

Note! The sound files are only playable when the Measurement Period is in daily mode and not averaging mode

You can type any comment which will show in the comment line next to the logger. Make sure the Apply button is clicked to save the comment.

gger Noise	121 850								= = >
🚹 Histogram	🖻 Sig	nal Spectrum	🔀 Leak	Score History	Min. Noise His	story	Comments	Picture	
ast Modified:	4/12/14	Modified by:	Paul						
RV Next to hy	/drant								
				Apply	Clear				
atitude: 51.3	8011°	Longitude: -2.	391656°						
01.0		congrade.							

Figure 40: Comment Window

Comment

- **Picture** This opens up a picture of the installed logger onsite. For this facility to be fully operational a photo must be taken during the logger installation using the PDA (Personal Digital Assistant) and ZONESCAN Mobile installation tool.
- **Logger Noise Report** The Create a Logger Noise Report allows one to choose the options in the window below before creating a report.
 - Click Open and a separate window will open which then can be sent to print

38 | 72

Create Logger Noise Report	1	×
Map:		
Street View:		
Histogram:		
Signal Spectrum:		
Leak Score History Chart:		
Noise Level History:		
Additional Information:		
	Open Cancel	

Figure 41: Create a Logger Noise Report

A separate window will open through the internet browser showing the included options chosen.

• Press the print button to send the report to a printer or PDF file





Figure 42: The Logger Noise Report





Figure 43: The Logger Noise Report – cont.

Export to CSV

The Export to CSV (Comma-separated values) will download the Loggers Leak Score into CSV file format and automatically open Excel with the data.

Opening LeakScores.cs	SV X
You have chosen to	open:
EeakScores.cs	av .
which is: Micr	osoft Excel-CSV-Datei
from: https://:	zs-test:8444
What should Firefo	x do with this file?
Open with	Microsoft Excel (default)
Save File	
📃 Do this <u>a</u> uto	matically for files like this from now on.
	OK Cancel

Figure 44: Create a Measurement Report



Manual Correlation The Manual Correlation opens a separate window and allows the user to pick any two loggers in the project to correlate between.



Figure 45: Manual Correlation Window

 Use the drop-down arrows in the Loggers' section to select your chosen Logger 1 and 2 or alternatively select logger 1 by clicking on the Map and Logger 2 by pressing CTRL and click on the Logger 2

Loggers							
Logger 1:	502628	~					
Logger 2: 502630 ¥							
To select logge select logger 2	er 1 in the map, click the logger. , press ctrl and click a logger.	То					



• Use the Measurement Period Average. Mode drop-down to select either daily, Last 5 days and last 30 days. Select the measurement date via the arrows or calendar

Avg. Mode:	Daily								
Date:	K < Jul 22, 2015 🖾 🔈	×							

Figure 47: Selecting the Measurement Period

Note! Filters are a very important part of correlation, it's recommended that the Filter On is left ticked as it keeps the correlation clean and helps remove unwanted noise

• The Filter from: is the low filter cut off and Filter to: is the high filter cut off, click and hold either slider to increase or decrease the filter to improve the correlation quality and graph. Filter once the true pipe information has been entered as this gives a better result

Filter	
Filter on:	
Filter from:	300
Filter to:	512

Figure 48: Selecting the Filter

Figure 51 is the section where the pipe data is entered for the correlation to give a true result. If no pipe data is entered then the correlation result will be displayed in survey mode; a distance over 600m.

• If the pipe data is known then select Manual Pipe Setup to enter the distance between the loggers, the pipe diameter and material type. If the distance between the correlated loggers is unknown then use Start Pipe Wizard to draw the pipe





Pipe Setup	
# Segments:	-
Pipe Length:	-
Sound Velocity:	-
Material:	-
Start Pipe Wia	ard Manual Pipe Setup Delete Pipe

Figure 49: Entering Data Pipe

• In the Manual Pipe Setup window click Add Segment to enter the Length, Material and Diameter. When all segments are entered click Save

#	Length	Material	Diameter	Sound Vel
1	100.0 m	Cast Iron, Grey Iron	100 mm	1342 m/s

Figure 50: Manual Pipe Setup

• There is also a Pipe Wizard available, refer to 3.2.3 Entering Pipe Data with Pipe Wizard

Once the Pipe Setup and Filtering is complete the Manual Correlation Dashboard window will look similar to the screen below. In this example a 70% correlation was achieved and the leak position is depicted by an orange dot on the map and the diagram between the cross correlation graph and the map.

• Use the signal spectrum as a guide to position the filters, in the example below there is a concentration of sound between 300 and 400 Hz so this must be included





Figure 51: Manual Correlation Result

• If the Pipe information is incorrect then simply click the Delete Pipe and repeat the Manual Correlation steps



4 Print Menu



Figure 52: Print Menu

The print section has four options which include print Leak Detection Report, Correlation Report, Measurement Report and the Map.

The Leak Detection Report includes the Leak Scores, Correlations and Map for the chosen date. A window will appear which gives the user the option to remove correlations, Logger Noise or Map before printing.

Create Leak Detection Report		×
Include Map:	V	
Include Correlations:		
Include Logger Noise:		
Additional Information:		*
		Ŧ
Ope	n Cancel	

Figure 53: Print Report Window Options

• A new browser window opens with the report; use the print button on the browser



Duality	Location	Logger 1	Logger 2	Dist. L1	Dist. L2	Center Dist.	Pipe Len.	Comments
100	22 Richards Park Ln	502987	502988	28.0	42.3	-7.2	70.3	
80	22-24 Wynyard Crescent	502982	502983	30.1	22.0	4.0	52.1	
100	22-24 Wynyard Crescent	502982	502994	34.2	157.9	-61.8	192.1	
50	11 Wynyard Crescent	502983	502994	17.2	122.8	-52.8	140.0	
50	11 Wynyard Crescent	502983	502994	17.2	122.8	-52.8	140.0	
40	197 Fernhill Rd	502975	502994	≥ 0.0	≥ 103.1	-54.0	98.1	
50	5 Avalon Crescent	502726	502975	29.0	83.0	-27.0	112.0	
40	11 Avalon Crescent	502726	502972	12.2	88.3	-38.0	100.5	
50	5 Wynyard Crescent	502972	502982	322.5	180.0	61.3	502.5	
40	137-139 Fernhill Rd	502995	502998	≥ 104.9	≥ 13.4	45.8	118.4	
100	15 Cameron Pl	502996	502997	51.1	18.0	16.5	69.1	

odder moree				
Leak Score	Logger	Min. Noise	Env. Noise	Comments
100	502988	37.0		PRV Noise
2	502989	3.0		
0	502992	0.0		
1	502979	5.5		
67	502978	17.0		
0	502968	0.5		
97	502987	36.0		PRV Noise
51	502983	15.0		
77	502982	19.0		
0	502993	0.0		
96	502986	32.0		PRV Noise

Figure 54: Print Report Page



5 Maintenance View



Figure 55: Maintenance View

Note! The following description assumes a fully activated map menu

5.1 Logger Table

In the Logger Table, all Loggers of the current project are displayed.

Alph	a Repea	ter Logger							
	Logger	Reachabilit	Batt.	Version	Min Temp.	Max Temp.	Peak Noise	Radio Operation Time	Comments
Ô	402 181	100%	3.69 V	5.1	24.5 °C	28.0 °C	27 dB	2:51:00	
ð	402 146	100%	3.60 V	5.1	23.5 °C	24.5 °C	17 dB	3:00:00	
â	402 189	100%	3.56 V	5.1	23.0 °C	24.0 °C	26 dB	3:00:00	
â	402 208	100%	3.63 V	5.1	23.0 °C	26.0 °C	49 dB	2:51:00	
Ô	402 143	100%	3.60 V	5.1	22.0 °C	23.0 *0	6 dB	3:00:00	
â	402 158	100%	3.64 V	5.1	22.0 °C	23.0 °C	35 dB	3:00:00	
ô	402 199	100%	3.60 V	5.1	22.0 °C	23.0 °C	11 dB	2:51:00	
â	402 178	100%	3.58 V	5.1	21.5 °C	23.0 °C	28 dB	3:00:00	
â	402 213	100%	3.62 V	5.1	21.5 °C	23.0 °C	63 dB	3:00:00	
ô	418 097	100%	3.58 V	5.1	21.5 °C	22.5 °C	54 dB	2:51:00	
ô	402 194	100%	3.57 V	5.1	21.0 °C	22.0 °C	32 dB	2:51:00	
â	400 233	100%	3.63 V	5.1	20.5 °C	21.5 *0	22 dB	3:00:00	
â	402 160	100%	3.58 V	5.1	20.5 °C	21.0 *0	10 dB	3:00:00	
Ô	402 171	100%	3.58 V	5.1	20.5 °C	22.0 °C	11 dB	3:00:00	

Figure 56: Logger Table

5.1.1 Table Fields

Logger	Reference number of the displayed Logger
Reachability	The fraction or percentage the loggers were reached in the last 5 days
Batt.	Current battery charge of the individual Loggers
Version	Version of the respective Logger
Min Temp.	The lowest temperature measured during the last measurement
Max Temp.	The highest temperature measured during the last measurement
Peak Noise	The largest dB value measured during the last measurement
Radio Operation	It's the time during which the logger can be reached for communication. Warning: 6 hours or longer radio operation times will reduce battery life
Comments	Comments is a text field with entries on, e.g. permanent noise sources

5.1.2 Context Menu

You can change the base settings of this table by right-clicking an entry in the table



Figure 57: Logger Settings



Reachability History	To display the History of when the Logger had communication with the ZONESCAN NET
Min Temp History	To display the Minimum Temperature of the selected Logger, click the Min Temp item
Max Temp History	To display the Maximum Temperature of the selected Logger, click the Max Temp item
Battery History	To display the charge state of the selected Logger, click the Battery History item
Comments	To add a comment about a Logger, select the Comments item. Enter the desired comment in the text field that appears. Click Apply to save the entered comment. The text is displayed in the table in the Comments field
Picture	To view an available Picture of the selected Logger. The Picture should have been taken and uploaded by ZONESCAN Mobile during the installation process
Maintenance	To Print out a report for the selected Logger to include all the fields in the Table
Add Logger	Click Add Logger to add a not-yet existing Logger to the list. In the window that opens, enter the values for Logger No., Location, Latitude and Longitude. After entering all values, confirm your entries by clicking the Save button
Edit Logger	To make changes to the base settings of existing Loggers, select Edit Logger. Make the desired changes and then click Save
Delete Logger	Loggers listed in the table can be deleted with the Delete Logger item
Delete Logger's Measurements	To delete the measurement data of a Logger, click the Delete Logger's Measurements item
Delete Logger's Sound Signals	Click Delete Logger's Sound Signals to delete the recorded signals
Delete All Loggers	Use this item to delete all Loggers for the current project
Delete All Loggers' Measurements	The measurement data of all Loggers is deleted by clicking this item
Delete All Loggers' Sound Signals	Click this item to delete the sound signals of all Loggers

Furthermore you have the options with context menus to select the Alpha Link and the Last Reached

Alpha Link

Indicates which Logger is connected



Figure 58: Alpha Link

Last Reached Shows the date when the Logger was contacted



Figure 59: Logger Settings

5.2 Alpha Table

In the Alpha Table, all Alphas of the current project are displayed.



A	lpha	Reachability	Batt.	Version	Min Temp.	Max Temp.	Comments
	50025	100%	7.18 V	2.40	9.0 °C	22.1 *0	

Figure 60: Alpha Table

5.2.1 Table Fields

Please refer to Tables and Settings of section Logger.

5.3 Repeater Table

In the Repeater Table, all Repeaters of the current project are displayed.

Alpha	Repeater	Logger							
	Repeater 🔺	Reacha	bility	Batt.	Version	Min Temp.	Max Temp.	Radio Operation Time	Comment
Ô	1 400 114		100%	3.66 V	7.6	17.0 °C	37.0 °C	2:51:00	
Ô	1 400 131		100%	3.63 V	7.6	15.5 °C	38.0 °C	2:51:00	
Ê	1 400 145		100%	3.64 V	7.6	16.0 °C	36.5 °C	2:51:00	
ê	1 400 147		100%	3.71 V	7.6	16.5 °C	34.5 *0	3:00:00	
ê	1 400 149		100%	3.64 V	7.6	16.0 °C	34.0 °C	3:00:00	
Ê	1 400 150		100%	3.71 V	7.6	16.0 °C	37.5 °C	2:51:00	
Û	1 400 153		0%	3.65 V	7.0	3.0 °C	10.0 °C	3:51:00	
Ê	1 400 155		100%	3.63 V	7.6	16.0 °C	34.0 °C	3:00:00	
ê	1 400 156		100%	3.66 V	7.6	16.5 °C	36.5 °C	3:00:00	
Ê	1 400 158		100%	3.66 V	7.6	16.5 °C	35.5 °C	2:51:00	
Ê	1 400 159		100%	3.63 V	7.6	16.5 °C	36.5 *0	3:00:00	
ê	1 400 160		100%	3.59 V	7.6	16.5 °C	36.0 °C	2:51:00	
	1 400 161		100%	3.64 V	7.6	16.0 °C	37.5 °C	3:00:00	
3	1 400 162		100%	3.60 V	7.6	16.0 °C	37.0 °C	3:00:00	

Figure 61: Repeater Table

5.3.1 Table Fields

Please refer to Tables and Settings of section Logger.

6 Administration View

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Note! This section is only relevant for users with supervisor level



Figure 62: Administration

- To change the settings of an existing project, click Administration in the View area of the menu bar. In the Project area, select the project that is to be changed. In the navigation bar, then click the Current Project > Settings item
- To save your settings, click the Save button in the respective table



6.1 Current Project Settings

Note! The preset values are guide values and may vary

6.1.1 General Table

						ZONESCAN
	View & Detection Administration		Project			
Current Project Messages Project Settings Areas Carolination East Calculation East Calculation East Calculation East Calculation Kull, Overlays	Administration Administration General Alpha Re Project Name: Description: Origent Name: Ori	a, 2 Approved to	es - El Repertor - El Logen Correlations Leak Sco	e Calulation	Events	Enal Settings

Figure 63: Settings > General

Project Name The name of the project is automatically taken over from the menu bar

Operating Type You can select the appropriate operating type according to operating mode. The Alpha item is preset. If you are working in a fixed network, click Fixed Network here. The data is then integrated in your network

6.1.2 Alpha Table

				ZONESCAN			
4	View	Project					
GUTERMANN	Naintenance	Albstadt 👻					
	Administration	2 Alphas - 57 Repeaters - 53 Loggers					
a 📑 Current Project	General Alpha Repeater Lo	ogger Correlations Leak Score	Calculation Events	Email Settings			
Hessages	Basebability Wassing Limits						
Project Settings	Reachability warning timits						
Areas	Warning when at or below:	60%	▼ [60%6]				
Email Import	Problem when at or below:	20%	✓ [2096]				
P Leak Calculation							
Events .	Battery Voltage Warning Limits						
S KML Overlays	Warning when below:	2.90 V	V [6]				
	Problem when below:	1.40 V	V [5.5]	V [5.5]			
	Temperature Warning Limits						
	Minimum temperature limit:		°C [-30]				
	Maximum temperature limit:		°C [70]				
	Warning when temp. below mini	mum for: 3	days [2	1			
	Problem when temp. below mining	mum for: 6	days [4	1			
	Warning when temp, above max	imum for: 3	days [2	1			
	Problem when temp, above max	imum for: 6	days (4	1			

Figure 64: Settings > Alpha

Reachability Warning Limits	Warning when not reachable for: Define the number of days after which a warning is displayed if an Alpha was not reached. Preset: 2 days
	Problem when not reachable for: Define the number of days after which an error is displayed if an Alpha was not reached. Preset: 4 days
Battery Voltage Warning Limits	Warning when below: Enter the charge state of the batteries of the Alphas below which a warning is displayed. Preset: 6.00 V
	Problem when below: Enter the charge state of the batteries of the Alphas below which an error is displayed. Preset: 5.50 V
Temperature Warning Limits	Minimum temperature limit: Enter the lower temperature value below which a warning or an error is displayed. Preset: -30.0 $^{\circ}$ C
	Maximum temperature limit: Enter the upper temperature value above which a warning or an error is displayed. Preset: 70.0 ℃
	Warning when temp. below minimum for: Enter the number of days after which a warning is displayed if the temperature measured at the Alpha remains below the limit value entered above. Preset: 2 days
	Problem when temp. below minimum for: Enter the number of days after which an error is displayed if the temperature measured at the Alpha remains below the limit value entered above. Preset: 4 days
	Warning when temp. above maximum for: Enter the number of days after which a warning is displayed if the temperature measured at the Alpha remains above the limit value entered above. Preset: 2 days



Problem when temp. above maximum for: Enter the number of days after which an error is displayed if the temperature measured at the Alpha remains above the limit value entered above. Preset: 4 days

6.1.3 Repeater Table

				ZC				
6	View	Project						
GUTERMANN	Maintenance Abs	tadt 👻						
	Administration 2.4	phas - 67 Repeaters - 63 Loggers						
a 📑 Current Droject	Ceneral Apha Repeater Logge	r Correlations Leak Ecore	Colculation E	Ovente Dinal Cettings				
Messages	Reachability Warning Limits							
Project Settings				trans 1				
Areas	warning when at or below:	00%		[ec.as]				
Email Import	Problem when at or below:	20%	* [[20%6]				
Events	Rattery Voltage Warning Limits							
S KML Overlays	Warning when below:	2.90 V	1	V [2.6]				
	Problem when below:	1.40 V		V [2.6]				
	Temperature Warning Limits							
	Minimum temperature limit:			°C [-30]				
	Maximum temperature limit:		0	°C [70]				
	Warning when temp, below minimum	for:	0	days [3]				
	Problem when temp. below minimum	for:	0	days (c)				
	Warning when temp, above maximum	n for:	0	days (3)				
	Problem when temp, above maximum	n for:	0	days (6)				
	Radio Operation Time Limits							
	Warning when ROP time exceeds:	6	ł	hours [6]				
	Problem when ROP time exceeds:	8		hours [8]				

Figure 65: Settings > Repeater

Reachability Warning Limits	Warning when not reachable for: Define the number of days after which a warning is displayed if a Repeater was not reached. Preset: 3 days
	Problem when not reachable for: Define the number of days after which an error is displayed if a Repeater was not reached. Preset: 6 days
Battery Voltage Warning Limits	Warning when below: Enter the charge state of the batteries of the Repeaters below which a warning is displayed. Preset: 2.80 V $$
	Problem when below: Enter the charge state of the batteries of the Repeaters below which an error is displayed. Preset: 2.60 V $$
Temperature Warning Limits	Minimum temperature limit: Enter the lower temperature value below which a warning or an error is displayed. Preset: -30.0 $^\circ\!\!C$
	Maximum temperature limit: Enter the upper temperature value above which a warning or an error is displayed. Preset: 70.0 $^{\circ}{\rm C}$
	Warning when temp. below minimum for: Enter the number of days after which a warning is displayed if the temperature measured at the Repeater remains below the limit value entered above. Preset: 3 days
	Problem when temp. below minimum for: Enter the number of days after which an error is displayed if the temperature measured at



the Repeater remains below the limit value entered above. Preset: 6 days

Warning when temp. above maximum for: Enter the number of days after which a warning is displayed if the temperature measured at the Repeater remains above the limit value entered above. Preset: 3 days

Problem when temp. above maximum for: Enter the number of days after which an error is displayed if the temperature measured at the Repeater remains above the limit value entered above. Preset: 6 days

6.1.4 Logger Table

Cat												ZC	DNE	SC/	AN/	NE	/
6		1	/iew				Pro	ject									
GUTERMANN	🦡 🗞 Maintenance 🂫 Abstadt			æ		*											
	Leak De	etection	Admin	istration			es - 57 Rep	satara - S	13 Loggers								
4 📳 Current Project		General	Alpha	Repeater		Logger	Correla	dons	Leak Score	Calculation	Events	Email Settings					
Nessages		Read	hability W	arning Lim	uts												
Areas	5	Warning when at or below:					-	5096			· [6096]						
Email Import	Backlass when at or below.																
P Leak Calculatio	n	PIODR	en wien	at or below				0%									
by Events		Batte	ry Voltag	e Warning	Limi	ts											
SKML Overlays		Warni	na when	helpur			6	00 V			V [2.9]						
		Broble	am when	halow				40.1			V (1.4)						
		FIODR	enn winen	Delow.				.40 V (27)									
		Temperature Warning Limits															
		Minim	um tempe	erature limit	t:		3	-20.0 °C			°C [-30]						
		Maxim	num temp	erature limi	t:		e	60.0 °C									
		Warni	ing when	temp. belo	w m	inimum f	ior: 3	3			days (4						
		Proble	em when	temp. belo	w m	nimum f	or: e	6				1					
		Warni	ing when	temp. abo	ve m	aximum f	for: 3	3				days [4]					
		Proble	em when	temp. abov	ve m	aximum f	for: 6	6				days (0)					
		Peak Decibel Warning Limits															
		Warni	ing when	Peak Noise	-0 f	or:	e	5			days [1	19					
		Proble	em when	Peak Nose	=0 fi	or:	1	10			days (2	days [2]					
		Radio	o Operatio	on Time Lin	nits												
1		Warni	ing when	ROP time e	excee	eds:	e	5			hours	6]					
		Proble	em when	ROP time e	excee	eds:	8	3			hours	0]					

Figure 66: Settings > Logger

Leak Value Warning Limits	Possible leak: Enter the values based on experience for displaying a possible leak. Preset: 40
	Probable leak: Enter the values based on experience for displaying a probable leak. Preset: 70
Reachability Warning Limits	Warning when not reachable for: Define the number of days after which a warning is displayed if a Logger was not reached. Preset: 4 days
	Problem when not reachable for: Define the number of days after which an error is displayed if a Logger was not reached. Preset: 8 days
Battery Voltage Warning Limits	Warning when below: Enter the charge state of the batteries of the Loggers below which a warning is displayed. Preset: 2.90 V
	Problem when below: Enter the charge state of the batteries of the Loggers below which an error is displayed. Preset: 1.40 V



Temperature Warning Limits	Minimum temperature limit: Enter the lower temperature value below which a warning or an error is to be displayed. Preset - 30.0 °C
	Maximum temperature limit: Enter the upper temperature value above which a warning or an error is to be displayed. Preset: 70.0°
	Warning when temp. below minimum for: Enter the number of days after which a warning is displayed if the temperature measured at the Logger remains below the limit value entered above. Preset: 4 days
	Problem when temp. below minimum for: Enter the number of days after which an error is displayed if the temperature measured at the Logger remains below the limit value entered above. Preset: 8 days
	Warning when temp. above maximum for: Enter the number of days after which a warning is displayed if the temperature measured at the Logger remains above the limit value entered above. Preset: 4 days
	Problem when temp. above maximum for: Enter the number of days after which an error is displayed if the temperature measured at the Logger remains above the limit value entered above. Preset: 8 days
Peak Decibel Warning Limits	Warning when dBmax=0 for: Enter the number of days after which a warning is displayed if the highest dB value measured at the Logger is equal to 0. Preset: 1 day
	Problem when dBmax=0 for: Enter the number of days after which an error is displayed if the highest dB value measured at the Logger is equal to 0. Preset: 2 days

6.1.5 Correlations Table

							ZONESCAN						
6	1	View			Project								
GUTERMANN	eak Detection	Nainte	nance	Abs	ladt	*							
	an Derectori	Adminis	stration	2 Alp	itan - 57 Repeaters - I	13 Logpera							
Current Project	General	alpha I	Repeater	Logoer	Correlations	Leak Sco	Calculation	Fuents	Email Settings	Admin			
Messages	Com	elation Cole											
Project Settings		-											
Areas	Yellov	w from:		40%			[40]						
Email Import	Red f	from:		80%			[80]						
Leak Calculation													
Events	Corre	elation											
S KML Overlays	Pipe	Length:		400.0 m			[400]						
I Projects	Pine	Material		Cast Iron Gray Iron			V [Durtis Iron]						
an Users		Discontract		case port, drey port			100 1						
System	Pipe	Dameter:		100 mm			[100 mm]						
Eind Device	Soun	d Velocity:		1342 m/	5		[1334]						
System Settings													
System Information	Filter	r Presets (S	Soft Materia	0									
	Filter	on:		[off]									
	Fiter	from:											
	Eltor	tor											
	T PCCT												
	nite	r Presets ()	Hard Hateria	al)									
	Filter	on:		V [off]									
	Filter	from:		250 Hz			[0]						
	Filter	to:		512 Hz			[512]						
	T PCCT			012 M									

Figure 67: Settings > Correlations

Correlation Color	There are two levels of warning thresholds: yellow in the range of 40 - 79%, which indicates a possible, and red in the range of 80 - 100% indicates a probable leak. The green indicator (0 - 39%, everything is in order) is here not shown. The default values are 40% and 80%
Pipe Presets	Pipe Length: Enter the distance between two Loggers. Preset: 600m Note! Incorrect evaluations will result if the entered length is shorter than the actual pipe length Note! If not sure, enter a value that exceeds the actual distance between the Loggers. Example: actual pipe length: 255m, entered pipe length: 600m
	Pipe - Material: Select the pipe material from the drop-down list.Preset: Ductile IronPipe - Diameter: Select the pipe diameter from the drop-down list.Preset: 100mmSound Velocity: The sound velocity is dependent on the pipe
Filter Presets (Soft Material)	material and is automatically set by the system upon selection of the pipe material. Preset: 1334 m/s Filter on: Select the check box if your pipe is made of soft material (e.g., PVC, PE) Filter from: Enter the lower Hz value above which filtering is to be performed. Preset: 0 Hz
	Filter from: Enter the lower Hz value above which filtering is to be performed. Preset: 512 Hz



 Filter Presets
 Filter on: Select the check box if your pipe is made of hard material

 (Hard Material)
 Filter from: Enter the lower Hz value above which filtering is to be performed. Preset: 120 Hz

Filter to: Enter the upper Hz value up to which filtering is to be performed. Preset: 512 Hz

6.1.6 Leak Score Table

			ZONESCAN
4	View	Project	
	Maintenance	Albstadt 👻	·
	Administration	2 Alphas - 57 Repeaters - 83 Loggers	
4 📑 Current Project	General Alpha Repeater Log	iger Correlations Leak Score	core Calculation Events Email Settings
Ilessages	Leak Score Color		
Project Settings	CERK SCOTE CORM		
Areas	Yellow from:	60	[40]
Email Import	Red from:	80	[79]
P Leak Calculation			
Cvents 🗧	Spectrum Evaluation		
SKUL Overlays	Find low frequency leaks (e.g.	on plastic or trunk main pipes)	s)
	Electric Mains Frequency:	50 Hz	✓ -60 Hz]
	Leak Score		
	Env. Noise:		[0]

Figure 68: Settings > Leak Score

Env. Noise In this field, the measurement sensitivity of the logger can be adjusted to the environmental sound intensity

6.1.7 Calculation Table

								ZON	ESC	CANAN=	
		View			Project						
GUTERMANN	Lesk Der	ection Adminia	nden 🖓	Abstadt 2.Autor - S	Provines - 10 Log	gent.					
# 📑 Current Project											
Wessages Project Settion											
Areas	*										
C Email Import											
P Leak Calcular	lon										
Events	10										
Projects	·										
St Users											
# 🗃 System											
C Logs											
System Settin	-						_	Last cak	ulation	until: Jul 31, 201	5, 6:00:2
D System Infor	mation										
D System Infor	metion					/		Comput	tion S	tatus: done	
D System information	mation				-			Comput	ition 9	tatus: done	
D System inter	until: Jul	31 2015	6:00:	23 AM	1			Comput	ition S	tatus: done	_
To System infor	until: Jul	31, 2015	, 6:00:	23 AM	1			Comput	ition S	tatus: done 100%	_
U System Infor	until: Jul	31, 2015	, 6:00:	23 AM				Comput	mpute	loova loova	
€ System telev	until: Jul	31, 2015	, 6:00:	23 AM				Comput C C F	mpute	leak data	0
To System inter	until: Jul	31, 2015	, 6:00:	23 AM				Comput C F T	mpute	tatus: done 100% leak data Jul 31, 2015 Jul 31, 2015	0
Toysten information to an	until: Jul	31, 2015 me	, 6:00:	23 AM	1			Comput c R T	mpute mr:	tatus: done 100% leak data Jul 31, 2015 Jul 31, 2015	0
Types who	until: Jul	31, 2015 me	, 6:00:	23 AM				Comput C P T	mpute mt	tatus: done 100% leak data Jul 31, 2015 Jul 31, 2015	0
Tystemator	until: Jul atus: do	31, 2015	, 6:00:	23 AM				Comput	mpute mr: ::	tatus: done 100% leak data Jul 31, 2015 Jul 31, 2015	0
Tystemation u	until: Jul atus: do	31, 2015 me	, 6:00:	23 AM				Comput	mpute mt:	Latus: done 100% kak data Jul 31, 2015 Jul 31, 2015	0
Tystem More	until: Jul atus: do	31, 2015 one	, 6:00:	23 AM				Comput C P T	mpute mt	100% 100% leak data 24 31, 2015 34 31, 2015	0
To system information and a standard st	untii: Jul atus: do	31, 2015 one	, 6:00:	23 AM				Comput Co R T	mpute	100% 100% leak data 3xl 31, 2015 3xl 31, 2015	0
To systemation of a systematic	atus: do	31, 2015 one	, 6:00:	23 AM	Ī			Comput c n T	mpute	latus: done 100% kak data Jul 31, 2015 Jul 31, 2015	0
Compute la	until: Jul atus: do 100 eak data	31, 2015 one	, 6:00:	23 AM				Comput C R T	mpute	tatus: done 100% leak data Jul 31, 2015 Jul 31, 2015	0
Compute la From:	untii: Jul atus: do 100 eak data Jul 3	31, 2015	, 6:00:	23 AM				Comput	mpute ann:	Itabus: done Itabus Itak data Jul 31, 2015 Jul 31, 2015	0
Compute la From:	until: Jul atus: do 100 eak data Jul 3	31, 2015	, 6:00:	23 AM				Comput	mpute am:	International Status (International International Internat	0

Figure 69: Settings > Calculation



Start Leak Calculation	Perform leak calculation manually
Interrupt Leak Calculation	Interrupt leak calculation
Delete Leak Scores	Delete all leak scores
Refresh Data	Check e-mail

6.1.8 Events Table



Figure 70: Settings > Events

One of the essential additions to version 1.5.0 is the Events Table where e-mail alarms can be set for the project. Within this table the project administrators can setup the e-mail alarm parameters including the e-mail addresses of the recipients. The settings are designed to alert on a genuine leak rather than a false positive.



6.1.9 E-mail Settings Table

Verv Praject Buttermann Last Internance Last Detection Last Research = D space Current Project Ceneral Asha Research = Logor Project Settings Server Type: # POP3 (adval) Port: 110 [151] Account: abbrait@conescan.net Password: Password: Server Conductable Bord Fred Dogers are received by the server: Server Conductable Only reade subject contains: Z54et: Delete e-mais faster transfe: Only e-mais Order mais Order than 30 davs Server automatclaby delek de emais <th></th> <th>ZONESCAN</th>		ZONESCAN
UTERMANN	4	View Project
Corrent Project Central Apha Repeater Logger Correlation Leak Score Calulatin Events Email Settings Image Server Type: P POP3 [ddfwl] Image Server Type: Image Pop3 [ddfwl] Image Server Collapse Server Type: Image Pop3 [ddfwl] Image Server Collapse Server Type: Port: Image Pop3 [ddfwl] Image Pop3 [ddfwl] Image Pop3 [ddfwl] I		Leak Detection Numerication 2 Advised V
● Massges Server Type: ● POP3 (aduat) ● Product Status ● DAA ● Last Gaudation ● Status ● Last Gaudation ● DAT: ● Port: 10 ● Part: 10 ● Account: ● bstati@conescan.net ● Part: 10 ● Account: ● bstati@conescan.net ● Part: 10 ■ Account: ● bstati@conescan.net ■ Pasword: ■ Conescan.net ■ Delete = mals after tantefre: ■ Evere: ■ Never ■ Daly at (con Ad) ■ Daly at (con Ad) ■ Every ■ Da	Current Project	General Alpha Repeater Logger Correlations Leak Score Calculation Events Email Settings
Image: Server: Image: SSL [st] Image: Server:	Messages	Senar Tune: @ PDP3 [ddp.d]
• rots JAW • Institution SSL [#7] • trait Calculation Server: • trait Calculation Server: • trait Calculation Port: • trait abstact/deconscan.net • Passivoword: Passivoword: • rots. Overways Account: • Automatically add loggers when e-mails from [wr] Itsl • Passivoword: Passivoword: • Passivoword:	Project Settings	
United and the server: SSL (∞) Versis Pot: 10 Pot: 10 [16] Account: abstradt@zonescan.net Password: Never Delete = emails inter transfer: moutes Never	Email moort	
Server: malLonescan.net Port: 110 Account: abstard@xonescan.net Password:	P Leak Calculation	SSL [off]
Port: 110 [10] Account: abstadt@zonescan.net Password:	by Events	Server: mal.zonescan.net
Account: abstadt@zonescan.net Password: Automatically add loggers when e-mails from prevoudy undefined loggers are received by the server: Server cadiguration Of only read e-mails whose subject contains: Z5-liet Delete e-mails after transfer: Never Never Never Delete e-mails after transfer: Never Delete e-mails after transfer: Delete e-mails after transfer: Delete e-mails after transfer: Never Delete e-mails after transfer: Delete	SKML Overlays	Port: 110 [110]
Password: Automatically add loggers when e-mals from [son] previously undefined begins are necessed by the server: Server configuration © Only read e-mals whose subject contains: 25-Het Delete e-mals after transfer: Only read e-mals whose subject contains: 25-Het Delete e-mals after transfer: Only read e-mals whose subject contains: 25-Het Delete e-mals after transfer: Only read e-mals whose subject contains: 25-Het Delete e-mals after transfer: Only read e-mals older than 30 days Server automatically checks e-mal: Only e-mals older than 30 days Server automatically checks e-mal: Only at 6:00 AM (margin: ±1:52) Only at 30 scheduled imports: ±1:52) Only at 30 scheduled imports: ±1:52) Only at 30 scheduled imports: ±1:52)		Account: abstadt@zonescan.net
Automatically add biogers when e-male from [ini] pervensionally undefined biogers are received by the server: Server Configuration I only read e-mails whose subject contains: [25-Het: Delete e-mails after transfer: Delete e-mails after transfer: Palete e-mails after transfer:		Password:
Only read e-mais whose subject contains: 25-tet Delete e-mais after transfer: Never Ahways [subset] Only e-mais older than 30 days Server automatically checks e-mai: Never Daly at [6:00 AM] Every minutes U Latest mail sent time of ats 35 obtel-back emposit: +1:52) of ats 35 obtel-back emposit: +1:47, on 7/12/15) 		previously undefined loggers are received by the server:
Com/ Yea e-mais whole subject contains <u>ZS-siec</u> Delete e-mais after transfer: Never Never Aways [Safuk1] Bolly e-mails older than <u>30</u> days Server automatically checks e-mail: Never Daly at <u>6:00 AM</u> (<u>5:00 AM</u>) Never Daly at <u>5:00 AM</u> (<u>5:00 AM</u>) Latest mails ent that Daly at <u>5:00 AM</u> (<u>5:00 AM</u>) Latest mails ent that O fast <u>5:00-00404</u> emotis: <u>4:152</u>) - of alst <u>3:00-00404</u> emotis: <u>4:152</u>)		Server computation
Only e-main and of data def. Never Always [shink1] Only e-main older than 30 days Server automatically checks e-main Never Only at (colo AM (for AM) Cerver) minutes U Latest mail sent time of als scheduled imports: +1:52) of als scheduled imports: +1:547, on 7/12/15)		Izi Only read e-mais whose subject contains: ZS-Net
Interver Anayas [Infinit] Only e-mals older than 30 days Server automatically checks e-mail: Never Daly at (6:00 AM Control AM) Every minutes Ulatest mail sent time of last scheduled imports: +1:52) of last 30 scheduled imports: +1:547, on 7/12/15)		Deter emission and constent.
Anays (where the other series) Anays (where the other series) Server automatically checks e-mail: Never Daily at (where the series) Daily at (where the series) Latest mail sent time of all scheduled monotts: +1:52) of all scheduled montts: +1:52) of all scheduled montts: +1:52)		
Conv d-mails over train 30 earlys Server automatically checks e-mail: Never Daly at 6:00 AM Every Conv d-mails Every Latest mail sent Latest mail sent denote: +1:02 of ast 3:0 scheduled imports: +1:147, on 7/12/15)		Annays (seems)
Server automutcally checks e-matc Never Never Server John M Server John M		© Only e-mails older than 30 days
Never Daly at 6:00 AM (6:00 AM (6:00 AM		Server automatically checks e-main
Daly 21 (-600 AM (-500 AM (-500 AM (-500 AM (-500 AM (-500 AM (-500 AM (-		C Never
Every minutes Every ninutes Ulatest mail sent time of last scheduled moorts: 41:3 AM (margin: +1:52) of last 30 scheduled imports: 41:3 AM (margin: +1:47, on 7/12/15)		Daily at 6:00 AM C (6:00 AM C (6:00 AM)
 ✓ Latest mail sont time • of last scheduled moots: +07 AM (marxin: +1-52) • of last 30 scheduled imports: 4:13 AM (marxin: +1:47, on 7/12/15) 		Every minutes
		 ✓ Latest mail sent time • of last scheduled imports: 4-07 AM (marchi: +1:52) • of last 30 scheduled imports: 4:13 AM (marchi: +1:47, on 7/12/15)
Test Results		Test Results



Server Type: Click to define your server type. Select the SSL (Secure Sockets Layer) check box if necessary. Preset: POP3

Server: Enter your server's name. Example: pop.1and1.com

Port: Enter the port enabled for e-mail reception. Preset: Port 110

Account: Enter the e-mail account that receives the data for the project. Example: albstadt@zonescan.eu

Password: Enter the password for the e-mail account entered above

Check the "Automatically add Loggers when e-mails from previously undefined Loggers are received by the server" to avoid having to manually set up new Loggers Preset: check box is selected

Server Configuration "Only read e-mails whose subject contains:" Select the check box and enter ZS-Net in the text field

Delete e-mails after transfer: Select whether and when the transferred e-mails are deleted:

- Never
- Always



 Only e-mails older than N days Enter the number of days after which e-mails are deleted Preset: Always

"Server automatically checks e-mail:" Select whether and when the server checks for new e-mail.

- Never
- Daily at Select the desired time from the drop-down menu
- Every N minutes
 Enter the number of minutes after which the server checks for new e-mail.

Preset: Daily at 5:00 AM

Note! When entering the time, note that the calculation is useful only after e-mail has been checked. The time of the correlation calculation can be defined in the Server Configuration table

Test Results If you test the e-mail settings with the Test e-mail settings button, the test results appear here

Use the Test e-mail settings button to test whether your settings are correct and e-mails can be received. The results of the test appear in the Test Results field

6.1.10 Administration Table



Figure 72: Settings > Administration



6.2 KML Overlays

The uploaded KML (Keyhole Markup Language) overlay files are displayed here in a list:

				ZONESCAN	
GUTERMANN	and been	Ven Statemente Adventution	Properti Alberturd V 2 Statemen - El Leggerer		
Current Project		Overlay id	Uphaded	Fierane	File size
O tiessages		1181	Dec 10. 2010. 5 32 34 Mil	Rydrantanz	120754
Project Setting	ps	1162	Dec 10, 2010, 5:30:35 PM	D2 Pfe/finger Dir. Ant	80287
 Areas Email Import Leak Calculation Events 	-	1183	Darr 10, 3010, 6 10 45 06	12 Gr Householdson, 3 - Concine	54182
Si Kili, Overleys					

Figure 73: List of the KML files

Import	Click Import to upload the KML files stored on the PC
Delete	Click to delete a selected KML file from the list
Delete All	Delete all KML files in the list

6.3 Projects

All currently running projects are displayed in a list:

					ZO	NESCAN						
GUTERMANN	Leak Detection	antenance Abstan	Project									User Klaus
# 3 Current Project	Project Name .	Active	Operating Type	Time Zone		Import (Server Time)	Last time margi	Minimum time m.	Created By Last	t Login	Description	
Messages	Abstadt	Active	Alpha	Berlin (UTC+1:00/+2:0	2)	06:00	+1:54	+1:47	2011	5-07-28 10:01		
Project Settings	alphatest	Active	Alpha	Berlin (UTC+1:00/+2:01	3)	06:00	-2.35	7:50	2011	5-06-23 16:38		
Areas	~	Active	Lift & Shift	Berlin (UTC+1:00/+2:0	3)		-		2015	5-06-23 16:38 -		
Ernel Import	1	Active	AMI	Los Angeles (UTC-8:0	0/-7:00)	17:00	-		2011	5-06-26 22:14		
P Leak Calculator		Autor	Alpha	Berlin (UTC+1:00/+2:0))	06:00	-0.16	-0.07	2011	5-07-14 09:59		
Events		Active	Alpha	Paris (UTC+1:00/+2:00	9	06:00	-1:48	-1:54	2015	5-07-24 16:41		
SKML Overlays		Active	Alpha	Berlin (UTC+1:00/+2:0	(0				2015	5-07-14 11:51 -		
I Projects		Active	Alpha	De-la (UTC+1:00/+2:0	3)	04:30	+0.10	+0.07	2011	5-07-24 16:40		
Users		Active	Alpha	Berlin (UTC+1:00+9-0	10	06:00	+2:05	+2:02	2015	5-07-08 12:42		
a System		Active	Alpha	Berlin (UTC+1:00/+2:01	0	08.00	+2:27	+2.26	2011	5-07-14 11:52 -		
Cops		Active	Alpha	Berlin (UTC+1:00/+2:0	2)	10.15	+5:27	+5:27	2011	5-07-08 13:19-		
Contex Cations		Active	Alpha	Berlin (UTC+1:00/+2:0	2)			-	2015	5-03-16 12:21		
D Custan informat		Active	Alpha	New York (UTC-5:00/-	4.00)	12:00	+1:45	+1:29	2015	5-01-15 10:38-		
- y system internal	ugn	Active	Alpha	Jerusalem (UTC+2.00/	-3:00)	00.45	+2.05	-1785	2011	5-07-23 14:06-		
System informat	601	Adve	Apha Apha	New York (UTC-5:00- Jerusalem (UTC+2:00/	4.00)	12.00 00.45	+1:45	+139 +1780	2011	5-07-23 14:06	_	
		Proje	ect warne 🔺	1	ACIVE	Operatin	g iype	110	ie Zulie			
		Albs	tadt		Active	Alpha		Be	rlin (UTC+1:00/+2:0	0)		
		alph	atest		Active	Alpha		Be	rlin (UTC+1:00/+2:0	0)		

Figure 74: Project List

Add	Create a new project
Edit	Edit a project selected in the list
Delete	Delete a selected project from the list
Import Project	An existing project stored on the PC is imported
Merge Project	To merge two projects, you need an (exported) project file that is then imported into an already existing project. In the project list, select the project into which the file is to be imported. Then click Merge Project
Export Project	All projects are exported



Import Loggers	Selected Loggers are imported
Export Loggers	All Loggers contained in the project are exported

6.4 Users

All users and their assigned projects are displayed in this table:

	ZONESCAN											
GUTERMANN	est Defection	Abstact	Project							User Haus		
# 🔋 Current Project	User Name	User Type	First Name	Last Name	Assigned Projects	Email Address	Created By	LastLogin	Conment/Company			
Illessages Project Settings	Kaus	Administrator			Albatadt elgihelest			logged in (20)				
Areas Control import Control	luces	Administrator										
Stat. Overlays	Operator	Operator			(7657)							
Projects	management,	Viewer										
St Users												
System Logs Logs Sectors												
System betings	netin2	Viewer			Allekladt alþratest			2816-86-12 11 21				

Figure 75: Users

Add	Click Add to create a new user. In the window that opens, enter			
	user name, password, user type as well as the first and last name.			
	Click to assign the user individual projects. Once all data has been			
	entered, click Save to activate the profile			
Edit	Click the Edit button to edit an existing profile			
Delete	Click Delete to remove an existing profile			

6.5 System

The system category lists all information related to the ZONESCAN NET server. This category is only available for Administrators.



	ZONESCAN					
6	View		Project			
GUTERMANN	🦡 👋 Mair	ntenance 🂫	Albstadt	~		
	Adm	inistration .	2 Alphas - 57 Repeaters - 83	Loggers		
Current Project	K < X >	N 🔊 🔊	80			
Messages	Date	Category Mess	sage			
Project Settings Areas Areas Cenaimport Cen	Jul 21, 2015, 6:0	info Suco	cessfully finished computation	process for project Albstadt.		
	Jul 21, 2015, 6:0	Info Sent	Sent [6] CAP messages to URL [http://10.135.20.10:10039/ibm/iss/common/rest/publisher]			
	Jul 21, 2015, 6:0	Info Start	Started computation process for project Albstadt			
	Jul 21, 2015, 6:0	Info Finis	Finished handling messages - read 2 messages - expunged 0 messages.			
	Jul 21, 2015, 6:0	Info Mail	check started for mailbox alb	stadt@zonescan.net@mail.zonescan.net.110	with protocol POP3.	
	Jul 20, 2015, 6:0	info Suco	cessfully finished computation	process for project Albstadt.		
	Jul 20, 2015, 6:0	Info Start	ed computation process for p	project Albstadt		
	Jul 20, 2015, 6:0	Info Finis	Finished handling messages - read 2 messages - expunged 0 messages.			
	Jul 20, 2015, 6:0	info Mail	Mail check started for mailbox albstadt@zonescan.net@mail.zonescan.net:110 with protocol POP3.			
	Jul 19, 2015, 6:0	info Suco	Successfully finished computation process for project Albstadt.			
	Jul 19, 2015, 6:0	info Sent	[13] CAP messages to URL [http://10.135.20.10:10039/ibm/iss/common/res	it/publisher]	
	Jul 19, 2015, 6:0	Info Start	ed computation process for p	project Albstadt		
	Jul 19, 2015, 6:0	Info Finis	hed handling messages - rea	d 2 messages - expunged 0 messages.		
	Jul 19, 2015, 6:0	Info Mail	check started for mailbox alb	stadt@zonescan.net@mail.zonescan.net.110	with protocol POP3.	
	Jul 18, 2015, 6:0	info Suco	cessfully finished computation	process for project Albstadt.		
	Jul 18, 2015, 6:0	Info Sent	[2] CAP messages to URL [h	ttp://10.135.20.10:10039/ibm/iss/common/rest	/publisher]	
	Jul 18, 2015, 6:0	Info Start	ed computation process for p	project Albstadt		
	Jul 18, 2015, 6:0	Info Finis	hed handling messages - rea	d 2 messages - expunged 0 messages.		
	Jul 18, 2015, 6:0	Info Mail	check started for mailbox alb	stadt@zonescan.net@mail.zonescan.net.110	with protocol POP3.	
	Jul 17, 2015, 6:0	info Suco	cessfully finished computation	n process for project Albstadt.		
	Jul 17, 2015, 6:0	Info Sent	[6] CAP messages to URL [h	ttp://10.135.20.10:10039/ibm/iss/common/rest	/publisher]	

Figure 76: System Messages

6.5.1 Messages

There are two types of messages:

Info This is a simple status message about system activities and background processes Warning

Please contact support if a message is displayed with the warning status

7 Appendices

7.1 Correction explained in detail

Leakage noise is generally a wild mixture of tones, each of which can be associated with individual frequencies (tone pitches, oscillations). The distribution of this frequency content is referred to as a spectrum.

First, the time series signal is recorded. These time series values can undergo a mathematical transformation, Fourier analysis.

A particularly efficient computational technique of Fourier analysis is the FFT (Fast Fourier Transform). This is used to calculate the frequency content and, in particular, identify the presence of dominant individual frequencies. Using this information, it is possible, for example, to draw conclusions on disturbances (e.g., electrical machines).

Frequencies are specified in units of Hz (Hertz) as the number of oscillations per second. For leakage noises, one usually finds a uniform mixture of frequencies, primarily located in the range from 50 to 1000 Hz.

The knowledge of the spectrum, i.e., of the frequency response, is particularly helpful for the computational use of filters, by means of which one can separate the useful and the interfering portions of the noise measurement spectra.

Correlation is a mathematical method for comparing two time series signals with one another.

A leakage noise is simultaneously recorded by two sensors at different locations. The sound emitted by the leak spreads in the water pipe at a defined sound velocity. If the acoustic event were to be brief and occur only once, e.g., a blow with hammer, it would be simple to measure the arrival at both receivers. In this case, one would only need to compare the arrival times at the two receivers with one another. If these are the same, the sound has traveled the same distance to the receivers, i.e., the sound source lies in the middle of the pipe between the receivers.

If the arrival times are different, it is possible to calculate the distance to the two receivers from the measured time difference. The sound arrives at the closer sensor before the more distant sensor.

Leakage noise, however, is not a one-time acoustic event, but it is also not completely monotonous. Small, irregular changes in sound intensity and frequency occur. These changing signatures travel to the two receivers in the same way as a hammer blow and may arrive at the sensors at different times.

Because the identification and comparison of an individual signature is not as simple as in the case of a hammer blow, the two time series signals are first recorded for a period of time; the time series includes many individually measured signal values.

The two time series signals are mathematically compared with one another, i.e., correlated with one another. If the leakage sound arrived at the sensors simultaneously, the same signatures are compared and the signals are then similar and the correlation is high.



In general, however, the respective signatures arrive at the sensors at different times and simultaneously recorded signals do not correlate with one another. Because the signals were digitally recorded and stored, it is possible to retroactively shift the signals with respect to one another and re-correlate them with one another.

This is performed systematically. From the results, one obtains a correlation curve that includes the individual correlation values over the respective computationally performed time shift.

If, during this process, one reaches precisely the time shift that corresponds to the propagation time difference from the sound source to the two receivers, the signal signatures match and one obtains a correlation maximum at this point.

Because this is the comparison of two different signals, it is also called a cross correlation.

In the context of leakage noises, the goal of the correlation measurement is primarily to determine the propagation time difference of two signals.

Because the correlation curve also includes spectral information, it is often of interest to define the character of the leakage noise, particularly for distinguishing noises that are not related to the leak, provided this can be detected by means of a frequency analysis (e.g., electrical noise). The correlation curve can also be mathematically filtered for the purpose of retroactively separating such interfering noise to better identify the correlation maximum caused by the leak.

7.2 Center Correction explained in detail

With correlation we measure the time delay between the leak noise reaching both sensors:



Figure 77: Center Correlation

From this we can calculate the leak distance from both sensors, but only if we know the pipe length between the sensors x. In practice, in ZONESCAN NET we often don't know the pipe length because it was not entered using the pipe wizard of manual pipe entry.

Even if we don't know the pipe length however, we can always calculate the offset of the leak from the center between the sensors using the default sound velocity. This is called center distance.



7.2.1 Example

The selected correlation between sensors 402179 and 402193 in project "Albstadt" below seems to be left of sensor 402193.



Figure 78: Center Correlation – cont.

As we can see from the KML (Keyhole Markup Language) overlay this is not possible because there is no direct pipe connection between the sensors. However, the center distance of 55m tells us that the noise source is 55m from the center between the sensors towards logger 402193 (if it was towards the first sensor, the center distance would be negative). From this we can see that the correlation position is the junction with the pipe coming from the PRV (Pressure Reduction Volve), which is also the cause for the correlation.

8 Hardware Description

8.1 Overview

As shown in Figure 1, the ZONESCAN system consists of the devices

- ZONESCAN 820 Logger
 - Model 4-1-C1 (EU, internal antenna),
 - Model 4-2-C1 (EU, external antenna),
 - Model 5-1-C1 (North America, internal antenna)
 - Model 5-2-C1 (North America, external antenna)
- ZONESCAN 820 Repeater
 - Model 4-1-C1 (EU)
 - Model 5-1-C1 (North America)
- ZONESCAN Alpha communication unit
 - Model S-ALPHA-4-0-A1 (EU)
 - Model S-ALPHA-5-0-A1 (North America)

External Antenna types

- ZONESCAN 820 Logger
 - Impedance 50Ω
 - Antenna gain: 0dBi max.
 - Polarisation: linear; vertical

Example: C02+MT07-1+174U+SMA M from CHIN MORE

 Model S-ALPHA Impedance 50Ω Antenna gain: 12dBi max. Polarisation: linear; vertical Example: YA9-11 from LAIRD TECHNOLOGY



8.2 Installation

The initial setup of the ZONESCAN system and/or specific training for the setup is provided by a qualified Gutermann representative.

8.3 Conformity

This device complies with part 15 of the FCC Rules and with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

9 Disposal

Never put electrical appliances, accumulators, and batteries in household waste bin. Always collected separately and perform an environmentally friendly recycling. When disposing of electrical appliances, accumulators, and batteries always comply with national and regional waste disposal regulations. If an orderly disposal of our products is not possible, send the unit to us. We dispose our products environmentally friendly. Address see imprint.

10 Imprint

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