A Higher Level of Performance

Manual

Centurion

Guided Wave Radar

TDR/GWR

For more information, please visit >

www.hawkmeasure.com

Contents

Principle of Operation

Low power microwave pulses are transmitted along a cable or probe to the product being measured. At the point where the wave meets the product surface it is reflected by the product.

The unit automatically calculates the distance to the pulse reflection using time of flight & time expansion. The intensity of the reflection depends on the dielectric constant of the product.

The instrument measures the time between emission and reception of the signal which is proportional to the distance.

Contact with the measured product ensures precise accuracy.

Function

The HAWK range of TDR product are ideal for the measurement of liquids, powders and granules to a range of 35m.

This technology is not affected by pressure, temperature, viscosity, vacuum, foam, dust, changes in dielectric constant or coating of the probe.

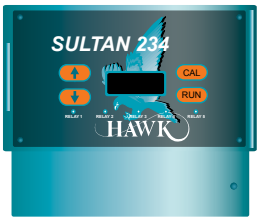
Primary Areas of Application

- Chemicals
- Petrochemicals
- Cement
- Building Aggregates
- Energy
- Food & Beverages
- Oil & Gas
- Pharmaceutical
- Pulp & Paper
- Wastewater

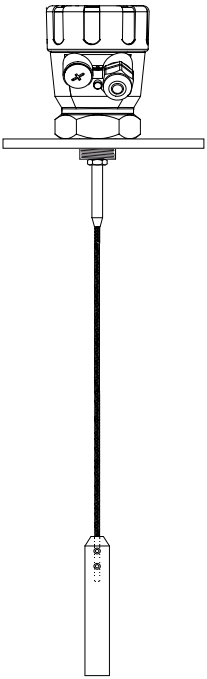
Features

- Remote, Integral & Smart versions
- Up to 35m range (316L cable)
- Simple setup
- Auto-Calibration to any dielectric
- Adjustable Sensitivity
- Adjustable signal amplification
- Precise & continuous accuracy
- 4 wire AC/DC
- 2 wire loop
- 4-20mA, HART, Foundation Fieldbus, Profibus PA, Profibus DP, DeviceNet, Modbus, GosHawk
- Protection class IP67, NEMA4x
- 3G remote communication support
- Measures extremely low dielectric (1.4)
- Programmable fail safe mode.

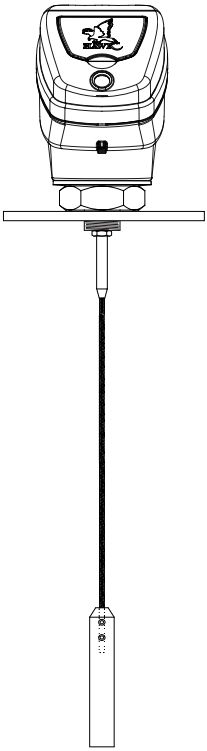
AWR Remote Amplifier with software v0580 or later



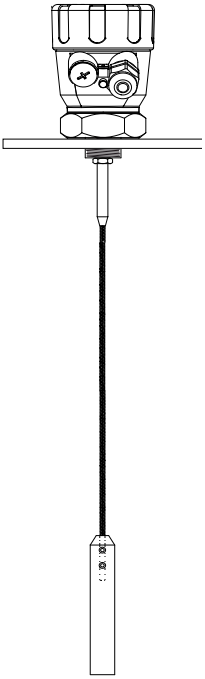
with TDRR Remote Probe



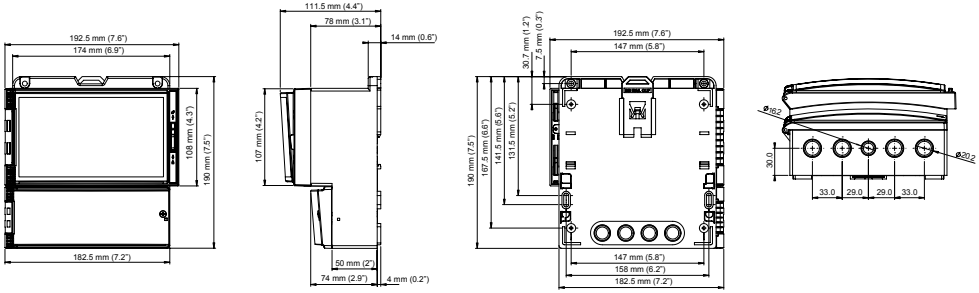
TDRI Integral



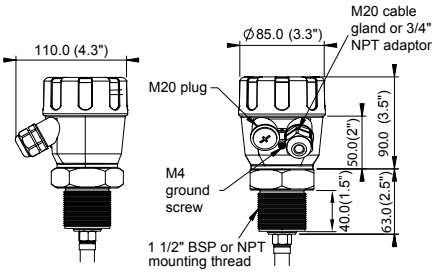
TDRS SMART



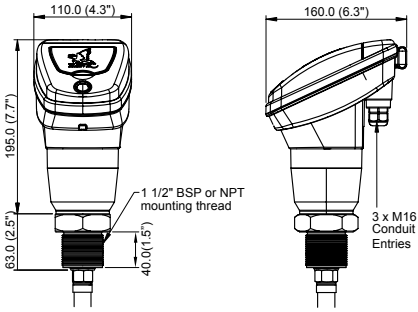
Remote Amplifier Housing



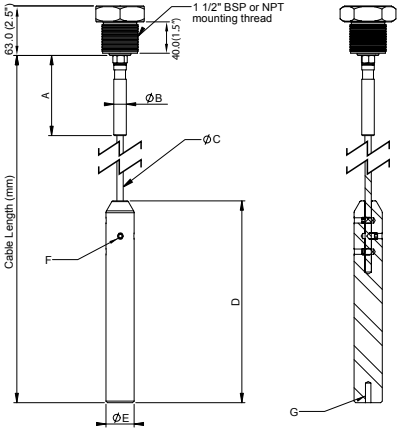
Remote / Smart Probe Housing



Integral Housing

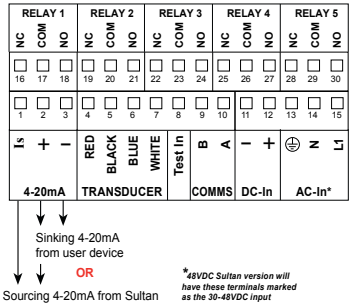


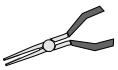
Probe



Inputs model dependant

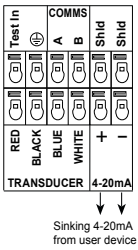
AWR234



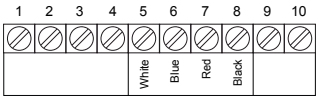


User long nose pliers to extract terminal blocks

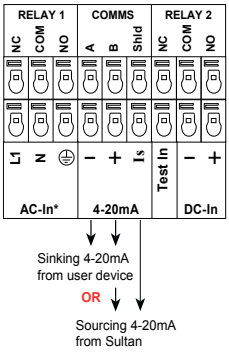
AWR2



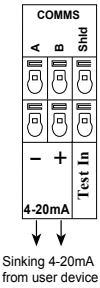
TDRR



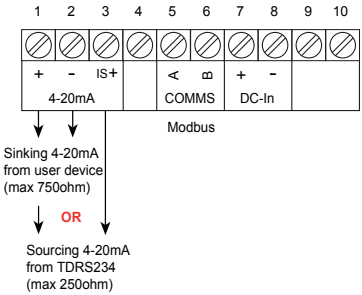
TDRI234



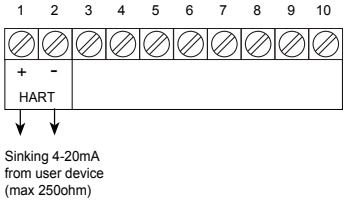
TDRI2



TDRS234

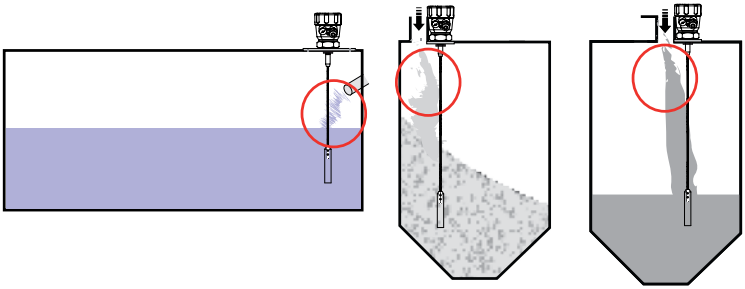


TDRS2

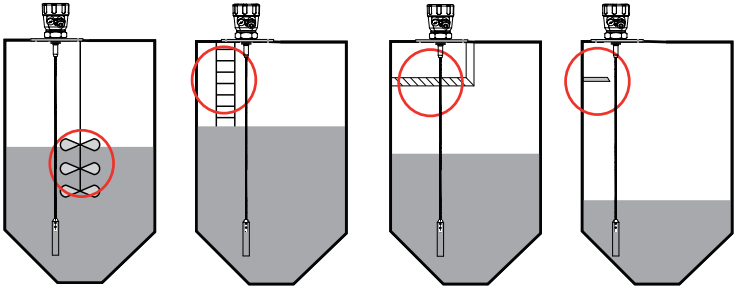


Placement Requirements

Do **NOT** mount near infeed



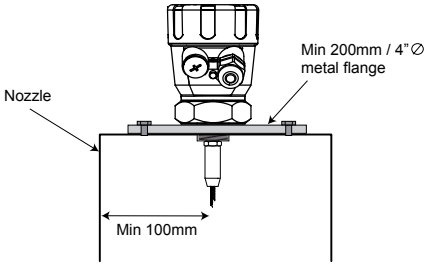
Do **NOT** mount over or adjacent to **any** obstacles

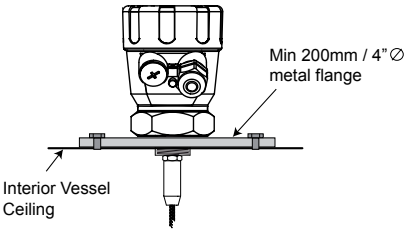


Connection Requirements - Metallic Vessels

The unit requires a metallic flange or sheet connected to the unit thread.

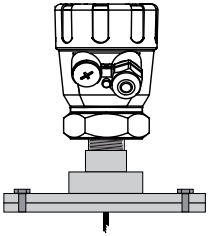
- Mount probes as far away as possible from internal structures.
- Probes should not contact metallic container walls or floors.





Multiple segmented connection

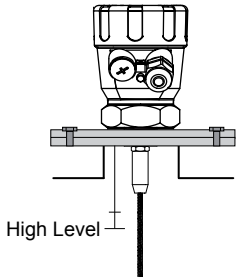
If using thread multiple connection pieces for thread standard and size integration a metallic plate or flange of minimum recommended size should be at the lowest possible point of the mounting.



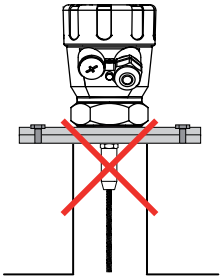
Nozzle Mounting

Avoid Narrow Nozzles

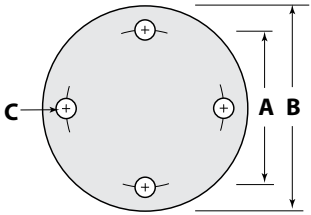
Minimum measurable distance can be affected by narrow nozzles. Increasing Blanking to a safe minimum distance for example: double nozzle height + 25% safe distance



Do NOT mount in long narrow nozzles



Standard Flange / Connection Dimensions



Note: Hawk Supplied flange bore hole is 1.5" BSP (fits TB15 units)

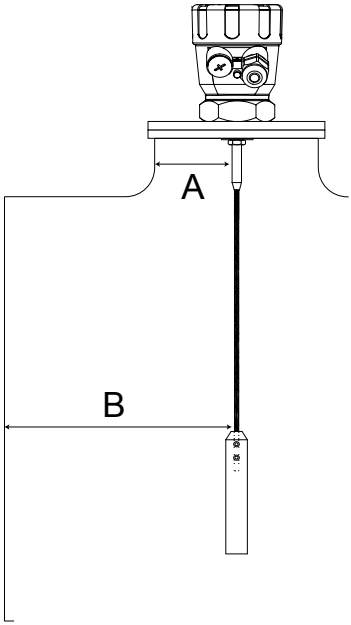
Part Number	Standard	A		B		C	
FA2	ANSI (Class 150)	120.7	4.75"	152.4	6"	19.1	0.75"
FD2	DIN (PN40)	125	4.9"	165	6.5"	18	0.7"

Minimum Clearance Specification

Typically high dielectric materials (such as liquids) provide a good return signal.

Low dielectric materials (such as plastics and powders) require higher levels of sensitivity to measure. Failure to adhere to mounting requirements can create a false signal reflection which will exhibit as high level lock-ups either from the distance of the interference of a multiple of the distance of the interference.

Take into account the possibility of cable sway encroaching on the minimum clearance requirements.

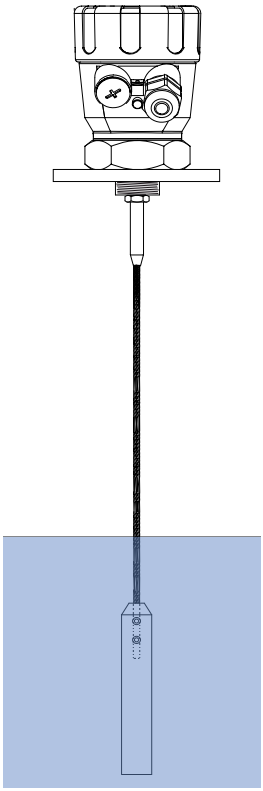


Clearances	8mm Cable	4mm Cable
A. Minimum Nozzle Clearance	100mm (4”)	100mm (4”)
A: Recommended Nozzle Clearance	300mm (12”)	300mm (12”)
B. Minimum Wall Clearance	100mm (4”)	100mm (4”)
B. Recommended Wall Clearance	500mm (20”)	300mm (12”)

Tensile forces are heavily dependent on the viscosity and abrasive characteristics of the product in the vessel. Ensure tensile loading is appropriate for the selected cable (8mm or 4mm) as well as the silo cover and mounting structure. In critical cases it is better to use a 8mm rope instead of a smaller one.

	8mm Cable	4mm Cable
Max Tensile Load at 20°C	19kN	5kN

- Confirm installation conforms to unit specifications
- High & Low level
- Fill vessel to touch probe
- Run Digitize



A. Confirm mounting is within recommended specifications.

B. Check the selected unit matches the required application specifications.

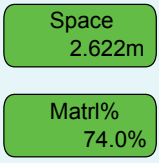
C. Check the wiring is correct and all connections are secure.

D. Apply power to the unit.

When power is applied the unit will start its normal load sequence. The following messages will cycle on the display.

Product Type
Serial number
Unit ID (Modbus)
TDR Warming up

The TDR will take up to 30 seconds to warm up, and then it will perform a scan to locate the level which will take approximately 1 second per metre (3ft) of probe).



Example standard displays

After the load sequence the first display will be either the default or selected LCD Display Mode for unit operation. The 2nd line will always display the measurement value.

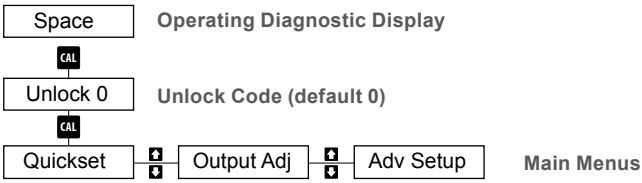
If an Error code is displayed see the 'Troubleshooting' section of this manual.

1. Quickset Parameters

In this operational state you can use the ▲▼ buttons to navigate through and view unit diagnostics and other measurements.

Setting Quickset Application Parameters

The **Quickset** menu contains the basic parameters required to get the unit up and running. It is one of the three main menu options in the internal software.



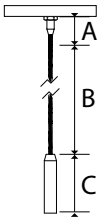
Quickset

Parameter	Description	Options
Unit	Adjust displayed measurement unit	Inches Feet Metres Centimeters
Low Level	Set Low Level (4mA) distance	Adjustable
Hi Level	Set High Level (20mA) distance	Adjustable
FailSafe	Set Analogue failsafe output	20mA 4mA LastKnown 20.20mA 3.50mA
FailTime	Set countdown for failsafe (seconds)	Adjustable
FillRate EmtyRate	Select or view application fill / empty speeds	View Fast (200m/h) Med (50m/h) Slow (5m/h) Custom (user selected speed)
DispMode	Select default Display mode	Space Material Material%
Lock Code	Adjust default unlock code (default 0)	0-200

See '**Measured Span Reference**'

Measured Span Reference

A	Blanking (non-measurable zone)
B	Measurable Span (blanking to top of weight/end of cable)
C	Weight (non measurable zone)



2. Output Adjustment Parameters

Setting Output Parameters

The **Output Adj** menu contains parameters related to adjusting analogue, switch & communication protocol and relay settings.

Output Adj

Parameter	Description	Options	
FillDamp	This value damps the measured output. Increase to create smoother trends during filling	Adjustable	
EmtyDamp	This value damps the measured output. Increase to create smoother trends during emptying	Adjustable	
4mA Adj	Fine tune the 4mA output current	Adjustable	
20mA Adj	Fine tune the 20mA output current	Adjustable	
Analog	Invert analogue from 4-20mA to 20-4mA	4-20mA 20-4mA	
Simulate	A simulated distance reading is transmitted as analogue (distance measured from sensor face)	Adjustable	
Comm Type	Adjust communication protocol settings. Standard Analogue and Switch models include Modbus as default.	Modbus HART Profibus (DP) DeviceNet FF/PA	→ See '**Comms Type**'
RlyMod 1-5	Configure Relay actions	De-energize Energize Failsafe Off	→ See '**Relay Actions**'

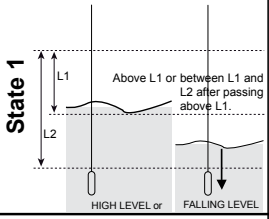
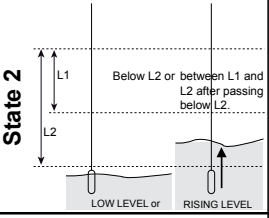
Comms Type

Sub-Menu	Description	Options
DeviceID	Adjust unit device ID for Modbus, HART, Profibus DP	1-255
FBusAdd	Adjust unit Device ID for (FF/PA, DeviceNet)	1-255
BaudRate	Adjust comms network speed	Comms dependant

Note: If using a HAWKLink communication device you must use Modbus with baud rate 19200

Relay Action

Sub-Menu	Description	Options
RlyL1 1-5	Adjust Relay switch point (L1 must be < L2)	Adjustable
RlyL2 1-5	Adjust Relay switch point (L2 must be > L1)	Adjustable

	Relay Action				
	Energise EN	DeEnergise DEN	FailSafe FS system operating normally	FailSafe FS power/system/ measurement failure	OFF
State 1 	NC COM NO	NC COM NO	NC COM NO	NC COM NO	NC COM NO — Relay Status NC COM NO — Remote Amplifier terminal function labels LED Status
State 2 	NC COM NO	NC COM NO	NC COM NO	NC COM NO	NC COM NO
POWER FAILURE	NC COM NO	NC COM NO	NC COM NO	NC COM NO	NC COM NO

3. Sensitivity Calibration

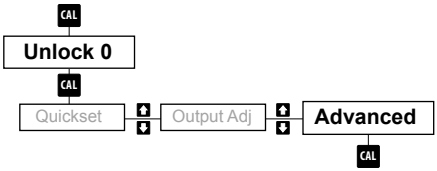
- Procedure A: Running Digitize while material is touching the probe
- Procedure B: Using dielectric pre-sets
- Procedure C: Manual Sensitivity Adjustment

Procedure A: Running Digitize while material is touching the probe

This procedure uses automatic procedure for sensitivity adjustment & mapping to calibrate the system based on the dielectric of the material touching the probe element and the mounting conditions.

This is the recommended calibration procedure for fastest and most accurate unit setup.

• **Digitize** is located in the **Adv Setup** menu.



• After entering the '**Adv Setup**' menu you will be prompted with the following.

• Scroll to the '**Digitize**' parameter and press **CAL.**

• ***Edit*** will flash on the display

Advanced Parameters ⇕ to scroll
Dielectric
Digitize
Cal Mount
CalSnstvty
Gain
Sensitivity
Sens Max
EchoSize
Thrshold
Blanking
TempTrim
DistTrim
ProbeReset
Amp Reset

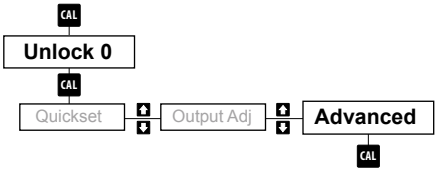
CAL

- Select scroll up to select '**Yes**' and press **CAL** to begin.
- If you are prompted to '**Confirm**' press up select '**Yes**' and press **CAL**.
- The Digitizing sequence will begin with '**Digitizing**' and '**Wait**' on the display. The sequence can take up to several minutes depending on how much of the Sensitivity range the unit needs to scan to find the correct echo.
- When it is complete it will display '**Done**'
- Press **RUN** several times to return to standard operating mode

Procedure B: Using dielectric pre-sets

This procedure uses pre-set sensitivity settings to calibrate the system based on a selected dielectric and separate mounting calibration.

• **Dielectric** selection is located in the **Adv Setup** menu.



• After entering the '**Adv Setup**' menu you will be prompted with the '**Dielectric**' menu option.

• Press **CAL** to select. ***Edit*** will flash on the display

Advanced Parameters ⇕ to scroll
Dielectric
Digitize
Cal Mount
CalSnstvty
Gain
Sensitivity
Sens Max
EchoSize
Thrshold
Blanking
TempTrim
DistTrim
ProbeReset
Amp Reset

CAL There are **5 options** to choose from

Dielectric Selection	Sensitivity pre-set %
>40	39.9
>20	49.9
>10	59.9
>5	75.0
>3	87.9
=<3	97.9

• The selection is just as an indication - conditions such as mounting, vessel construction & range will have a significant effect the required sensitivity range.

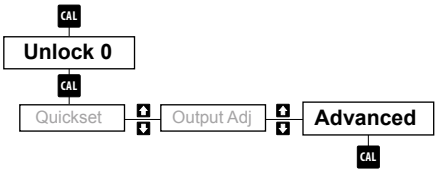
• Press **CAL** to select the approximate Dielectric. Press **RUN** several times to return to standard operating mode.

• Performing a **Cal Mount** for the higher level area of the probe is also recommended for potential mounting interference.

Procedure C: Manual Sensitivity Adjustment

This procedure is an advanced method for calibrating the sensitivity of the system. This involves manually adjusting the sensitivity until the unit is measuring the length of the sensing element or to the depth of material touching the sensing element.

• The '**Sensitivity**' parameter is located in '**Adv Setup**'



• After entering the '**Adv Setup**' menu you will be prompted with the following. Scroll to the '**Sensitivity**' Parameter and press **CAL**.

• ***Edit*** will flash on the display

Advanced Parameters ⇕ to scroll
Dielectric
Digitize
Cal Mount
CalSnstvty
Gain
Sensitivity
Sens Max
EchoSize
Thrshold
Blanking
TempTrim
DistTrim
ProbeReset
Amp Reset

CAL

• Use the arrow to increase or decrease sensitivity. Low dielectric materials will require a higher Sensitivity value.

• You can press '**CAL**' to fire test pulses. After each pulse the unit will return the signal strength and distance (depth) of the echo. You should aim for a signal strength of 2-2.5V. This may not be achievable with low dielectric materials. The minimum signal strength required is 0.40V

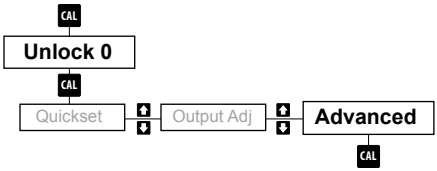
• After the unit is returning the correct level (either the end of the probe or the level of the material touching the probe press **RUN** several times to return the unit to operating mode.

• If the unit is locked onto a high target (such as reflections from mounting) re-attempt this procedure with the measured material touching the probe. If you still have problems see Troubleshooting '**False Echo Elimination**'.

Performing a Cal Mount

This procedure performs a digital mapping routine of a user selected span. Typically this can be used at the high level (eg from the Blanking down to a specific distance) to create a digitally adjustable sensitivity zone to tell the unit to ignore false echoes. The routine uses a uniform sensitivity adjustment or bias shift (parameter: CalSnstvty) to allow the user to increase or decrease the units ability to see the echoes mapped via this process.

• **Cal Mount** is in the '**Adv Setup**' menu



• After entering the '**Adv Setup**' menu you will be prompted with the following. Scroll to the '**Cal Mount'** parameter and press **CAL**.

• ***Edit*** will flash on the display.

Advanced Parameters ⇕ to scroll
Dielectric
Digitize
Cal Mount
CalSnstvty
Gain
Sensitivity
Sens Max
EchoSize
Thrshold
Blanking
TempTrim
DistTrim
ProbeReset
Amp Reset

CAL

• Press **UP** and select **YES**.

• You will be prompted to select the '**Cal Start**' distance. Typically this should be the start of Blanking (default 0.280m). Press **CAL** to edit and the arrows to adjust. Press **CAL** to save.

• Next you will be prompted to enter the '**Cal End**'. Use a '**safe**' distance (such as an additional 0.5m / 2ft) beyond any problem echoes.

• After entering distances you will be prompted to '**Execute Cal**' and then to '**Confirm Sel'**.

• Once you have executed and confirmed the **Cal Mount** it can be removed using the '**Reset**' option in the **Cal Mount Yes / No / Reset** menu.

• ! **Wait** ! while flash on the screen during the '**Cal Mount**' mapping process. 'Done' will be displayed when it is complete. Press **RUN** to move back to the '**Adv Setup**' menu.

• You can now adjust '**CalSnstvty**' to increase or decrease the sensitivity in the programmed span. If you are looking to remove false echoes reduce the value by small margins and press **CAL** to fire test pulses. When finished adjustment press **RUN** several times to return the unit to standard operation mode.

• The unit will scan to find the next acceptable echo.

In this operational state you can use the ▲▼ buttons to navigate through and view unit diagnostics and other measurements.

Diagnostic	Typical Reading	Description
Status	Normal Recover Fail	Unit is operating normally Unit is searching for new signal Unit is in failsafe mode
Win Bk	4.600m	Tracking Window end distance
Win Fwd	6.200m	Tracking Window start distance
T	23.8	Temperature in Celsius
N:	0.00%	Noise (electrical and frequency interference)
R	0.00%	Current Recover Gain added
G:	44.6%	Gain applied at measured distance
S	2.49V	Signal strength in Volts
E:	5.320	Non-damped measured distance
Application Type	Liquids	Selected Application type

Advanced parameters are for adjusting primary Sensitivity, echo controls/filters and running auto calibration routines as well as factory resets.

Parameter	Description	Options
Dielectric	Auto-set Sensitivity based on approximate Dielectric of material to be measured. (see Setup Procedure B)	>40 (Sensitivity autoset: 39.9%) >20 (Sensitivity autoset: 49.9%) >10 (Sensitivity autoset: 59.9%) >5 (Sensitivity autoset: 75.0%) >3 (Sensitivity autoset: 87.9%) =<3 (Sensitivity autoset: 97.9%)
Digitize	Perform auto-Digitization of Sensitivity based on mounting and Dielectric of material touching the probe (see Setup Procedure A)	Yes/No
Cal Mount	Performs a digital mapping routine of a user selected span. Used when there is signal interference at high level or mounting. Use Digit Bias to adjust bias (cal sensitivity) of mapping range	Yes/No/Reset Cal Start (distance) Cal End (distance) ConfirmCal (Yes/No)
CalSnstvty	Increase or decrease the probe sensitivity for the range specified during Cal Mount	Adjustable
Gain	Increase or decrease the amplification of the signal detected by the Sensitivity routines and adjustments. This setting typically does not require adjustment.	Adjustable (Default 58.8%)
Sensitivity	Manual adjustment of Sensitivity. This value will also be automatically adjusted by other calibration routines. Sensitivity is the primary adjustment for the units ability to detect media	Adjustable
Sens Max	Adjust the peak Sensitivity cap. This value will be automatically adjusted by other calibration routines	Adjustable
EchoSize	EchoSize is the target Echo Signal size the unit is attempting to maintain. Any signal which is detected by the Sensitivity setting will be either full signal (2.5V) or less. If the signal detected by Sensitivity is less than EchoSize the unit uses Gain to amplify the signal to the EchoSize.	Adjustable (default 1.0V)
Thrshold	Threshold is a filter which tells the unit to ignore any echoes of a Signal size less than this value. This can be used as part of troubleshooting (see Troubleshooting: False echo elimination)	Adjustable (default 0.39V)
Blanking	Blanking is a non-measurable zone. This can be increased to 'Blank' out high level false echoes caused by mounting.	Adjustable (default 0.350mm)
ProbeReset	Restores Probe settings back to factory default. Most probe settings are in the 'Adv Setup' menu.	Yes/No
Amp Reset	Restores the Amplifier settings back to factory default. Most Amplifier settings are in 'Quickset' and 'Output Adj' menus.	Yes/No

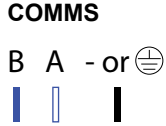
Setup

GosHawkII is Hawk's PC interface software which can be used to calibrate, monitor and troubleshoot Hawk products. You will need a HAWKLink-USB connector with a computer or laptop or a HART USB device for HART units.

GosHawkII software is available as a free download from our web site http://www.hawkmeasure.com. **GosHawkII is updated regularly - please ensure you have the latest version.**

Before connecting the USB you must install the windows driver. This is included as a mini CD with the USB kit or is available from our web site.

Wire the HAWKLink-USB to the COMMS terminals. Blue wire to B, blue/white to A and black to DC- or shield.



Double click the GosHawkII shortcut icon which should be located on your desktop after GosHawkII installation.

The main GosHawk navigation window will open.

You may need to check and confirm the USB is reading the correct comm port on your computer.

General function information

Press

Read All Parameters	Green Cell	Red Cell
To refresh any menu	Read / write successful	Read / write failed

Navigation window options

Menu Selection	Description	Options
File	Load and save custom application settings	Load / Save current setting Load Application setting
View	Adjust view settings, access options menu	Toolbar Status bar Options
Help	Access Help file & display GosHawk version info	Help About
Connect	Attempts to open communication or terminate communication with unit	Connect Disconnect
DeviceID	Select DeviceID (if using comms networked units with unique IDs assigned	Adjustable via Client Information in 'Options' menu
Setup	When connected the setup menus will be listed under the arrow button to the right	Info Screen Quick Set Output Adjust Advanced
Diag	When connected this opens the Diagnostic window where you can view live echo profiles and operational diagnostics and measurements.	
NetView	If you have multiple Hawk units connected to a single network you can view the basic measurement	
Flash	For updating unit software. This button is locked	
Report	This button can generate a PDF report of the current settings & serial numbers of the unit or view the settings of a stored report.	Preview current setup Preview stored setup

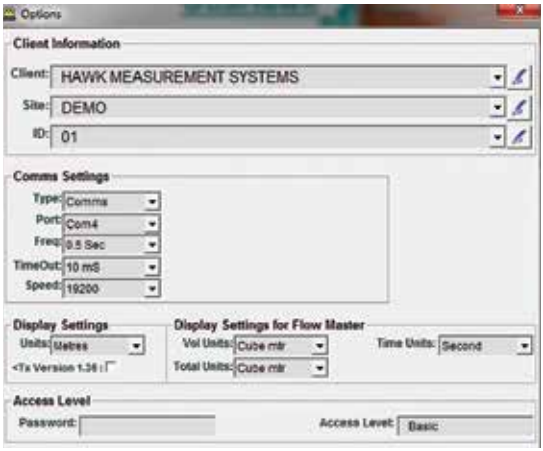
Options Screen - Setting up Direct Connection (HAWKLink USB)

Use the ‘write button to add/edit client, site and device ID.

HAWKLink USB connection (Modbus)

Type:	Comms
Port	PC dependant
Frequency & Timeout	does not need to be adjusted
Speed	19200 (Required for HAWKLink-USB with Modbus.

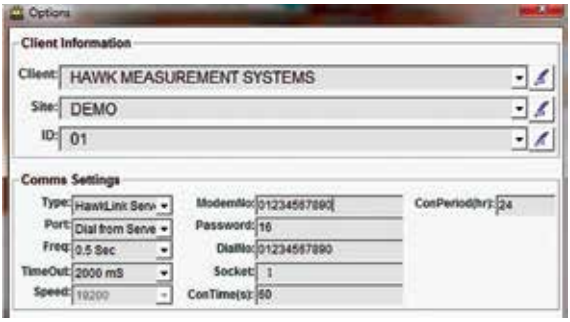
You can adjust the unit display calculation from metres to feet if required



For HART connection

Type	HART comms
Port	PC dependant
Freq & Timeout	2 seconds
Speed	1200

Setting up Remote Connection (HAWKLink HLR Modem)



Type	HAWKLink Server
Port	Dial From Server
Freq	does not need to be adjusted
Timeout	1500-3000 (time out delay for querying. Slow connections will need a slower time
ModemNo	ModemNo - must match number programmed in modem software
Password	Modem password - default 16
DialNo	Sim card dial number
Socket	Default 1 (network port 1000). You may need to unblock this port. socket 2 = port 2000 and socket 3 = port 25
ConTime	Length of connection before auto-disconnect. A count down will appear when this time approaches which can be over ridden by the user

Info Screen

The **Info Screen** appears after a successful connection is established. This displays basic unit information including model types, software version and serial numbers.

	Description
Serial No	Amplifier serial number
SoftVer	Amplifier software revision
Modbus ID	Amplifier Modbus ID
Probe Serial No	Amplifier serial number
Probe Model	Probe Model type (remote, integral, smart)
Probe SoftVer	Probe software revision
Probe ModbusID	Probe Modbus ID

Hawk
TDR
234 Wire
Remote
Cable diameter is 4mm

QuickSet

The **Quickset** menu contains the basic parameters required to get the unit up and running. It is one of the three main menu options in the internal software.

Parameter	Description	Options
Low Level	Set Low Level (4mA) distance	Adjustable
Hi Level	Set High Level (20mA) distance	Adjustable
FailSafe	Set Analogue failsafe output.	20mA 4mA LastKnown 20.20mA 3.50mA
FailTime	Set countdown for failsafe (seconds)	Adjustable
Fill Speed	Adjust process fill speeds	View Fast (200m/h) Med (50m/h) Slow (5m/h) Custom (user selected speed)
Fill Damp	This value damps the measured output. Increase to create smoother trends during filling	Adjustable
Empty Speed	Adjust process empty speeds	View Fast (200m/h) Med (50m/h) Slow (5m/h) Custom (user selected speed)
Empty Damp	This value damps the measured output. Increase to create smoother trends during emptying	Adjustable
DispMode	Select default Display mode	Space Material Material%
Lock Code	Adjust default unlock code (default 0)	0-200

Output Adjustment

The **Output Adj** menu contains parameters related to adjusting analogue, switch & communication protocol relayed settings.

Parameter	Description	Options
Analog	Invert analogue from 4-20mA to 20-4mA	4-20mA 20-4mA
Simulate	A simulated distance reading is transmitted as analogue (distance measured from sensor face)	Adjustable
Comm Type	Adjust communication protocol settings. Standard Analogue and Switch models include Modbus as default.	Modbus HART Profibus (DP) DeviceNet FF/PA
RlyMod 1-5	Configure Relay actions	De-energize Energize Failsafe Off

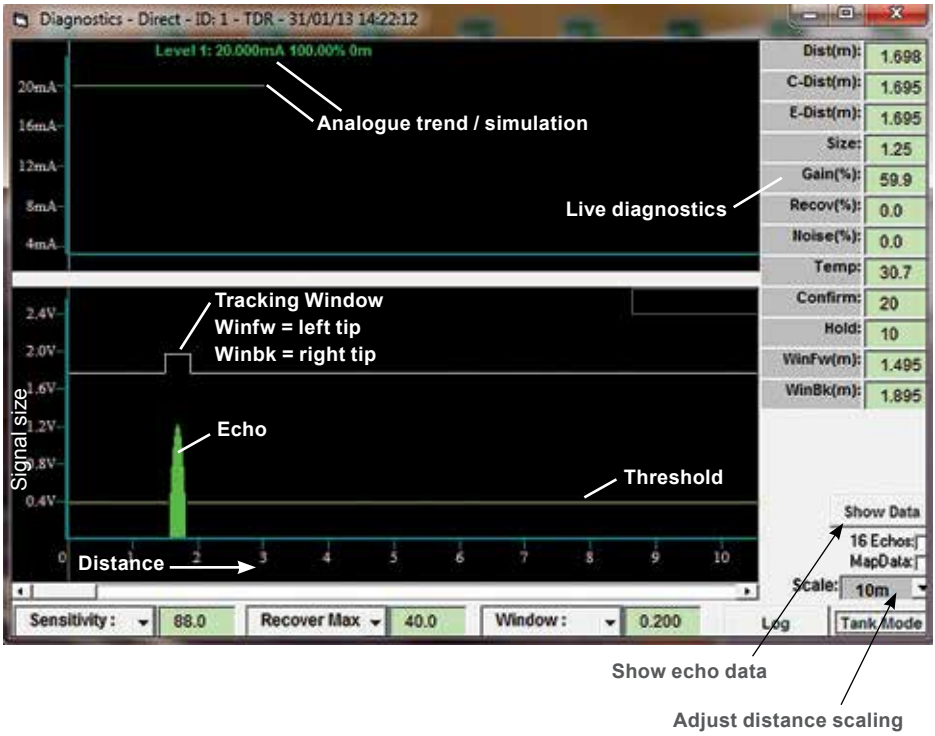
Advanced Setup

Advanced parameters are for adjusting primary Sensitivity, echo controls/filters and running auto calibration routines as well as factory resets.

Parameter	Description	Options
Dielectric	Auto-set Sensitivity based on approximate Dielectric of material to be measured. (see Setup Procedure B)	>40 (Sensitivity autoset: 39.9%) >20 (Sensitivity autoset: 49.9%) >10 (Sensitivity autoset: 59.9%) >5 (Sensitivity autoset: 75.0%) >3 (Sensitivity autoset: 87.9%) =<3 (Sensitivity autoset: 97.9%)
Digitize TDR	Perform auto-Digitization of Sensitivity based on mounting and Dielectric of material touching the probe (see Setup Procedure A)	Click button
Cal Mount	Performs a digital mapping routine of a user selected span. Used when there is signal interference at high level or mounting. Use CalSnstvty to adjust bias (sensitivity) of mapped range *Note: If you wish to disable or remove a Cal Mount you must perform a Probe Reset.*	Click button
CalSnstvty	Increase or decrease the probe sensitivity for the range specified during Cal Mount	Adjustable
Gain	Increase or decrease the amplification of the signal detected by the Sensitivity routines and adjustments. This setting typically does not require adjustment.	Adjustable (Default 58.8%)
Sensitivity	Manual adjustment of Sensitivity. This value will also be automatically adjusted by other calibration routines. Sensitivity is the primary adjustment for the units ability to detect media (see Setup Procedure C)	Adjustable
Sens Max	Adjust the peak Sensitivity cap. This value will be automatically adjusted by other calibration routines	Adjustable
EchoSize	EchoSize is the target Echo Signal size the unit is attempting to maintain. Any signal which is detected by the Sensitivity setting will be either full signal (2.5V) or less. If the signal detected by Sensitivity is less than EchoSize the unit uses Gain to amplify the signal to the EchoSize.	Adjustable (default 1.0V)
Thrshold	Threshold is a filter which tells the unit to ignore any echoes of a Signal size less than this value. This can be used as part of troubleshooting (see Troubleshooting: False echo elimination)	Adjustable (default 0.39V)
Blanking	Blanking is a non-measurable zone. This can be increased to 'Blank' out high level false echoes caused by mounting.	Adjustable (default 0.280m)
ProbeReset	Restores Probe settings back to factory default. Most probe settings are in the 'Adv Setup' menu.	Click button
Amp Reset	Restores the Amplifier settings back to factory default. Most Amplifier settings are in 'Quickset' and 'Output Adj' menus.	Yes/No
Temp Trim Dist Trim	These are factory settings and should not be adjusted	

Diagnostics

Note: The 'Diagnostics' window must be live (actively selected) in order to view updates



Diagnostics

Note: the size of the Tracking window is directly affected by the fill and empty speeds selected in Quickset.

Live Diagnostic	Typical Reading	Description
Dist	Distance after damping	Distance is read measured down to level of material. This value will match the converted data outputted from analogue/comms
C-Dist	Distance confirmed	Confirmed distance is the measurement the unit has accepted as the correct level with no damping applied. If there is a sudden change in distance (level outside of the tracking window) the unit will run through a hold/scan routine before 'confirming' the new distance
E-Dist	'Live' pulse by pulse distance	This is the pulse by pulse distance with no damping applied
Size	2.0	Signal size (V)
Gain(%)	60%	Gain amplifies the signal size of an echo which has passed the primary Sensitivity filters
Recov(%)	0.00%	Recover Gain is applied to the unit to increase the signal size to the EchoSize parameter if there is not enough Gain
Noise(%)	0.0%	Noise is an electrical or signal interference which can affect the amount of Gain% available
Temp	2.49V	Temperature measured at probe
Confirm	20	Confirm counter - when the unit has a good consistent signal this value will be full (20). If there signal is intermittent or the unit is moving to a new target this will count down to 0
Hold	10	Hold counter - when there is no echo inside the tracking window or there is a closer echo the unit will count down this hold time before expanding the size of its tracking window to find the new echo
WinFw	Distance	'Front' (close) tip of the tracking window
WinBk	Distance	'End' (far) tip of the tracking window

Setup Procedure

Sensitivity Calibration

Procedure A: Running **Digitize TDR** while material is touching the probe.

- Digitize uses automatic procedure for sensitivity adjustment & mapping to calibrate the system based on the dielectric of the material touching the probe element and the mounting conditions.
- This is the recommended calibration procedure for fastest and most accurate unit setup.
- '**Digitize TDR**' is located in the Advanced Setup menu. Click the button to begin Digitization process.

The toolbar will display the progress of the digitization.

Reading of TDR digitized data - time remains

- After digitization process is complete the toolbar will display.

Digitizing was successful

- In the Advanced menu you can click 'Read all Parameters' to view the automatically adjusted **Sensitivity** setting.
- Click on the '**Diagnostics**' window to view the live echoes to confirm the distance is correct.

Procedure B: Using dielectric pre-sets

- '**Dielectric'** pre-sets are located in the Advanced Setup menu.
- Click on the '**Dielectric**' drop menu box and select the closest dielectric to your application requirement.
- This will automatically set '**Sensitivity**' to a pre-set. You can manually increase or disappears Sensitivity as required in addition to the Dielectric pre-set.
- Click on the '**Diagnostics**' window to view the live echoes to confirm the distance is correct.
- If you are tracking an incorrect distance continue to reduce Sensitivity until this echo disappears - then unit will go through a scan process of the entire cable and will eventually lock to the next best echo.

Procedure C: Manual Sensitivity Adjustment

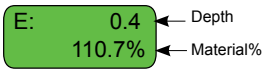
- '**Sensitivity'** parameter is located in the Advanced Setup menu.
- Increase or disappears this value.
- Click on the '**Diagnostics**' window to view the live echoes to confirm the distance is correct.
- If you are tracking an incorrect distance continue to reduce Sensitivity until this echo disappears - then unit will go through a scan process of the entire cable and will eventually lock to the next best echo.
- '**Sensitivity**' will not exceed '**Sens Max**' (this can be increased).

False Echo Elimination

Before conducting these steps it is recommended to perform Setup Procedure: Sensitivity Adjustment Procedure A and ensure mounting requirements are met. Some of the procedures below are performed automatically by the routine.

1a. Sourcing false echo distance (high level lock)

While the unit is operating and locked onto a false echo you can scroll through diagnostics using the arrow keys on the keypad. The top line of the display will change but the bottom line will continue to indicate the standard display mode measurement (such as Space or Material%)



Press the UP arrow until the 'E:' diagnostic is displayed. This indicates the depth of the false reading.

1b. Identify signal size of false echo

Press the UP arrow again until the 'S:' diagnostic is displayed on the top line. This indicates the signal size of the echo the unit is measuring (this will be between 0.4V and 2.5V).

2. Eliminating false echo

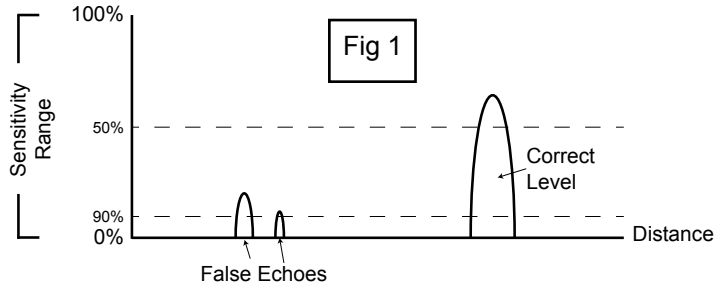
There are three primary methods of echo elimination.

2-1. Cal Mount:

- If you cannot perform **Sensitivity Adjustment Procedure A** you can manually perform part of this procedure via '**Cal Mount**' in '**Adv Setup'**. You will be prompted to enter the '**Cal Start**' and '**Cal End**' distance. You should enter a distance safely closer and deeper than the false echo. You should not enter a value longer than the probe.
- If the material in the vessel is touching the probe ensure the '**Cal Mount**' does not pass this depth. The parameter '**CalSnstvty**' in '**Adv Setup**' can be used to increase or decrease the uniform sensitivity of the '**Cal Mount**' span.
- After the **Cal Mount** is complete press **RUN** several times to return to unit operation. The unit will then begin to scan deeper down the length of the cable to find the next valid echo.

2-2. Reduce Sensitivity:

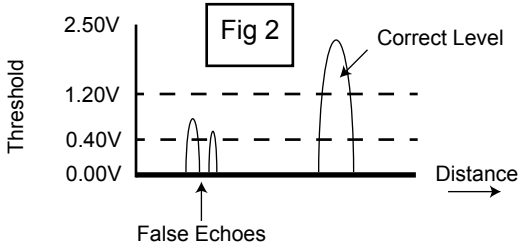
- Enter the '**Adv Setup**' menu and scroll until you see '**Sensitivity**' parameter.
- Press **CAL** to edit. Use the **DOWN** arrow to reduce this value.
- Pressing **CAL** will fire a test pulse and return the diagnostic data of the Signal size and E: distance. Fire several test pulses for a good sample size.
- Reduce this value until the unit is no longer displaying the false echo while firing test pulses.
- Press **RUN** to save and **RUN** again to return the unit to operating mode.
- The unit will then begin to scan deeper down the length of the cable to find the next valid echo.



In Fig 1 you can see at 90% Sensitivity both false echoes and the correct level are considered valid targets by the unit. At 50% Sensitivity the only echo the unit will see is the correct level

2-3. Increase Threshold & Echo Size:

- The Threshold is the minimum Signal size the unit will consider to be a real echo.
- If the Signal size of the false echo is less than 2.0V you can increase the Threshold beyond the Signal size (ideally do not exceed Threshold value of 2.0V) of the false echo to eliminate it as a target.
- Threshold is located in the 'Adv Menu'. After increasing this it is also recommended to increase 'Echo Size' (also Adv Menu) to a value higher than Threshold.
- In all but very low dielectric applications the unit will measure the material which touches the sensing element as a larger echo than reflections from mounting.



In Fig 2 you can see a representation of false echoes passing the Threshold at 0.40V, but after lifting the Threshold to 1.40V only the correct signal is accepted as a valid reading.

3. Blanking & Span adjustment

- If the previous steps are unable to solve a high level lock up there will be a significant signal interference. Visually examine within the vessel for any objects near or touching the sensing element.
- Extend Blanking beyond the depth of the false echo and adjust High level so it is not within the blanked distance.
- Perform a 15 second power cycle, the unit will re-scan for the closest signal which beyond the Blanking distance.
- Attempt to perform Setup **Procedure A**, **B** or **C** if the unit does not locate the correct distance with the false echoes blanked out.

Unit is reading deeper than actual level

This may occur in low dielectric applications where the cable weight returns a stronger echo than the measured material.

If you have used any other parameters such as '**Cal Mount**' perform a Probe Reset.

Increase Sensitivity:

- Enter the '**Adv Setup**' menu and scroll until you see '**Sensitivity**' parameter.
- Press **CAL** to edit. Use the **UP** arrow to increase this value.
- Pressing **CAL** will fire a test pulse and return the diagnostic data of the Signal size and E: distance.
- Fire several test pulses for a good sample size.
- Increase this value until the unit is returning a strong (2-2.5V) Signal size from the false echo.
- Press **RUN** to save and **RUN** again to return the unit to operating mode.
- Perform a 15 second power cycle - when the unit re-starts it will begin a new scan over the entire probe to find the closest echo which passes the Threshold value.

Unit is measuring deeper than the length of the cable

- Press **CAL** and enter **Unlock Code 196** and press **CAL**.
- Scroll through the main menus to locate '**FactoryTDR**' menu.
- Press **CAL** to enter this menu.
- Scroll down to locate the '**EmptDist**' parameter.
- This should be the length of the cable by factory default. If not, reduce this value to the correct length with a small additional margin (+250mm/12"). **DO NOT ADJUST ANY OTHER PARAMETERS IN THIS MENU.**
- Perform a 15 second power cycle - when the unit re-starts it will begin a new scan over the entire probe to find the closest echo which passes the Threshold value.

False Echo Elimination

Before conducting these steps it is recommended to perform Setup Procedure: Sensitivity Adjustment Procedure A and ensure mounting requirements are met.

1. Sourcing false echo distance

- Load the '**Diagnostics**' window. See '**GosHawkII Diagnostics'** for explanation & details of the visible Diagnostics.
- The false echo will be visible - If it is not near the high level you may need to adjust the scaling until it is visible.
- For a precise reading of the distance of the echo press the '**show data**' button. This will tell you the start and end point of the false echo as well as the signal size.

2. Eliminating false echo

There are three primary methods of echo elimination.

2-1. Cal Mount:

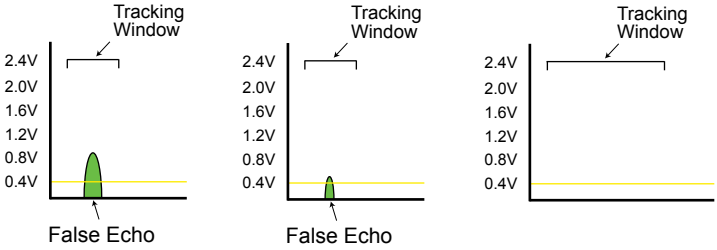
- If you cannot perform **Sensitivity Adjustment Procedure A** you can manually perform part of this procedure via **'Cal Mount'** button in 'Adv Setup'. After clicking the button you will be prompted to enter:
  Cal Start
  Cal End
- You will be prompted to confirm to run **Cal Mount**. After selecting '**Yes**' the unit will perform its routine.
- When complete you have created a digital map of the selected span - this span has a unique uniform Sensitivity adjustment labeled '**CalMntSens**'. Reduce this % value until the false high level echo has disappeared.
- After this the unit will go through its scan routine to locate the next echo (typically the cable weight). *Note that if you have material touching the probe you should perform Setup Procedure A.*

2-2. Reduce Sensitivity:

- In the **'Advanced Setup'** menu you can manually adjust the Sensitivity% value. This is the primary adjustment of the unit. Reduce this % in increments of several percent at one time until the false echo disappears from the diagnostic.
  Note that you must click on the Diagnostic window (it must be selected/active to view the live echoes).
- After this the unit will go through its scan routine to locate the next echo (typically the cable weight). *Note that if you have material touching the probe you should perform Setup Procedure A.*

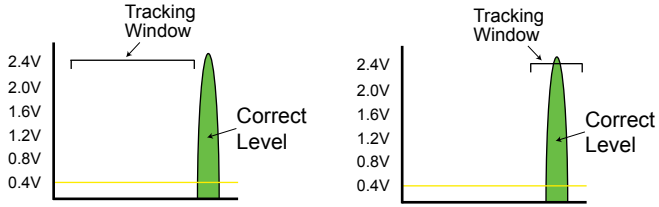
See Fig3 for illustrated simulation of reducing Sensitivity

Fig 3



Reducing Sensitivity incrementally - false echo becomes smaller then disappears.

Unit begins its scanning routine which includes expanding the Tracking Window



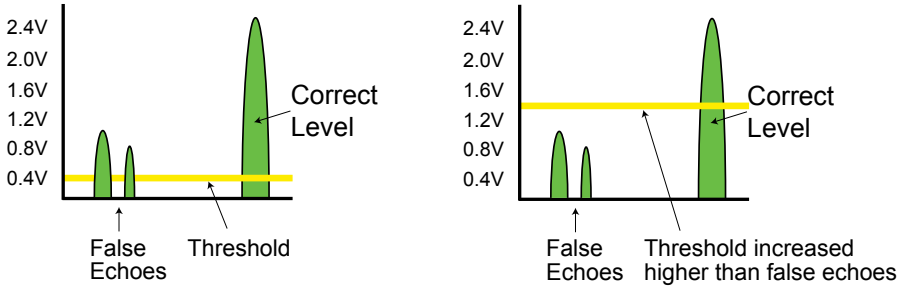
When the Window approaches the correct level the echo will be detected by the scan

The Window 'locks' onto the new echo and restores itself to the default width. The unit will adjust the measurement output based on the new level.

2-3. Increase Threshold & Echo Size:

- The **Threshold** is the minimum **Signal** size the unit will consider to be a real echo.
- If the **Signal** size of the false echo is not too large (less than 2.0V), you can increase the **Threshold** beyond the Signal size (ideally do not exceed Threshold value of 2.0V) of the false echo to eliminate it as a valid target.
- Increase '**Echo Size**' (also **Adv Menu**) to a value higher than **Threshold**.
- In all but very low dielectric applications the unit will measure the material which touches the sensing element as a larger echo than reflections from mounting - typically >2.0V. Echo size instructs the unit to amplify the signal to the value selected.

Fig 4



In Fig 4 you can see a representation of false echoes passing the Threshold at 0.40V, but after lifting the Threshold to 1.40V only the correct signal is accepted as a valid reading.

3. Blanking & Span adjustment

- If the previous steps are unable to solve a high level lock up there will be a significant signal interference.
- Extend Blanking distance beyond the distance of the false echo and adjust High level so it is not within the blanked distance.
- Re-start the Amplifier.
- The unit will re-scan the cable excluding the Blanking distance.
- **You can now attempt the Digitize routine.**

CommErr1

- Unit has lost communication to the probe and is attempting to re-connect.
- After the Fail Time has counted down the unit will enter Failsafe and then display **Error 01.**

Error 01

- Unit cannot communicate with probe. Check wiring for the following specs.
- Check the red/black labeled terminals for voltage (9-10VDC). If using a junction box or cable extension ensure the voltage is tracked to the correct terminals on remote probe. If this voltage is low, disconnect the probe wires and check the terminals again. If this restores voltage to 9-10VDC this indicates the probe/wiring has a fault.
- Measure the resistance between the following wires. Anything significant different to the below indicates a problem with the wiring or probe:

  Blue/White 33kOhm
  Blue/Black 16kOhm
  White/Black 16kOhm
  Red/Black high resistance / overload

- There should be no open circuits.

Error 02

- Unit can communicate with the probe but is not / cannot receive data correctly.
- Check the resistances and voltage between the wires as per the above **Error 01** procedure

Error 03

- A Specific comms mode is selected (eg Profibus, FF) but comms module is not connected or responding
- Check your unit part number on the sticker to ensure it has correct comms
- If you do not have additional comms (part number option X) then select Modbus.

Error 04

- Amplifier is programmed with incorrect/old software or has wrong hardware connected.
- Contact your local support.

Material	Dielectric Constant
Acetal	3.6
Acetic Acid	6.1
Acetone	17.7
Acetyl Acetone	23.1
Acetyl Bromide	16.5
Allyl Alcohol	21.0
Allyl Bromide	7.0
Allyl Choloride	8.2
Allyl Iodide	6.1
Ammonia	15.5
Amyl Alcohol	11.2
Amyl Bromide	6.3
Amyl Choloride	6.6
Amyl Ether	3.1
Amyl Iodide	6.9
Amyl Nitrate	9.1
Arsenic Tribromide	9.0
Arsenic Trichloride	12.4
Arsenic Triiodide	7.0
Asphalt	2.65
Benzene	2.3
Benzil	13.0
Benzoyl Chloride	22.1
Benzyl Alcohol	13.0
Benzyl Chloride	6.4
Boron Bromide	2.6
Bromine	3.1
Butane	1.4
Butyl Chloride	9.6
N Butyl Iodide	6.1
Iso Butyl Iodide	5.8
Cable Oil	2.2
Camphene	2.7
Carbon Dioxide	1.6
Carbon Disulphide	2.6
Carbon Tetrachloride	2.2

Material	Dielectric Constant
Castor Oil	2.6
Camphene	2.3
Cement	2.1
Chloracetic acid	12.3
Chlorine	2.0
Chloroform	5.5
Creosol	10.6
Cyclohexane	2.0
Deuterium	1.3
Deuterium Oxide	78.3
Dichloracetone	14.0
Dichlorobenzene	2.8
Dichloroethane	16.7
Diethyl Sulfide	7.2
Dimethyl Ethyl	11.7
Dimethyl Sulfide	6.3
Dimethyl Sulfate	55.0
Dowtherm	3.3
Ethanol	24.3
Ethyl Acetate	6.4
Ethyl Amyl Ether	4.0
Ethyl Benzene	2.5
Ethyl Benzoate	6.0
Ethyl Cyclobutane	1.9
Ethylene Chloride	10.5
Ethylene Cyanide	58.3
Ethylene Glycol	37.0
Ethylene Oxide	13.9
Ethyl Iodide	7.4
Ethyl Nitrate	19.7
Ethyl Silicate	4.1
Fly Ash	2.6
Formic Acid	58.5
Freon 12	2.4
Freon 11	3.1
Freon 113	2.6

Material	Dielectric Constant
Glycerine	47.0
Glycerol	43.0
Glycol	35.6
Heptane	1.9
Heptanoic Acid	2.5
Hexane	1.9
Hydrogen Bromide	3.8
Hydrogen Chloride	4.6
Hydrogen Cyanide	95.4
Hydrogen Fluoride	84.0
Hydrogen Iodide	2.9
Hydrogen Peroxide	84.2
Hydrogen Sulfide	5.8
Hydrazine	52.9
Iodine	118.0
Isobutyl Alcohol	18.7
Kerosene	1.8
Lead Oleate	3.2
Lonone	10.0
Menthol	3.95
Mesityl Oxide	15.4
Methanol	33.6
Methyl Alcohol	33.0
Methyl Ether	5.0
Methyl Ether Ketone	18.4
Mineral Oil	2.1
Nephthyl Ethyl Ether	3.2
Nitroethane	19.7
Nitromethane	39.4
Octane	1.96
Octyl Alcohol	3.4
Octylene	4.1
Oleic Acid	2.46
Oil, Oiive	3.1
Oil, Peanut	2.2
Oil, Transformer	2.2

Material	Dielectric Constant
Palmitic Acid	2.3
Pentane	1.8
Phenol	9.9
Phenol Acetate	6.9
Phosgene	4.7
Phosphorus	4.1
Polyethylene chips	1.3
Polyethylene powder	1.4
Propyl Acetate	6.3
Propyl Alcohol	21.8
Propyl Benezene	2.4
Pyridine	12.5
Reburned Lime	2.2
Sand (Dry)	4.8
Sodium Chloride	6.1
Sodium Oleate	2.7
Succinic Acid	2.4
Sodium Chloride	6.1
Sulphur	3.4
Sulphur Dioxide	17.6
Sulfuryl Chloride	10.0
Sulphur Trioxide	3.6
Teflon Powder	1.3
Teterabromiethane	7.1
Thionyl Bromide	9.1
Thionyl Chloride	9.3
Titanium Tetrachloride	2.8
Toluene	2.4
Trichloroxoluene	6.9
Trimetylbenzene	2.2
Trimethyl Borate	8.2
Urethane	3.2
Valeric Acid	2.6
Vinyl Ether	3.9
Water	80.0
Xylene	2.4

Remote Electronics

Model

AWR2 Remote 2 Wire Amplifier, No relays, 24VDC only

AWR234 Remote 2/3/4 Wire Amplifier, 5 relays

Housing

S Polycarbonate

Power Supply

B 12-30VDC

C 30-48VDC and 48-90VAC (234 units only)

U 12-30VDC and 90-260VAC (234 units only)

Additional Communications (Modbus & PC comms GosHawk standard)

S Switch, 5 relays (AWR234 only)

X 4-20mA analogue

H 4-20mA analogue with HART 2 wire (AWR2 only)

I 4-20mA analogue with HART Isolated 4 wire (AWR234 only)

W Modbus

P Profibus DP (AWR234 only)

A Profibus PA

F Foundation Fieldbus

D DeviceNet (AWR234 only)

Internal HAWKLink Modem

X Not available

Approval Standard

X Not Required

A 22 ATEX Grp II Cat 3 GD T75°C IP67 Tamb -40°C to 65°C

Additional Software

X Not Required

AWR234	S	U	X	X	X	X

Remote Probe

TDRR Remote TDR Probe

Housing

S Mild Steel

Process Temperature

1 80ºC (176 ºf)

Probe Type

1 4mm stainless steel cable non insulated with weight

2 8mm cable non insulated with weight

Mounting

TN15	1.5” NPT Thread
TB15	1.5” BSP Thread
FA2	2” Flange ANSI (Class 150)
FD2	2” Flange DN 50 PN 40
FA4	4” ANSI
FD4	DN100

Approval Standard

X	Not Required
A22	ATEX Grp II Cat 3 GD T75°C IP67 Tamb -40°C to 65°C

Probe/Cable Length

C100	100 cm (3’3”) flexible cable
C200	200 cm (6’7”) flexible cable
C300	300 cm (9’10”) flexible cable
C500	500 cm (16’5”) flexible cable
C1000	1000 cm (12’11”) flexible cable
C2000	2000cm (32’10”) flexible cable

TDRR	S	1	1	FA2	X	C500

Integral System

Model

TDRI2 Integral 2 wire TDR System
TDRI234 Integral 234 wire TDR System

Housing

S Valox 357U

Power Supply

B 12-30VDC
U 12-30VDC and 90-260VAC (234 units only)

Process Temperature

1 80°C (176 °f)

Probe Type

1 4mm stainless steel cable
2 8mm stainless steel cable

Mounting

TN15 1.5” NPT Thread
TB15 1.5” BSP Thread
FA2 2” Flange ANSI (Class 150)
FD2 2” Flange DN 50 PN 40
FA4 4” ANSI
FD4 DN 100

Additional Communication (Modbus & PC comms GosHawk standard)

S Switch, 2 relays (TDRI234 only)
X 4-20mA analog output module
H 4-20mA analogue with HART 2 wire (TDRI2 only)
I 4-20mA analogue with HART Isolated 4 wire (TDRI234 only)
A Profibus PA
F Foundation Fieldbus

Approval Standard

X Standard CE Approved
A22 ATEX Grp II Cat 3 GD T75°C IP67 Tamb -40°C to 65°C

Probe/Cable Length

C100 100 cm (3’3”) flexible cable
C200 200 cm (6’7”) flexible cable
C300 300 cm (9’10”) flexible cable
C500 500 cm (16’5”) flexible cable
C1000 1000 cm (12’11”) flexible cable
C2000 2000 cm (32’10”) flexible cable

TDRI234	**S**	**U**	**1**	**1**	**FA2**	**X**	**X**	**C500**

Smart System

Model

TDRS2 SMART 2 wire TDR Probe (Time Domain Reflectometry), 4-20mA with HART, no display

TDRS234 SMART 4 wire TDR Probe (Time Domain Reflectometry), 4-20mA with Modbus, no display

Housing

S Mild Steel

Power Supply

B 12-30VDC (TDRS234) or 240VDC (TDRS2)

Process Temperature

1 80°C (176 °f)

Probe Type

1 4mm stainless steel cable

2 8mm stainless steel cable

Mounting

TN15 1.5” NPT Thread

TB15 1.5” BSP Thread

FA2 2” Flange ANSI (Class 150)

FD2 2” Flange DN 50 PN 40

FA4 4” ANSI

FD4 DN 100

Additional Communication (Modbus & PC comms GosHawk standard)

H 4-20mA analogue with HART 2 wire

X 4-20mA analogue with Modbus

Approval Standard

X Standard CE Approved

A22 ATEX Grp II Cat 3 GD T75°C IP67 Tamb -40°C to 65°C

Probe/Cable Length

C100 100 cm (3’3”) flexible cable

C200 200 cm (6’7”) flexible cable

C300 300 cm (9’10”) flexible cable

C500 500 cm (16’5”) flexible cable

C1000 1000 cm (12’11”) flexible cable

C2000 2000 cm (32’10”) flexible cable

TDRS2	S	B	1	1	FA2	X	X	C500

Operating Voltage - 3,4 wire

- 12 – 30VDC (residual ripple no greater than 100mV)
- 90 – 265VAC 50/60Hz (remote, integral)
- 48Vdc, 48VAC – 90VAC 50/60Hz (remote, integral)

Operating Voltage - 2 wire & Smart

- 14 – 30VDC (residual ripple no greater than 100mV)
- HART 24VDC @ 250 Ohm

Power Consumption - 3,4 wire

- <3W @ 24VDC
- <10VA @ 240VAC (remote, integral)
- <4W @ 48VDC, 7VA @Vac-90VAC (remote, integral)

Power Consumption - 2 wire & Smart

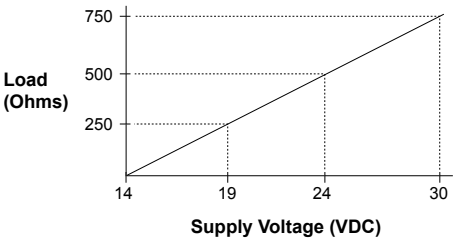
- <0.5W @ 24VDC

Analog Output 3,4 wire

- 4 – 20mA (750 Ohm@ 24VDC User Voltage supply) or Internal driven 250 Ohm

Analog Output 2 wire & Smart

- 14V @ 0 Ohm
- 19V @ 250 Ohm
- 24V @ 500 Ohm



Communications

- GosHawk, HART, Modbus, Profibus DP, DeviceNet, Foundation Fieldbus, Profibus PA.
- Multidrop mode can address 1-250 units over 4 wires

Relay Output

- (2 Relays Integral) (5 Relays Remote)
- Form 'C' SPDT contacts, rated 0.5A @ 240VAC non-inductive
- All relays have independently adjustable dead bands

Maximum Range

- 35m cable

Dielectric Range

- > = 1.4

Instrument Extension Cable

- 4 conductor shielded twisted pair instrument cable.
- Conductor size dependent on cable length
- BELDEN 3084A Max = 500m (1640 ft)

Memory

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

Measurement Range of Electronics

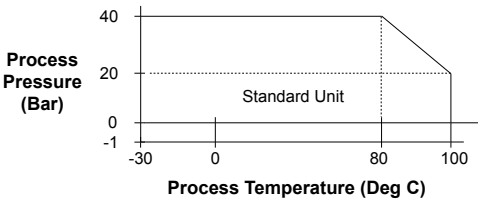
- Min 350mm
- Max 35m

Operating Temperature

- -20°C to + 80°C (Smart)
- -20°C to + 65°C (Integral)
- -20°C to + 65°C (Remote Amplifier)
- -20°C to + 80°C (Remote Probe)

Process Pressure

- -1 to 40 BAR



Display

- Integral / Remote 3, 4 wire units: 2 line x 12 digit alphanumeric LCD with back light.
- Integral / Remote 2 wire units: 2 line x 12 digit alphanumeric LCD
- Smart unit: No displays.

Enclosure Sealing

- Remote Transmitter IP65
- Integral Transmitter IP66
- Smart Transmitter IP67
- Remote Probe IP67

Approvals

- ATEX Grp II Cat 3 GD T75°C IP67 Tamb -40°C to 65°C

Weight

- Enclosure
- Smart & Remote probe: Aluminum Housing with cable gland entry.
- Sultan Integral housing with Aluminum Housing
- Remote Sultan Enclosure (remote amplifier)

Tensile Load

- 4 tonnes at 23°C, 8mm cable
- 3 tonnes at 80°C, 8mm cable

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