

Production Array Imager (PAI) Surface Test

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Software Needed

- Sondex Warrior v8.34 or later
- Warrior Key license (P10V5)
- PAI service file

Interface & Tool Combinations

- UltraWire Telemetry Controller for toolstring communication
- Simultaneous operation with other UltraWire Logging tools
- Bottom end tool or bullnose is required for UltraWire termination

Gas Array Sensor (PAIGAT) Config Setup (1)

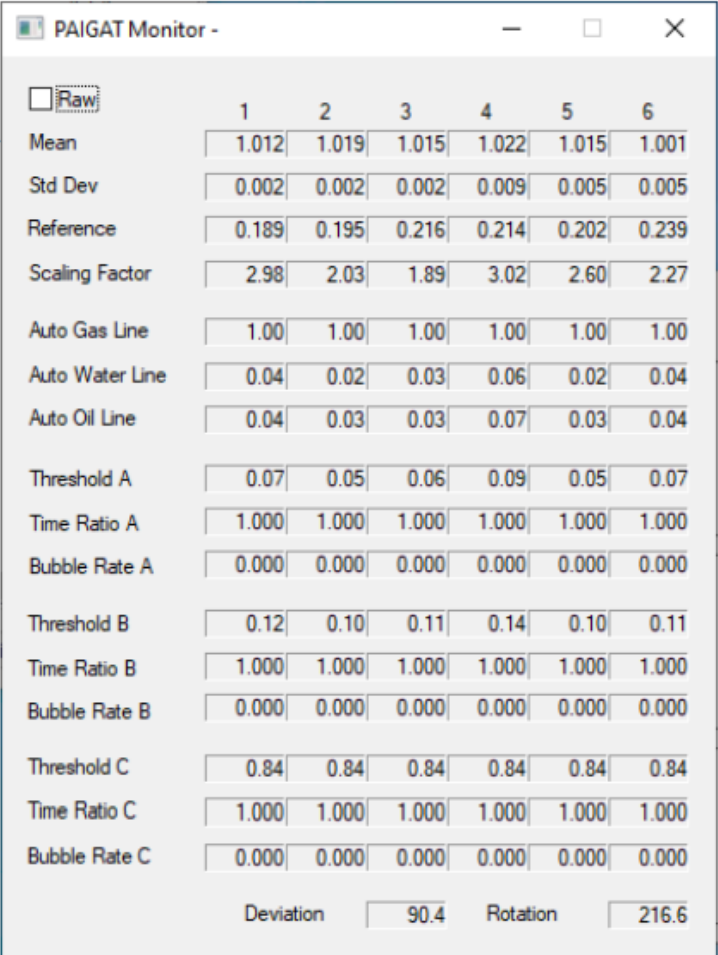
- Apply a Isopropyl Alcohol (IPA) Spray or water to each of the six Gas Array sensor tips in turn.
- In the Warrior software, open the PAIGAT Monitor window.
- Select the “Raw” tick box and monitor the Gas Array Sensors mean raw value (PGMNRx) in air, where x is the sensor number.
- The acceptable minimum PGMNRx air values are:
 - For biconical tips - 0.07. Typical values are between **0.07 and 0.12**.
 - For conical tips - 0.2. Typical values are between **0.2 to 0.5**.

A low PGMNRx value can indicate that the tips are covered by debris and will require a further clean.

- Continue to clean the GAT Sensor Tips until PGMNRx values reach the maximum possible value. If the value remains low after a thorough clean, replace the GAT Sensor Tip.

Gas Array Sensor (PAIGAT) Config Setup (2)

- Un-tick the “Raw” tick box in the PAIGAT Monitor window to view the normalised Gas Array Sensor mean value (PGMNx) in air. The acceptable values for PGMNx in air is between **0.90 to 1.05**.
- If the PGMNx value does not fall between the acceptable range, perform re-normalization in air.
- If the PGMNx value is < 0.9 it can indicate that the tool requires a further clean



The screenshot shows the PAIGAT Monitor window with the 'Raw' checkbox unselected. The main table displays configuration parameters for six sensors (1-6). At the bottom, there are fields for 'Deviation' (90.4) and 'Rotation' (216.6).

	1	2	3	4	5	6	
Mean	1.012	1.019	1.015	1.022	1.015	1.001	
Std Dev	0.002	0.002	0.002	0.009	0.005	0.005	
Reference	0.189	0.195	0.216	0.214	0.202	0.239	
Scaling Factor	2.98	2.03	1.89	3.02	2.60	2.27	
Auto Gas Line	1.00	1.00	1.00	1.00	1.00	1.00	
Auto Water Line	0.04	0.02	0.03	0.06	0.02	0.04	
Auto Oil Line	0.04	0.03	0.03	0.07	0.03	0.04	
Threshold A	0.07	0.05	0.06	0.09	0.05	0.07	
Time Ratio A	1.000	1.000	1.000	1.000	1.000	1.000	
Bubble Rate A	0.000	0.000	0.000	0.000	0.000	0.000	
Threshold B	0.12	0.10	0.11	0.14	0.10	0.11	
Time Ratio B	1.000	1.000	1.000	1.000	1.000	1.000	
Bubble Rate B	0.000	0.000	0.000	0.000	0.000	0.000	
Threshold C	0.84	0.84	0.84	0.84	0.84	0.84	
Time Ratio C	1.000	1.000	1.000	1.000	1.000	1.000	
Bubble Rate C	0.000	0.000	0.000	0.000	0.000	0.000	
Deviation	90.4		Rotation				216.6

PAIGAT Normalisation

- Run Warrior software and open the PAIGAT Normalisation window (Action > Calibrate > PAI_PAIGATX Normalisation).
- Tick the Sensor tick box for all sensors which require re-normalization.
- Select the Tip type for each of the sensors.
- Check the Norm Target value is '1'.
- Press the CALC button to calculate "Scaling Factor" value
- Press SEND button in the Tool Memory area to send and store the updated "Scaling Factor" value to the tool memory. DO NOT tick the Backup box.
- Verify in the PAIGAT Monitor window that Mean PAIGAT (PGMNx) value for each sensor is between 0.90-1.05.

PAIGAT Normalisation - 000002

Settings

Normalisation Date
Thu Nov 19 11:10:01 2020

Sensor	1	2	3	4	5	6
Tip Type	Conical	Conical	Conical	Conical	Conical	Conical
Norm Mean	0.463	0.310	0.404	0.350	0.315	0.394
Norm Target	1	1	1	1	1	1
Scaling Factor	2.159	3.227	2.477	2.856	3.174	2.539

Tool Memory

Backup

PAIGAT- Air Measurement

- In the Warrior software, open the PAIGAT Configuration window
- Select “Gas” and Tick all the sensors - “Sensor 1” through to “Sensor 6”.
- Click the “Calculate” button. This will store the current PAIGAT measurements to the selected column. Ideal value is between **0.90-1.05**.
- Click the “Send” button below the “Gas” column to store the Gas measurements to the Tools memory

PAIGAT Configuration - 15111912

Fixed Base Lines

Calculate Oil Water Gas

Sensor	Oil	Water	Gas
Sensor 1 <input checked="" type="checkbox"/>	0.043	0.043	0.999
Sensor 2 <input checked="" type="checkbox"/>	0.027	0.020	0.999
Sensor 3 <input checked="" type="checkbox"/>	0.027	0.027	0.999
Sensor 4 <input checked="" type="checkbox"/>	0.067	0.063	1.000
Sensor 5 <input checked="" type="checkbox"/>	0.027	0.024	0.999
Sensor 6 <input checked="" type="checkbox"/>	0.035	0.035	1.000

Send Send **Send**

Times Series Control

Presets: Low Flow (250ms) ▾

Reduce Bandwidth

Send

Logging Control

Stats Frame Rate: 6 fps ▾

Send

PAIGAT - Water Measurement

- Select “Water” and the Sensor to be tested. The example above shows “Sensor 1” selected.
- Submerge the required PAIGAT tip inside water. Recommended to use a straw filled with water that is sealed at one end with your fingers to keep the water in place. PAIGAT measurement < **0.1** for biconical tips and **0.35-0.55** for conical tips.
- Once the required PAIGAT tip is submerged into water, click the “Calculate” button to store the selected PAIGAT tips measurement to the Tools memory.
- Repeat steps for all the Sensors that remain. Only perform this process one Sensor at a time.
- Once all PAIGAT measurements have been calculated, tick all Sensors and click the “Send” button at the bottom of the column to store the Water measurements in the Tools memory.

PAIGAT Configuration -

Fixed Base Lines

Oil Water Gas

Sensor 1	<input checked="" type="checkbox"/>	0.055	0.055	0.999
Sensor 2	<input type="checkbox"/>	0.039	0.039	0.999
Sensor 3	<input type="checkbox"/>	0.042	0.042	0.999
Sensor 4	<input type="checkbox"/>	0.074	0.074	1.000
Sensor 5	<input type="checkbox"/>	0.040	0.040	0.999
Sensor 6	<input type="checkbox"/>	0.051	0.051	1.000
		<input type="button" value="Send"/>	<input type="button" value="Send"/>	<input type="button" value="Send"/>



PAIGAT - Oil Measurement

For all Biconical Tips:

- Manually set the fixed base line measurements for “Oil” to 0.2.
- Tick all the Sensors and click the “Send” button at the bottom of the column.

For all Conical Tips:

- The fixed base line for Oil is set the same as Water. Therefore manually type in the “Oil” column the same values as the “Water” column for all the Sensors.
- Tick all the Sensors and click the “Send” button at the bottom of the column

PAIGAT Configuration - ×

Fixed Base Lines			
	Oil	Water	Gas
Calculate	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sensor 1 <input checked="" type="checkbox"/>	0.2	0.055	0.999
Sensor 2 <input checked="" type="checkbox"/>	0.2	0.039	0.999
Sensor 3 <input checked="" type="checkbox"/>	0.2	0.042	0.999
Sensor 4 <input checked="" type="checkbox"/>	0.2	0.074	1.000
Sensor 5 <input checked="" type="checkbox"/>	0.2	0.040	0.999
Sensor 6 <input checked="" type="checkbox"/>	0.2	0.051	1.000
	<input type="button" value="Send"/>	<input type="button" value="Send"/>	<input type="button" value="Send"/>

Times Series Control	
Presets	Low Flow (250ms) <input type="button" value="v"/>
Reduce Bandwidth	<input type="checkbox"/>
	<input type="button" value="Send"/>

Logging Control	
Stats Frame Rate	6 fps <input type="button" value="v"/>
	<input type="button" value="Send"/>

PAIGAT – Set Threshold

For all Biconical Tips:

- Select “Custom” in the “Presets” drop down box.
- In column A: Tick “Below Fixed WL” and set the Bin Offset to 2.
- In column B: Tick “Above Fixed WL” and set the Bin Offset to 10.
- In column C: Tick “Below Fixed GL” and set the Bin Offset to 10.
- Click the “Send” button

	A	B	C
Below Fixed GL	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Above Fixed WL	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Below Fixed WL	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Fixed OL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below Auto GL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Auto WL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below Auto WL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Auto OL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bin Offset	2.00	10.00	10.00

For all Conical Tips:

- Select “Custom” in the “Presets” drop down box.
- In column A: Tick “Above Fixed WL” and set the Bin Offset to 2.
- In column B: Tick “Above Fixed WL” and set the Bin Offset to 5.
- In column C: Tick “Below Fixed GL” and set the Bin Offset to 10.
- Click the “Send” button

	A	B	C
Below Fixed GL	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Above Fixed WL	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Below Fixed WL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Fixed OL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below Auto GL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Auto WL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Below Auto WL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Auto OL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bin Offset	2.00	5.00	10.00

Resistance Array Sensor (PAIRAT) Config Setup (1)

- In the Warrior software, open the PAIRAT Configuration window.
- When the tool is at the surface:
 - Select the “Hydrocarbon” column in the Fixed Base Lines area.
 - Make sure all the Sensors are ticked.
 - Click the “Calculate” button.
 - Click the “Send” button at the bottom of the “Hydrocarbon” column.
- When the tool is in air, the sensors can be set for under water:
 - Select the “Water” column in the Fixed Base Lines area.
 - Make sure all the Sensors are ticked.
 - In the “Water” column, manually type 0.5 in all the value boxes for all the Sensors.
 - Click the “Calculate” button.
 - Click the “Send” button at the bottom of the “Water” column.

The screenshot shows the PAIRAT Configuration window with the following sections:

- Fixed Base Lines:** A table with columns for 'Water' and 'Hydrocarbon'. A 'Calculate' button is at the top left. Below the table are 'Send' buttons for each column.
- Sensors:** A list of six sensors, each with a checked checkbox and two numerical input fields.
- Times Series Control:** Includes a 'Presets' dropdown set to 'Low Flow (250ms)', a 'Reduce Bandwidth' checkbox, and a 'Send' button.
- Logging Control:** Includes a 'Stats Frame Rate' dropdown set to '6 fps' and a 'Send' button.
- Thresholds:** Includes an 'Auto Scale Histogram' checkbox, 'Auto' checkboxes for 'A' and 'B', and 'Bin Offset' spinners set to 2.00. A 'Send' button is at the bottom.
- Tool Firmware:** Includes a 'Version' button.
- Tool Settings:** Includes a 'Read' button.
- Exit:** An 'Exit' button at the bottom right.

Resistance Array Sensor (PAIRAT) Config Setup (2)

- In the Time Series Control area:
 - Select “Low Flow (250ms)” in the “Presets” pull down box.
 - Click the “Send” button to store the values in the Tools memory.
- In the Thresholds area:
 - Tick “A” and “B” for “Auto”.
 - Set the Bin Offset to 2.
 - Click the “Send” button to store the values in the Tools memory.

The screenshot shows the PAIRAT Configuration window with the following sections:

- Fixed Base Lines:** Includes a "Calculate" button, radio buttons for "Water" and "Hydrocarbon" (Hydrocarbon is selected), and a table for sensor configurations.
- Times Series Control:** Includes a "Presets" dropdown menu set to "Low Flow (250ms)", a "Reduce Bandwidth" checkbox, and a "Send" button.
- Logging Control:** Includes a "Stats Frame Rate" dropdown menu set to "6 fps" and a "Send" button.
- Thresholds:** Includes an "Auto Scale Histogram" checkbox, radio buttons for "A" and "B" (both are selected), and "Bin Offset" spinners set to 2.00 for both A and B, with a "Send" button.
- Tool Firmware:** Includes a "Version" button.
- Tool Settings:** Includes a "Read" button.
- Exit:** Includes an "Exit" button.

Sensor	Water	Hydrocarbon
Sensor 1	0.500	0.975
Sensor 2	0.500	0.978
Sensor 3	0.500	0.979
Sensor 4	0.500	0.974
Sensor 5	0.500	0.972
Sensor 6	0.500	0.972

PAIRAT Check Sensor

- Cover each of the PAIRAT tips sensor with a wet tissue.
- Make sure the measurements are between the air and fixed water base line values.

Spinner Array Calibration

- Not supplied with the tool as it is best performed in the well.
- Plots must be made of tool measurements against cable (tool) velocity

Thank you !

Questions and Answering Session