

A Higher Level of Performance



Manual

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## Gladiator

### Acoustic Switch Series



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## Gladiator Acoustic Switch Series



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#### PROPRIETARY NOTICE

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#### WARNING

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation, or handling of internal circuit boards or devices:

#### Handling Procedure:

1. Power to unit must be removed prior to commencement of any work.
2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal devices are installed, removed or adjusted.
3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective container until the immediate time of installation. Removed boards must be placed immediately in a protective container for transport, storage, or return to factory.

# Overview

## Gladiator Acoustic Switch Series



### Principle of Operation

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The Gladiator Acoustic Switch uses Acoustic Wave technology in a new Sender / Receiver form for blocked chute detection and anti collision for heavy machinery. The Gladiator Amplifier powers two Transducers which use special HAWK developed software where both units pulse & receive each others Acoustic echoes. When the path between the Transducers is blocked the units immediately detect the presence/absence change of the return signal and trigger a communications relay for indication or control purposes.

HAWK's Acoustic Wave Transducers are **self cleaning**. The Acoustic Switch is designed for continuous operation in dusty, wet environments where other technologies fail. The power of each pulse (pressure wave) blows the water, moisture & build-up off the face of the diaphragm.

### Typical Uses

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- Blocked chute detection in wet or dry environments
- Wet screen blocked chute detection
- Nucleonic/tilt switch replacement
- Hi level alarm / Low level alarm
- Truck/machine detection (ROM bins, Primary Crusher Dump Pockets)
- Sewage sludge handling

### Function

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Detection of objects or material between two points. Can be used for blockage detection, barrier detection, machine detection / protection and point level detection.

### Features

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- No contact with the product required
- Self cleaning Transducers
- Heavy duty titanium version available
- Designed for dusty, wet environments
- LCD setup/diagnostics on remote amplifier
- Blocked chute ranges up to 15 meters (50 ft)
- Simple '1-minute' setup
- 2 Relay outputs
- Remote test function
- Adjustable ON and OFF delays
- Communication options: GosHawk, Modbus, HART, Profibus DP, DeviceNet
- Remote GSM connection option & support
- Remote Amplifier to Transducer separation up to 500 meters (1640 ft)

# System Components

Gladiator Acoustic Switch Series



## Remote Amplifier

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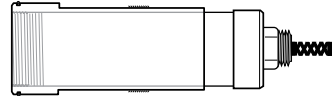
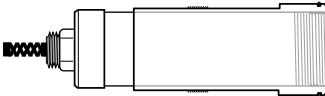
## Junction Box

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## Acoustic Switch Remote Transducers

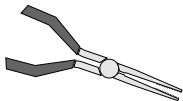
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Acoustic Switch Remote Transducers labeled TD1 and TD2 with UHMW flush mount sleeve  
FA4A 4" ANSI standard flange



**Gladiator Amplifier**



Use long nose pliers to extract terminals

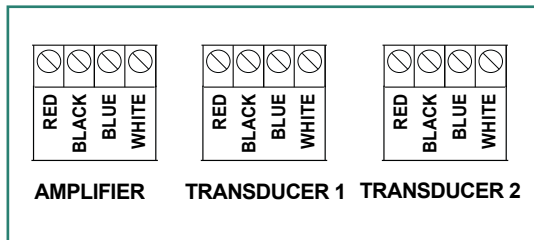
						SLAVE IN MASTER OUT TEST IN			RELAY 1			RELAY 2		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Is</b>	<b>+</b>	<b>-</b>	<b>RED</b>	<b>BLACK</b>	<b>BLUE</b>	<b>WHITE</b>		<b>B</b>	<b>A</b>	<b>-</b>	<b>+</b>	<b>⊕</b>	<b>N</b>	<b>L1</b>
4-20mA (N/A)			SENSOR			COMMS			DC-In			AC-In*		

**Relay 1** - Output Relay  
**Relay 2** - FailSafe Relay

\*AC-In is replaced by 36-60VDC with Power Input Option 'C'.

**HAWK AWRT-JB-01 Junction Box**

Connect colour to colour

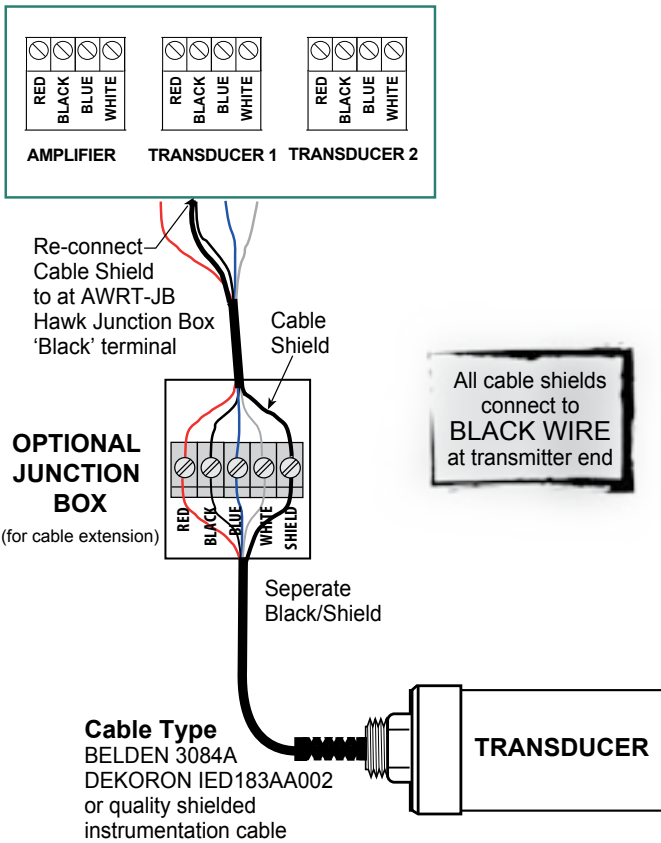




### Transducer Cable Extension

Note: Cable length between Transducer and AWRT-JB Hawk Junction should not exceed 30m.

Additional cable extension should be the single cable run between AWRT-JB Junction Box 'Amplifier' terminal and the Remote GSA Amplifier.

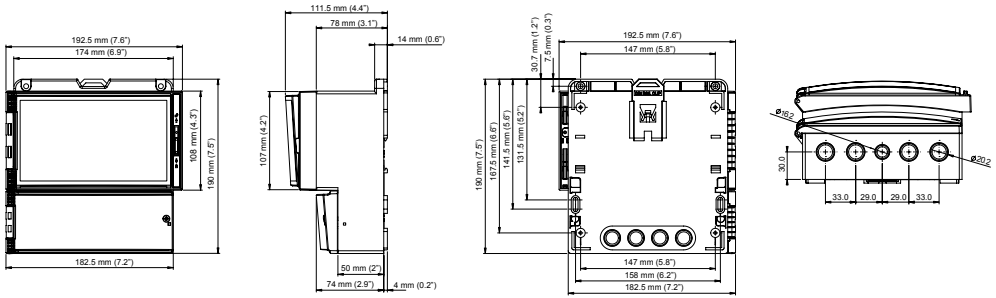


# Dimensions

## Gladiator Acoustic Switch Series

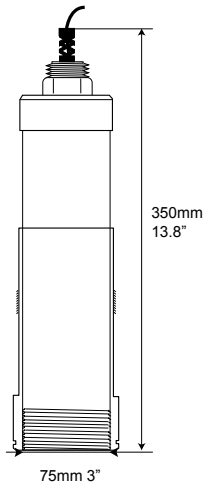


### Remote Amplifier



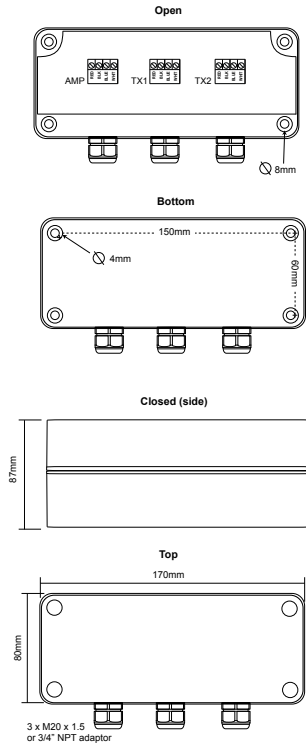
### Remote Transducer with UHMW Sleeve

15kHz



See 'blocked chute mounting' for sleeve dimensions

### AWRT-JB Junction Box

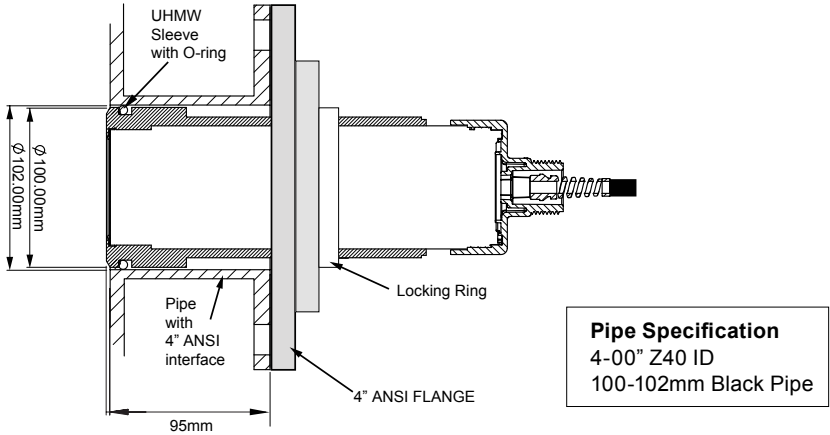


# Mounting Dimensions

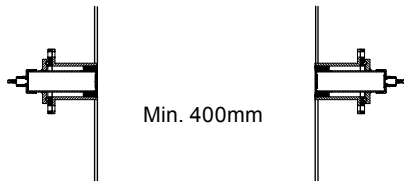
Gladiator Acoustic Switch Series



## Blocked Chute Mounting



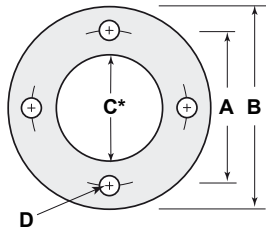
## Minimum Range



## HAWK FA4A-4 Flange

STANDARD 4" ANSI FLANGE DIMENSIONS

SIZE	FLANGE TYPE	A (PCD)		B (OD)		C (ID)		D (Hole)	
		mm	in.	mm	in.	mm	in.	mm	in.
4"	FA4A	190.5	7.5	228	9.0	100	4	19	0.75



C\* Interior diameter does not include HAWK's threaded decoupled connection flange



# Mounting Instructions

Gladiator Acoustic Switch Series



## Flush Mount

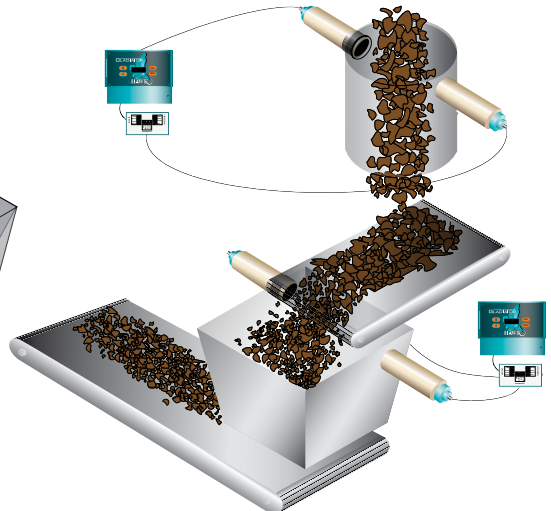
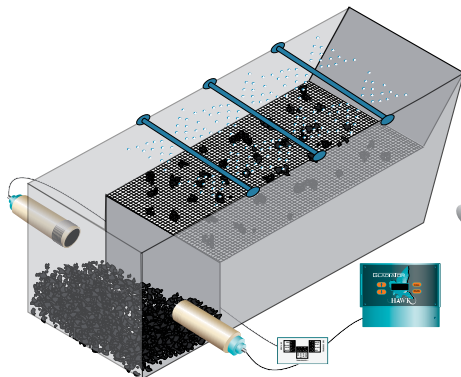
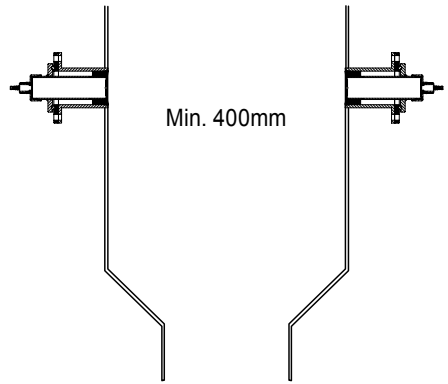
For vessels with falling product the transducers should be installed out of the main product flow where possible. For heavy falling product chutes the titanium face version is recommended along with welding a protective hood above each transducer (not in front of). Avoid mounting immediately next to the perpendicular wall.

The transducer has a specially designed UHMW seal which must be flush with the vessel wall interior. It should not be recessed. Pipe Specification: 4-00" Z40 ID = 100mm Black Pipe. Ideally the transducer should be a snug fit without excessive insertion force required during installation.

The closest point of the mounting flange when fully screwed on will be 95mm from the face of the transducer. Take note that this 95mm should theoretically be the flush mount point for the transducer face in the vessel. HAWK's flanges are specially decoupled to reduce 'noise' created by mounting related vibration.

Alignment - The transducers need to be as accurately facing each other as possible. No special rotation required. 'Alignment' software not required.

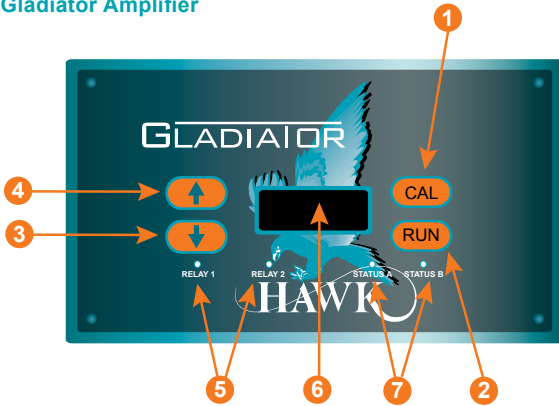
See page 7 'Blocked Chute Mounting' for mounting dimensions.





### Facia Controls

#### Gladiator Amplifier



- 1 Calibrate button
- 2 Run button
- 3 Down button
- 4 Up button
- 5 Relay LEDs 1 and 2
- 6 Display (LCD with backlight)
- 7 Status LEDs A and B  
Status A blinking indicates units are pulsing correctly.  
Status B is not used

All software adjustments can be made by the push buttons on the amplifier facia.



#### In Run Mode

(A) Press and hold - interrupts normal operations and allows access to software menu headings.

#### In Calibrate Mode

- (B) Steps into a menu selection to allow editing (down one level)
- (C) Saves selected value and moves onto the next menu item.



#### In Run Mode

(A) Hides diagnostics if they are in view and returns to the standard running display.

#### In Calibrate Mode

- (B) Steps out of a menu or selection (up one level). Parameter value will be stored automatically when stepping up.
- (C) Returns to running mode from the top level menu.



#### In Run Mode

(A) Scrolls through operating diagnostics on display LCD.



#### In Calibrate Mode

- (B) Scrolls through software parameters when browsing the menus.
- (C) Changes display value when editing a parameter.

# Setup Procedure

## Gladiator Acoustic Switch Series



### 1. Mount the unit in its actual position

(see mounting - pages 7-8)

### 2. Check where the actual level or target is relative to the sensors.

Make sure that the material or target is not blocking the path between the transducers.

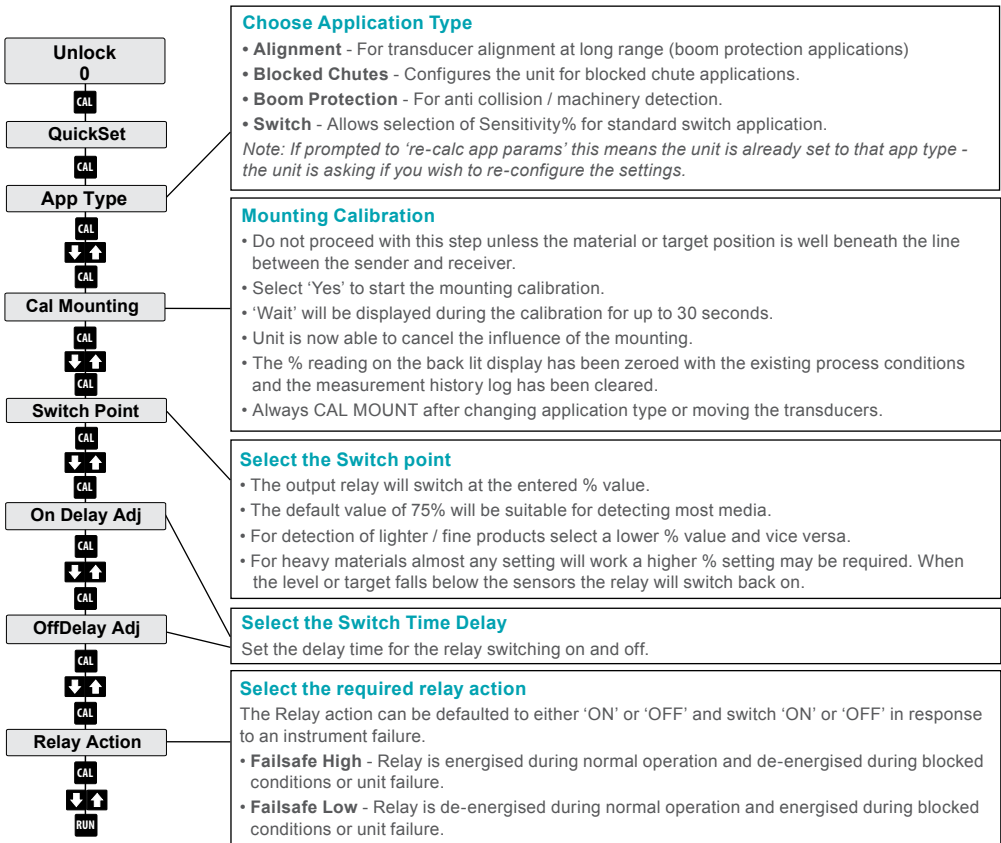
### 4. Turn the power on

The display will turn on and the fail-safe relay will switch. The display will scroll through the following messages: HAWK, Amp SerialNo, Type, Amp Soft

Ver, Device ID, SensorSerial, SensorModel, Sens SoftVer, Sensor Addr, Gladiator System Amp. The unit will then go into operational mode displaying 'Switch' with a % value. This % value represents the changing amount of signal loss between the transducers.

⚠ If you see an error code, see 'troubleshooting'.

### 5. Simple "1-minute" Setup - Follow the flow chart



## Setting Maximum Range

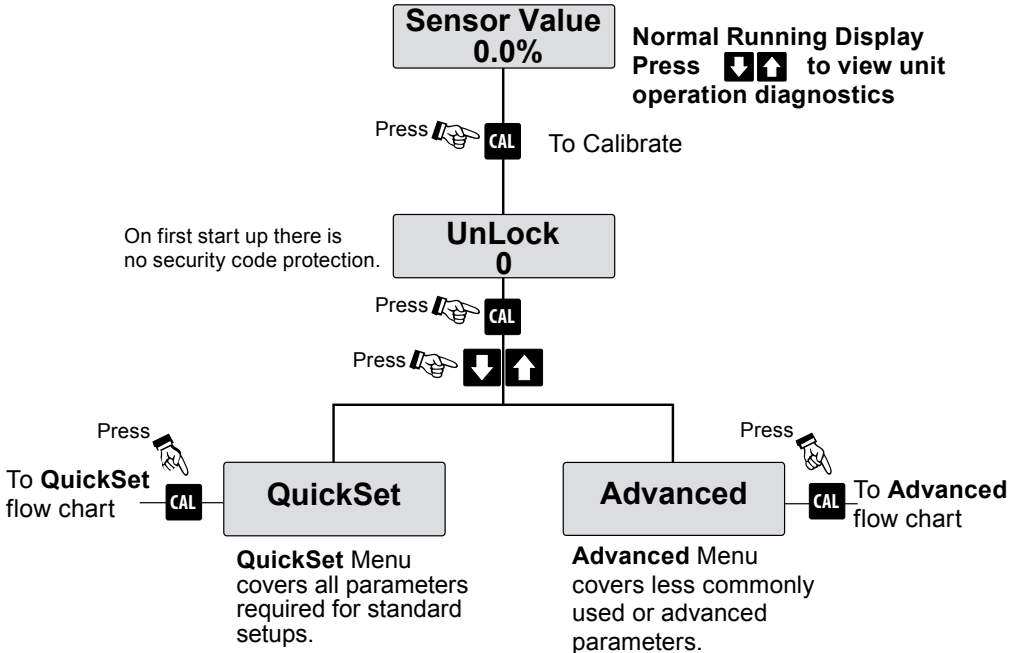
Gladiator Acoustic Switch Series



- After a calibration the unit has a high & fluctuating switch%
- Check the echo distance diagnostic (while the unit is **RUNNING**, press down arrow until the top line reads **E: x.xx**. If this value (distance) is double the approximate space between sensors or greater you will need to adjust the 'empty distance' to restrict the maximum range.
- The setting is called 'Empty Dist' in the main menu labelled 'Advanced'.
- Press CAL to edit, then the arrow to adjust this distance to 125% of the space between the sensors (example, if there is approximately 4.00m between the sensors adjust this value to 5.00m).



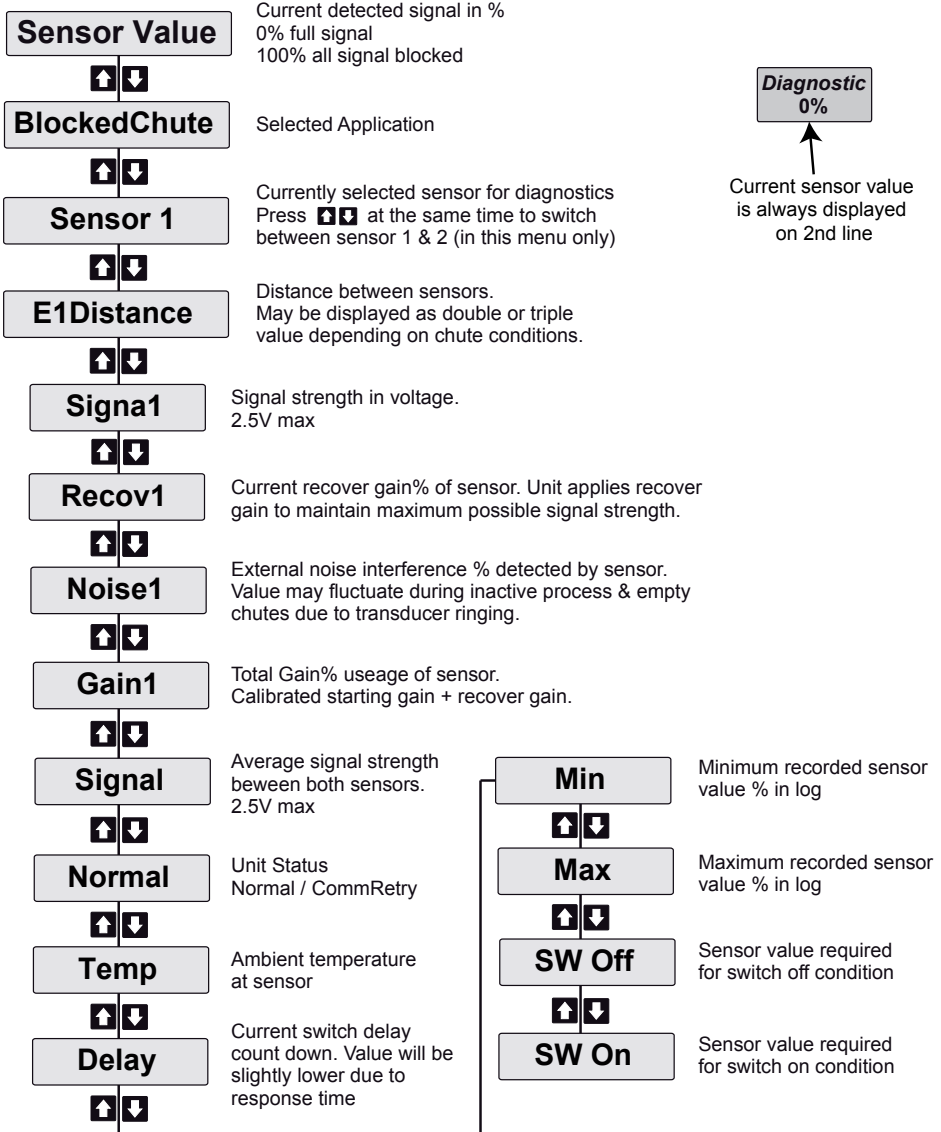
Software Tree



Press **RUN** to return to normal operation



While the unit is in RUN mode you can press **↑ ↓** to view information about current unit settings & operating characteristics.

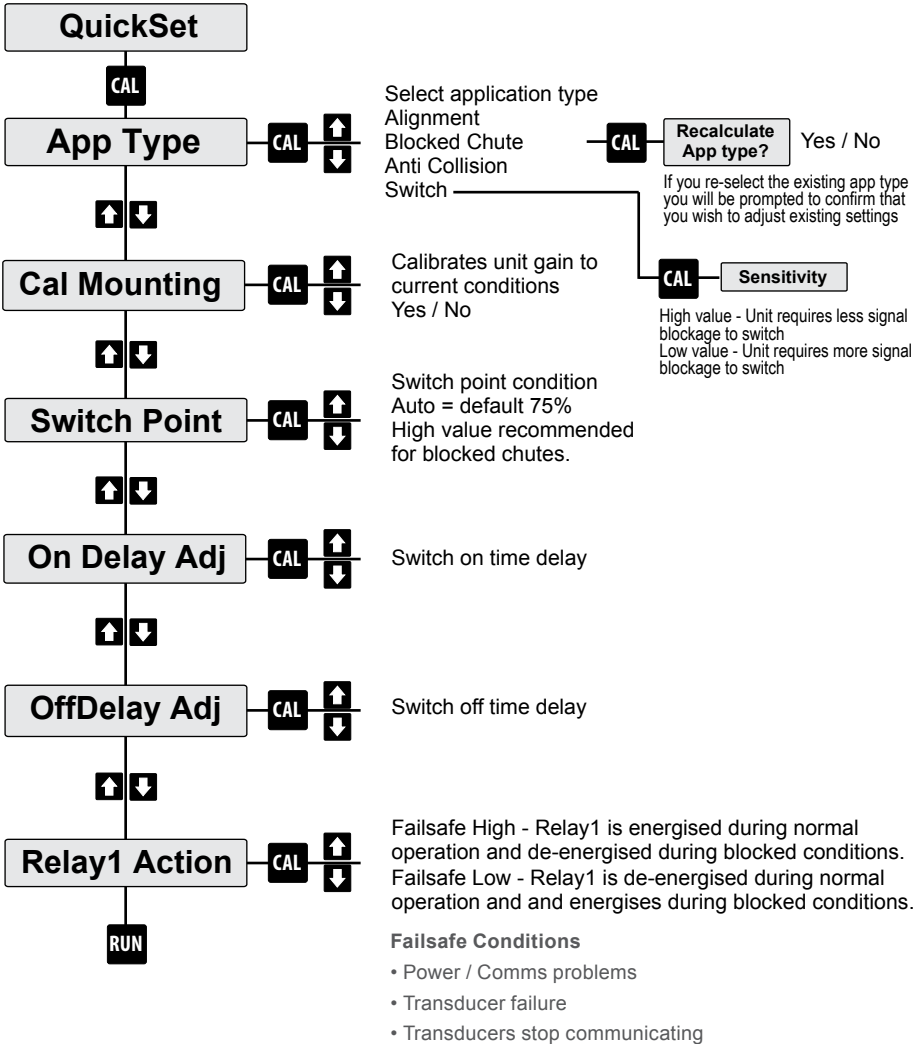


# Quickset Flow Chart

Gladiator Acoustic Switch Series



Software Rev 7.41





## App Type

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### Alignment

- For Aligning the unit in long range (boom protection applications).
- Unit is set to 1.2V signal (~48% sw value).
- Move the unit face to get the sw value reading low (0% indicates perfect alignment at current gain setting).
- Calibrate & re-select this mode and repeat till you cannot improve the alignment.
- This mode is only for alignment, not for an active process.

### Blocked Chute

- Configures the unit for blocked chute applications

### Boom Protection

- Sets the unit to Boom Protection mode.
- This can also be used for machinery or object detection

### Switch

- For standard switch applications where blocked chute or boom protection is not appropriate.
- A high value will make the unit more sensitive to switching and responding to lighter materials.
- A low value will make the unit more resilient and ignore dust / build up.

### Cal Mounting

- Do not proceed with this step unless the material or target position is well beneath the line between the transducers.
- Select 'Yes' to start the mounting calibration.
- 'Wait' will be displayed during the calibration during the procedure and the Status A & B lights will flash while the unit is pulsing.

- The unit then performs a final check.
- The Cal Mounting process configures the system to the optimum settings to achieve a 2.4V signal (signal in volts viewable in the diagnostics).

### Switch Point

#### Auto:

- The output relay will switch on at displayed % value (default 75%) Auto settings will be suitable for detecting most media.
- Adjusting the switch on % will automatically adjust the switch off %.
- For blocked chute applications a higher % switch on value is recommend such as 90%.

#### Manual:

- To adjust both switch point values see 'Switch Mode' in the 'Advanced' menu.

### On & Off Delay Adjustment

- Set the time to be used for both switch on and switch off delays (default: 1 second).

### Relay1 Action

- Relay1 can be set to Low or High.
- When the Relay is in high mode it is always switched on (EN) and will switch off (DEN) when there is a blocked chute condition or unit failure.
- High is recommended.
- When in Low mode the Relay will be switched off (DEN) during normal operation and will switch on (EN) when there is a blocked chute condition or unit failure.

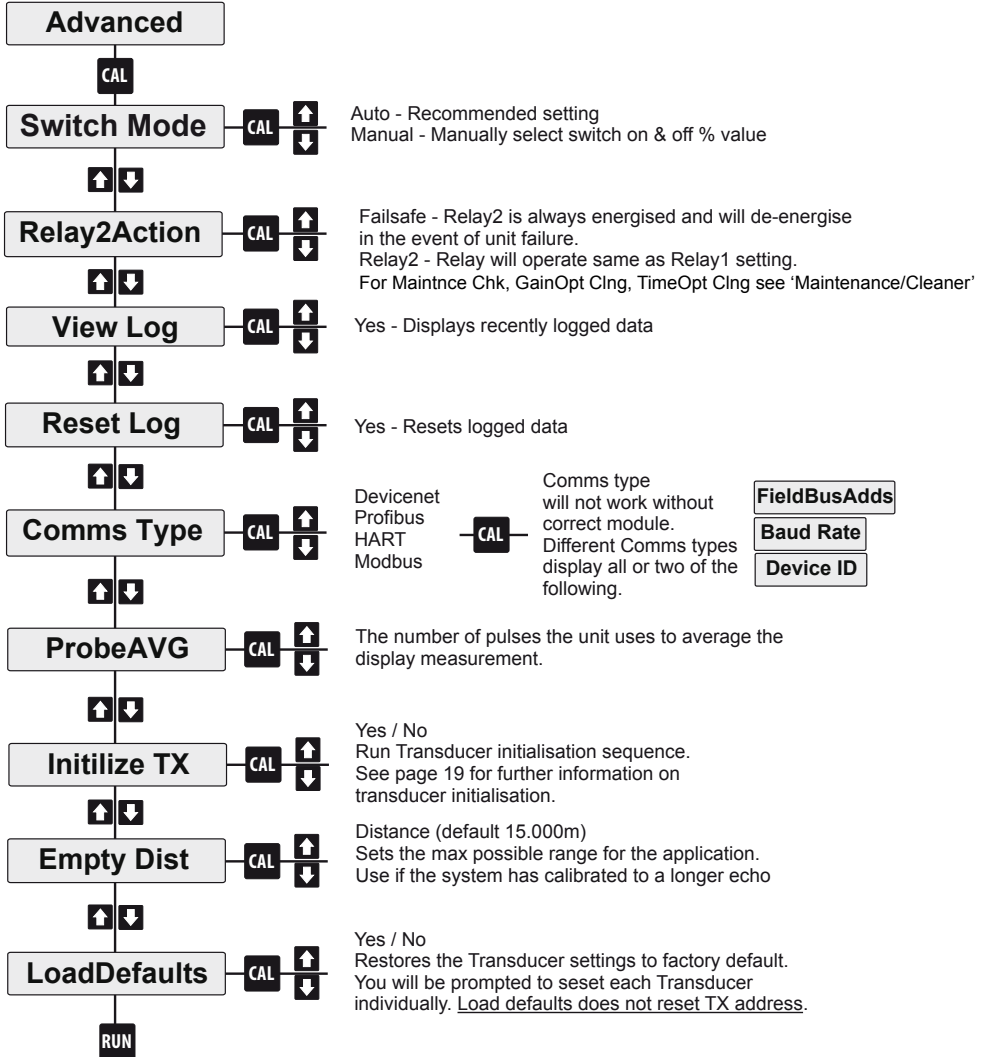


# Advanced Menu Flow Chart

Gladiator Acoustic Switch Series



Software Rev 7.41



# Advanced Menu Parameters

## Gladiator Acoustic Switch Series



### Switch Mode

- Switch mode alters the switch on/off display % condition for the relay.
- Auto is the recommended HAWK default with switch on at 75%.
- Manual mode allows you to specify the on & off % condition.

### Relay2Action

- The second relay can be set for failsafe conditions or as another switch.
- Usually failsafe is the preferred option.
- The relay will always be switched on but will switch off if there is a fail condition with the system.

### Failsafe Conditions:

- Power / Comms problems
- Transducer failure
- Transducers stop communicating
- The second relay2 action is relay2.
- This programs the relay to mirror the action of relay1.
- See 'Maintenance/Cleaner' on next page for information about Maintnce Chk, GainOpt & TimeOpt Cleaning

### View Log

- View log displays the highest & lowest logged values for the display % and temperature since the last log reset.

### Reset Log

- Clears the logged data.

### Comms Type

- If your unit has an additional comms module (Modbus is standard with switch only units) such as DeviceNet, Profibus PA or HART you can select and configure the address / ID / line speed for the comms option.

### Back Light

- The LCD back light can be switched on or off.
- The display will be bright green when switched on.

### ProbeAVG

- This setting is similar to a 'damping' setting.
- The unit display reading will be an average of the ProbeAVG figure.
- The figure is measured in transducer pulses.
- The default setting is 2.
- Increasing this setting will slow the unit response time for switching and give a more stable switch % value.

### Initilize TX (see page 20)

- If you need to re-initialize the transducer address connection sequence you can run this program.
- You will have the option to clear each transducer address.
- If the transducers are already correctly addressed within the amplifier the unit will cycle through and display 'found' and then 'too many transducers'.
- In this event press and hold RUN firmly to return to the menus.

### V In Chk

- V in Chk ensures the minimum required voltage for unit operation (9.5V) is being supplied to the unit.
- If switched off the LCD will display 'volt fail' when voltage drops below 9.5V.
- When switched on the unit will enter failsafe mode and display volt fail when input voltage drops below 9.5V.

### Empty Dist

- See 'setting maximum range' on Page 11

### LoadDefaults

- Restores factory default settings to amplifier, sensor 1 and sensor 2.
- You will be prompted to set each individually.



### Concept

- The Gladiator Amplifier has received a firmware update to utilise the **Relay 2** as a trigger mechanism to notify the user or activate a cleaning system based on time or conditions within the application which require cleaning.
- There are three software options using two different concepts. The first concept is based on total Gain used and the second is based on a Time interval.
- The options are located in the **Advanced** menu as a sub menu for **Relay2Action**.

The selectable software options are as follows:

#### [Maintnce Chk]

- The unit will switch on the relay when total **Gain** is greater than the **CleanGainHigh** % - the relay will switch off when Gain falls below **CleanGainLow** %.

#### [GainOpt CIng]

- When total **Gain** exceeds the **CleanGainHigh** point the unit activates the relay for 1/2 of the **On Delay** time and then switches off.
- The unit will then count the **Clean Time** interval time before repeat the process until total **Gain** is below **CleanGainLow** point.

#### [TimeOpt CIng]

- At every **Clean Time** interval the unit will switch on the relay for 1/2 of the **On Delay** time and then switch off.

### Setup Example - Gain Based

- In 'Quickset' Set 'On Delay' to 4.0 seconds - this will provide a 2.0 second water blast.
- In 'Advanced' set 'Relay2Action' to 'GainOptCIn' with a 'CleanGainHi' of 80%, 'CleanGainLo' of 70% and 'Clean Timer' to 5.0min
- This will trigger the water spray for 2 seconds when Gain goes above 80%.
- The spray will repeat every 5 minutes until Gain goes below 70%.
- You can view Gain while the unit is running by using the arrow key to locate the diagnostic display





## Error Codes

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### Too Many Transducers

- This code can be displayed if both transducers are already **correctly** initialised when run the Initialise TX program. Press and hold the RUN button to exit this code loop.

### Com Retry

- Unit is attempting to communicate with a transducer.

### Failed

- Unit has failed to communicate with both transducers.
- Check amplifier & junction box wiring connections.
- Pull each wire to ensure they are locked in correctly.

### Error No 01:

- Amplifier cannot communicate with transducer 1.

### Error No 11:

- Amplifier cannot communicate with transducer 2.

### Existing installation

- For both error codes 1 and 11 the first thing to check is the amplifier & junction box wiring connections, both HAWK and customer supplied if applicable.
- Pull each wire to ensure they are locked in correctly.
- Check sensor for damage.

### New installations

- You may need to re-initialise the transducers.
- The re-initialisation sequence assigns each an ID which the amplifier is looking to communicate with.
- The re-initialise program is in the 'Advanced' Menu.
- While an error code is on the screen you will need to push and firmly hold the CAL button to access the unlock screen. This may take 5-10 seconds.

### Error 02:

- Amplifier can talk to transducer but transducer gives incorrect response.
- This can indicate a communication data corruption between Amplifier and Transducer.
- It can be a result of noise in data lines or one of data lines (blue or white) being open circuit.

### Error 03:

- A communications option in output adjustment has been selected (eg Profibus, FF) but the module is not present, connected or responding.

### Error 04:

- Amplifier is programmed with incorrect software.

### Error 08:

- Incorrect transducer - ensure connected transducer is Acoustic Switch (AS).

### Power Supply

- LCD / LEDs / Relays dimming or dropping out in non-blocked conditions.
- The GSASUS when powered by AC will output a DC voltage from the DC +/- terminals.
- You should read approx 16V stable from DC +/- while under AC power. If your AC power is stable and the DC is outputting a lower or unstable value there is likely a problem with the internal AC power supply.
- You can use a 24DC regulator and power the unit via DC terminals.
- **High / Inconsistence switch % after calibration**
- See 'setting maximum range'

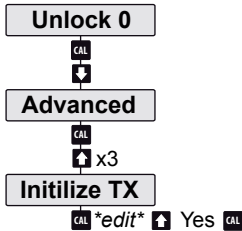


### Error 01 - Error 11

- If the LCD is displaying 'Error 01 or Error 11 after installing a single transducer or full system you may need to re-initialise a transducer.
- If your system is displaying Error 01 or Error 11 after the system has been working correctly it is very likely there is a different problem.
- If Comm Err is displayed while navigating menus check your wiring, terminals, junction boxes and transducers for damage or connection problems.

### Initializing a Transducer

- If you need to re-initialize the transducer address you can run this program.
- You will have the option to clear each & initialise transducer address.
- First - **Disconnect Transducer 2**
- Press and hold CAL to force the unit to open the 'unlock' menu.
- Navigate to the Initialize TX menu as per below:



After selecting 'Yes', you will see one of these messages:

**T'ducer1  
Initilize?**                      **Plz connect  
Transducer 1**                      **T'ducer 1  
Ready**

*During the boot sequence of the amplifier information about each transducer is cycled on the LCD. Each transducer will pulse once during this phase confirming power is present.*

*If both transducers pulse at the same time they have been assigned the same TX ID. You will need to re-initialise one of them.*

### T'ducer1 Initilize?

- Transducer 1 is detected and has not been initialised.
- Press CAL to edit, press UP until you see 'Yes'.
- Press CAL to select.
- Re-connect Transducer 2 and press RUN several times to re-activate the unit.

### T'ducer 1 Ready

- Press CAL to edit, press UP twice to display 'Clear? Yes'.
- Press CAL.
- The unit will cycle to T'ducer 2 displaying 'Ready'.
- Re-connect Transducer 2 and press RUN several times to re-activate the unit.

### Plz connect Transducer 1

- Press RUN firmly until it moves to 2nd Transducer.
- Display should read 'T'ducer 2 Ready' (if this does not occur, skip to below note).
- Press CAL to edit, press UP twice to display 'Clear? Yes'. Press CAL.
- The unit will not have returned to the advanced menu.
- Press UP and re-enter TX initialize.
- You should now be prompted with T'ducer1 Initilize, refer to relevant steps.

### \*Note\*:

- If the unit menu does not scroll to 'T'ducer 2 Ready' you will need to perform a 'Load Defaults' routine (located in Advanced Menu). This will prompt you to load defaults and confirm selection followed by resetting the sensor - do not reset the sensors.
- After the load default press RUN to re-start the unit. Next, perform a power cycle of the entire system.
- When prompted to connect Wire Tx 1, Press CAL. When prompted to connect Transducer 1, press RUN.
- 'T'ducer 2 Ready' should now be displayed. Press UP arrow to display 'Clear'. Press CAL. The unit will now re-start.
- Follow on-screen instructions to complete setup.

# Part Numbering

Gladiator Acoustic Switch Series



## Remote Amplifier

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### Model

GSA Remote Gladiator System Amplifier

### Housing

S Standard polycarbonate electronics housing

### Power Supply

B 12-30VDC

C 30-48VDC & 48-90VAC

U 12-30VDC & 90-260VAC

### Output Options

S Switch. 1 level relay, 1 failsafe relay, with Modbus

### Other Options

A22 ATEX Grp II Cat 3 GD T85°C IP67 Tamb -40°C to 70°C

**GSA S U S**

## Junction Box

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**AWRT-JB-01** HAWK multi purpose junction box for dual transducer applications includes 1m amplifier connection cable.

**AWRT-JB-06** HAWK multi purpose junction box for dual transducer applications includes 6m amplifier connection cable.

**AWRT-JB-06**

## Mounting Flange

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**FA4A-4** HAWK Transducer body mounted 4" ANSI flange

## Extra Cable (Length in metres)

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**CA-TXCC-R-** C15  
C30  
C50  
C100



### Remote Transducer

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#### AWRT Acoustic Wave Remote Transducer

15 15kHz for chutes with heavy duty self cleaning requirements

#### Transducer Diaphragm / Sleeve Material

T Teflon / UHMW (applications suitable for Teflon (no sensor face wear))

Y Titanium face / UHMW (applications with possible sensor face wear eg crushers)

#### Transducer Housing Material

4 Polypropylene

#### Thread Standards for End cap

X Not Available (FA4A-4 Standard Flange Mount)

#### Mounting Thread Sizes

X Not Available (FA4A-4 Standard Flange Mount)

#### Approval Standard

(contact factory for hazardous location approval options)

X Not Required

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

#### Connection

C IP68 Sealed unit with cable

#### Cable Length

15 15m cable

30 30m cable

#### Accessories

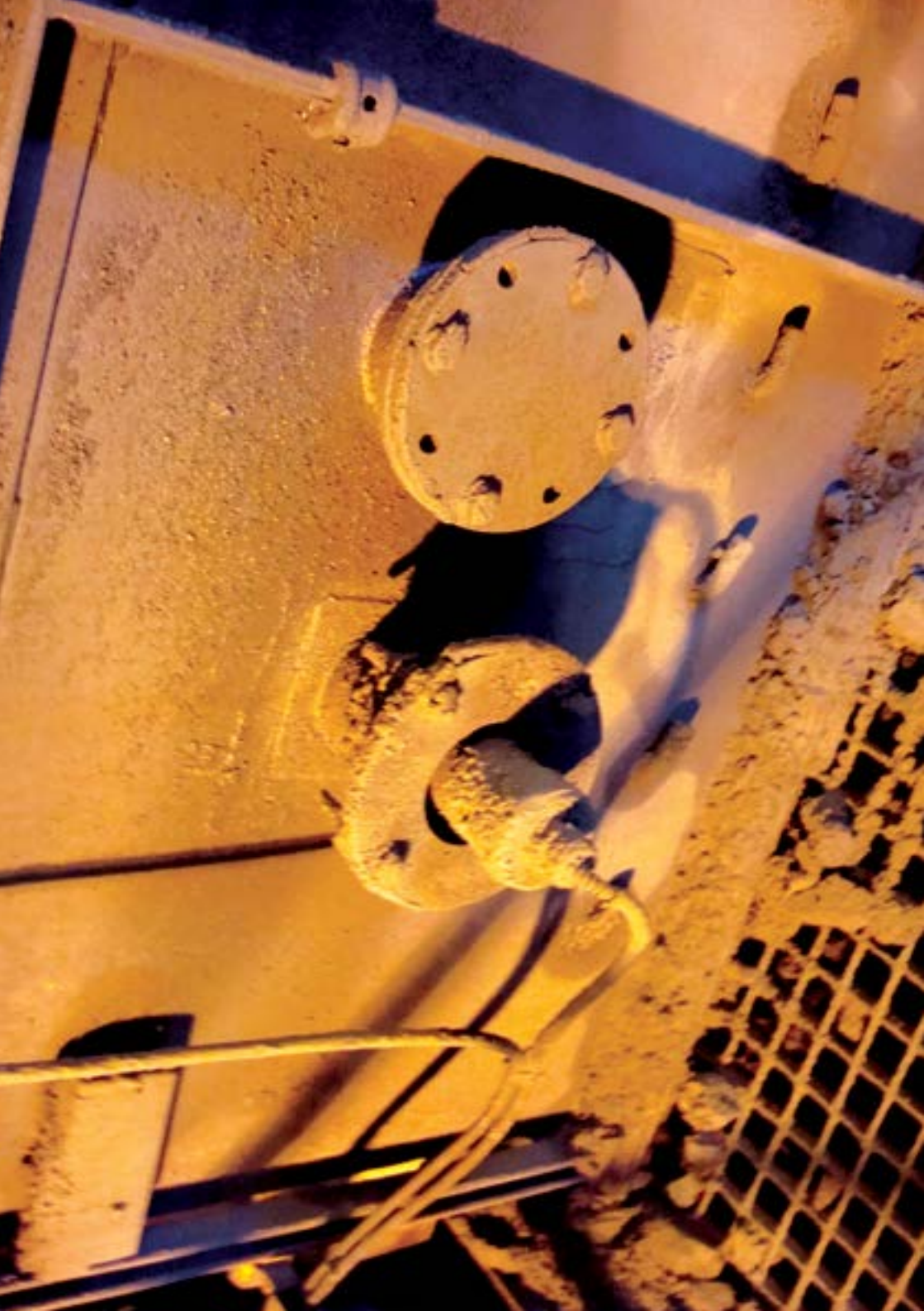
X UHMW Sleeve

#### Software Options

AS Gladiator Acoustic Wave Switch

**AWRT 15 Y 4 X X X C 15 X AS**







# Specifications

## Gladiator Acoustic Switch Series



### Operating Voltage

- 12-30VDC (residual ripple no greater than 100mV)
- 90-260VAC
- 36-60VDC

### Power Consumption

- <0.8W @ 24VDC
- <6W @ 48VDC
- <5VA @ 240VAC
- <3VA @ 115VAC

### Communications

- GosHawk, Modbus
- Multidrop mode can address 1-250 units over 4 wires

### Relay Outputs: (2) Remote

- Form 'C' (SPDT) contacts, rated 5A at 240Vac resistive
- Remote fail-safe test facility for one relay.

### Operating Temperature

- Remote electronics -40°C (-40°F) to 80°C (176°F)
- Remote Sensors -20°C (-4°F) to 80°C (176°F)\*

### Fail-Safe

- Selectable - presence or absence of material
- **High level fail-safe:**  
relay is activated when material is present.
- **Low level fail-safe:**  
relay is activated when no material is present.

### Maximum Range

- Blocked Chutes: Under ideal conditions: 15m (50ft)

### Minimum Range

Blocked Chutes: • 15kHz 400mm (32")

### Transducer to Amplifier Separation

- Up to 500m (1640ft) using specified extension cable (Belden 3084A)

### Maximum Operating Pressure

- 2 BAR

### Display

- 2 line x 12 character alphanumeric LCD
- Backlight standard

### Memory - Remote

- Non-Volatile (No backup battery required)
- >10 years data retention

### Enclosure Sealing

- Remote Electronics IP67 (NEMA 4x)
- Remote Sensors IP68

### Cable Entries

- Sensors: 1xM20 Gland/3/4" NPTF threaded adaptor
- Amplifier: 4x20mm (0.8"), 1x16mm (0.6") knock outs

### Mounting

- Transducer 4" ANSI flange
- Remote Amplifier Back mount, DIN rail mount
- Pipe Specification: 4-00" Z40 ID=102mm Black Pipe

Typical Weight	kg	lb
15kHz Transducer	8	17.6
Remote Amplifier	1	2.2

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