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Subject to technical change.

We assume no liability for typing errors.



Scope of the manual / Fast start-up

Scope of the manual

This manual describes programming and start-up of all Nivowave units using the push buttons and the display on the unit. It does not show the programming with the Nivowave PC software.

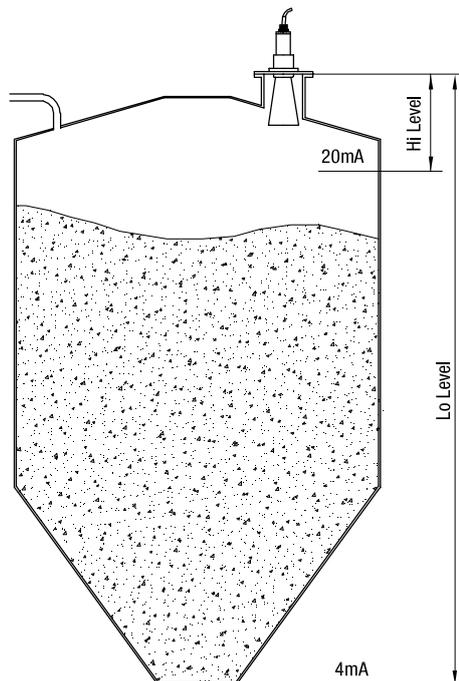
Fast start-up overview

The "Fast start-up" instructions enable a fast and correct set-up of the unit for normal applications.

The start-up sequence, which is described in the following table, results in the standard setting, as follows:

- Nivowave software adjusted to the silo and material requirements.
- 4-20mA output as shown in the drawing
- All relays off

If other output settings are required, they can be adjusted in the "Output adjustment menu".



Fast start-up sequence

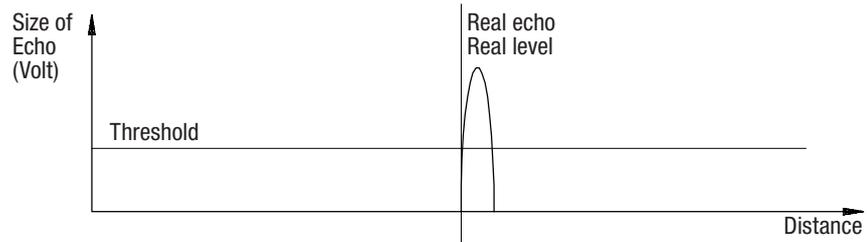
Step		Action	Parameters to set	See page
1	Power on			
2	Set starting parameters	Enter in Main menu	-	4
		Enter in Quickset menu		4
		Set parameters	Unit	5 / 6
			Lo Level	5 / 6
			Hi Level	5 / 6
			Application Type	5 / 7
			Fill rate	5 / 7
			Empty rate	5 / 7
			Display mode	5 / 7
3	Run the measurement	Press button twice	-	
			Parameters to check	See page
4	Check echo situation with diagnostic values	Press button (maybe several times)	E: (Echo distance)	22
			S: (Size of Echo)	22
5	Optimize echo situation	See possible 4 situations on next page		

Fast start-up

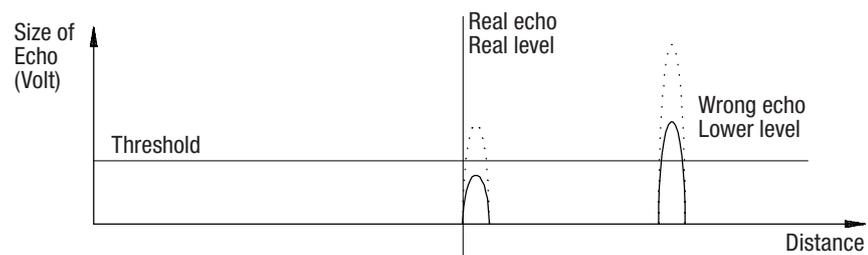
The system will always accept the first echo, which is larger than the Threshold. Four possible situations can arise. The "Gain" value can be adjusted according to the situation. Solid lines show echo situation before "Gain" correction, the dotted lines show after "Gain" parameter correction.

Note: If the stated "Necessary Action" DON'T lead to success, please contact your local supplier.

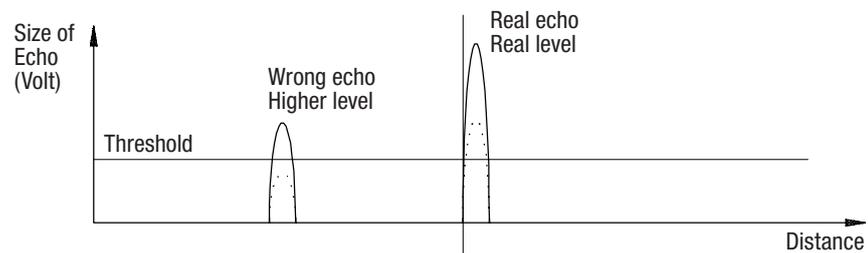
Situation 1	Diagnostic values show:	Necessary Action
	E: Echo distance shows real level S: Size of echo is >0,9V	No action needed



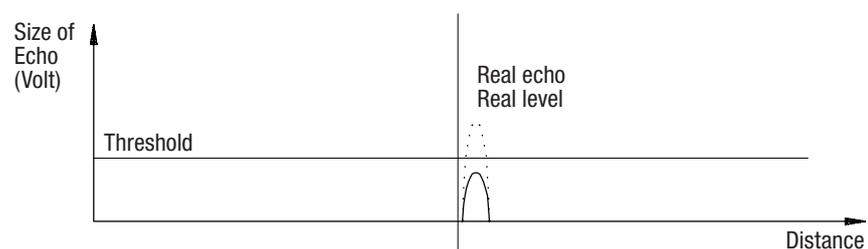
Situation 2	Diagnostic values show:	Necessary Action	See page
	E: Echo distance shows lower level than real level	Increase "Gain" parameter (TX Setup Menu), until the "E:" value shows the right level and the "S:" value is >0.9V	4 / 11 / 12



Situation 3	Diagnostic values show:	Necessary Action	See page
	E: Echo distance shows higher level than real level	Decrease "Gain" parameter (TX Setup Menu), until the "E:" value shows the right level and the "S:" value is >0.9V	4 / 11 / 12



Situation 4	Diagnostic values show:	Necessary Action	See page
	E: No Echo distance is shown	Increase "Gain" parameter (TX Setup Menu), until the "E:" value shows the right level and the "S:" value is >0.9V	4 / 11 / 12



Fast start-up

Programming Buttons

All software adjustments are carried out using the four push buttons on the front panel of the unit.



- (A) Press and hold - interrupts normal operations and allows access to menus. Changes headings and allows EDIT function to occur.
- (B) Saves selected value.
- Press and hold – scrolls through menus and parameters.



- (A) Increases displayed value.
- (B) Scrolls up in menus.



- (A) Decreases displayed value.
- (B) Scrolls down in menus.



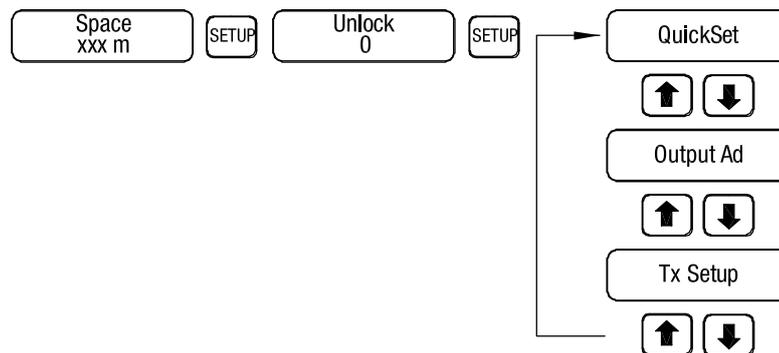
- (A) Only used when selections are finished.
- (B) Stores the current values in memory, and checks the validity of the software selections, then returns to normal operation (measurement operation)..

Fast start-up Main menu

If the unit is working in normal operation (measurement operation), the SETUP button brings up the Main menu. After pressing SETUP "Unlock 0" is displayed on the LCD.

Unlock

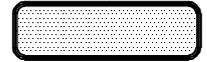
The code, which was set in the Quickset menu (Lock Code) is the access code for the main menu. The factory default is 0. If the code has been forgotten, see comments on page 7. Use the arrow buttons to select the access code.



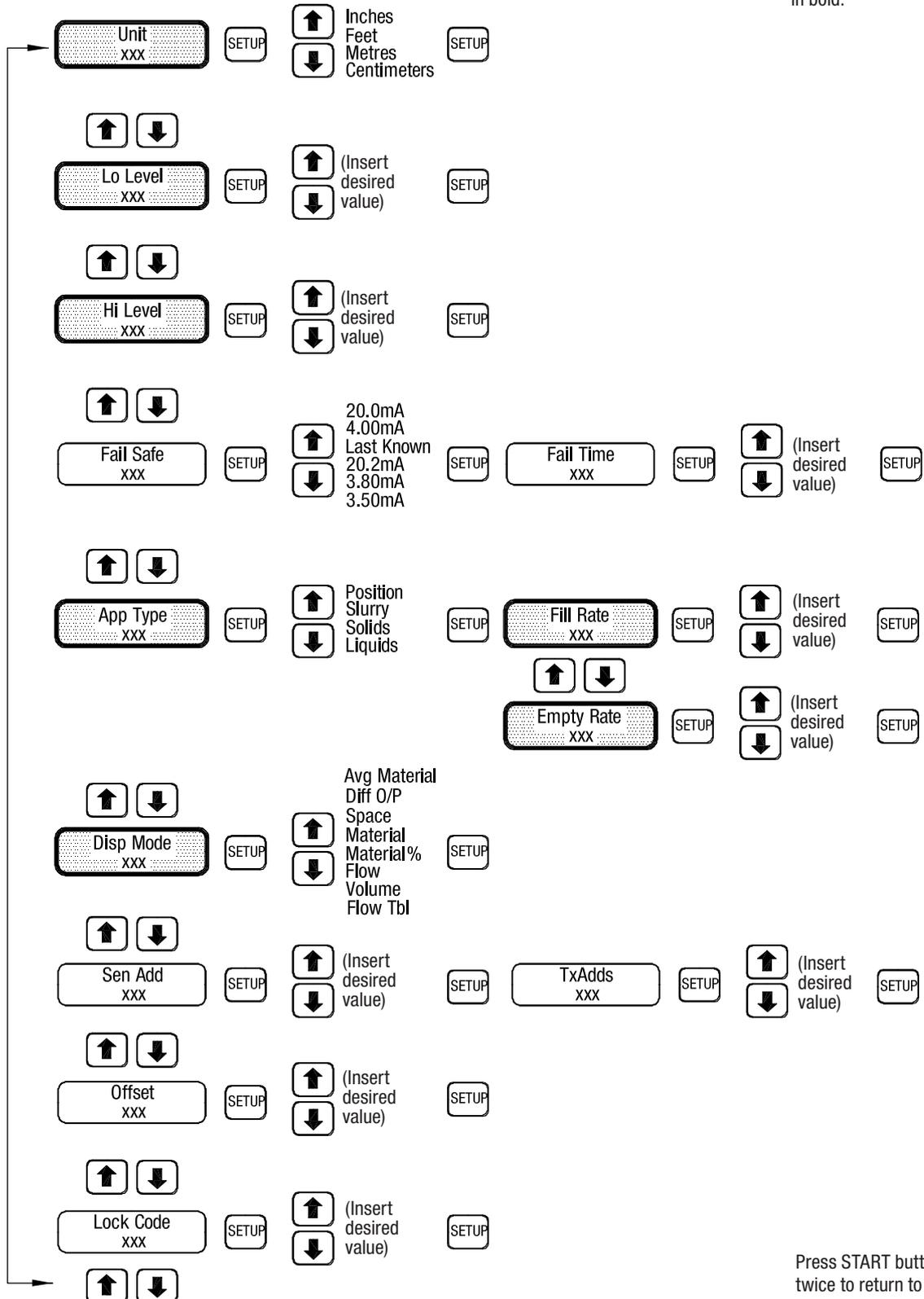
Press START button twice to return to normal operation.

Programming: Quickset Menu

Quickset Menu



Parameters used for **Fast start-up** are marked in bold.



Programming: Quickset Menu

Quickset Menu

The Quickset menu is used for fast and easy adaption of the system to standard applications.



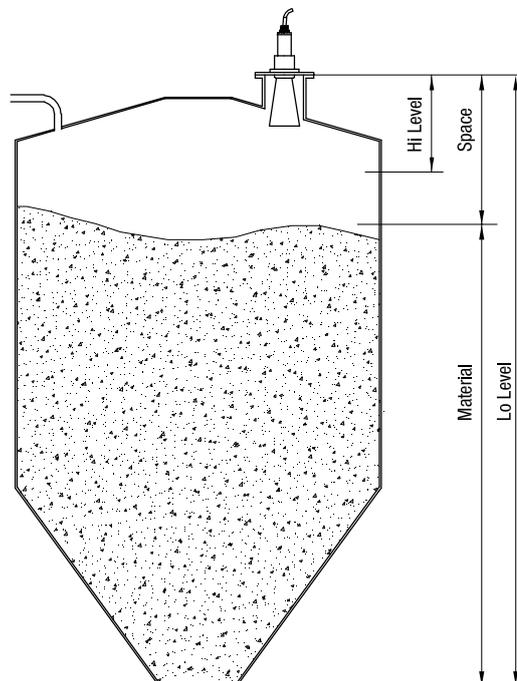
Units
 Selects the unit for display



Lo Level
 Sets the distance from the face of the transducer to the Low level in the vessel being monitored
 Note: Low Level must always be set (even if only distance measurement is required)



Hi Level
 Sets the distance from the face of the transducer to the High level in the vessel being monitored
 Note: When setting the High and Low levels a minimum distance of 100mm (4") between Hi Level and Lo Level must be maintained. The setted Hi Level value must always be smaller than the Lo Level value.
 Note: Hi Level can be set even within the Blanking distance to enable use of the analogue 4-20mA output across the total fill level. The Hi Level value can also be set to 0 to have the output 4-20mA showing the full height of the silo.



Fail Safe

Status of the 4-20mA output when error occurs

Fail safe occurs if a valid echo has not been detected. This happens, when there is a certain time without an echo greater than the Threshold, even if the window has complete opened from Blanking distance to Empty distance. The fail safe occurs after the Fail Safe timer has counted down to 0.

Note: The Fail safe output is affected by the setting "Analogue" in the "Output adjustment menu".

If the "Analogue" setting is 4-20mA (factory provided), then the output current is the same as the Fail Safe.

If the "Analogue" setting is 20-4mA, then the output current is the reverse of the Fail Safe.

Fail Time

If there is a missing valid echo, the failsafe output occurs after the set Fail safe Time

It is not recommended to change this parameter, unless required by the application (the value should not be reduced below a minimum of 50 seconds).

Programming: Quickset Menu

Quickset Menu



App Type

Setting of the application

The response of the system is automatically changed according to the application requirements.
Note: Setting "Position" is not used for Level measurement applications.



Fill Rate / Empty Rate

Setting the approximate speed of the filling and emptying speed

Dependent on the adjustment, various parameters can be changed that result in a faster or slower system response.

The setting is in m/h (meters per hour).

The software uses default values for Fill Rate and Empty Rate, but these values should be checked and customised to the values of the application. The fill level in the conical part of the silo can change quicker. Therefore, the programmed values should always be somewhat (e.g. 20%) more than the max. expected value in the application to allow the software to accurately track the fill level.

Note: The Fill Rate parameter affects the parameter "Wind Fwd"; the Empty Rate affects the parameter "Wind Back" in the Tracking menu.



Disp Mode

Preferred fill level display on the LCD

"Space" displays the distance from the Transducer face to the material surface.

"Material" displays the level between "Lo Level" setting and material surface.

"Material%" displays from 0% at "Lo Level" setting to 100% at "Hi Level" setting.

Note: The settings "Flow", "Volume" and "Flow Tbl" are not described in this manual.

Sen Add

Setting of the internal address of a remote transducer

This is used, if two transducers are connected in parallel on the same transducer terminal of NW 2001.

This situation allows to measure the average and difference of the two transducers in combination with "Avg Material" and "Diff O/P" setting of the "Disp Mode" parameter.

Note: Sen Add setting is not described in this manual.

Offset

Reference point, from where the measurement starts

Offset default is set to 0. The membrane face of the transducer is the reference point. If an offset value is given, then the displayed echo distance is greater than the real measured distance.

Lock Code

Access code for the main menu

Using a code other than the factory set 0, can prevent unauthorised access to the main menu.

The Lock Code also enables access to advanced programming menus:

Lock code:	Access to Menu:
195	Tracking
196	Tracking and Factory

Note 1 Setting to 1 stops the pulsing of the Transducer. This is used for demonstration purposes and should not be normally used.

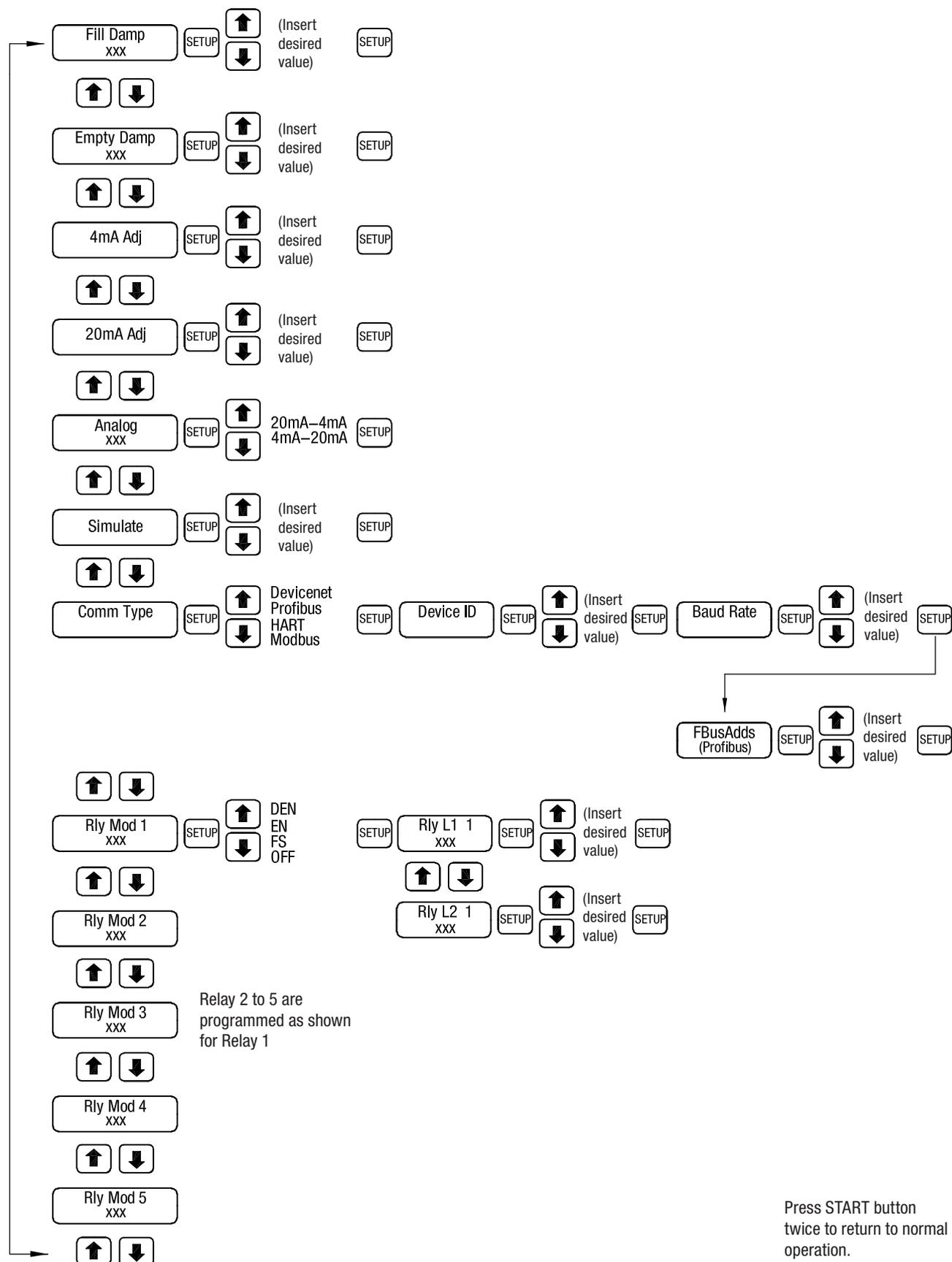
Note 2: The programmed Lock Code is displayed for approx. 10 minutes after entering the main menu.

After this time the Lock Code is no longer displayed.

Note 3: If the Lock Code is forgotten, it is possible to bypass it using code 195 or 196. The last Lock Code can be seen when entering "Lock Code" in this menu.

Programming: Output Adjustment Menu

Output Adjustment Menu



Programming: Output Adjustment Menu

Output Adjustment Menu

The Output Adjustment Menu is used for setting the 4-20mA, Relay and Field bus output.

Fill Damp / Empty Damp

Output signal characteristics

It is not recommended to change the factory settings, unless required by the application.

This parameter defines, how quickly the 4-20mA output, the relay output and the display responds to changes in the measured level.

A low damping value gives a fast response and a high damping value gives a slow response. The damping limits are from 0 to 999. For example: a damping value of 60, the displayed distance is the average of the last 60 echo pulses.

4mA Adj / 20mA Adj

Fine Calibration of the 4mA and 20mA values

It is not recommended to change the factory settings, unless required by the external 4-20mA evaluation unit.

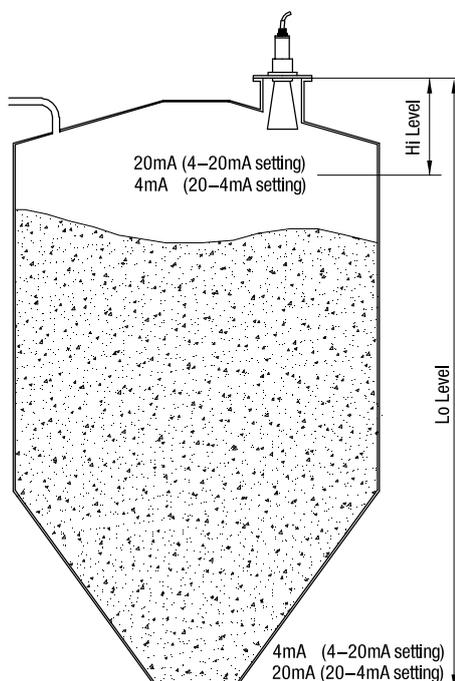
When the display shows "4mA Adj" / "20mA Adj", then the current output is set to 4-20mA. The actual loop current can be measured with an external meter and finely adjusted by pressing the UP or DOWN arrows .

Analogue

Mode of 4-20mA output

The output of the instrument can be set to 4-20mA or to 20-4mA.

Note: The "Analogue" setting affects the "Failsafe" current (see notes in "Quickstart menu").



Programming: Output Adjustment Menu

Output Adjustment Menu

Simulate

Verification of the 4-20mA output and relays using a simulated measurement distance

This mode can be used to check the outputs, or externally connected output equipment characteristics. In simulation mode, the UP and DOWN arrow keys vary the distance from the transducer to the material surface level on the display. The 4-20mA current output and the relays behave exactly as they should when the distance really would be measured. (in SPACE mode without damping).

Comm Type

Selection of the field bus and setting of the field bus parameters

Manual set-up the Device ID (address). Ensure that all units connected in the network have their own individual addresses.

Set the Baudrate manually. Factory setting is:

HART 1200 baud, Modbus 19200 baud, Profibus DP 12Mbps, DeviceNet 125kbps.

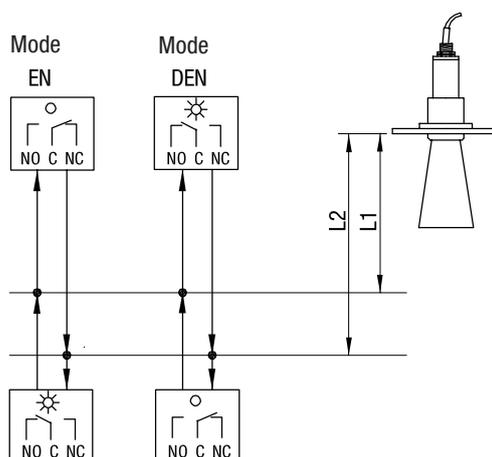
Rly Mode

Setting of the relay switching points

This allows the set-up of up to 5 relays for switching (The number of relays depends on the version).

The relays are programmed with the distance from the transducer face to the required material surface switching point. The relays can be set to energise or de-energise. The relay logic is as follows:

- DEN** The relay is normally de-energised and is energised when the product rises above the L1 level. It remains energised until the product falls below the L2 level.
- EN** The relay is normally energised and is deenergised when the product rises above the L1 level. It remains deenergised until the product falls below the L2 level.
- L1** L1 is the upper switching point.
- L2** L2 is the lower switching point.
Note: L2 must always be greater than L1.

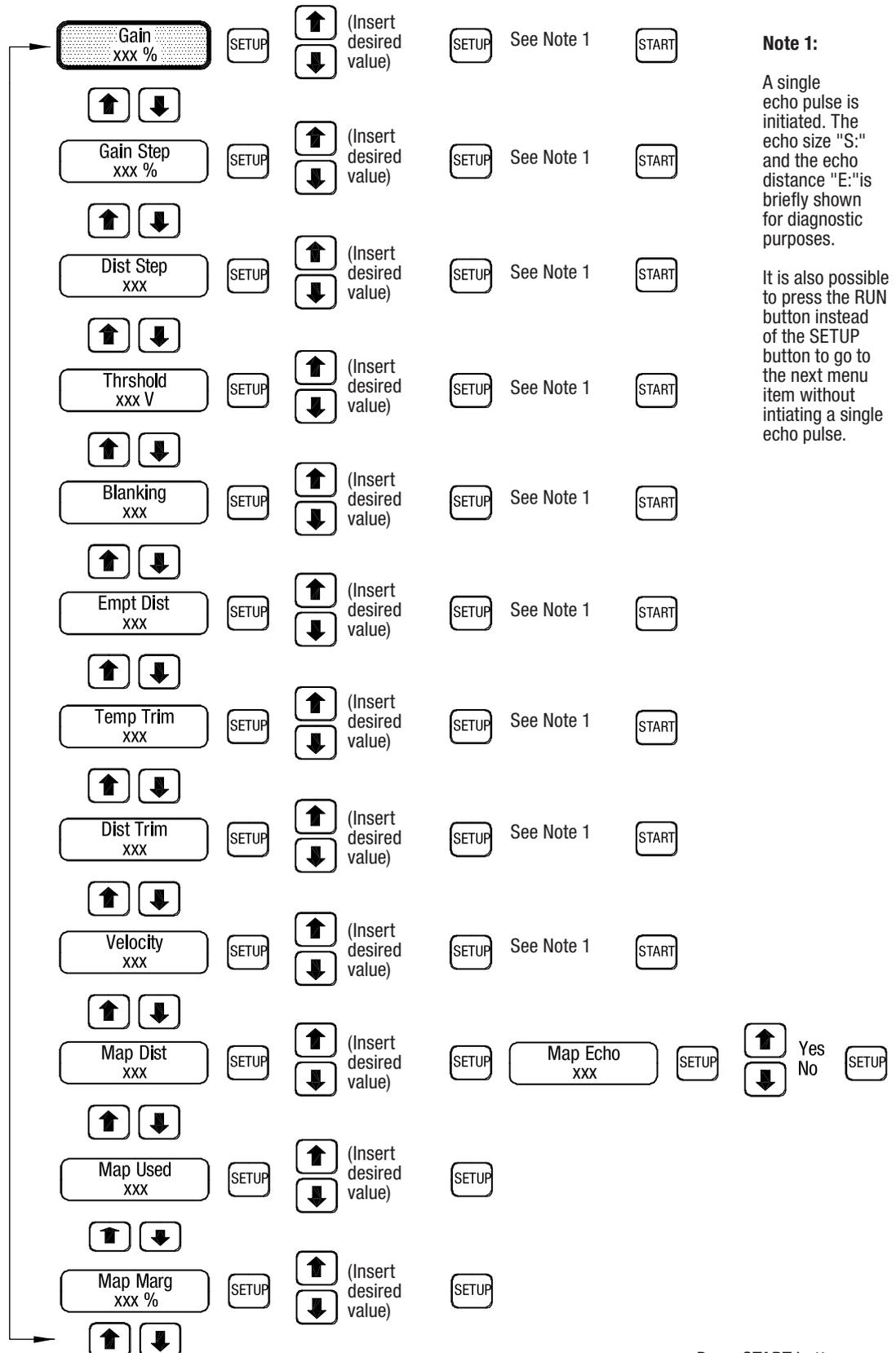


LED on unit	Relay
○ OFF	De-energized
☀ ON	Energised

- FS** If FS is selected, the relay will operate as a fail safe relay. The relay is normally energised. Should fail safe occur, or the power supply fails, then the relay will become de-energised.
- OFF** The relay is switched off (regardless of the measured distance or vessel contents).

Programming: TX Setup Menu

TX Setup Menu



Note 1:
 A single echo pulse is initiated. The echo size "S:" and the echo distance "E:" is briefly shown for diagnostic purposes.
 It is also possible to press the RUN button instead of the SETUP button to go to the next menu item without initiating a single echo pulse.

Press START button twice to return to normal operation.



Programming: TX Setup Menu

TX Setup Menu

The TX Setup Menu is used for adjusting the measurement properties of the transducer.

Gain

Start value for the distance dependant gain

This parameter defines the Gain value at the point after Gain Step (G3) / Distance Step (D3).

For more details see background information page 23.

Note: This Gain parameter is typically NOT the actual working gain which is used at a certain echo distance. The actual used working gain is defined by this Gain parameter and increased by the parameters "Slope Dist" and "Slope Increase". The actual working gain can be checked with the "G:" diagnostic value in measuring mode (see page 22).

Gain Step

Limitation of the used gain at close distance (Dist Step) to the transducer face

"Gain Step" must always be less than the "Gain" parameter setting.

"Gain Step" in combination with "Dist Step" are typically used to lessen the effect of poor mounting situations.

For more details see background information page 23.

Dist Step

Definition of the distance from the transducer face, when the gain is limited with "Gain Step"

For more details see background information page 23

Note: Dist Step is the same as Dist Step D3.

Threshold

Echo size (in Volt) which defines the threshold between accepted echo and ignored echo.

Any echoes smaller than Threshold are ignored by the software.

Blanking

Distance from the transducer face where no measurement is possible

In this area, echoes are not registered, because the returned pulse is received too soon after the transmitted pulse and results therefore overlapping.

Empt Dist

Max. possible range of the transducer

Note: The factory value is set to the max. possible distance according to the Transducer.

This value should not be changed.

Temp Trim

Setting of the actual process temperature to correct the speed of sound.

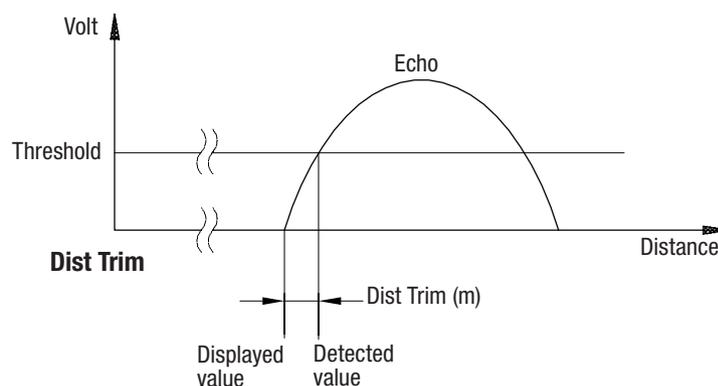
The temperature sensor behind the transducer membrane does not measure the exact temperature.

However, the exact temperature difference based on the value in "Temp Trim" is measured.

Dist Trim

Distance between the displayed value and the detected value of an echo

The factory set value should not be changed



Programming: TX Setup Menu

TX Setup Menu

Velocity

Adjustment of the displayed distance caused by different atmospheric conditions within the silo.

Different atmospheric conditions within the silo can cause different echo velocities.

The normal measured distance is calculated with an echo speed of 331 m/s (1086 Ft/sec) at 0°C.

The normal measured distance multiplied by the "Velocity" value gives the indicated output distance.

For example: Echo speed = 364 m/s. -> Velocity = 1.1 -> Indicated distance = measured distance x 1.1.

Mapping parameters

Mapping changes the gain curve to eliminate wrong echoes.

Mapping means that the max. allowable gain is set to the distance of any to be detected echoes, which are greater than the Threshold. This means that false echoes will be smaller than the threshold and therefore are no longer detected by the software.

Note:

Use of Mapping is critical and should be avoided wherever possible.

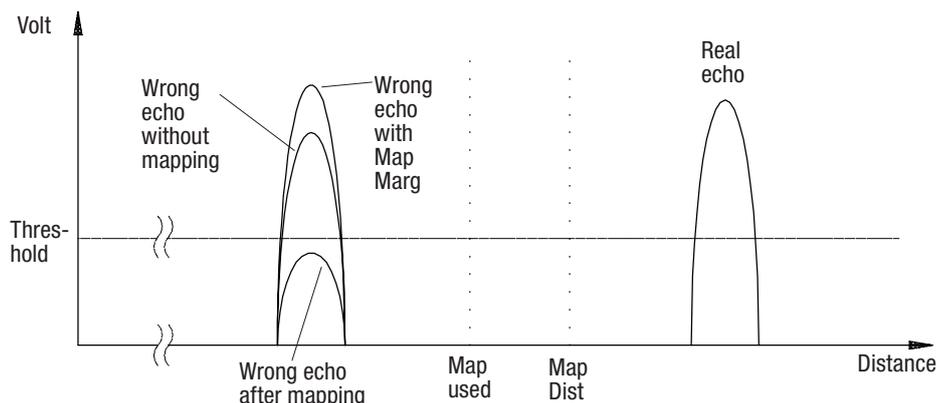
It is not possible for the gain curve to be more than the defined mapping value, which means that the echo of the measurement level in this area could be lost.

False echoes which are close to the Transducer should be eliminated as follows:

Firstly: Change the mounting position of the transducer to eliminate wrong echoes

Secondly solution: Use the Gain Step / Dist Step Parameter.

Thirdly : Using the Mapping procedure.



Map Dist

Distance from the sensor face within which all echos will be mapped.

The value is used when "Map Echo" is executed.

It must be absolutely certain, that the real echo (material level) is outside of this range.

Map Echo

Starts the mapping procedure

Setting to Yes starts the mapping procedure with the set values. The transducer pulses for a certain amount of time during which the software saves the echo situation at various gain settings.

Map Used

Distance in which the mapping is used.

Map Dist must be greater than Map Used. A setting of 0 means, that mapping is switched off.

Map Marg

Tolerance factor of the actual size of the false echo.

Setting the value to 1.1 means for example, that the false echo could be 10% bigger than at the time, when mapping occurred and is still under the Threshold value.

The recommended value is 1.1. This value is a good compromise between:

- The echo of the material is still detected, if the material level is in the distance of the false echo. The allowed working gain is then high enough to detect the material.
- Changes of the size of the false echo do not lead to a situation, where the size of the mapped wrong echo becomes greater than the Threshold value.



Programming: Tracking and Factory Menu

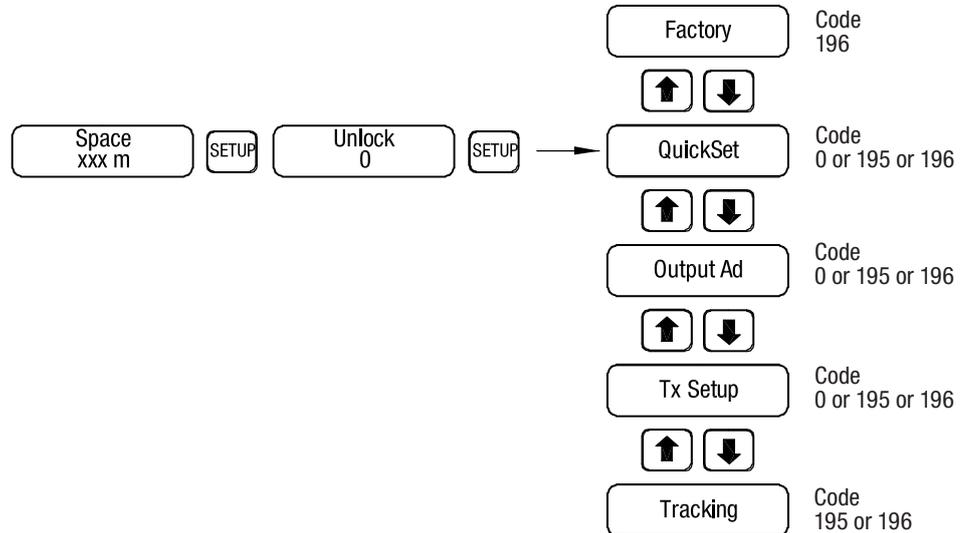
Main menu Tracking and Factory

If the unit is working in normal operation (measurement operation), the SETUP button brings up the main menu.

After pressing SETUP:

“Unlock 195” provides access into the Tracking Menu.

“Unlock 196” provides access into the Tracking and Factory Menu.



Programming: Tracking Menu

Tracking Menu

The Tracking Menu is used to set specific parameters for echo processing

Recover parameters:

Recover is an additional working gain, which is added to the normal working gain. It is used for compensation of any change of measurement situation (such as dust, foam, ..) which reduces the size of the echo. The unit switches automatically from the Normal- to the Recover-mode, when the echo becomes too small.
 See background information page 23 and 24.

Recov Fst

Starts recover gain, when the unit switches to Recover mode

When Normal to Recover mode is changed, an additional amplification (%) to the working gain occurs.

Recov Inc

Incremental steps of Recover gain, until the echo size is large enough

After the initial Recov Fst gain, the working gain is increased step by step as defined in Recov Inc.

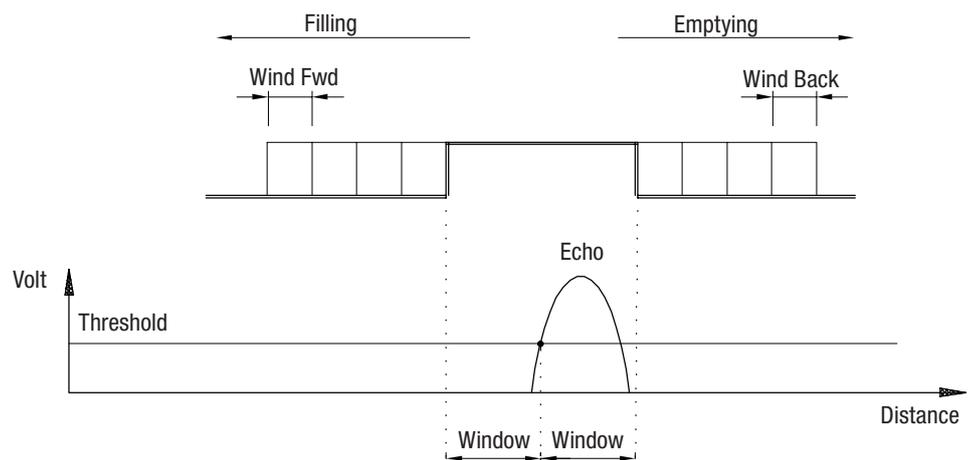
Recov Max

Max. allowed recover gain

This value is the max. allowed working gain, which is added to the working gain. It is used for compensation of any change of measurement situation (like dust, foam) which reduces the size of the echo. An additional value of ca. 15% must also be used for temperature compensation of the 20kHz and higher frequency Transducers.

Window parameters:

Measurements made by the unit are expected to be able to rise or fall at a known maximum rate defined by the parameters "Fill Rate" and "Empty Rate" in the "Quickset Menu". The unit uses a window of reasonable width around its last confirmed distance measurement to avoid false echo filtering. Only echoes falling within this window are considered to be valid. The window must be set wide enough to accommodate the maximum expected level change between measurement pulses, and also wide enough to be able to lose an echo, due to noise or absorption, for a short time and still catch it again as signal conditions improve. The echo must still fall within the window once it returns.



Programming: Tracking Menu

Tracking Menu

Window

Size of the half window

This parameter shows the size of the half window. The whole size of the window is double this value (left and right side of the echo). The factory set value is bigger for solids than for liquids, to take into account the irregular surface level of solids.

Wind Fwd

Step distance for the Window opening in filling direction

Window forward is the step distance (in metres), in which the window opens in the filling direction, when the software searches for a usable echo (echo which is over the Treshold). This parameter is automatically calculated by the parameters "Fill Rate" and "Empty Rate". Wind Fwd is only active in Recover mode.

Wind Back

Step distance for the Window opening in emptying direction

Window back is the step distance (in metres), in which the window opens in the emptying direction, when the software searches for a usable echo (echo which is over the Treshold). This parameter is automatically calculated by the parameter "Fill Rate" and "Empty Rate". Wind Back is only active in Recover mode..

Confirm

Number of required valid echoes before the software accepts a new distance

If the echo is lost within the actual window, the software will start to search for an echo. Once a new valid echo has been detected (echo greater than the Treshold inside the opened window), the software waits for the set number of valid echoes, before it accepts this distance to be the actual valid distance. See background information on page 25.

Hold

Time (in seconds) after echo loss, before the opening of the window occurs

First step: After a lost echo, the window opens one step forward (as defined in Wind Fwd) and at the same time one step backwards (as defined in Wind Back). This happens after 1 x the Hold value time. Next steps: After each 1/4 of the Hold value the window opens another step forward and backwards. See background information on page 25.

Tx Charge

Internal voltage reference for the sending pulse

This parameter defines the voltage level for the internal capacitor, which transfers its energy to the transducer to send a pulse. Standard setting is 8.0V. This value should not be changed.

Movement

Increased output signal damping for static material level

Setting of a width (metres). This parameter avoids fluctuating output signals due to small changes in the echo, even when the material level remains static. In the set range, the output signal damping is increased by adding the parameters "Fill Damp" and "Empty Damp" and this total is used for echo changes in emptying and filling

Noise Sw

This parameter is not mentioned in this manual.

Eco Width

Filter to eliminate brief echoes caused by acoustic or electromagnetic noise

A typical material echo has a certain minimum width (time between echo start and echo end). This parameter avoids that narrow echos, caused by acoustic or electromagnetic noise, influence the measurement. The parameter acts as a filter and only allows echoes wider than the set value to be valid.. Setting is in meter.

Search Fst

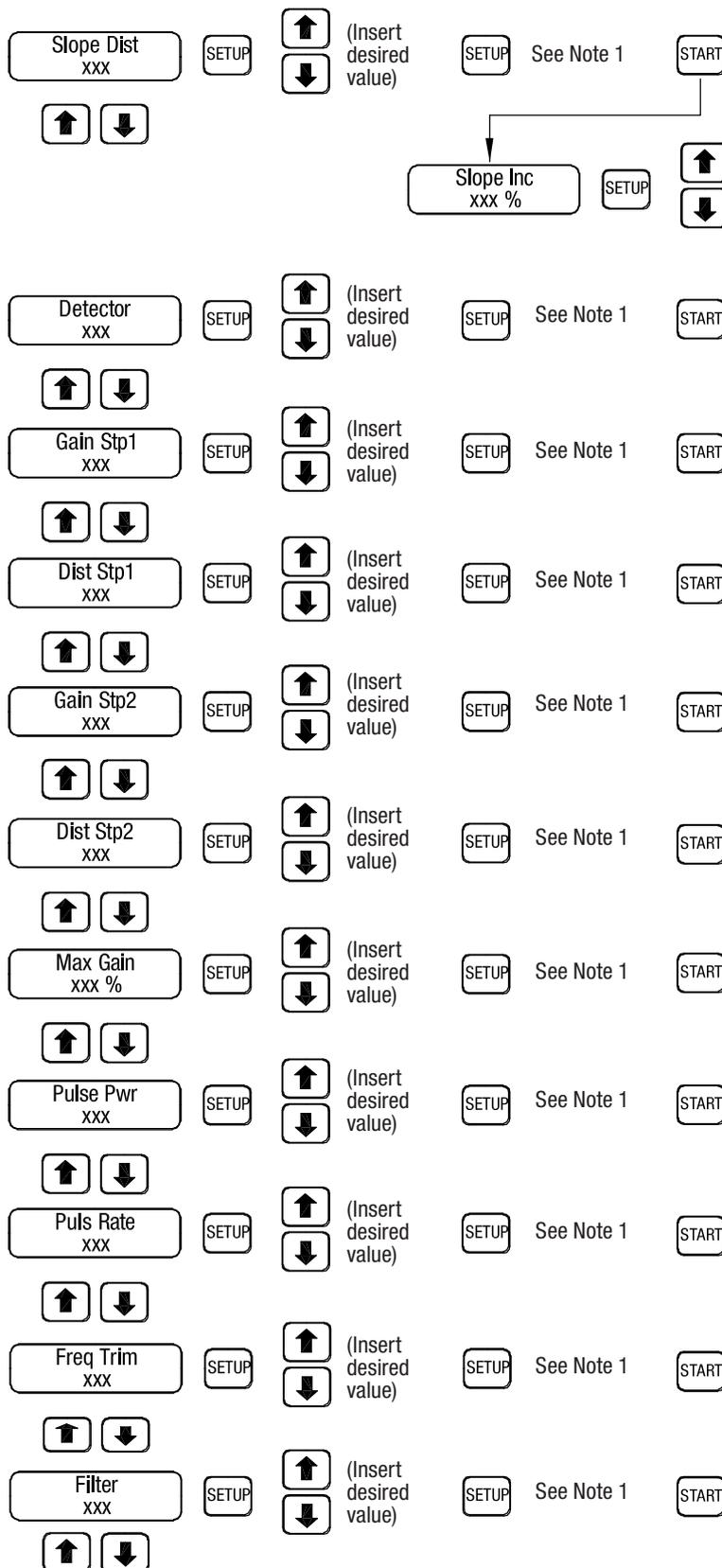
Additional working gain during the startup to enable a valid echo to be found quickly

After switching the power supply on, Search First is used (instead of Recover) to find a valid echo. Setting is an additional working gain value in %.



Programming: Factory Menu

Factory Menu



Factory menu can only be entered by using unlock code 196 in the main menu.

Note 1:

A single echo pulse is initiated. The echo size "S:" and the echo distance "E:" is briefly shown for diagnostic purposes.

It is also possible to press the RUN button instead of the SETUP button to go to the next menu item without initiating a single echo pulse.

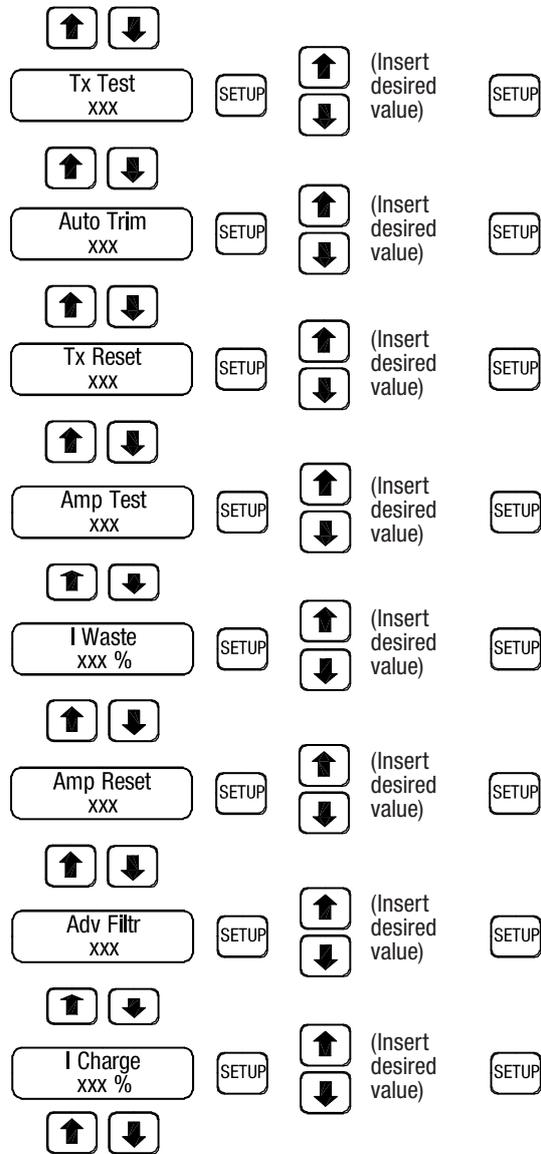
Continued on next page

Press START button twice to return to normal operation.

Programming: Factory Menu

Factory Menu

Continued from previous page



Leads to "Slope Dist"
on previous page

Press START button
twice to return to normal
operation.

Programming: Factory Menu

Factory Menu

The Factory Menu enable advanced programming of various parameters.

Slope Dist / Slope Inc Adjusts the slope of the gain curve

Slope distance (in metres): This parameter is used to set the gain curve for the required measurement range. A lower value steepens the gain -curve, a higher value flattens the gaincurve.

Slope increment (in %): The value is the same for all transducer types. It should never be changed. See background information on page 23.

Gain Stp1 Gain used during the transmission pulse

This gain is related to the time interval during the transmission pulse. The receiver electronics are actuated, but are not sensitive enough to detect the transmission pulse. See background information on page 23.

Dist Stp1 Distance in which Gain Stp1 is used

This should never be changed.
See background information on page 23.

Gain Stp2 Gain used during ringing of the transducer

This gain is related time interval during which the pulse oscillation decays ie the time it takes the membrane face to stop oscillating after the pulse transmission.
Gain Stp2 is set so that ringing echoes are not detected, however it is still possible to detect echos close to the transducer.
See background information on page 23.

Dist Stp2 Distance (incl Dist Stp1) in which Gain Stp2 is used.

Dist Stp2 must be greater than Dist Stp1.
See background information on page 23.

Max Gain Maximum gain possible during the whole measurement range

The max. possible value is 100%.
See background information on page 23.

Pulse Pwr Transmission pulsepower

The factory setting should only be changed if there are ringing problems, when there is too much energy in the transmission pulse. The max. possible measuring range decreases when the power is reduced. Increasing the factory setting can result in hardware damage.

Pulse Rate Counter that activates a pulse, even when there is insufficient power

This parameter is only used applications using solar panels, where the internal capacitor can not be properly charged (Tx voltage) to generate a pulse because of insufficient power supply. This can effect the measuring range, but not the accuracy.
After each pulse the Pulse Rate counter is reset and then counts down to 0. When the value 0 is reached, a pulse is generated.

Freq Trim Trimming of the excitement frequency r

This parameter is not mentioned in this manual.

Filter Echo receive filter

This parameter is not mentioned in this manual.



Programming: Factory Menu / Error Codes

Factory Menu

Tx Test

Transducer self test

This parameter is not mentioned in this manual.

Auto Trim

This parameter is not mentioned in this manual.

Tx Reset

Resets transducer parameters to the factory settings

Amp Test

Checks if the amplifier is working.

This parameter is not mentioned in this manual.

I Waste

Internal tolerance for stabilising the 4-20mA current output

This parameter is not mentioned in this manual.

Amp Reset

Resets amplifier parameters to the factory setting

Adv Filtr

This parameter is not mentioned in this manual.

I Charge

Internal capacitor load current (mA) for the pulse power

Decreasing this parameter causes a slower pulse rate. 110mA is the max. rating..

Error codes

Code	Description	Action
01	Communication data error between the electronics and transducer.	1. Ensure wiring is correct. 2. If this does not help, send it back to the factory for checking.
02	Communication data error between the electronics and transducer. It can be a result of noise in the data cables or there is an open circuit	1. Ensure wiring is correct. 2. If this does not help, send it back to the factory for checking.
03	Incorrect selection of the communications parameter.	Select the correct parameter „Comm Type“ in the „Output Adjustment Menu“.

Diagnose

Diagnose

During measurement mode, diagnostic parameters can be shown on the display.

Use the  button to move to the next parameter.

Upper display row

Display	Example	Meaning	Description
E:	1.9	Echo distance (meter)	Actual valid echo distance measured from the Transducer face. Display does not take into account the delay of the output signal to the actual echo by a change in the material level.
S:	2.24V	Echo size (Volt)	Size of the valid echo. The value should always be >0.9V in order to be safely over the threshold value
G:	38%	Working gain (%)	Actual used gain to detect the valid echo. Note: This value includes any recover gain used.
R:	0%	Recover gain (%)	Additional gain to boost the echo size over the threshold value. See background information on page 24.
N:	3.5%	Noise (%)	Noise value inside the silo. High noise can reduce the max. working gain. See background information on page 24.
T:	25.5C	Temperature (°C)	Temperature at the transducer face measured by the internal temperature sensor.
W 	1.7	Window start distance (metres)	Distance between sensor face and the start of the actual window used.
W 	2.0	Window end distance (metres)	Distance between sensor face and the end of the actual window used.
Normal		Normal or Recover	Size of the echo is greater than the threshold value. An additional displayed arrow indicates if the level is rising or falling.
Recover		Normal or Recover	Additional gain to boost the echo size over the threshold value. See background information on page 24.
Tx	1	Internal address for the transducer	Normally the internal address is always 1. This value is only relevant if 2 Transducers are connected in (see Quickset Menu parameter "Sen Add").
Space Material Matl %		Displays the measurement value without diagnostic parameters	Shows the actual setting of "Display Mode" in the "Quickset menu".
Solids Liquids Slurry Position		Display of the application setting	Shows the actual setting of "App Type" in the "Quickset menu".

Lower display row

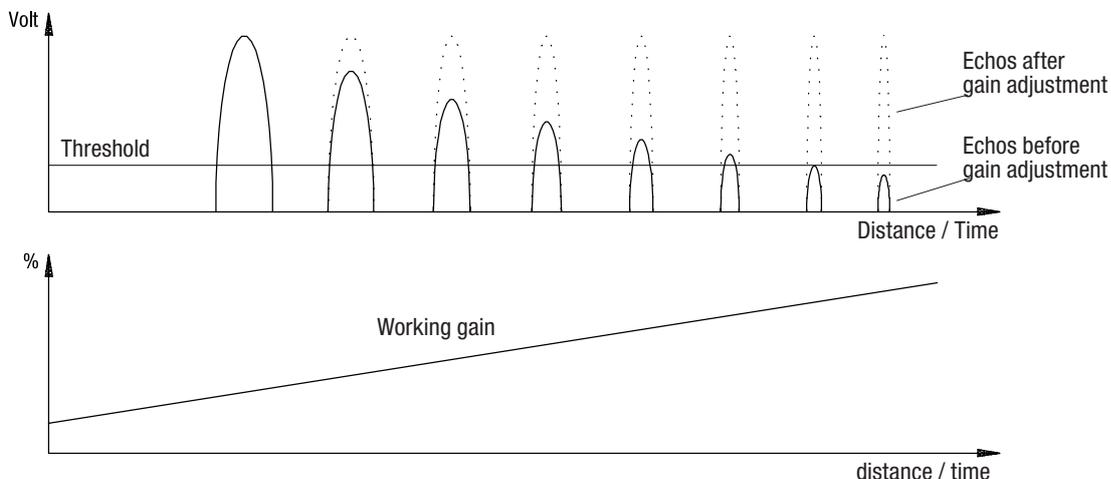
Display	Example	Meaning	Description
m ft %	1.95m 18.6ft 84%	Display of actual measurement value	Shows the "Units" and "Display Mode" in the "Quickset menu" dependant on the chosen setting. The display takes into account the delay in the output signal to the actual echo by a change in the material level.

Background Information: Gain Control

Gain control: principle

Distance dependant gain control:

The size of an echoes from a longer distance is smaller than an echo from a shorter distance. To compensate for this, the working gain increases with increasing distance.



Gain adjustment: Gain curve

The actual working gain curve occurs in 3 steps to limit the gain close to the transducer face.

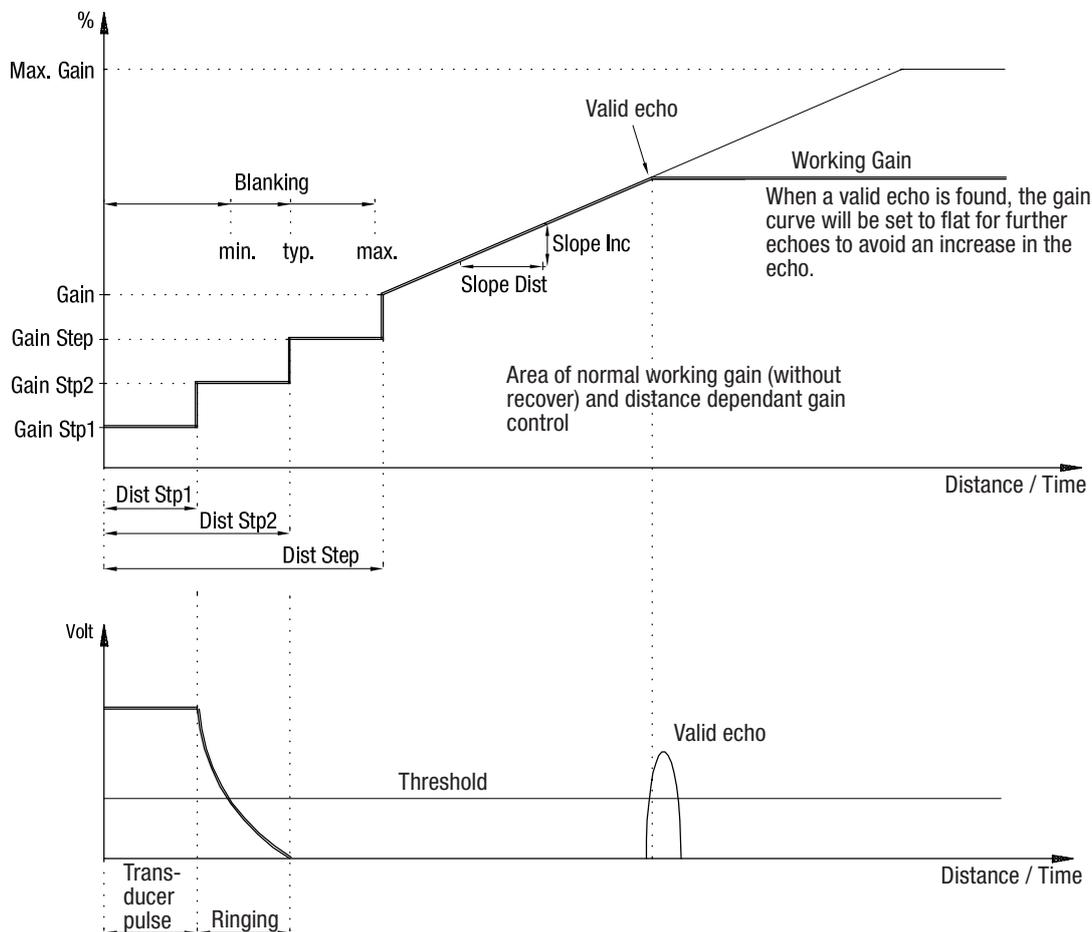
Gain Stp1, Gain Stp2 and Gain Step depend on the Transducer model, but the "Gain" parameter does not.

Dist Stp1 typically is the time / distance during the transmission pulse of the transducer.

Dist Stp2 typically is the time / distance of the ringing signal decay.

The Blanking (distance in which no measurement is possible) is typically between Dist Stp2 and Dist Step.

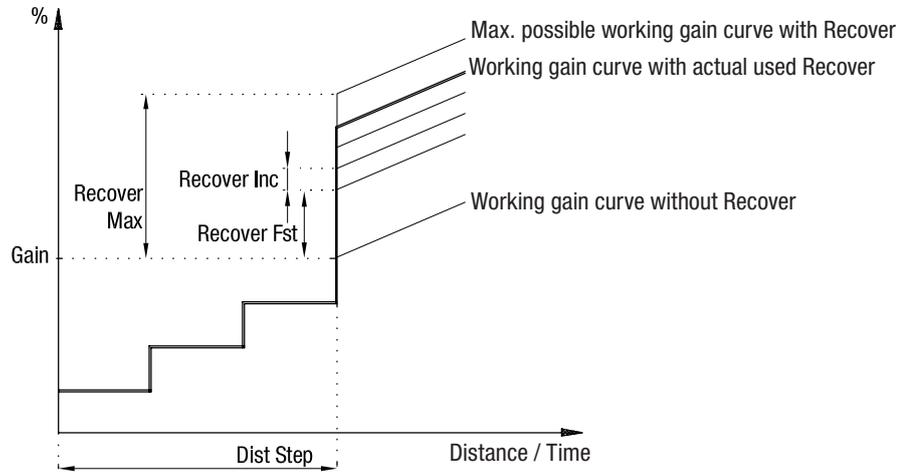
Gain Step and Dist Step are typically used to lessen the effect of poor mounting. They are the only parameters that should be changed, should field problems occur.



Background Information: Gain control / Window characteristics

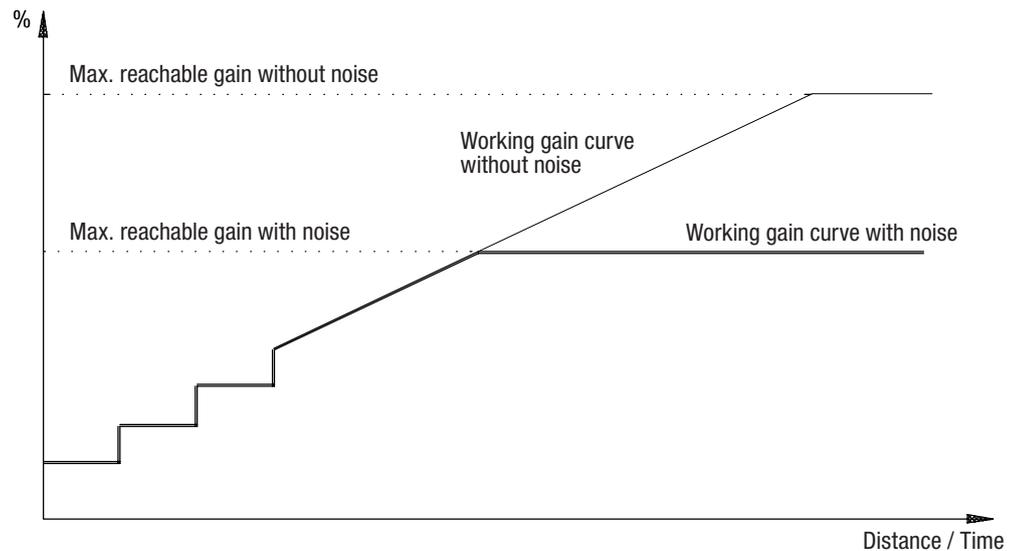
Gain adjustment: Recover

The Recover is used to increase the actual working gain so that a small echo signal is larger than the threshold. The Recover procedure works automatically according to the set parameters.



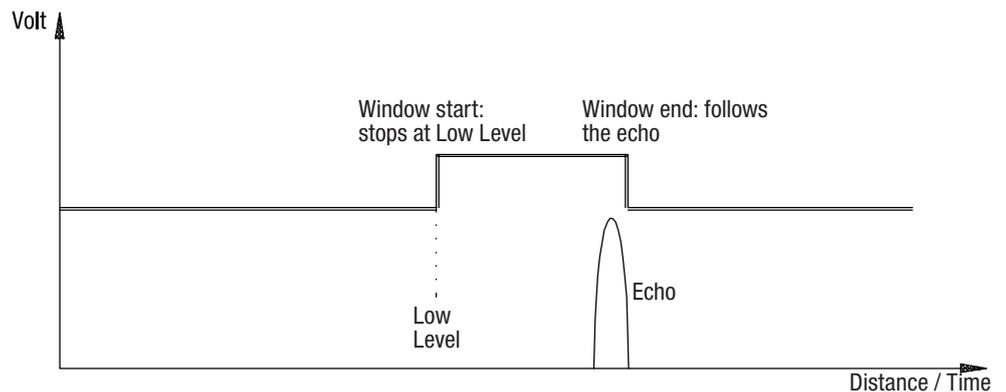
Gain adjustment: Noise influence

Acoustic noise is permanently measured by the system. Dependant on the amount of noise the max. reachable working gain is automatically limited.



Window characteristics

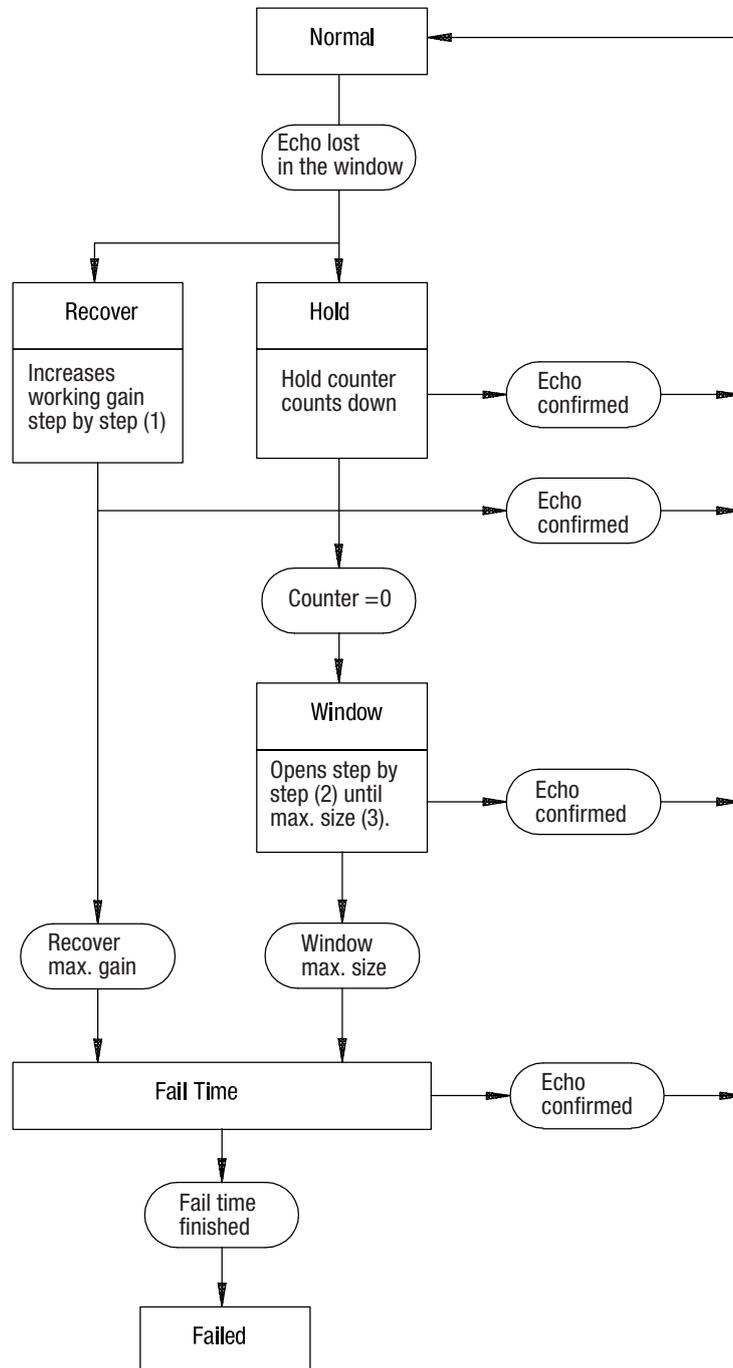
Window characteristics when the echo is below the Low Level



Background Information: Handling of lost echo

Handling of lost echo

The diagram shows the software algorithm, when the echo is lost during normal operation.



Notes:

- (1) According to the settings "Recov Fst", "Recov Max" and "Recov Inc".
- (2) According to the "Wind Back" and "Wind Fwd" settings.
- (3) Max. size is from Blanking Distance to Empty Distance.

Average measurement

For average measurement, two measurement levels are averaged to give the average level. This is achieved using two NW 1000 sensors connected to an NW 2000 controller.

The NW 2000 display shows the average of the two measurement levels in metres in this mode.

Also the analogue 4-20mA output from the controller is averaged.

The modbus provides both the average level and the average distance.

When connecting the sensors and during parameter settings, it must be ensured that sensor 1 is mounted in the position with largest LoLevel (see diagram below). The measured difference between sensor 1 and sensor 2 in the empty silo is set in the parameter "Offset". This means that any measurement errors due to for example different dimensions of the process connection of the positions of the sensors are corrected.

The average value is calculated by the software and is output as follows:

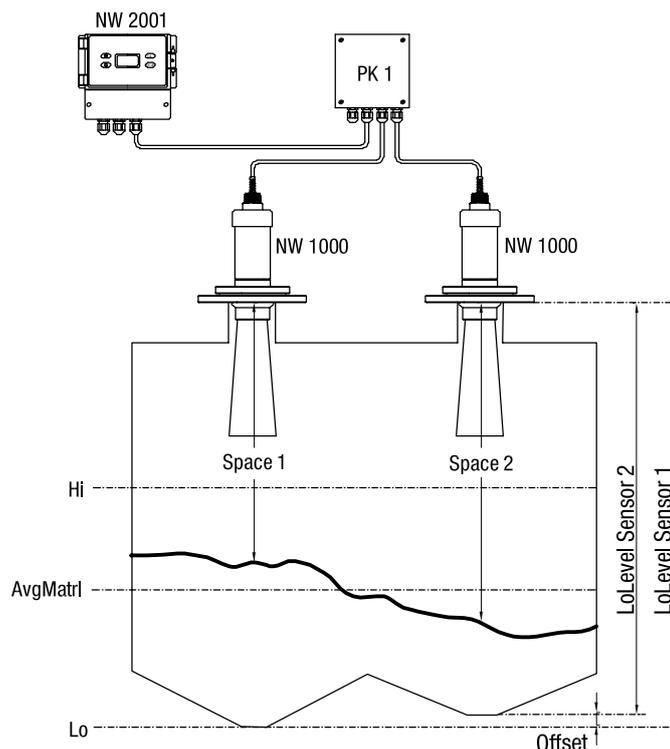
Average distance in metres:
$$\text{AvgSpace} = \frac{(\text{Space1} + \text{Space2} + \text{Offset})}{2}$$

Average level in metres:
$$\text{AvgMatrl} = \text{LoLevel1} - \text{AvgSpace}$$

Analogue output in mA:
$$16 \times \frac{\text{AvgMatrl}}{\text{LoLevel} - \text{HiLevel}} + 4$$

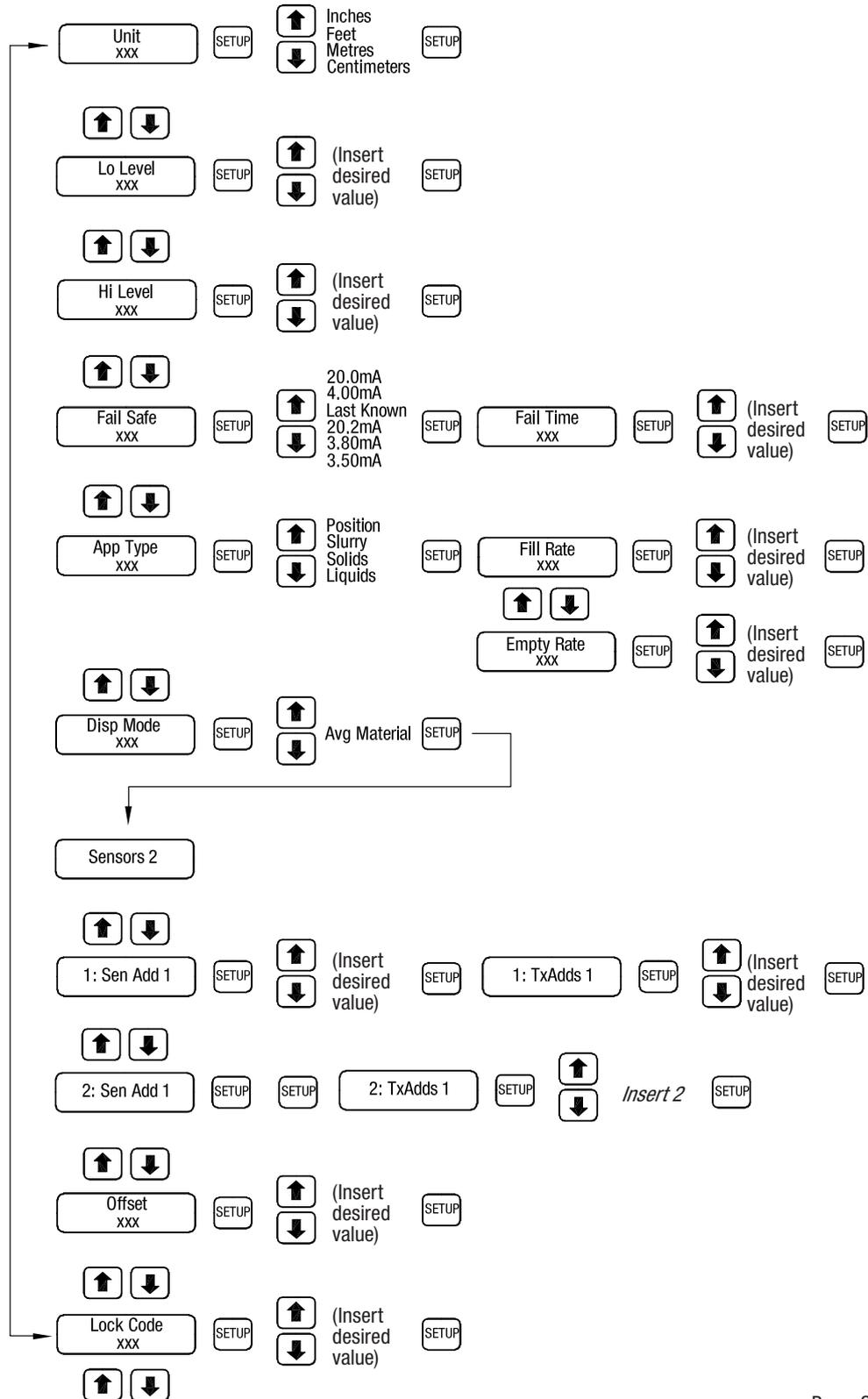
Carry out the following steps to programme the average level:

1. Connect the sensor, which will be used as sensor 2.
2. In the Quickstart menu, set the parameter *Disp Mode* to *AvgMatrl* (see flowchart).
3. In the Quickstart menu, set the parameter *2:TxAddS* to 2 and confirm with SETUP (see flowchart).
4. Connect sensor 1, set the *HiLevel* and *LoLevel* and start the NW 2000 using the START button.
5. To calculate the value for the *Offset* parameter, read the measured distance of both sensors in the empty silo.
 Go to the parameter *1:TxAddS* and press the SETUP button twice. Then the echo size is displayed in volts and the distance in metres one after another for sensor 1 (note the distance value). Now go to parameter *2:TxAddS*, and press SETUP button twice and note the distance value of sensor 2.
6. Set the difference between distance 1 and 2 in the parameter *Offset* (see flowchart).



Average measurement

Quickset Menu Flowchart



Press START button twice to return to normal operation.

Average measurement

Access to the sensor parameters

The sensor 1 & 2 parameters can be interrogated and changed via the keypad or via the Nivowave-PC-Software.
The parameter display can be changed from sensor 1 to sensor 2 (and conversely) by pressing the arrow down button in Run Mode.
This displays the actual sensor. Press both arrows at the same time to change the display to the other sensor.

Via the keypad:

The TxSetup, Tracking und Factory menu parameters that can be seen in the display for the sensor can be changed.
To programme the parameters for the other sensor, you need to switch to the other sensor (see above - access to the sensor parameters).

Via the Nivowave-PC-Software:

The software communicates with the sensor that is currently displayed. Switching to the software is only possible by the keypad (see above - access to the sensor parameters).

Relays

The relays are programmed in the Menu *Output Adjustment*.
The input is in distance, whereas the swtiching point is relates to the average distance.

Differential measurement

For differential measurement, the difference between two measurement levels is measured.

The controller display shows the difference of the fill levels in meters between the two sensors in this mode.

The analogue 4-20mA output from the controller is based on the difference.

The definition of the 4mA and 20mA is according to the input of HiLevel1 und LoLevel1.

The input of LoLevel1, HiLevel1, LoLevel2, and HiLevel2 is required because the sensors could be positioned differently, for example different dimensions of the process connection of the positions of the sensors are corrected.

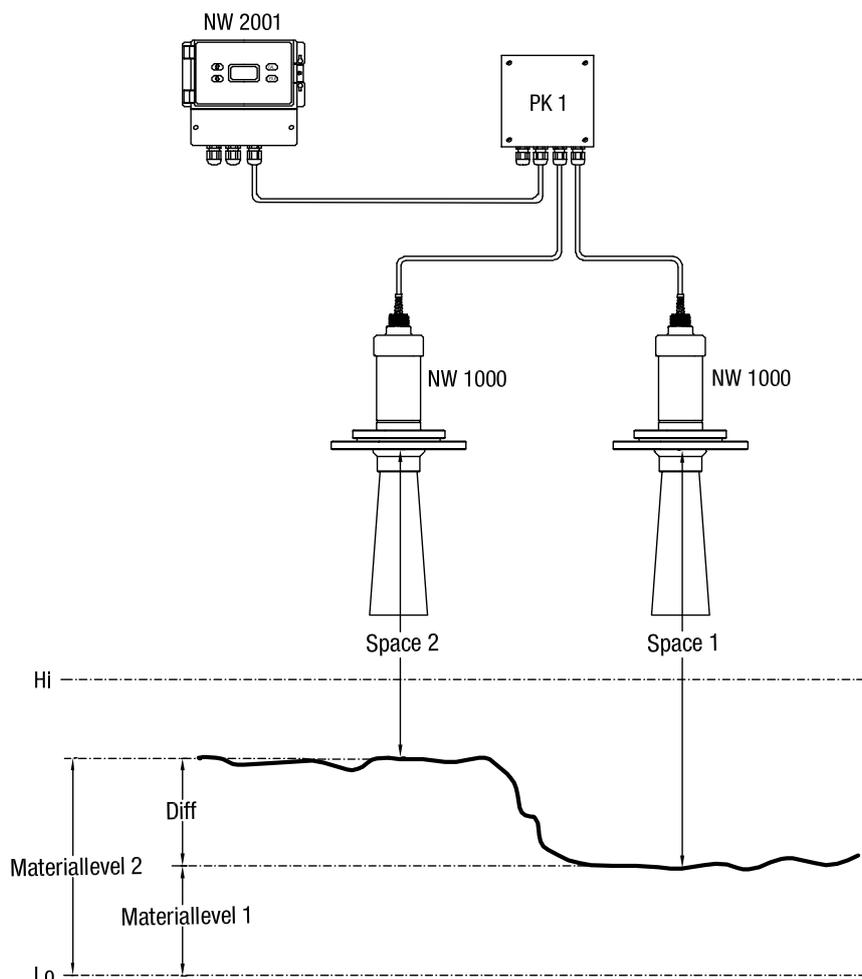
The average value is calculated by the software and is output as follows:

Difference in Metres: $Diff = Materiallevel2 - Materiallevel1$
 $Materiallevel2 = LoLevel2 - HiLevel2$
 $Materiallevel1 = LoLevel1 - HiLevel1$

Analogue output in mA: $16 \times \frac{Diff}{LoLevel1 - HiLevel1} + 4$

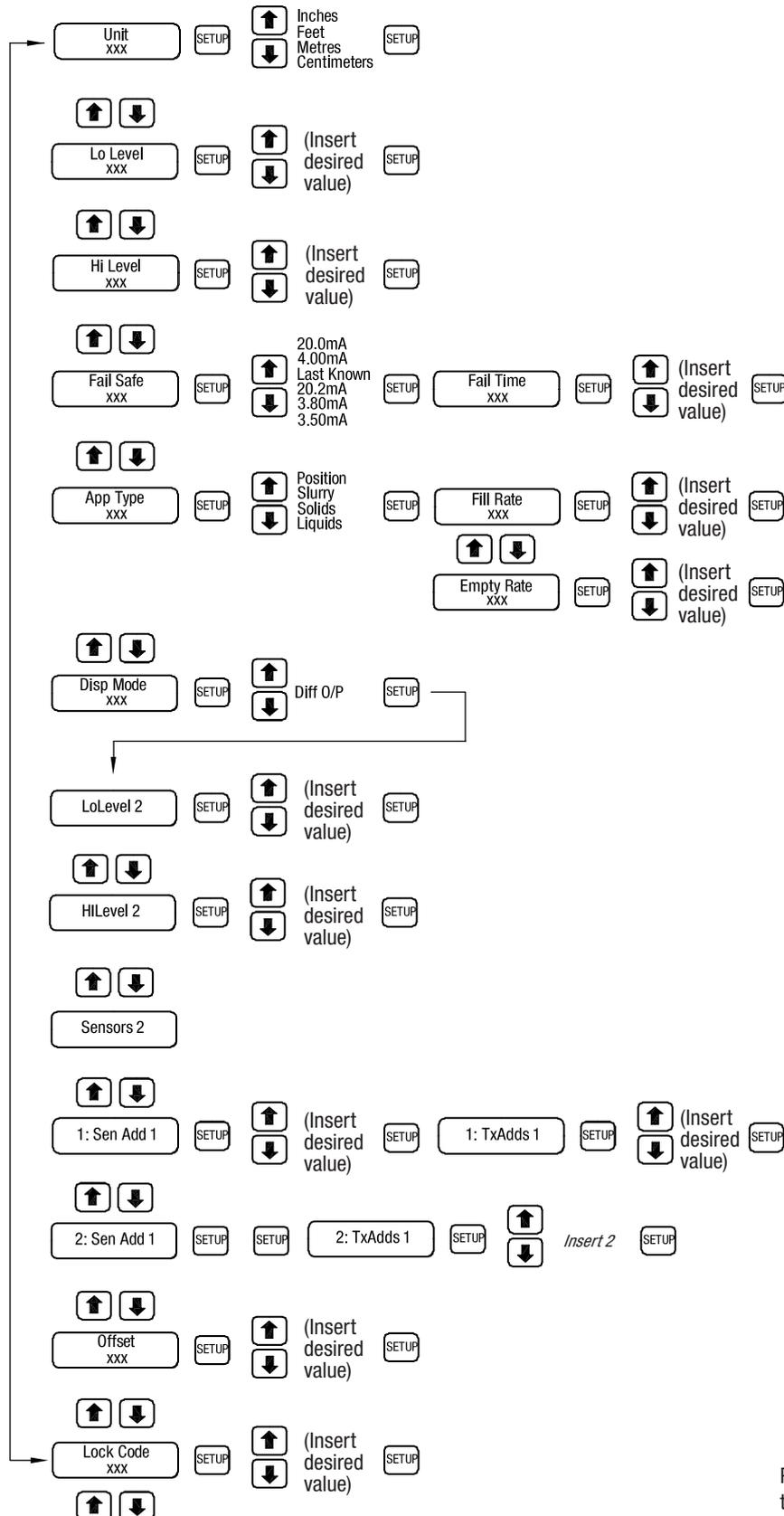
Carry out the following steps to programme the differential level:

1. Connect the sensor, which will be used as sensor 2
2. In the Quickstart menu, set the parameter *Disp Mode* to *Diff*(see flowchart).
3. In the Quickstart menu, set the parameter *2:TXAdd2* to 2 and confirm with SETUP (see flowchart).
4. Connect sensor 1, set the *HiLevel1*, *LoLevel1* und *HiLevel2*, *LoLevel2* and start the NW 2000 using the START button.



Differential Level

Quickset Menu Flowchart



Press START button twice to return to normal operation.



Differential Level

Access to the sensor parameters

The sensor 1 & 2 parameters can be interrogated and changed via the keypad or via the Nivowave-PC-Software.
The parameter display can be changed from sensor 1 to sensor 2 (and conversely) by pressing the arrow down button in Run Mode.
This displays the actual sensor. Press both arrows at the same time to change the display to the other sensor.

Via the keypad:

The TxSetup, Tracking und Factory menu parameters that can be seen in the display for the sensor can be changed.

To programme the parameters for the other sensor, you need to switch to the other sensor (see above - access to the sensor parameters).

Via the Nivowave-PC-Software:

The software communicates with the sensor that is currently displayed. Switching to the software is only possible by the keypad (see above - access to the sensor parameters).

Relays

The relays are programmed in the Menu *Output Adjustment*.

The switching point relates to the differential value, in which the relays shall switch.

