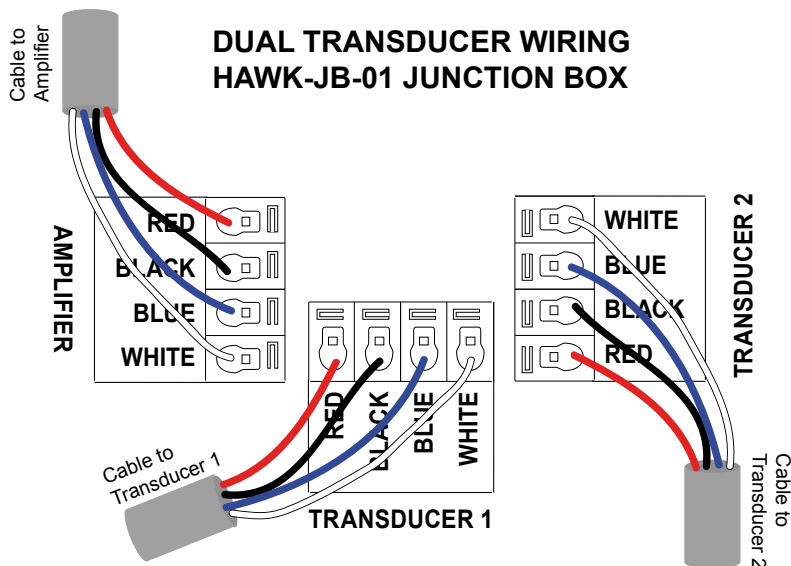
### Amplifier



### Junction Box



## TRANSDUCER CONNECTION



The unit will emit a single pulse from Transducer 1 then display

**T'Ducer1  
Xducer Ready**

again press **CAL**

The unit should now display either 'plz connect T'ducer 2' or it will pulse Transducer 1 then Transducer 2 and display.

**T'Ducer2  
Xducer Ready**

The transducers are now correctly set-up.

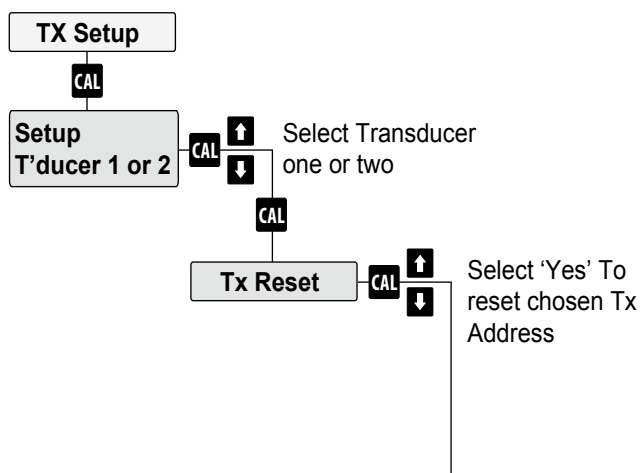
Connect Transducer 2

If you could not correctly set up the Transducers following this procedure see you may need to re-assign one of the TX IDs, see 'Assigning Transducer Address'.

## ASSIGNING TRANSDUCER ADDRESSES

The Dual amplifier contains a unique set up procedure to ensure the transducers are not assigned the same TX address.

If both transducers are on the same address the unit will read 'error 1' or 'error 11' during its normal startup phase. If this happens you need to re-set and re-assign the unique TX ID of one of the Transducers by performing the following steps. Press & hold CAL until the unlock code comes up



**Repeat 'Transducer Connection' procedure.  
You may need to reset the Tx ID of the OTHER  
Transducer if it does not work the first time.**

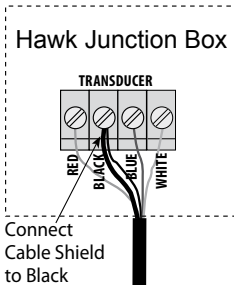
## CABLE EXTENSION

If you need to extend the cable length using a customer supplied junction box it is important to match the wires to the correct input & output.

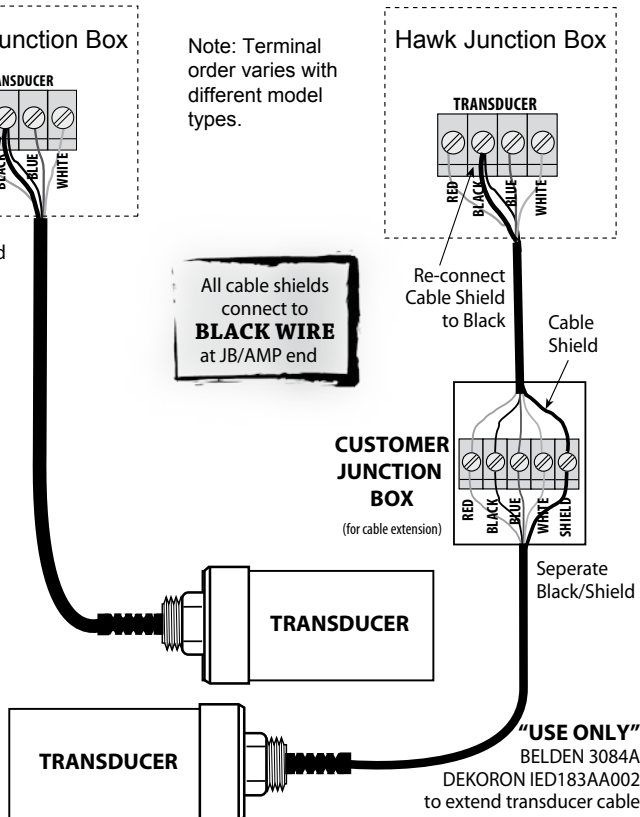
The standard Sultan transducer cable has both GND/SHLD together within the black cable. When connecting to the junction box

you must separate these two cables and continue one as 'black' and connect the other to a shield terminal. These 5 cables must also run from the junction box to the Sultan Amplifier, but you must connect both the black & shield into the 'black' labelled transducer wire terminal.

### Direct Connection to Hawk Junction Box



### Connection via Customer Junction Box to Hawk Junction Box



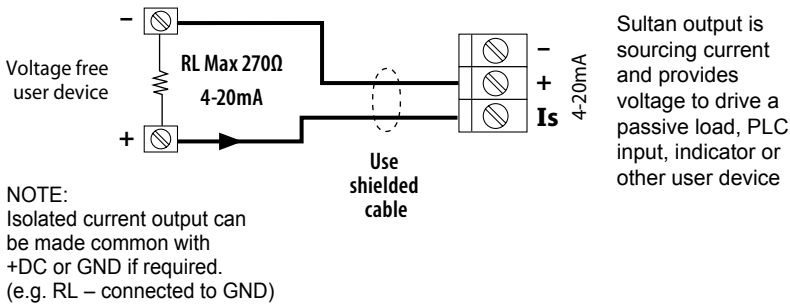
\*When extending transducer cable using DEKORON shielded twisted pair cable types, ensure that one pair is used to extend Blue and White, and another pair is used to extend Red and Black.

## WIRING 4-20mA OUTPUT

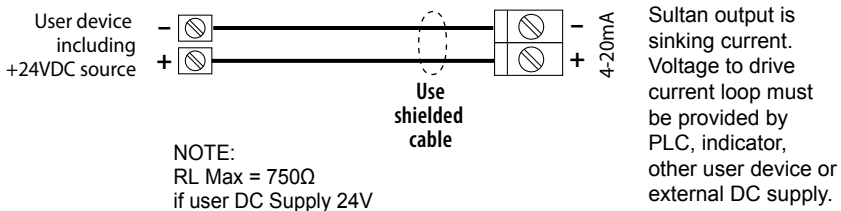
### STANDARD WIRING

When connecting the 4-20mA output to a user device such as a PLC input, DCS or indicator, use a voltmeter to check the field wires to be used for the 4-20mA signal. If DC voltage around 24V is present, use sinking connection. If no voltage is present, use sourcing connection.

### SOURCING Type Output



### SINKING Type Output (also 2 wire loop powered)



### ADDITIONAL WIRING

See the following diagrams for further/advanced wiring options



## WIRING 4-20mA OUTPUT

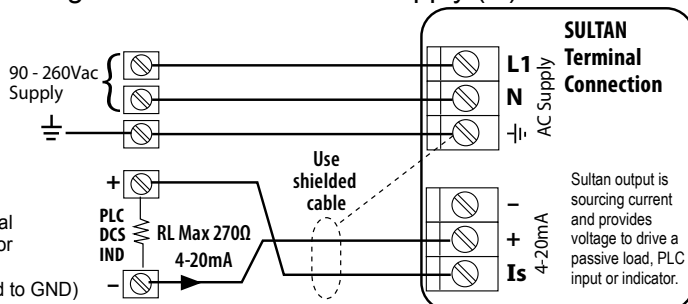
### Terminal Connections for AC Powered Operation

234 models with AC power option and SIM card positioned for 3/4 wire mode

#### a) 5 Wire – Driving from Internal Isolated Supply (Is)

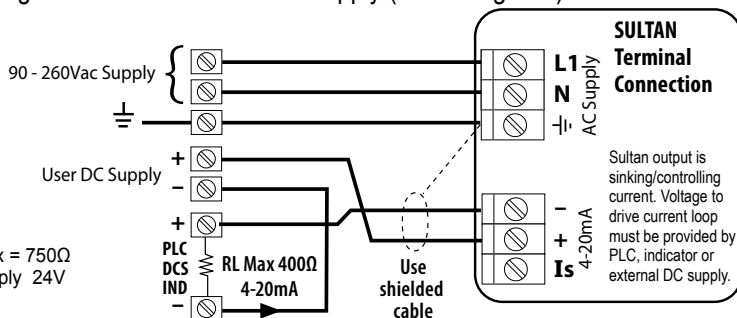
**NOTE:**

Isolated current output can be made common with external DC Supply Positive or Negative if required.  
(e.g. RL – connected to GND)



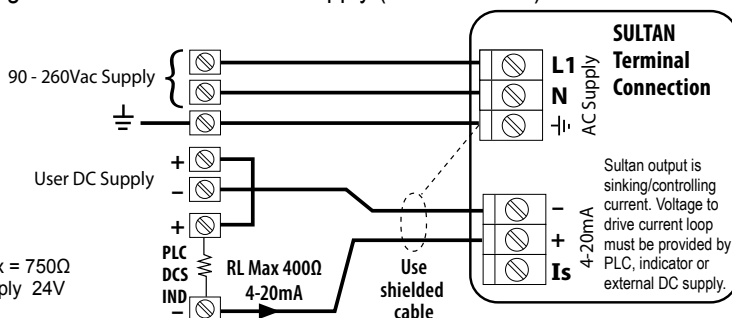
#### b) Modulating from User's External DC Supply (RL to Negative)

**NOTE:** RL Max = 750Ω  
if user DC Supply 24V



#### c) Modulating from User's External DC Supply (RL to Positive)

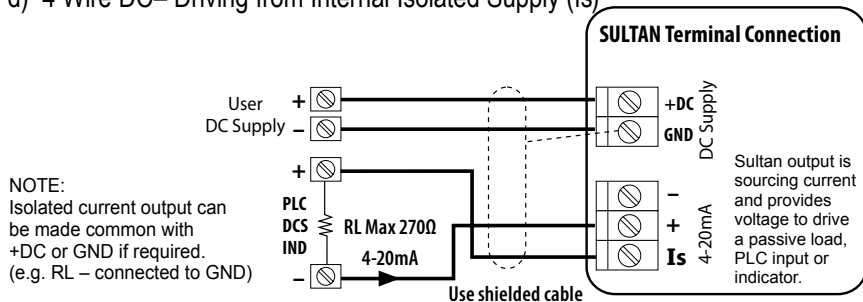
**NOTE:** RL Max = 750Ω  
if user DC Supply 24V



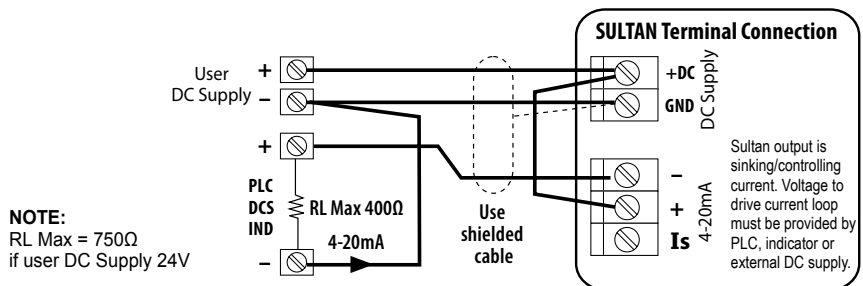
## WIRING 4-20mA OUTPUT

Terminal Connections for DC Powered Operation – AWST models and all 234 models with SIM card positioned for 3/4 wire mode.

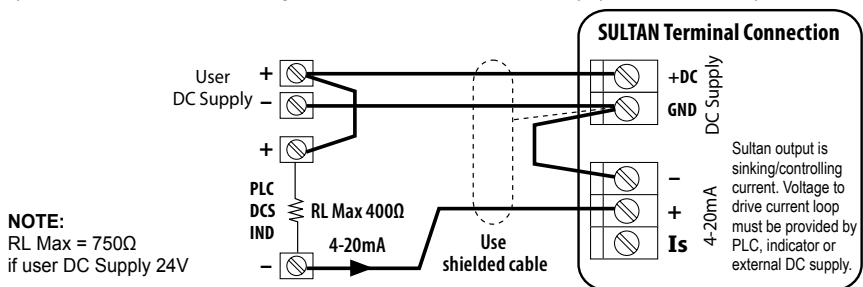
### d) 4 Wire DC– Driving from Internal Isolated Supply (Is)



### e) 3 Wire DC – Modulating from Common User Supply (RL to Negative)



### f) 3 Wire DC – Modulating from Common User Supply (RL to Positive.)

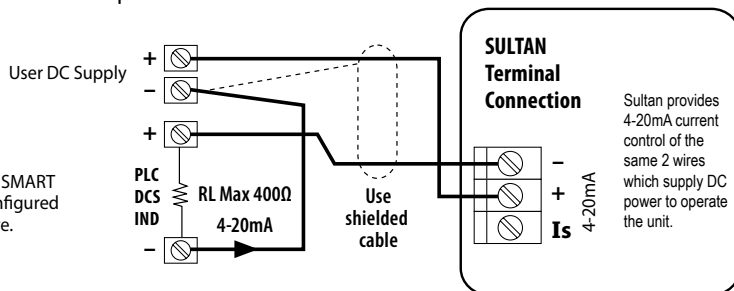


## WIRING 4-20mA OUTPUT

Terminal Connections for DC 2 Wire 4-20mA Loop Powered Operation  
AWSTA, Sultan 2 and 234 models with SIM Card positioned for 2 wire mode.

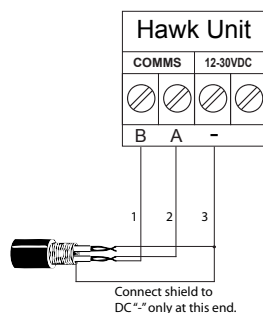
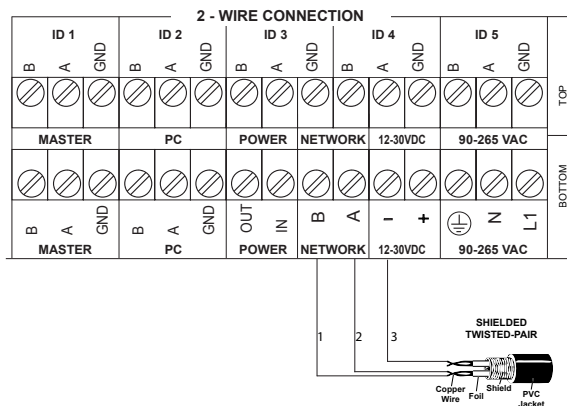
g) 2 Wire DC Loop Powered

**NOTE:**  
Internal SMART  
card configured  
for 2 wire.

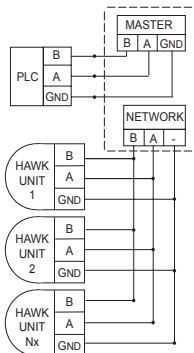


## WIRING HAWKLINK

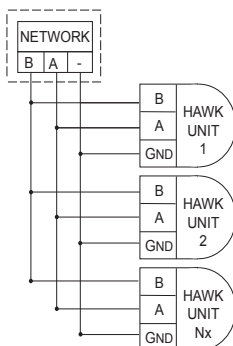
## HAWKLINK MODEM TERMINAL BLOCK



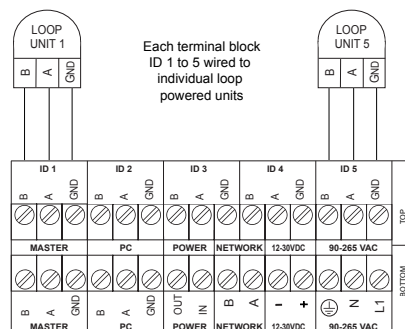
## PLC CONNECTION



## STANDARD CONNECTION

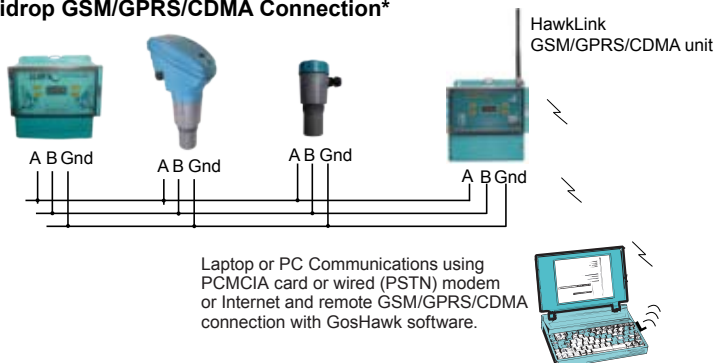


## LOOP POWER CONNECTION

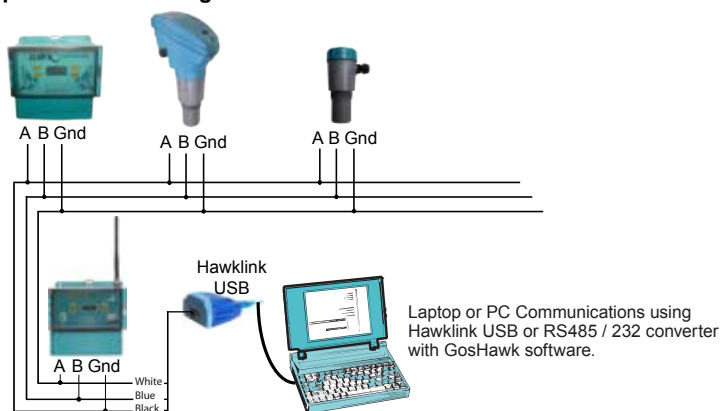


## MULTIDROP WIRING

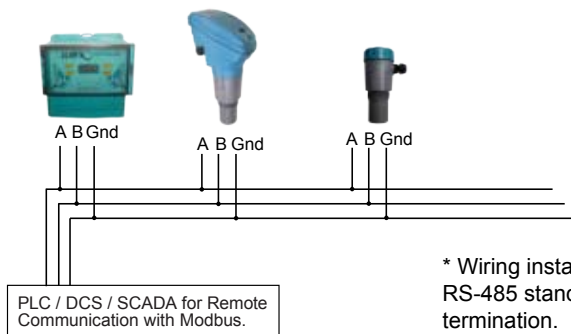
### Multidrop GSM/GPRS/CDMA Connection\*



### Multidrop Connection Using HawkLink USB\*



### Multidrop Connection to PLC/DCS/SCADA\*



\* Wiring installation should follow RS-485 standards for layout and termination.

# INSTALLATION GUIDE

## AMPLIFIER - FIELD MOUNT

Select a suitable mounting position that is not in direct sunlight. If necessary, utilize a sunhood (Hawk supplies purpose made sunhoods). Observe the minimum and maximum temperature limits (-20°C/-4°F to 60°C/140°F) Do not mount near sources of high E.M.F. such as high current cables, motor starters, or S.C.R. variable speed drives. Avoid mounting in high vibration areas such as handrails and rotating plant. Use rubber absorption mounts if mounting in light vibration areas. Remove the P.C.B. assembly before knocking out the cable and conduit entry holes.

## AMPLIFIER - PANEL MOUNT

- Select a suitable position within a panel layout which allows clearance around the outside of the front panel of the unit.
- Ensure that sufficient space is available behind the panel to accommodate the depth of the amplifier housing, and also allow cable bend clearance for wiring to the terminals on the rear of the amplifier.
- Mark and cut a 90x90mm (3.54x3.54") square cut out through the panel in the desired position.
- Insert the Sultan amplifier through the panel and install supplied screw clamps into the slotted holes in the amplifier housing. Tighten the screws until just firm to secure the amplifier in place.

- Connect wiring as required to the correct terminals on the removable rear panel connectors. \*When plugging connectors in to the rear panel, ensure that they are re-installed in the correct position (upper or lower).

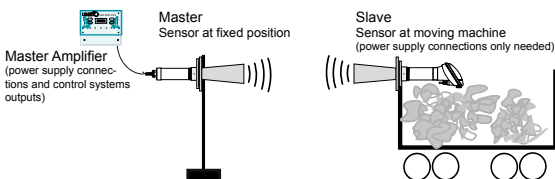
## TRANSDUCER

Selecting a suitable position to mount the transducer on the vessel is the single **MOST IMPORTANT** step. Please read all of the installation guide and contact your Hawk representative if you have any doubts or questions. The transducer face **MUST** be at least the blanking distance away from highest product level in the vessel. Use common sense when selecting the transducer mounting position. A clear line of sight from the transducer to the product being monitored is highly recommended. In high / low level applications take into account the change in material shape, level and whether the acoustic pulse will reflect back to the transducer or bounce away. If the transducer face is not perpendicular to the product the acoustic pulse will bounce around the vessel creating false echoes, which can affecting unit performance.

## MONITORING SOLIDS

In general, the transducer mounting position can be determined by measuring the distance from the infeed to the vessel wall, and mounting the transducer 1/3rd this distance from the wall.

## POSITION MEASUREMENT



# MOUNTING

## Incorrect Mounting

Failure to mount the unit suitably can result in the unit operating incorrectly which can lead to application hazards such as overfilling vessels and damage to critical components (see incorrect mounting on the next page).

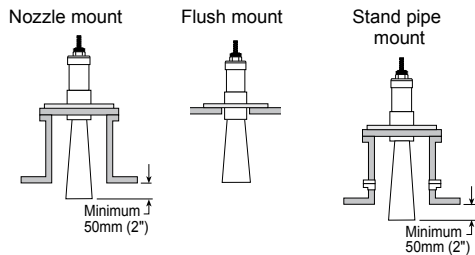
## Mounting Conditions

Ensure the process conditions within the vessel such as temperature, pressure and chemical composition of contents are suitable for the Sultan unit.

The unit should not come into contact with the measured content.

## Minimum Ingress

The transducer face or cone must be at least 2 inches inside the tank.



## Moisture Seal

Sultan Integral units have a cable gland with a moisture seal which can be tightened around the cable.

## Transducer orientation

It is vital the Transducer has a clear view of the product surface at all times and is kept **away from the inflow**. If the inflow passes in front of the transducer face you will have operation problems.

## Blanking Distance

Where possible use the conservative values and increase this distance by 50% if there is foam, dust, steam, or condensation in the vessel being monitored. (**refer to Blanking Distance table.**) If using a flange mounting, use a rubber or neoprene gasket and washers. If using a nipple mounting, ensure that the mounting bracket is **>6mm (0.24 in) from the rear** of the transducer. Do not over tighten the lock nuts. When using a focaliser cone, ensure that it protrudes at least 50mm (2 in) into the vessel. If the transducer needs to be mounted above the roofline, use an appropriate standpipe or nozzle.

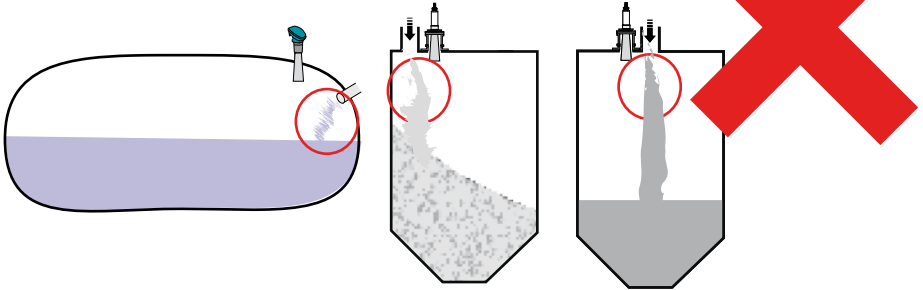
Blanking Distance Transducer Frequency		Minimum	Nominal	Conservative
AWRT50	50kHz	0.25m (10")	0.3m (1ft)	0.35m (1.2ft)
AWRT40	40kHz	0.3m (1.1ft)	0.35m (1.2ft)	0.4m (1.4ft)
AWRT30	30kHz	0.35m (1.5ft)	0.4m (1ft)	0.5m (2.2ft)
AWRT20	20kHz	0.5m (2.2ft)	0.6m (1.3ft)	0.8m (2.6ft)
AWRT10	10kHz	1.0m (3.3ft)	1.1m (3.5ft)	1.3m (4.2ft)
AWRT5	5kHz	1.2m (3.9ft)	1.4m (4.6ft)	1.5m (5ft)

*Always use conservative nominated distances if possible*

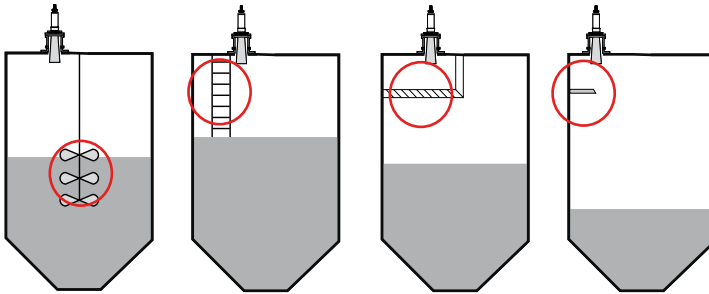
## INCORRECT MOUNTING

These are examples of common **INCORRECT** mountings which can prevent the unit from operating correctly.

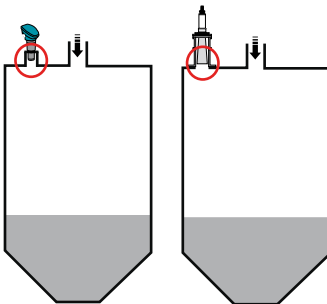
Do **NOT** mount near infeed



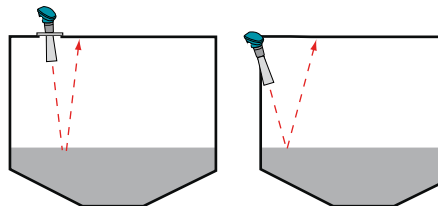
Do **NOT** mount over or adjacent to **any** obstacles



Do **NOT** mount cone or transducer face above roofline

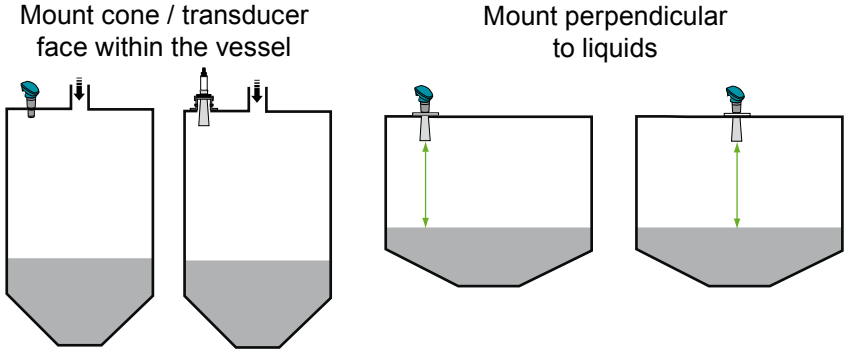
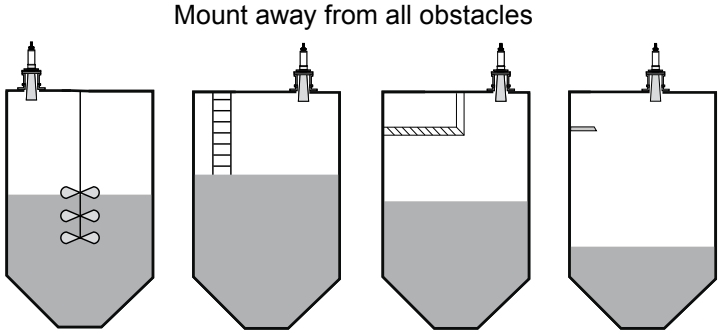
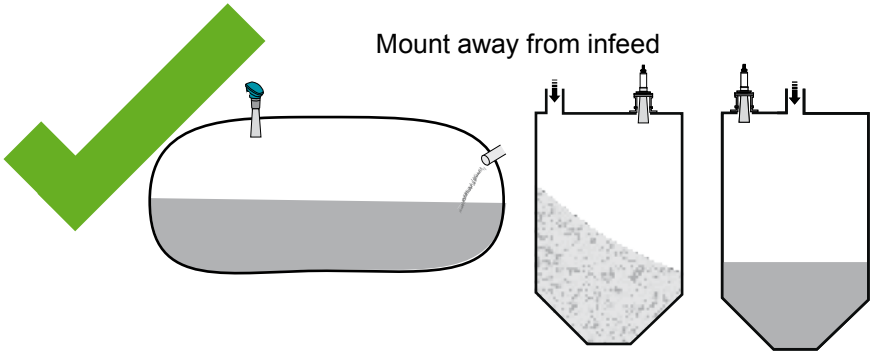


Do **NOT** mount on angle in liquid applications





# CORRECT MOUNTING



# TRANSDUCER MOUNTING EXAMPLES

## SOLID (Granular)



Aim transducer at point of outfeed.

## LIQUID



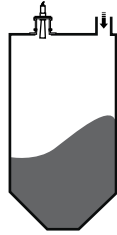
Transducer should be as perpendicular to product as practicable.

## DUAL OUTFEED



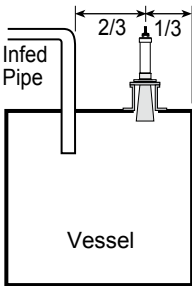
Use two transducer and select sequence option to avoid cross-talk.

## POWDER

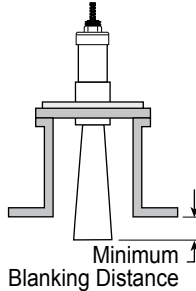


Mount away from infeed

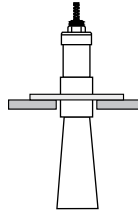
## MOUNTING POSITION



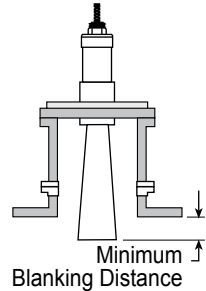
## NOZZLE MOUNT



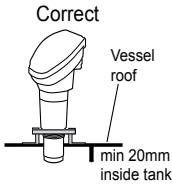
## FLUSH MOUNT



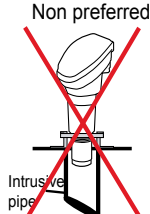
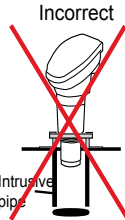
## STAND PIPE MOUNT



## 2" VERSION



We recommend a focaliser cone for all transducers, they are designed specifically to increase the acoustic performance of the Sultan product range.  
Hawk supplies a variety of cones for all Sultan Transducers.

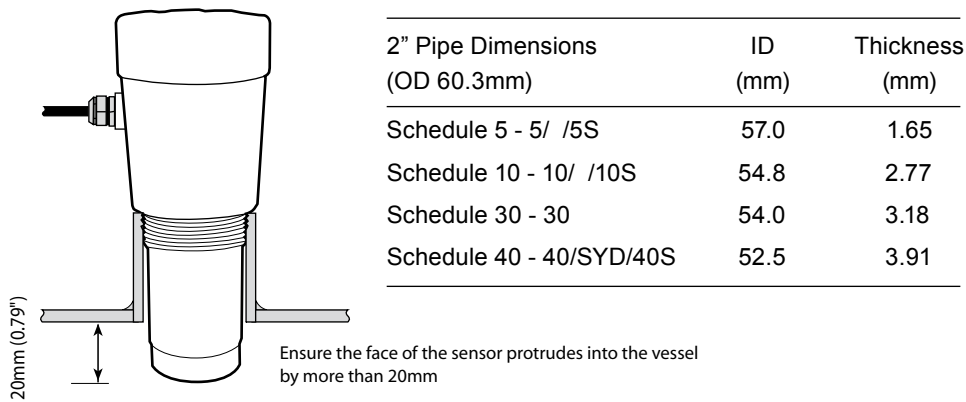


Bevil inside diameter at 45 degrees

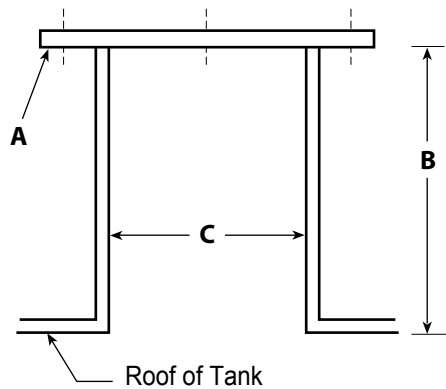
If a stand pipe **MUST** be used ensure a 45° angle is cut to minimise echo return from the end of the pipe. You may need to increase the Blanking parameter to avoid seeing an incorrect return echo from the end of the pipe.

# MOUNTING DIMENSIONS

## 2 INCH BSP/NPT THREADED NOZZLE MOUNTING



## NOZZLE MOUNTING FOR SENSORS WITH FLANGE AND CONE



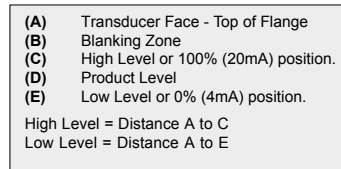
NOZZLE MOUNTING DIMENSIONS							
A				B		C	
100mm	(4in)	DIN, ANSI, JIS		240mm	9.44in	100mm	4in
150mm	(6in)	DIN, ANSI, JIS		240mm	9.44in	150mm	6in
200mm	(8in)	DIN, ANSI, JIS		300mm	11.80in	200mm	8in
250mm	(10in)	DIN, ANSI, JIS		390mm	15.35in	250mm	10in

# SETTING YOUR SYSTEM

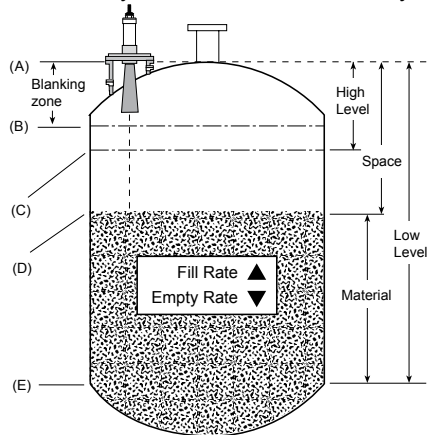
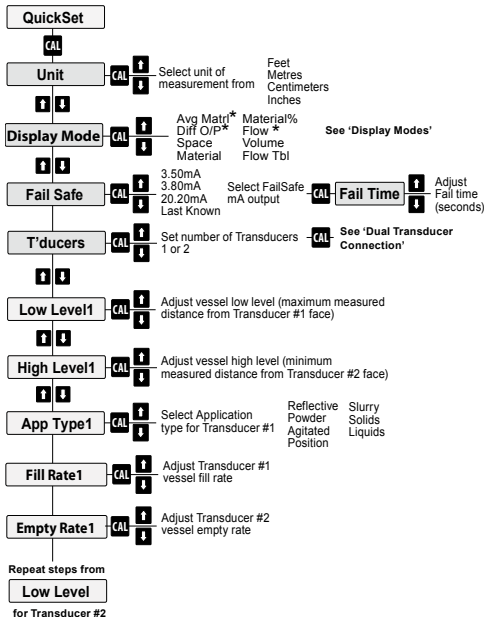
After the unit has been installed, mounted and powered you can now enter the Quickstart settings to get the unit operational in your application conditions.

Note the important measurement sections high & low level, space, material, fill rate and empty rate of your vessel. Space & Material are selectable as primary display modes.

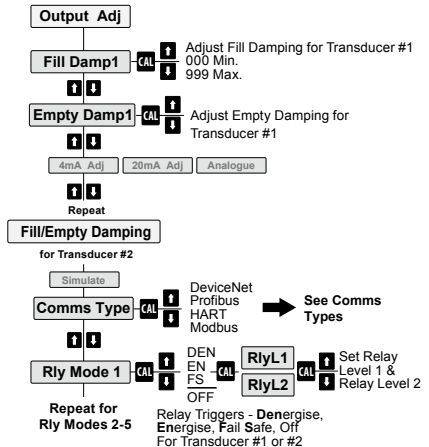
App Type, Fill Rate and Empty Rate tailor other unit settings to match your process. If you are unsure of your specific fill & empty speed enter a value you are sure is faster than your process.



All of the mentioned settings (except Blanking) are in the 'Quickset' menu of the unit. You access this menu on the control pad by pressing **CAL** and entering Unlock code 0.



You may also need to set your communication switch(es). This is found in 'Output Adjustment'. These relay alarms can be set on/off for hi/lo levels & failsafe.



## TRACKING THE CORRECT ECHO

### **‘Gain’ is not always the answer.**

A common mistake made by operators is increasing the ‘Gain’ parameter as the first reaction to any unit performance problems. When the unit needs more sensitivity increasing the Gain CAN help during difficult process conditions where the unit is struggling to find ANY echoes, but ultimately the most important settings are app type, fill rate, empty rate and your high & low level.

### **Which echo will the unit find?**

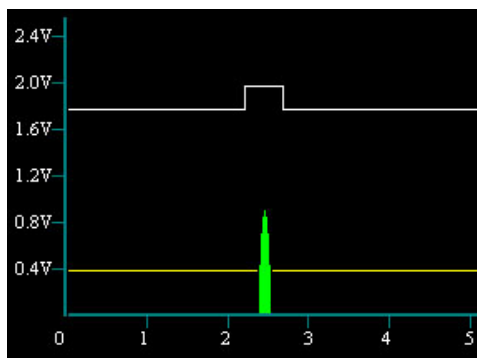
The Sultan unit will track the closest echo it detects above its minimum threshold. Its minimum threshold is illustrated in the screen capture from our GosHawkII software as the yellow line at 0.4V. Any echo weaker than that will be ignored. It is common for the Sultan to see multiple echoes at different distances.

### **Which echo will the unit follow?**

The unit will always want to follow the closest echo within its ‘window’ above the yellow line. The window is illustrated as the squared white line above the green echo in the screen cap. The diagnostics ‘Win Fw and Win Bk’ indicate the window’s current size. This window will move at a pre-determined rate to ‘lock’ onto an echo. If the echo it is tracking disappears, it will expand until it finds a new echo or enter fail safe mode if it cannot find an echo within its fail time.

### **How do I set up the unit to track my vessel level?**

Application Type, Fill rate & empty rate directly control how your window moves. If you have a fast fill rate and slow empty rate the unit automatically calculates how fast the window will need to shift forward &



GosHawkII screen cap, tracking a good echo at 2.4m

backward to track your vessels level during its filling & emptying. As stated previously, if you are unsure of your fill & empty rate always set it faster than your prediction. If you fill or empty your vessel faster than the window is programmed to move the unit will not track your level correctly.

## DIAGNOSTIC MENU

### Diagnostics

While the unit is operating the user can access the diagnostics using the up & down arrows. They indicate the basic function such as the strength of the recieved echo or whether the unit is having difficulty in detecting echoes.

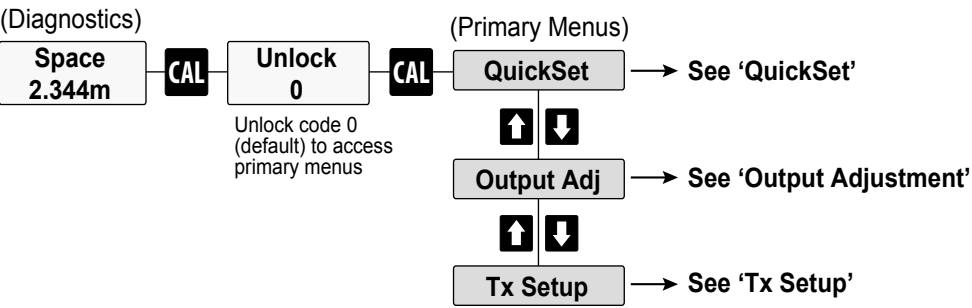
The top most diagnostic '**SPACE**' (or whatever selected 'display mode' is the distance between the transducer face and the targeted material.

Pressing **RUN** several times at any time will return the unit to its standard operating mode where you access the diagnostics.

App Type		Solids	Pulse by pulse distance measurement
E:	Echo	4.2m	Echo size in volts (1V+ is a good echo)
S:	Size	1.4V	Current gain level including recover.
G:	Gain	30.0%	The amount of gain simulated to recover a missing echo when the echo is less than the minimum voltage threshold.
R:	Recover	2.7%	
N:	Noise	2.4%	Externally sourced noise around the transducer face which the unit is detecting. High levels of noise can affect the units ability to recieve its own echoes.
			Current temperature at the transducer face.
T:	Temperature	23.2 °C	Current start (closest point) of the window.
Win	WFwd	4.8m	Current end (furthest point) of the window.
Win	WBk	3.6m	<b>Normal</b> - Unit is operating with echo above minimum threshold detected (default 0.4V). <b>Recover</b> - Unit is operating without an echo detected above threshold and is in recover mode until either an echo is detected or the fail time is reached. <b>Fail</b> - Fail time has passed and unit has entered FailSafe mode.
Normal		Normal	
Recover			
Fail			
Note: your selected primary display mode eg 'Space' will always be			

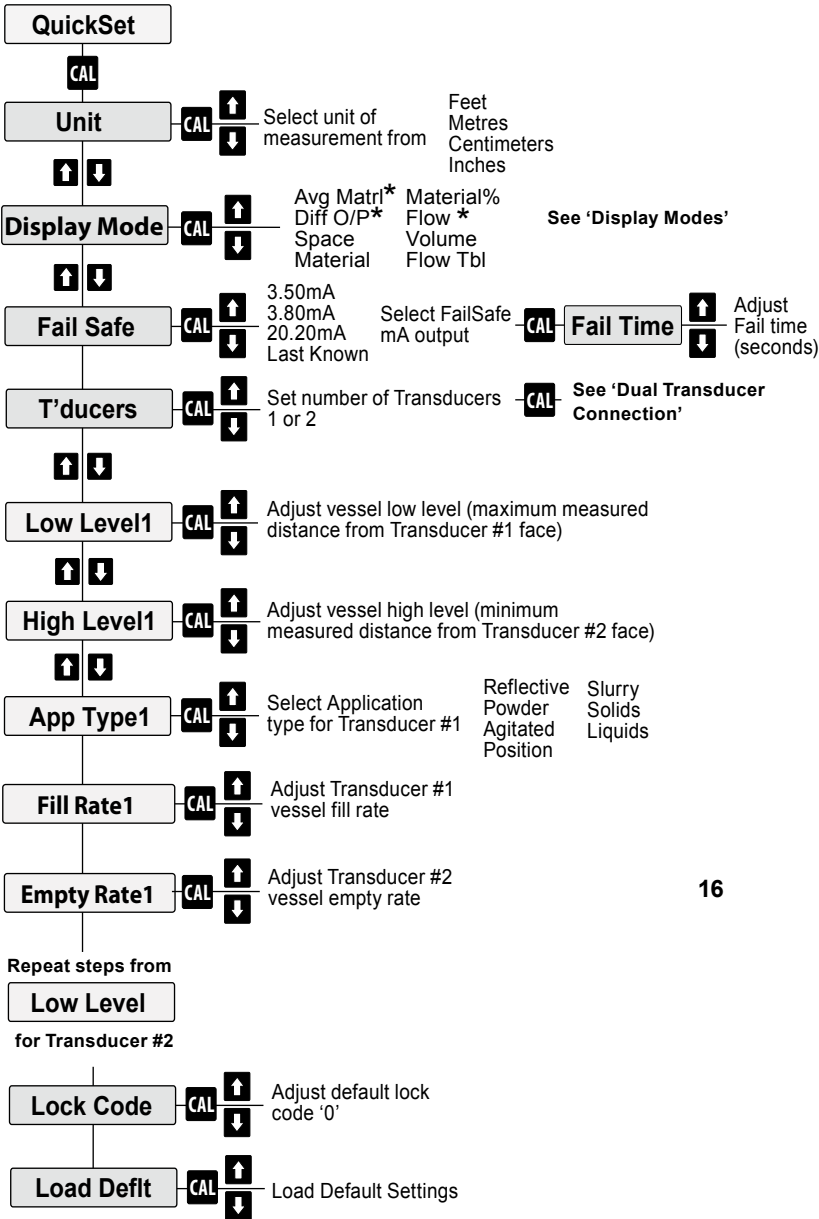
Note: your selected primary display mode eg '**Space**' will always be displayed on the second line of the diagnostics.

# PRIMARY SOFTWARE MENUS



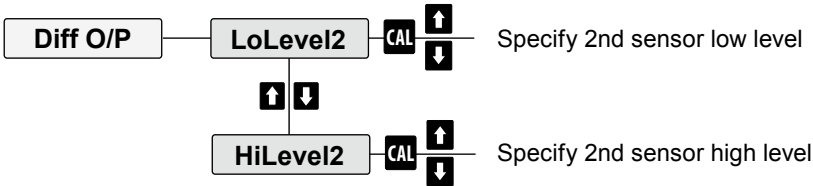
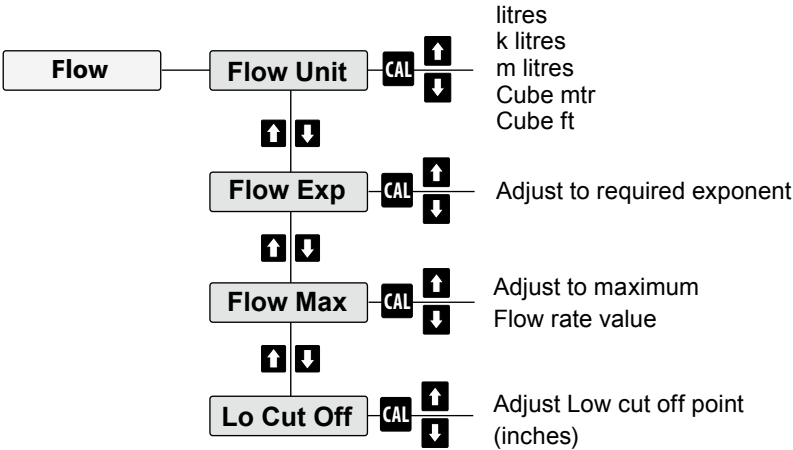
# QUICKSET MENU

Quickset adjusts the basic unit settings to get the unit operational for your application.





## QUICKSET MENU (Display Modes)



**\*Press RUN twice at any time to revert to normal operation**

## QUICKSET PARAMETERS

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### QUICKSET

To gain access to the **Quickset** parameter menu, press and hold the **CAL** button until "Unlock 0" is displayed on the LCD. Then use the **↑** **↓** buttons to select the access code.

The factory default is 0.

### Unit

Allows the user to select the units for display of measured distances and relay set point programming. The choices are metres / centimetres or feet / inches.

### Low Level1 / 2

Sets the distance from the face of the transducer that corresponds to the low level in the vessel being monitored -4mA analog output level.

### High level 1 / 2

Sets the distance from the face of the transducer that corresponds to the High level in the vessel being monitored - 20mA analog output level.

Note: When setting the High and Low levels a minimum span of 100mm MUST be maintained.

### Fail-Safe

Allows the user to select their preferred Fail-safe condition. There are 5 possible mA output failure values. They are: 20mA, 4mA, Last Known, <4.00mA and >20.00mA.

### Application Type 1 / 2

Allows the user to select the type of application Liquids, Slurries, Solids. The response of the system is automatically changed to allow for application required. If using GosHawk you must change the Fill & Empty rate after changing the Application Type.

### Display Mode

Allows the user to select the primary display mode reading. Options are average material, diff o/p, space, material, material%, flow, volume and flow tbl

### Code

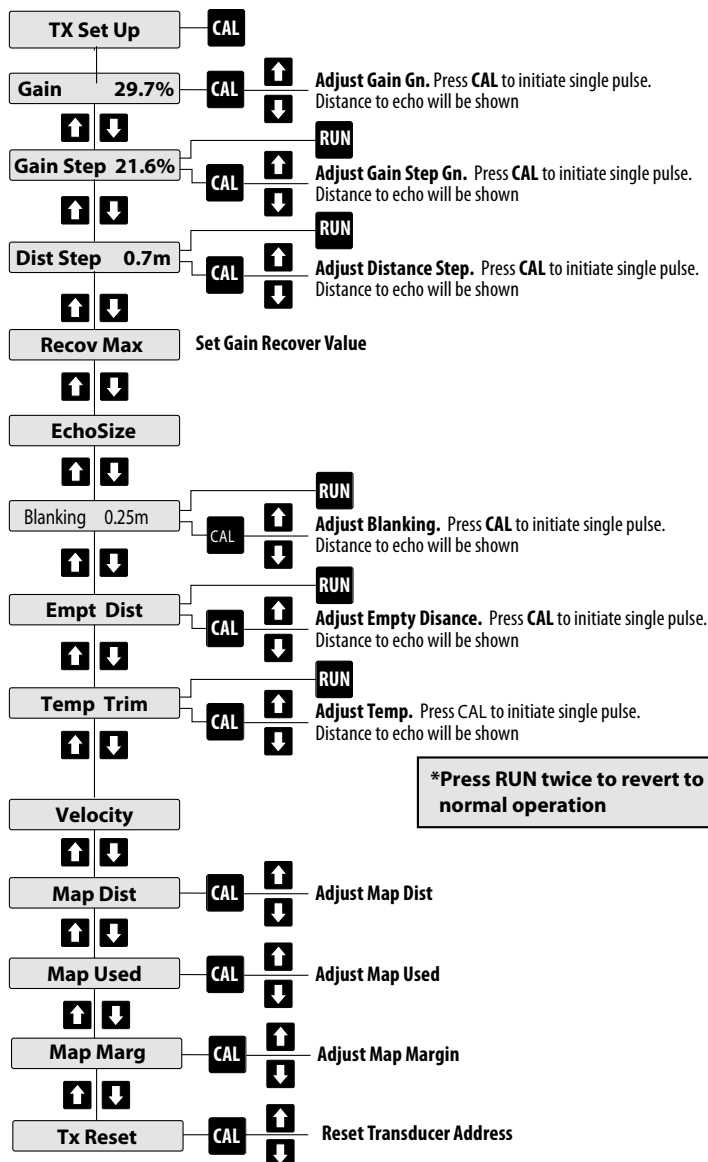
Allows the user to set an access code other than 0 to avoid unauthorised changes to the programming. Use the **↑** **↓** buttons to select the desired access code.

### Fill Rate / Empty Rate 1 & 2

Allows the user to select the approximate speed of the level change. This automatically sets various parameters to allow a faster or slower response.

## TX (TRANSDUCER) SETUP MENU

TX setup adjusts the transducer sensor characteristics. It is not recommended you adjust these settings unless you are familiar with the effect they will have on your unit



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## TX PARAMETERS

---

### Gain (Gn):

This is a settable level which represents the starting value for the units receiver gain at the beginning of normal control (time varying gain control). This value will take over gain control after the last of the gain limit steps (Gs/Ds). The true effect of this parameter is to increase or decrease gain levels (and echo sizes) at all points on the gain curve, by moving the whole gain curve up or down (as if holding it by its end). This is generally used to increase or decrease the size of echoes across the whole measurement range (except for very close to the transducer, which can be controlled by fixed gain steps if required). Increasing Gain (Gn) has a similar effect to decreasing detection Threshold (Thld) and the reverse is also true.

The result of changes can be seen immediately as the unit pulses during adjustment of this parameter and displays the distance found (in SPACE mode without damping). This parameter is duplicated under the Tracking menu (only seen in code 195). Changes made either here or in Tracking will result in a change to both. It is included twice in order to simplify user access under code 0.

### Gain Step (Gs):

This value represents the maximum receiver gain (%) at which the unit will operate within a distance of Ds (described below) from the transducer face. Inside this distance the receiver may operate at a lower gain if G1 and/or G2 are set to lower values than Gs, otherwise the unit will operate with a fixed gain value Gs for measurement of distances up to Ds.

Normally Gs and Ds must be considered and adjusted as a pair, and should only need adjustment to assist in masking mounting or transducer related problems.

The result of changes can be seen immediately as the unit pulses during adjustment of this parameter and displays the distance found (in SPACE mode without damping). This parameter is duplicated under the Tracking menu (only seen in code 195). Changes made either here or in Tracking will result in a change to both. It is included twice in order to simplify user access under code 0.

### Distance Step (Ds):

This value represents the distance from the transducer face (in metres or feet as per the user selection) over which a gain limit of Gs will be applied. This gain limit can be used to lessen the effect of poor mountings and is the only one of the three gain steps which should be used for field problem correction (G1/D1 and G2/D2 steps are normally only used at default values to hide transmit pulse / ringing).

Normally Gs and Ds must be considered and adjusted as a pair, and should only need adjustment to assist in masking mounting or transducer related problems.

The result of changes can be seen immediately as the unit pulses during adjustment of Ds either here or in Tracking will this parameter and displays the distance found (in SPACE mode without damping). This parameter is duplicated under the Tracking menu (only seen in code 195). Changes made result in a change to both. It is included twice in order to simplify user access under code 0.

## TX PARAMETERS

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### Threshold:

The Thld (Threshold) parameter is a settable size (in Volts), which an echo must reach in order to be detected. The instrument will accept the first echo exceeding the threshold voltage as the correct measured distance. It is the user's responsibility to ensure that correct transducer positioning will always make the first echo detected the true level being measured (it will be if the transducer has a clear "view" of the level and no obstructions). Adjustment of the gain control parameters and threshold parameter can help to select a correct echo from a number of different echoes present. Increasing a threshold value will also increase noise immunity if the echo from the level is sufficiently strong. Do not exceed a setting of 2.00 for Threshold. The default is 0.4V which should be acceptable for most applications.

### Blanking:

The Blanking Distance is the minimum amount of space which should be between the transducer face and the liquid being monitored.

Where possible use the conservative values and increase this distance by 50% if there is foam, dust, steam, or condensation in the vessel being monitored. (*refer to table on page 10*). If using a flange mounting, use a rubber or neoprene gasket and washers. If using a nipple mounting, ensure that the mounting bracket is **>6mm (0.24 in) from the rear** of the transducer. Do not over tighten the lock nuts. When using a focaliser cone, ensure that it protrudes at least 50mm (2 in) into the vessel. If the transducer needs to be mounted above the roofline, use an appropriate standpipe or nozzle. Use common sense when selecting the mounting position. A clear line of sight from the transducer to the product being monitored is preferred.

### Empty Distance:

Adjust the distance from the transducer face when which the vessel would be empty.

### Map Distance

The distance the software looks at various gain levels to identify any unwanted echoes within the nominated distance

### Map Used

This is a distance which allows a portion of the Map used to be less than the original Mapped Distance..the software will only then use the distance entered in this parameter.

### Map Echo

Begins the mapping process...and uses the distance entered in Map Used as how far down it will store the unwanted echoes.

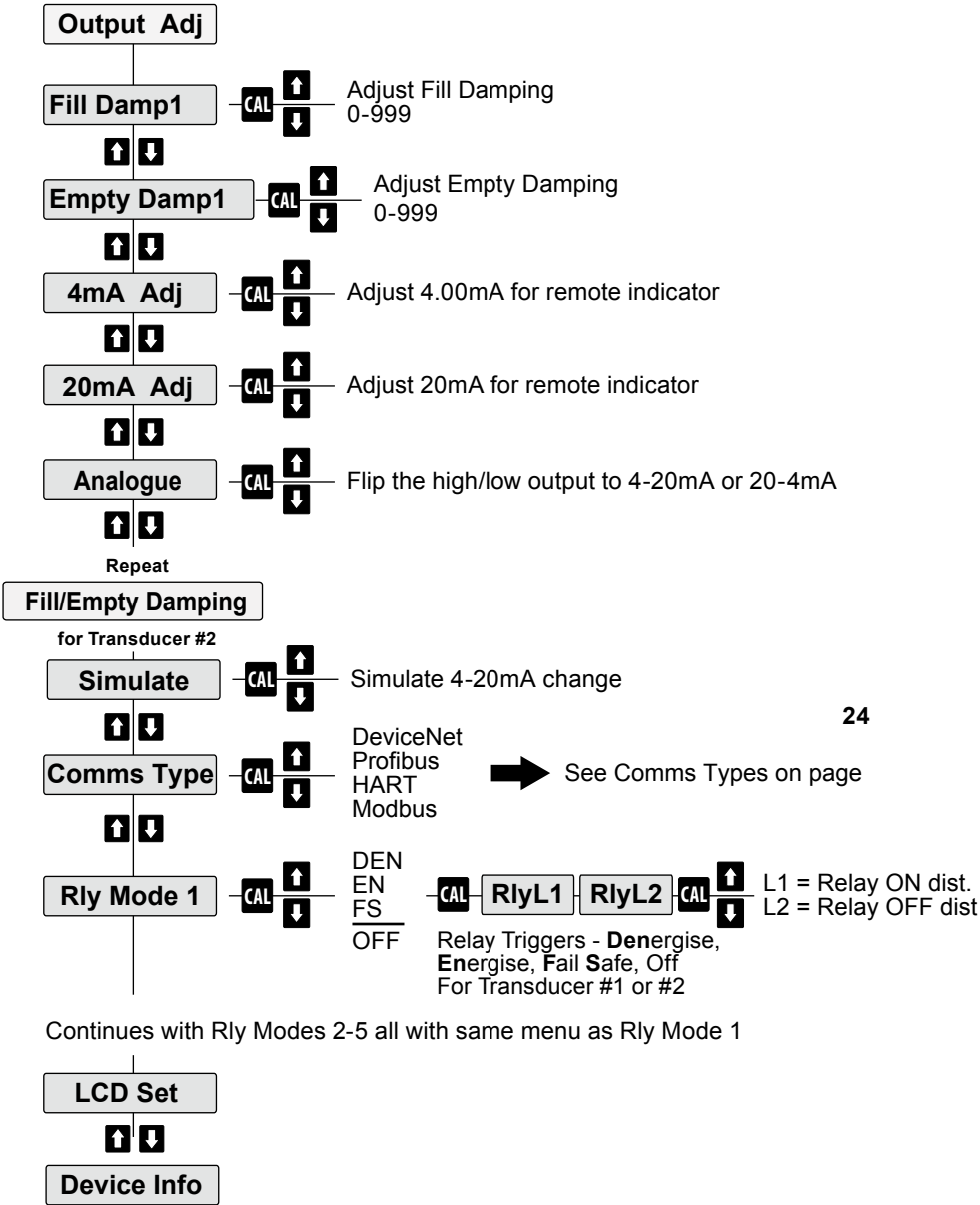
### Map Margin

This is the amount of security for changes in the unwanted echoes position in both gain terms and distance terms.

The echo can change with sudden changes in air temperature or material build up on the area Mapped..this is represented by Margin % which gives changes due to the echo getting bigger for any process related reason..and the distance allows the echo to get closer than its initial position when the mapping was initiated.

# OUTPUT ADJUSTMENT MENU

Output Adjustment is where you set relay outputs and communication settings



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## OUTPUT ADJUSTMENT PARAMETERS

---

### Fill & Empty Damping

Allows the user to define how quickly the switch responds to changes in the measured level within the vessel being monitored. A low damping value gives a fast response and a high damping gives a slow response. The damping limits are from 0 to 999. Eg: If you set the damping to a value of 60, the displayed distance will be the average of the last 60 pulses.

### 4mA Adj & 20mA Adj:

Whilst the display shows '4mA Adj' or '20mA Adj', the analog (4-20mA) current output will be forced to its respective 4mA or 20mA state. The actual loop current can be measured with an external meter and calibrated exactly by pressing the **UP** or **DOWN** arrows until the external meter reads exactly 4.000mA or 20.000mA. Pressing the **CAL** button will store the calibration in the instruments memory.

Re-Calibration should only be necessary if a complete model reset is performed with factory assistance, or if parts of the electronics assembly are changed in maintenance or repair operations.

### Analog:

4-20/20-4mA The analog current output of the instrument can be set to act in the normal (4-20mA) or reverse (20-4mA). The default condition is 4-20mA, where the furthest distance from the transducer (low level) is output as 4mA, and current increases with filling to the closer (high level) span point of 20mA.

### Simulate:

(Y/N): Select **Y** to access measurement simulation mode. In simulation mode, the

**UP** and **DOWN** arrow keys vary the distance on the display. The current output and any relays used will behave exactly as they should do if the measured distance (in **SPACE** mode without damping) was that shown on the display. This mode can be used to test correct behavior of outputs, or externally connected equipment.

### Relays

Allows the user to set the relays for switching. The relays are programmed in a distance from the transducer face to the position where switching is required. Relays work in the following manner:

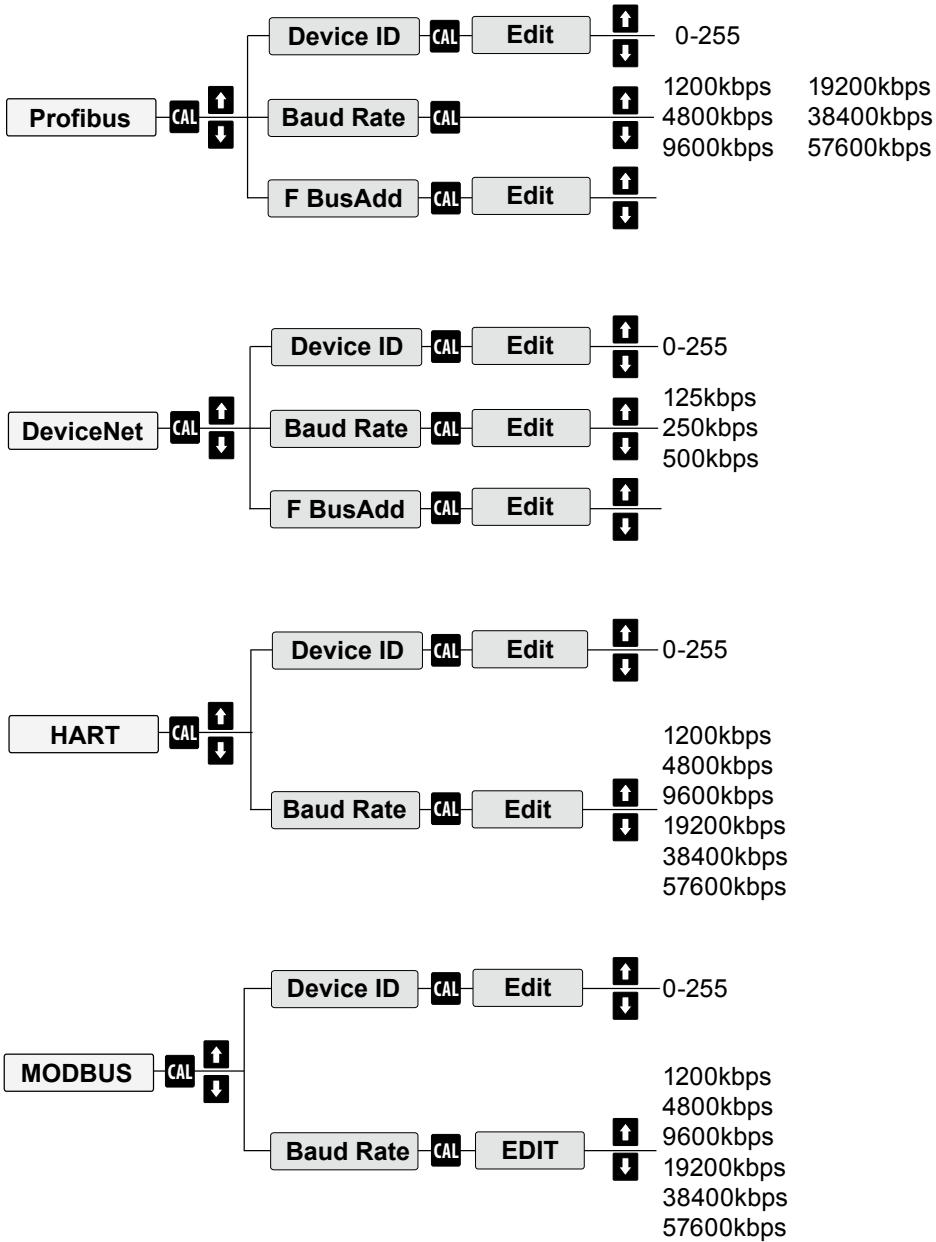
**OFF** The relay will always remain off

The relays can be programmed to energise (**EN**) or de-energise (**DEN**) depending on the product level in the vessel being monitored.

**FS** If FS is selected, the relay will operate as a fail safe relay. The relay will be energised at all times and will de-energise if the ultrasonic switch goes in to failsafe condition or if anything interferes with the unit's ability to keep the relay energised.

See also 'Relay Functions' for further information about the Relay switching on the next page

# COMMUNICATION TYPES SETUP





# RELAY FUNCTIONS

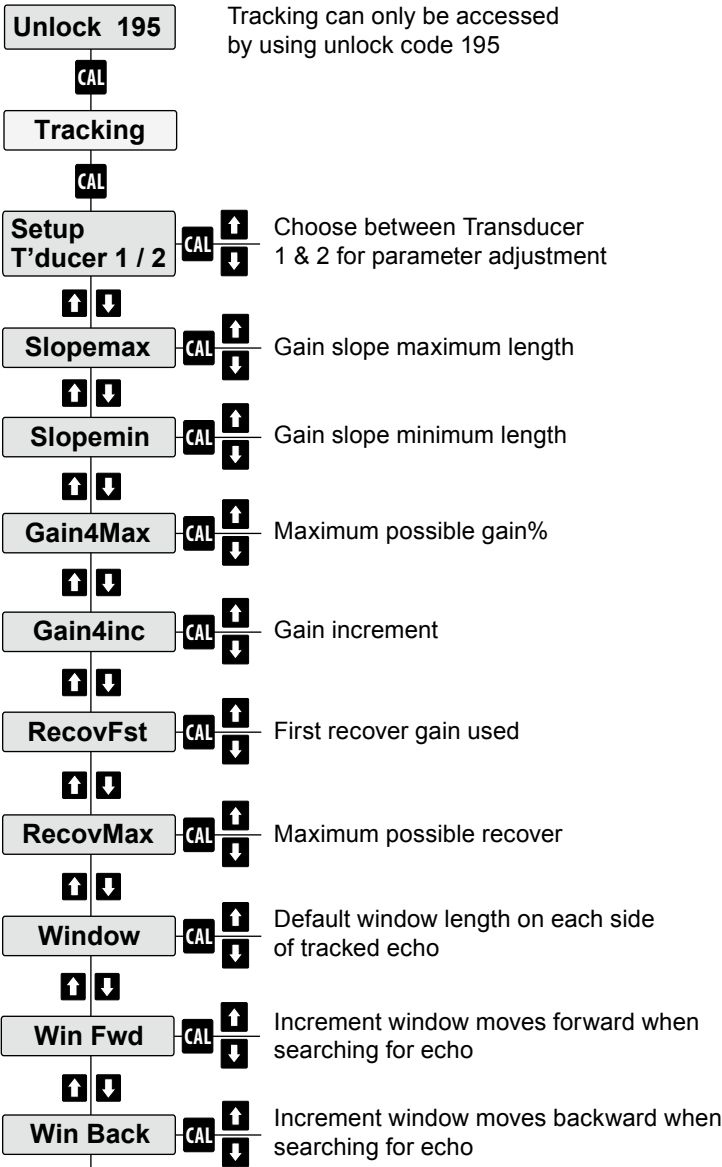
## Level Switch Contact Actions

**Relay 1-5** - for Dual 34 versions  
(Set Relay Parameters in Output Adjustment menu via local keypad or GosHawk2 software)

- 3. L1 and L2 distances are measured from the transducer face or flange face.
- 4. L1 must be equal to, or less than L2.

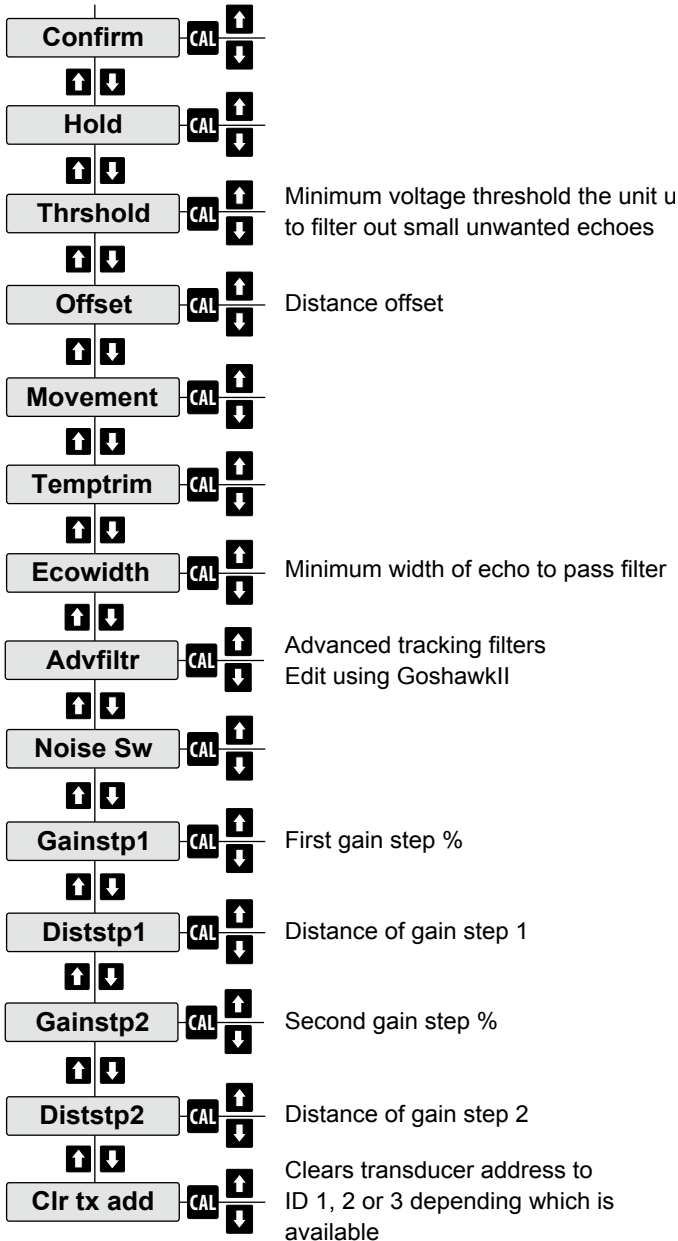
		Relay Action				
		Energise EN	DeEnergise DEN	FailSafe FS <small>system operating normally</small>	FailSafe FS <small>power/system/ measurement failure</small>	OFF
State 1						
POWER FAILURE						

# TRACKING



Continued next page

## TRACKING



## CROSS TALK PREVENTION

The term Cross Talk is used to refer to interference between acoustic wave units of the same frequency located near to one another.

Sultan units emit high powered acoustic waves so only a small loss of signal will and occur through the environment where a sensor is working. As a result, transducers located near to one another, or in a common space are likely to 'hear' direct or reflected signals from one another.

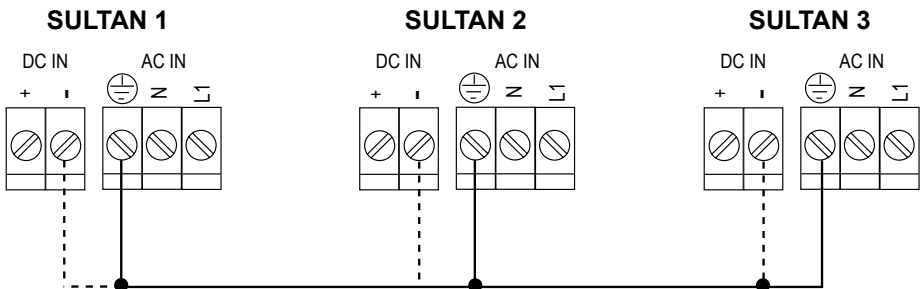
Cross Talk may cause one or more of a group of sensors located near to one another to generate randomly false measurements and outputs whilst giving correct performance at other times.

Cross Talk is more likely to cause problems where the applications require units to be programmed to accept fast changes of level.

It is recommended that units working near to one another be linked according to the following steps to eliminate the possibility of Cross Talk.

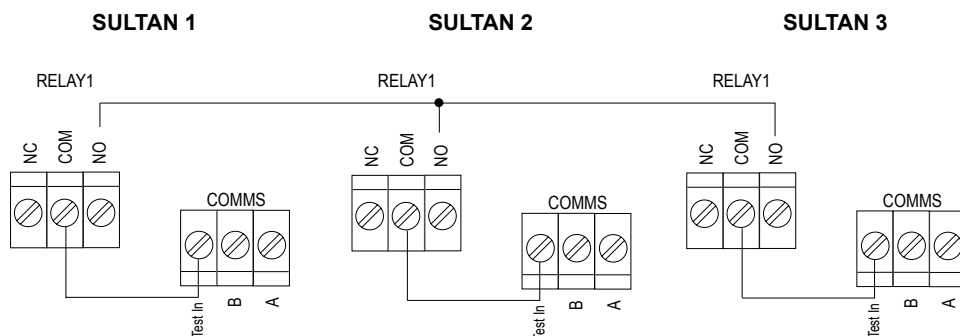
1. All units to be linked must be connected to a common ground, or have wiring between their 'GND', or their 'DC-' terminals (parallel connection of all units).

\* GND and DC- terminals are electrically connected inside Sultan 234 units, so either one may be used.



## CROSS TALK PREVENTION

- At each individual unit, wire a connection between Relay 1 'Common' terminal and the 'TEST' terminal of the same amplifier.
- Wire a connection between the Relay 1 'Normally Open' terminals of all units to be linked (parallel connection of all units).



- In the software setup of each individual unit, program Relay 1 to 'FS' (Fail-safe) mode in the Output Adjust menu. (You could use a different relay number in the same way if Relay 1 is needed for another function). The units will now be linked so that they can not crosstalk.

The 'TEST' terminal acts as an input when the unit is about to pulse, and will cause the instrument to enter a paused state (not pulse) if it sees a connection to ground. Each unit also drives its own 'TEST' terminal to ground when it is busy pulsing. These two functions combined mean that if two or more units have their 'TEST' terminals connected in parallel, and share a common ground, then at any time when one is pulsing, it will ground the 'TEST' terminals of all units to which it is connected, and temporarily pause them until it is finished, then release them. The next unit which becomes ready to pulse will follow the same procedure in turn, and the process continues in an endless cycle.

The connections described are made via a normally open relay contact, programmed into Failsafe mode. The function of this is simply to prevent a possible lock up of the whole system if one unit has a problem e.g. power failure. If at any stage a transducer is in its failed state, it will be disconnected by the relay from the other units, so they can continue to work together.

## AVERAGE LEVEL

### What is Average Level?

Average mode is used to measure the average of two material levels using two sensors and one amplifier, and provides one output result.

In average mode, two individual sensors are referred to as Sensor 1 and Sensor 2. Capability for averaging of more than two sensors may be added in the future.

### Average Material Calculation

The display mode 'AvgMatrl' (Average Material) gives a result calculated as follows:

$$\text{AvgMatrl} = \text{LowLevel} - \text{AvgSpace}$$
 where  

$$\text{AvgSpace} = (\text{Space1} + \text{Space2} + \text{offset})/2$$

### Analog Output

Analog output is calculated based on the average material level.

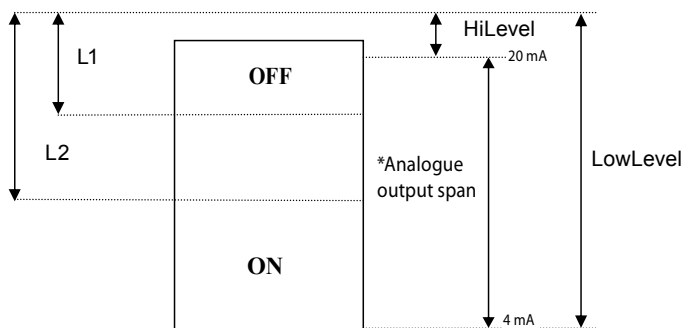
The span of the analog output is defined by the LowLevel and HiLevel parameters. The analog output is calculated as follows:  

$$\text{Current (mA)} = 16 * \text{AvgMatrl} / (\text{LowLevel} - \text{HiLevel}) + 4\text{mA}$$

### Relays

The relays are switched based on the average space value. The relay set points L1 and L2 should be set considering the average space values at which the relay is required to switch.

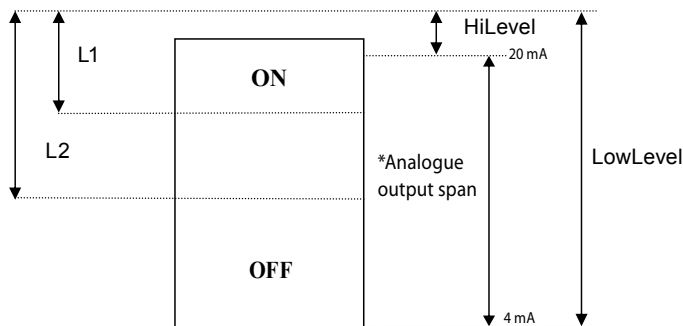
### Relay Mode = EN



\* 4-20 mA action may be reversed according to setting of the 'Analog' parameter in the Output Adjustment menu.

## AVERAGE LEVEL

### Relay Mode = DEN



\* 4-20 mA action may be reversed according to setting of the 'Analog' parameter in the Output Adjustment menu.

To use Average mode, two sensors must be assigned different addresses.

Carefully follow the steps below starting with 2 new sensors:

1. Connect only the sensor which will be used as Sensor 2 to the amplifier.
2. Set the Application Type to 'AvgMatrl'.
3. Set the 'Sensors' parameter to a value of 2.
4. Set the '1:SenAdd' parameter to a value of 1.
5. Set the '1:TxAdd' parameter to a value of 1.
6. Set the '2:SenAdd' parameter to a value of 1.
7. Set the '2:TxAdd' parameter to a value of 2.
8. Connect Sensor 1 together with Sensor 2.

The system is now ready for measurement, and in the 'Run' mode both sensors should pulse alternately.

### Accessing both Sensors Parameters

Both sensor1 and sensor 2 parameters can be accessed through KeyPad and GosHawkII.

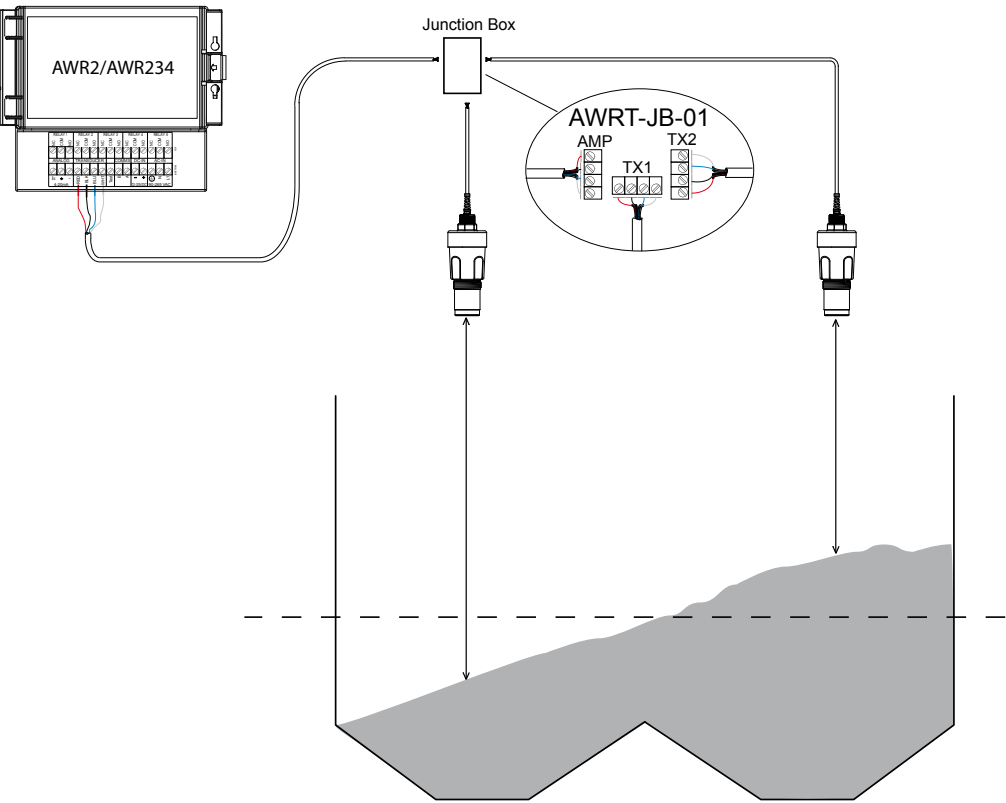
#### Via KeyPad

The parameter 'Sensor' in the TxSetup, Tracking and Factory menus determines which sensor (1 or 2) will be currently accessed via that menu.

#### Via GosHawkII

When on Run mode, press the down key once to get the 'Tx' value on the display. If 'Tx' is 1, then GosHawkII will communicate with Sensor 1 and the diagnostics displayed will refer to Sensor 1. To swap to the other sensor, hold both the 'Up' and 'Down' arrow buttons simultaneously.

**AVERAGE LEVEL WIRING**





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## DIFFERENTIAL LEVEL

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### What is Differential Level?

Differential Level is the term used to define the measured difference between two material levels. Measurement of Differential Level is achieved by using two sensors and one amplifier. Below is reference as to how the two sensors need to be setup and connected to the amplifier.

### Sensor Addressing

Parameters 1: *SenAdd* and 2: *SenAdd*: in Quickset menu are the MODBUS addresses of sensor 1 and sensor 2 saved in the unit. The default MODBUS addresses of sensor 1 and sensor 2 are 1 and 2.

Important notes:

- Changing *SenAdd*, does not change the transducer modbus address.
- To change the transducer address, change the *TxAdd*.
- To get to *TxAdd* parameter press CAL twice when on *SenAdd*.

Both sensors which are connected to the amplifier must have different MODBUS addresses then the following needs to be carried out:

1. Set the application type to Diff on the Sultan unit;
2. Connect the sensor that is used as sensor No2.
3. Set 2:SenAdd to 1 and press Cal twice.
4. Set the 2:TxAdd to 2.
5. Connect Sensor No1.

## DIFFERENTIAL LEVEL

### Analog Output

Analog output is calculated based on the differential value.

The span of the analog output is according to the Lowlevel1 and Hilevel1. The analog output is calculated according the following equation:

$$\text{Current (mA)} = 16 * (\text{Diff}) / (\text{LowLevel1} - \text{HiLevel1}) + 4\text{mA}$$

### Relays

The relays are switched based on the diff value. This means that the relay set points L1 and L2 should be set to diff values that the relay is required to switch.

Relay Mode = EN (L1 < L2)

Relay Mode = DEN (L1 < L2)

OFF		ON	
L2 = Diff2	_____	L2 = Diff2	_____
L1 = Diff1	_____	L1 = Diff1	_____
ON		OFF	

### Differential Mode

Differential Mode is introduced to measure the difference between two material levels using two sensors and one amplifier.

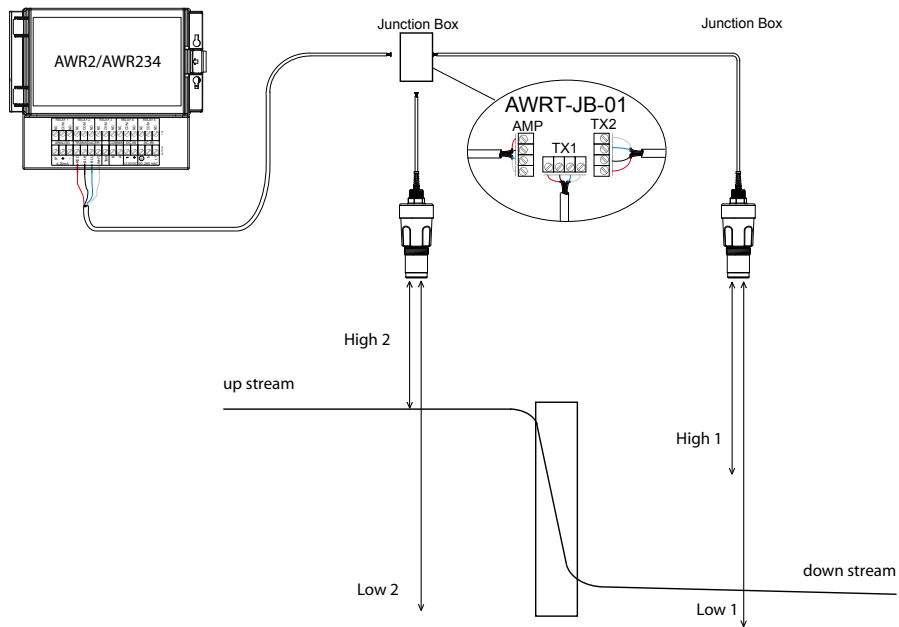
Each sensor has its own Hi and Low levels. Parameters, LowLevel2 and HiLevel2 were introduced for sensor 2. This is useful when the sensors are not mounted at the same levels.

### Diff Calculation

In differential Mode the material level measured by sensor 1 is subtracted from the material level measured by sensor 2. Negative results will be reset to zero. The differential value is calculated as follow:

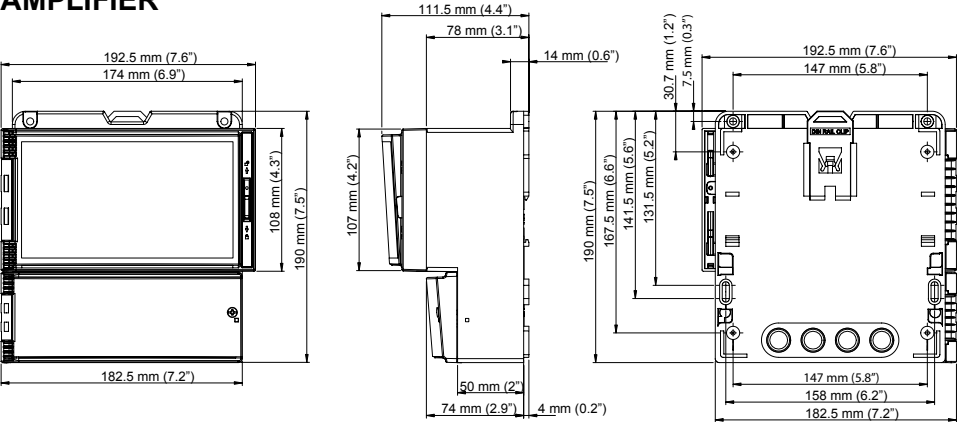
$$\begin{aligned} \text{Diff} &= \text{MaterialLevel2} - \text{MaterialLevel1} \\ \text{MaterialLevel2} &= \text{LowLevel2} - \text{Space2} \\ \text{MaterialLevel1} &= \text{Lowlevel1} - \text{Space1} \end{aligned}$$

# DIFFERENTIAL LEVEL WIRING

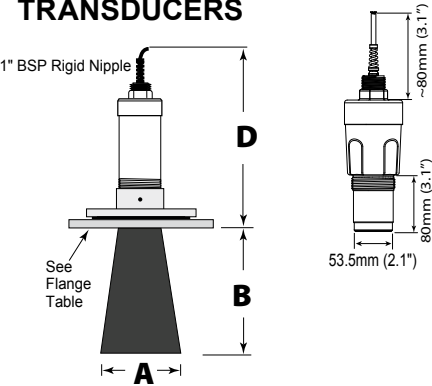


DIMENSIONS

AMPLIFIER

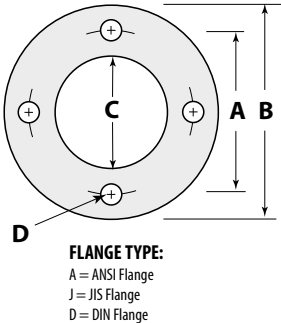


TRANSDUCERS



Dimensions Table						
Sensor Frequency	Selected Flange	A mm	A in	B mm	B in	C mm
5 kHz	10"	236	9.2	455	17.9	840
10 kHz	10"	236	9.2	415	16.3	540
	"8"	195	7.6	280	11.1	540
15 kHz	10"	236	9.2	455	17.9	440
	"8"	195	7.6	280	11.0	440
20 kHz	4"/"6"	98.5	3.9	280	11.0	390
30 kHz	4"/"6"	98.5	3.9	280	11.0	350
*6" and 8" are non standard. Please contact factory before selecting.						

FLANGE



STANDARD ANSI/DIN/JIS FLANGE DIMENSIONS						
SIZE	FLANGE TYPE	A (PCD) mm	A (PCD) in.	B (OD) mm	B (OD) in.	C (ID) mm
4"	FA4	190.5	7.5	228	9.0	100
	FD4	180	7.0	220	8.7	100
	FJ4	175	6.9	210	8.4	100
10"	FA10	362	14.3	406	16.0	250
	FD10	350	13.8	395	15.6	250
	FJ10	355	14.0	400	15.7	250
NON STANDARD ANSI/DIN/JIS FLANGE DIMENSIONS						
6"	FA6	241	9.5	279.5	11.0	150
	FD6	240	9.4	285	11.2	150
	FJ6	240	9.4	280	11.0	150
8"	FA8	298.5	11.8	343	13.5	200
	FD8	295	11.6	340	13.4	200
	FJ8	290	11.4	330	13.0	200

Note: Other flange sizes available upon request.

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## ERROR CODES

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### ERROR CODE 01 - 04

**Error 01:** Amplifier can not talk to transducer.

**Error 02:** Amplifier can talk to transducer but transducer gives incorrect response.

**Error 03:** ProfiBus or DeviceNet is selected but ProfiBus or DeviceNet module is not connected or responding.

**Error 04:** Amplifier is programmed with incorrect software.

In general Error Code 01 indicates there is NO communication and Error Code 02 says there IS communication, but not of sufficient quality to be read reliably.

### ERROR CODES

#### Error 01 Information

If Error 01 exists, then the amplifier can not communicate with the transducer, so it is impossible for it to display the address for you (the display cycle for Error 01 does not show any transducer information).

To find the transducer address you must connect directly to the transducer wires, then you will need to use the 'ID Search-Tx ID Search' function of GosHawkII, or the Modscan program and Txfind utility. The BLUE and WHITE transducer communication wires and a Ground connection must be connected to your PC via the RS485 converter. The PC then communicates directly with the transducer, not via the amplifier. The RED and BLACK transducer wires must remain connected to the amplifier terminals. These supply the correct power to the transducer.

The amplifier should be powered ON as normal, then press CAL until the display stops scrolling through the diagnostic messages. Start GosHawkII and use the 'ID Search- Tx ID Search' function. The transducer serial number will appear next to the ID number to which it is currently set. The same thing will occur if you use the Modscan program and Txfind utility.

Record the ID number found, power off, and reconnect the transducer BLUE and WHITE wires to the amplifier terminals, and connect the RS485 converter to the 'A' and 'B' Modbus terminals as normal.

#### Error 02 Information

Error 02 indicates a communication data corruption between AWA and Transducer. It can be a result of noise in data lines or one of data lines ("A" or "B") being open circuit.

1. Make sure wiring is correct especially look to the screen (earth).
2. If it still doesn't work, you should then disconnect the Transducer from AWA and check modbus ID's of both AWA and Tx through GosHawkII "ID Search". If the ID numbers don't match, write down Transducer ID number and then connect AWA to GosHawkII and change it's Modbus ID to recorded value through "Info Screen" window.
3. If the Transducer can't communicate with GosHawkII send it back to Factory for replacement.

# PART NUMBERING

## Remote Amplifier

**AWRD34** Remote 3/4 Wire, 5 relays, two 4-20mA outputs, Dual Transducer capable

**Housing**

**S** Standard polycarbonate electronics housing

**Power Supply**

**B** 24 VDC standard

**C** 48 VDC

**U** Universal AC power supply (12-30VDC and 90-260 VAC input)

**Additional Communications** (PC comms Goshawk standard)

**S** Switch only. 5 relays for AWRD34 only

**X** Analog 1: 4-20mA analog driving/modulating output module  
Analog 2: 4-20mA analog modulating output module  
Includes Modbus Comms

**Internal HawkLink Modem**

**X** Not Required

**G6** GSM Quad Band Frequency 850/1900MHz and  
900/1800MHz Band (worldwide)

**Approval Standard**

**X** Not Required

**A22** ATEX Dust (Grp II Cat 3 D T85C IP67)

**AWRD34 S U X X X**

## PART NUMBERING

### Remote Transducer 2" Version

**AWRT** Acoustic Wave Remote Transducer

**Transducer Frequency**

- 50** 50kHz for applications up to 5m, available in 2" only
- 40** 40kHz for applications up to 7m, available in 2" only
- 30** 30kHz for applications up to 11m for 2"

**Process Temperature - Facing material selection**

- T** Standard Temperature (Wet Atmosphere, 2" Tefzel)
- Z** Special Request

**Transducer Housing Material**

- 6** Full Tefzel including tefzel face for 2"

**Thread Standards for End cap**

- TB** BSP
- TN** NPT

**Mounting Thread Sizes**

- 20** 2" thread for 50,40,30 kHz in Tefzel housing only
- CS** Cable suspension

**Approval Standard**

- X** Not Required
- A0** IECEx Zone 0 (Ex ia IIA T4) / ATEX (Grp II Cat 1 GD IP67 EEx ia IIA T4)
- A1** ATEX Encapsulated (Grp II Cat 2 GD EEx m II IP68)
- A20** ATEX Dust (Grp II Cat 1 D T85C IP67)
- A21** ATEX Dust (Grp II Cat 2 D T85C IP67)
- A22** ATEX Dust (Grp II Cat 3 D T85C IP67)
- GP** CSA Equip Class 2; Pollution deg 2; measurement II (ordinary locations)
- RN** CSA Class I; Div 1/2; Group D; Zone 0; AEx/Ex ia IIA; T4
- KN** CSA Class II; Div 2; Group F & G; Class III

**Connection**

- C** IP68 Sealed unit with cable
- S** Screw top with integral junction box without cable

**Cable Length**

- 6** 6m cable (Standard)
- 15** 15m cable
- 30** 30m cable
- 50** 50m cable
- X** Not Required

**Mounting Accessories**

- X** Not Required
- F** Flow incl Flange
- CS** Cable Suspension for remote 50/40/30 only

**Software Options**

- PS** Position Slave
- FP** Fast Pulsing for 30kHz only
- F** Flow - Including multifit shading flange and fast temp compensation
- X** Not required

**AWRT30 T 6 TN20 X C 6 X X**

## PART NUMBERING

### Remote Transducer 3" Version

**AWRT** Acoustic Wave Remote Transducer

- 30** 30kHz for applications up to 15m for 3" (4" cone is required for 3" units)
- 20** 20kHz for applications up to 20m, available in 3" only (4" cone is required)
- 15** 15kHz for applications up to 30m, available in 3" only (10" cone is required)
- 10** 10kHz for applications up to 40m, available in 3.5" only (10" cone is required)
- 05** 05kHz for applications up to 60m maximum, available in 3.5" only (10" cone is required)

**Process Temperature - Facing material selection**

- S** Standard Temperature Dry Atmosphere only, (Polyolefin face) for 4, 5, 9 and 10kHz only
- T** Standard Temperature (Wet Atmosphere, 3" Teflon face)
- Y** High Temperature (Wet and Dry Atmosphere, 150C, Titanium face) for 10kHz & 15kHz only
- Z** Special Request

**Transducer Housing Material**

- 4** Polypropylene
- 6** For 3" Teflon please contact factory

**Thread Standards for End cap**

- X** Not Required (Standard Flange Mount, see flange & cone selection)
- TB** BSP
- TN** NPT

**Mounting Thread Sizes**

- X** Not Required (Standard Flange Mount, see flange & cone selection)
- 20** 2" thread for 50,40,30 kHz in Tefzel housing only
- 30** 3" thread on the back cap for 30,20,15 kHz only. For 15kHz use "B" type flange.
- 50** 3.5" thread on the end cap for 10, 9, 5 and 4kHz only

**Approval Standard**

- X** Not Required
- A0** IECEx Zone 0 (Ex ia IIA T4) / ATEX (Grp II Cat 1 GD IP67 EEx ia IIA T4)
- A1** ATEX Encapsulated (Grp II Cat 2 GD EEx m II IP68)
- A20** ATEX Dust (Grp II Cat 1 D T85C IP67)
- A21** ATEX Dust (Grp II Cat 2 D T85C IP67)
- A22** ATEX Dust (Grp II Cat 3 D T85C IP67)
- GP** CSA Equip Class 2; Pollution deg 2; measurement II (ordinary locations)
- RN** CSA Class I; Div 1/2; Group D; Zone 0; AEx/Ex ia IIA; T4
- KN** CSA Class II; Div 2; Group F & G; Class III

**Connection**

- C** IP68 Sealed unit with cable
- S** Screw top with integral junction box without cable

**Cable Length**

- 6** 6m cable (Standard)
- 15** 15m cable
- 30** 30m cable
- 50** 50m cable
- X** Not Required

**Mounting Accessories**

- X** Not Required
- F** Flow incl Flange
- CS** Cable Suspension for remote 50/40/30 only

**Software Options**

- PS** Position Slave
- FP** Fast Pulsing for 30kHz only
- F** Flow - Including multifit shading flange and fast temp compensation
- X** Not required

**AWRT30 T 6 TN20 X C 6 X X**



# PART NUMBERING

## Accessories

### Focalizer Cone C

**Cone Size**

- 02N** Adaptor for 2" NPT Sensor to fit into 4" cone (included)
- 02B** Adaptor for 2" BSP sensor to fit into 4" cone (included)
- 03** 3" cone for 30,20 and 15kHz transducers with TB30 or TN30 threads
- 04** 4" cone, 30 and 20kHz 3" transducer
- 08-15** 8" cone,15kHz
- 08-10** 8" cone, 10kHz
- 10-15** 10" cone,15kHz
- 10-09** 10" cone, 9kHz
- 10-10** 10" cone, 10kHz
- 10-04** 10" cone, 4kHz
- 10-05** 10" cone, 5kHz

**Cone Material**

- 4** Polypropylene
- 6** Teflon
- 7A** Carbon Fibre. Comes attached to Carbon Fibre ANSI Flange
- 7D** Carbon Fibre. Comes attached to Carbon Fibre DIN Flange
- 7J** Carbon Fibre. Comes attached to Carbon Fibre JIS Flange
- 8** Polyurethane\*
- Z** Special Request

C 10-10 - 8

### F Flange Dimension Standard

- A** ANSI
- D** DIN
- J** JIS
- Z** Special Request

**Flange Sizes**

- 2N** 2" NPT flange
- 2B** 2" BSP flange
- 4** 4" acoustically isolated flange
- 6** 6" acoustically isolated flange
- 8** 8" acoustically isolated flange
- 10** 10" acoustically isolated flange
- Z** Special Request

**Flange Mounting Position**

- A** Cone Mounted
- B** Transducer Body Mounted
- C** Angle flange

**Flange Material**

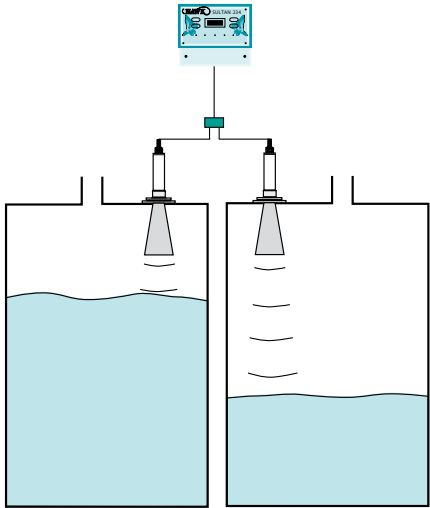
- 4** Polypropylene
- 6** Teflon
- Z** Special Request

F A 10 A - 4

# TYPICAL APPLICATIONS

## Storage Tanks

High/Low/Continuous level  
(Liquid/Chemical)

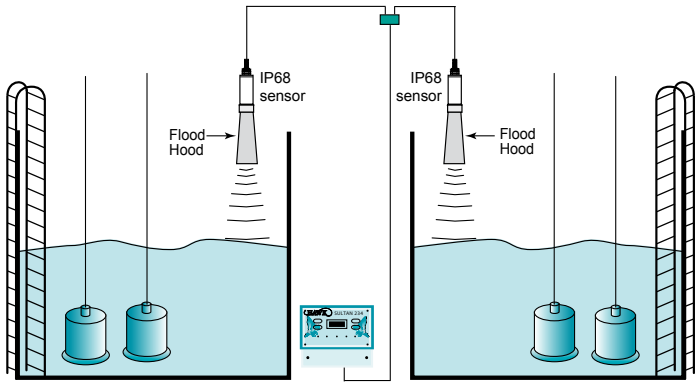


## Dual Outfeed



## Sewage Wet Well

High/Low/Continuous level



Latest version on [www.hawkmeasure.com](http://www.hawkmeasure.com)

Rev 1.0, Jun 2010

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