

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)

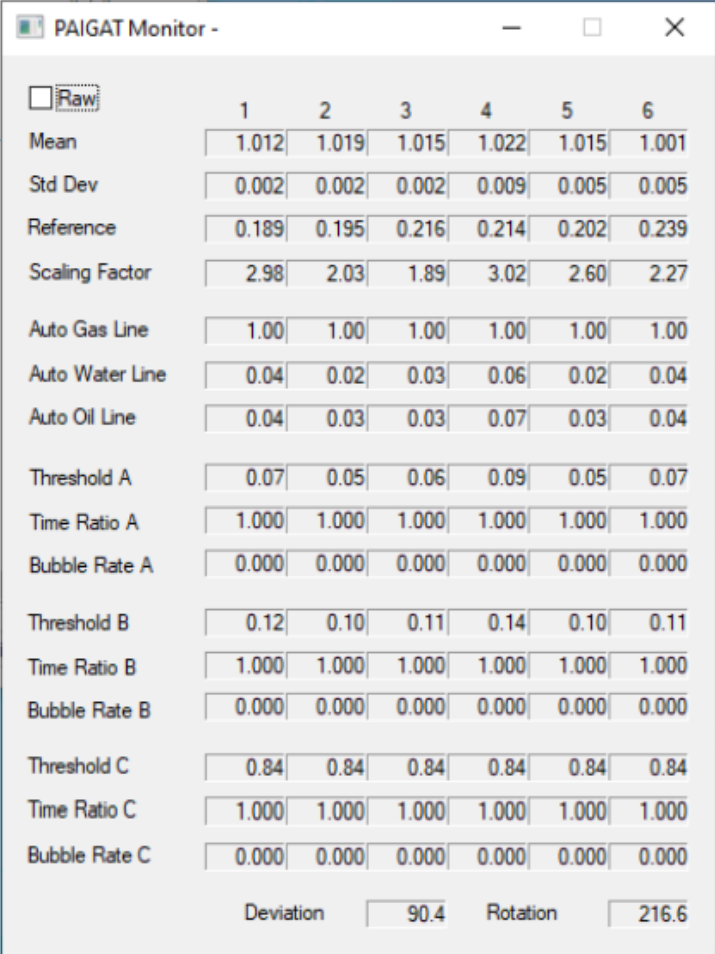
- Apply a Isopropyl Alcohol (IPA) Spray or water to each of the six Gas Array sensor tips in turn.
- In the Warrior software, open the PAIGAT Monitor window.
- Select the “Raw” tick box and monitor the Gas Array Sensors mean raw value (PGMNRx) in air, where x is the sensor number.
- The acceptable minimum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



	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

☒ 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

CALC

Tool Memory

READ
SEND
☐ Backup

Exit

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 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

	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	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

Sensor 1	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.055"/>	<input type="text" value="0.999"/>
Sensor 2	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.039"/>	<input type="text" value="0.999"/>
Sensor 3	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.042"/>	<input type="text" value="0.999"/>
Sensor 4	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.074"/>	<input type="text" value="1.000"/>
Sensor 5	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.040"/>	<input type="text" value="0.999"/>
Sensor 6	<input checked="" type="checkbox"/>	<input type="text" value="0.2"/>	<input type="text" value="0.051"/>	<input type="text" value="1.000"/>
		<input type="button" value="Send"/>	<input type="button" value="Send"/>	<input type="button" value="Send"/>

Times Series Control

Presets ▼

Reduce Bandwidth ☐

Logging Control

Stats Frame Rate ▼

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

Threshholds

Presets: Custom

	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

Send

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

Threshholds

Presets: Custom

	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

Send

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:** Includes a "Calculate" button and radio buttons for "Water" and "Hydrocarbon". Below is a table for 6 sensors, each with a checkbox and two value boxes. The "Hydrocarbon" column is currently selected.
- 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", "Bin Offset" spinners set to 2.00, and a "Send" button.
- Tool Firmware:** Includes a "Version" button.
- Tool Settings:** Includes a "Read" button.
- Exit:** A button at the bottom right.

		Water	Hydrocarbon
Sensor 1	<input checked="" type="checkbox"/>	0.500	0.975
Sensor 2	<input checked="" type="checkbox"/>	0.500	0.978
Sensor 3	<input checked="" type="checkbox"/>	0.500	0.979
Sensor 4	<input checked="" type="checkbox"/>	0.500	0.974
Sensor 5	<input checked="" type="checkbox"/>	0.500	0.972
Sensor 6	<input checked="" type="checkbox"/>	0.500	0.972

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 image shows a software window titled "PAIRAT Configuration". It contains several sections for configuring the sensor:

- Fixed Base Lines:** Includes a "Calculate" button, radio buttons for "Water" and "Hydrocarbon" (Hydrocarbon is selected), and a table for 6 sensors. Each sensor has checkboxes and input fields for "Water" and "Hydrocarbon" values. "Send" buttons are at the bottom of the table.
- 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, "Auto" checkboxes for "A" and "B" (both checked), "Bin Offset" input fields (both set to "2.00"), and a "Send" button.
- Tool Firmware:** Includes a "Version" button.
- Tool Settings:** Includes a "Read" button.
- An "Exit" button is located at the bottom right of the window.

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