

Programme

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- 2. Precautions
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- 4. Recommended file naming convention
- 5. Field communications
- 6. Training runs Learning to use the software
- 7. System Maintenance
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System Components



Precautions

- This system contains rechargeable batteries and sophisticated components and electronics. Do not expose this system to prolonged extreme heat (>60°C) or cold (<-10°C) or moisture. Please observe the maintenance and storage instructions specified herein.
- Do not attempt to dissemble the casing. Refer servicing to qualified personnel only. ONLY USE BATTERY CHARGERS PROVIDED BY THE MANUFACTURER. Using other chargers may cause damage to the system or result in fire or personal injury.
- Hold the mains-plugs by the head when removing it from the wall socket, as pulling the lead can damage the internal wires.
- When using the system, please observe the local site safety and environmental instructions. It is advised to always wear safety clothing (helmet, reflective vest, reinforced shoes, safety goggles, etc.) when operating this system.
- The voltage used must be the same as that specified on the battery charging units. Using a higher or lower voltage is dangerous and may result in fire or other type of accident causing damage.
- REDUCT cannot be held responsible for any damage or personal injury resulting from improper use of the system or it's components.
- This system may be operated only by "Reduct Certified Operators".

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System assembly and basic OMU operation

- Wheel assembly
- OMU assembly
- ON/OFF procedure: Sound signals and Led indicators (see QRG)

OMU	Status	Summary
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Red LED	Green LED	Beeping	Status	Solution
Off	Off	None	OMU is switched off	N/A
Flashes twice intermittently	Switched on continuously	Twice (one time)	OMU in logging mode	N/A
Once intermittently	Four times intermittently	Continuous	There is data in the OMU flash memory. OMU cannot start logging.	Delete data from memory
Flashes continuously	Switched on continuously	None	IP connection with PC established	N/A
Switched on continuously	Flashes twice intermittently	None	Data download to PC in progress	N/A

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Recommended file naming convention

Assume the below project information

San	nple Project Lo	g Information		
Client Name	Brussels Gas HDD BE014 22/03/2011			
Project Name				
Measurement date				
OMU Serial Number		84440105		
Measurement Dataset Information	Dataset started at coordinate A or B?	Number of passes/runs through the pipe before switching OMU off	OMU moved Forward or Backward	
Dataset 1	А	4	FFFF	
Dataset 2	В	2	FB	

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Recommended file naming convention

Green = Auto generated input Red = Manual Input

Sample Project Log Information			
Client Name	Brussels Gas		
Project Name	HDD BE014		
Measurement date		22/03/2011	
OMU Serial Number		84440105	
Measurement Dataset Information	Dataset started at coordinate A or B?	Number of passes/runs through the pipe before switching OMU off	OMU moved Forward or Backward
Dataset 1	А	4	FFFF
Dataset 2	В	2	FB

In project directory			
Project Sub-directory	20110322-Brussels Gas-HDD BE014		
In X-Traction			
Project Log File (optional)	110322-Brussels Gas-HDD BE014		
Project Log + Datase t1 Raw Data	110322-Brussels Gas-HDD BE014-D1-105-A-FFFF		
Project Log + Dataset <mark>2</mark> Raw Data	110322-Brussels Gas-HDD BE014-D2-105 <mark>-B-FB</mark>		
Profile Dataset1 - Run1	110322-HDD BE014-D1-R1-AB-F		
Profile Dataset1 - Run2	110322-HDD BE014-D1-R2-BA-F		
Profile Dataset1 - Run3	110322-HDD BE014-D1-R3-AB-F		
Profile Dataset1 - Run4	110322-HDD BE014-D1-R4-BA-F		
Profile Dataset2 - Run1	110322-HDD BE014-D2-R1-BA-F		
Profile Dataset2 - Run2	110322-HDD BE014-D2-R2-AB-B		
In X-View			
Average 3D XYZ	110322-Brussels Gas-HDD BE014-Average-XYZ		
Average Depth Profile XZ	110322-Brussels Gas-HDD BE014-Average-Depth Profile		

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Field communications

The basic principle of communication is:

Less is More

There are two forms of communication:

- 1. Verbal (Walkie-Talkie)
- Rope movement: Experienced crews know by the movement of the rope what is happening at the other side.

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Specifications may change without prior notice





Specifications may change without prior notice





Always communicate unexpected events

Unexpected event	Message
If you are standing at the OMU <u>departing side</u> and the pulling cord stops moving unexpectedly. This could indicate that the tools is stuck and the cord is stretching.	"Pulling cord stopped moving. Please confirm."
If you are standing at the arriving side and you notice that pulling is very heavy.	"Pulling is very heavy. Please confirm you are not braking hard."

Communicate any other unexpected event immediately !

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Suggested rope markings

To forewarn that the OMU is nearing the end of the pipe and to prevent it from falling out of the pipe Reduct recommends to clearly mark the pulling cord.



Specifications may change without prior notice

Training Runs

- Step 1: Perform AB F run and process data.
- Step 2: Perform ABA FF run and process data.
- Step 3: Perform ABA FB run and process data

(Move track slightly if possible (not entry/exit))

• Step 4: Perform ABABA FBFB run and compare result to results of Step 3.

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Small test: Which data graph belongs to the Pos (X) chart?



How to detect measurement errors

The most important indicator of unreliable results is the scaling factor. Almost all human and system errors will result in an abnormally *high* scaling factor.



Possible cause	Cross Verification	Solution
Both wheels have slipped simultaneously and as a result distance information is missing for part of the measurement.	See section 'Odometer diagnostics' in this chapter to verify whether slippage has occurred during the run.	 Data is not reliable; the measurement needs to be repeated. Verify that the spring force of the wheels units is sufficient.
Sensor signals have saturated and the shape of the run is incorrect.	Compare results of multiple runs in X-View. If the spread is large, saturation is likely.	 Data is not reliable; the measurement needs to be repeated.
Incorrect GIS data was entered for the entry and exit points.	Check GIS values file if saved, or check the first and last coordinates in the .csv output file.	 If incorrect, re-execute the data using correct coordinates.
The wrong Wheel Unit configuration was used during the processing of the data.	Verify that the wheel configuration setting in the 'Ductrunner Configuration' window matches the manufacturers instructions.	 Re-execute the data processing steps using the correct configuration setting.

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Potential operational hazards

1. OMU runs over pulling cord. **RISK = HIGH**

In HDDs the OMU departs at a <u>sloping angle</u>. The weight of the OMU will likely cause it to run over the pulling cord which may get tangled up in the front and/or rear wheel set. This may cause the OMU to get stuck inside the pipe in if there are welds.



Recommendation 1: Operator at departing side applies slight tension on the pulling rope to stop OMU moving faster than pulling speed. Recommendation 2: Create a 15m section of rope with a garden hose around it before and after the OMU.

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Potential operational hazards

2. Knots in the pulling cord.

In many cases, a nice looking rope will already be installed in the pipe. Be aware that when you use it, it may at some point have large knots that will block the winch.

Recommendation: Never leave the winch when pulling.

RISK = Moderate



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Potential operational hazards

Using temporary coordinates RISK = Poor result

Sometimes, you do not have the exact coordinates of entry and exit point yet but you do want to verify that the recorded data is good. You can use temporary coordinates where A or B is (0,0,0), but be sure the ORIENTATION of you coordinates is approximately correct. Consider the 5 HDDs of each 400m.

Correct temporary coordinates are:

HDD	General Orientation	Coordinate A	Coordinate Bn
A-B1	W to E	0, 0, 0	400, 0, 0
A-B2	SW to NE	0, 0, 0	283, 283, 0
A-B3	S to N	0, 0, 0	0, 400, 0
A-B4	SE to NW	283, 0, 0	0, 283, 0
A-B5	E to W	400, 0, 0	0, 0, 0



Why bother? EARTH ROTATION!

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	Event	Actual impact on results	How to detect/suspect	
	Overshooting the endpoint			
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	Event	Actual impact on results	How to detect/suspect	
	Overshooting the endpoint	Straight runs: minor	Sudden bend in depth profile at	
/		Curved runs: moderate	end point.	
1		90 degree runs: could be significant	Suggestion: Keep a field log to	
		NEVER PUSH THE OMU BACK IN.	remember afterwards.	
	Very loose odometer			
/	wheels			
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	Event	Actual impact on results	How to detect/suspect	
	Overshooting the endpoint	Straight runs: minor	Sudden bend in depth profile at	
/		Curved runs: moderate	end point.	
1		NEVER PUSH THE OMU BACK IN.	remember afterwards.	
6	Very loose odometer	Two wheels measure redundantly,	See 'position' chart in X-Traction	
/	wheels	so theoretically very little impact.	for single wheel signal.	
11		However, be aware of	Bigger than expected spread in	
-		misalignment!	X-View indicates misalignment.	
	OMU stopped 2 minutes in			
	the middle and continued			
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_				
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	Event	Actual impact on results	How to detect/suspect	
	Overshooting the endpoint	Straight runs: minor	Sudden bend in depth profile at	
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		90 degree runs: could be significant	Suggestion: Keep a field log to	
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	wheels	so theoretically very little impact.	for single wheel signal.	
		However, be aware of	Bigger than expected spread in	
-		misalignment!	X-View indicates misalignment.	
	OMU stopped 2 minutes in	None	Keep a field log to remember	
	the middle and continued		afterwards because the 2-minute	
			stop is not a calibration period!	
	OMU stopped, moved			
	backwards a couple of			
	meters, then continued.			-
				1
				1

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Event	Actual impact on results	How to detect/suspect
Overshooting the endpoint	Straight runs: minor Curved runs: moderate	Sudden bend in depth profile at end point.
	90 degree runs: could be significant NEVER PUSH THE OMU BACK IN.	Suggestion: Keep a field log to remember afterwards.
Very loose odometer wheels	Two wheels measure redundantly, so theoretically very little impact. However, be aware of misalignment!	See 'position' chart in X-Traction for single wheel signal. Bigger than expected spread in X-View indicates misalignment.
OMU stopped 2 minutes in the middle and continued	None	Keep a field log to remember afterwards because the 2-minute stop is not a calibration period!
OMU stopped, moved backwards a couple of meters, then continued.	Additional length was created.	Higher than expected 'scaling factor'. Measurement is NOT VALID.
Switched A and B points in		
X-Iraction.		

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	Event	Actual impact on results	How to detect/suspect
	Overshooting the endpoint	Straight runs: minor Curved runs: moderate 90 degree runs: could be significant NEVER PUSH THE OMU BACK IN.	Sudden bend in depth profile at end point. Suggestion: Keep a field log to remember afterwards.
11/	Very loose odometer wheels	Two wheels measure redundantly, so theoretically very little impact. However, be aware of misalignment!	See 'position' chart in X-Traction for single wheel signal. Bigger than expected spread in X-View indicates misalignment.
	OMU stopped 2 minutes in the middle and continued	None	Keep a field log to remember afterwards because the 2-minute stop is not a calibration period!
	OMU stopped, moved backwards a couple of meters, then continued.	Additional length was created.	Higher than expected 'scaling factor'. Measurement is NOT VALID.
	Switched A and B points in X-Traction.	Result will be mirrored. Visible in X- View.	Forward and backward runs do not match.
	Make an error in B XY- coordinate.		
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Event		Actual impact on results	How to detect/suspect
Overshooting the e	ndpoint S	Straight runs: minor	Sudden bend in depth profile at
	0	Curved runs: moderate	end point.
Ĩ	9	90 degree runs: could be significant NEVER PUSH THE OMU BACK IN.	Suggestion: Keep a field log to remember afterwards.
Very loose odomet	er T	Two wheels measure redundantly,	See 'position' chart in X-Traction
wheels	S	so theoretically very little impact.	for single wheel signal.
	F	However, be aware of	Bigger than expected spread in
	n	misalignment!	X-View indicates misalignment.
OMU stopped 2 mi	nutes in 🛛 🔊	None	Keep a field log to remember
the middle and con	tinued		afterwards because the 2-minute
			stop is not a calibration period!
OMU stopped, mov	/ed A	Additional length was created.	Higher than expected 'scaling
backwards a couple	e of		factor'. Measurement is NOT
meters, then contin	nued.		VALID.
Switched A and B p	oints in R	Result will be mirrored. Visible in X-	Forward and backward runs do
X-Traction.	V	View.	not match.
Make an error in B	XY- A	ALL Coordinates will be wrong	Usually, scaling is very high.
coordinate.			
Make an error in B	Z		
coordinate.			
·			

	Event	Actual impact on results	How to detect/suspect
	Overshooting the endpoint	Straight runs: minor	Sudden bend in depth profile at
_		Curved runs: moderate	end point.
1		90 degree runs: could be significant NEVER PUSH THE OMU BACK IN.	remember afterwards.
-	Very loose odometer	Two wheels measure redundantly,	See 'position' chart in X-Traction
/	wheels	so theoretically very little impact.	for single wheel signal.
		However, be aware of	Bigger than expected spread in
		misalignment!	X-View indicates misalignment.
	OMU stopped 2 minutes in	None	Keep a field log to remember
	the middle and continued		afterwards because the 2-minute
			stop is not a calibration period!
	OMU stopped, moved	Additional length was created.	Higher than expected 'scaling
	backwards a couple of		factor'. Measurement is NOT
	meters, then continued.		VALID.
	Switched A and B points in	Result will be mirrored. Visible in X-	Forward and backward runs do
	X-Traction.	View.	not match.
	Make an error in B XY-	ALL Coordinates will be wrong	Usually, scaling is very high.
	coordinate.		
	Make an error in B Z	ALL Coordinates will be wrong	Unexpected depth profile is
	coordinate.		observed. Scaling can be high if
V			error is large.

System maintenance

- Recharging the batteries
- Cleaning the OMU and the wheel sets
 - (Warm) water and cloth.
 - Moderate disinfectant (if used in potable water networks), then rinse with cold water.
- Cleaning the odometer magnets
 - Toothbrush
 - Cloth





Round-up

- Certified Operator Certificate handover.
- Signing of Maintenance Contract.
- Signing of System Acceptance document.



