

Technical Note

Vertex™ Line Integrity Test Option

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Overview

Honeywell Analytics now offers the optional capability to check for leaks in Vertex™ sample lines. Analyzers equipped with option 1295-0510 detect a pneumatic signal from valves installed at the end of the sample line. Any leak in the tubing will cause a change in the signal and will be detected. This test is performed automatically as a line integrity test (LIT). This new test complements the ability of all Vertex™ analyzers to detect blocked sample lines.

The Line Integrity Test Option requires a minimum software revision of 1.21.1 and configuration of analyzer software (minimum v1.09) by a Honeywell Analytics Field Service Engineer.

Pneumatic Overview

The pneumatic design of the Vertex™ rack is summarized in Figure 1. The Vertex™ analyzer contains eight sample pressure transducers, one for each point. The external tubing is terminated with a filter and a check valve. The check valve will not permit any flow until a “cracking” pressure of about 1.0 in-Hg is applied. (See Note 1) A leak between the analyzer and the check valve will result in an increase in pressure at the analyzer.

Before the LIT test can be performed, the Vertex™ and the external plumbing must be “characterized”. This process involves measuring the sample pressure when the tubes are known to be leak-free and otherwise correct. It is possible to confirm that a tube is leak-free by plugging the end and observing the sample flow decrease to zero. During the characterization process, the Vertex™ records the observed sample pressure. Later LIT tests will issue a fault if the sample pressure increases significantly. Performing the characterization without a leak check invalidates the LIT.

Note 1: In this document all pressures are given in inches of mercury. This may be converted to kilopascals by multiplying by 3.38. Furthermore, all pressures are reported as gauge pressure, not as vacuum. Using this nomenclature, the effect of a sample line leak is described as a pressure increase instead of a vacuum decrease.

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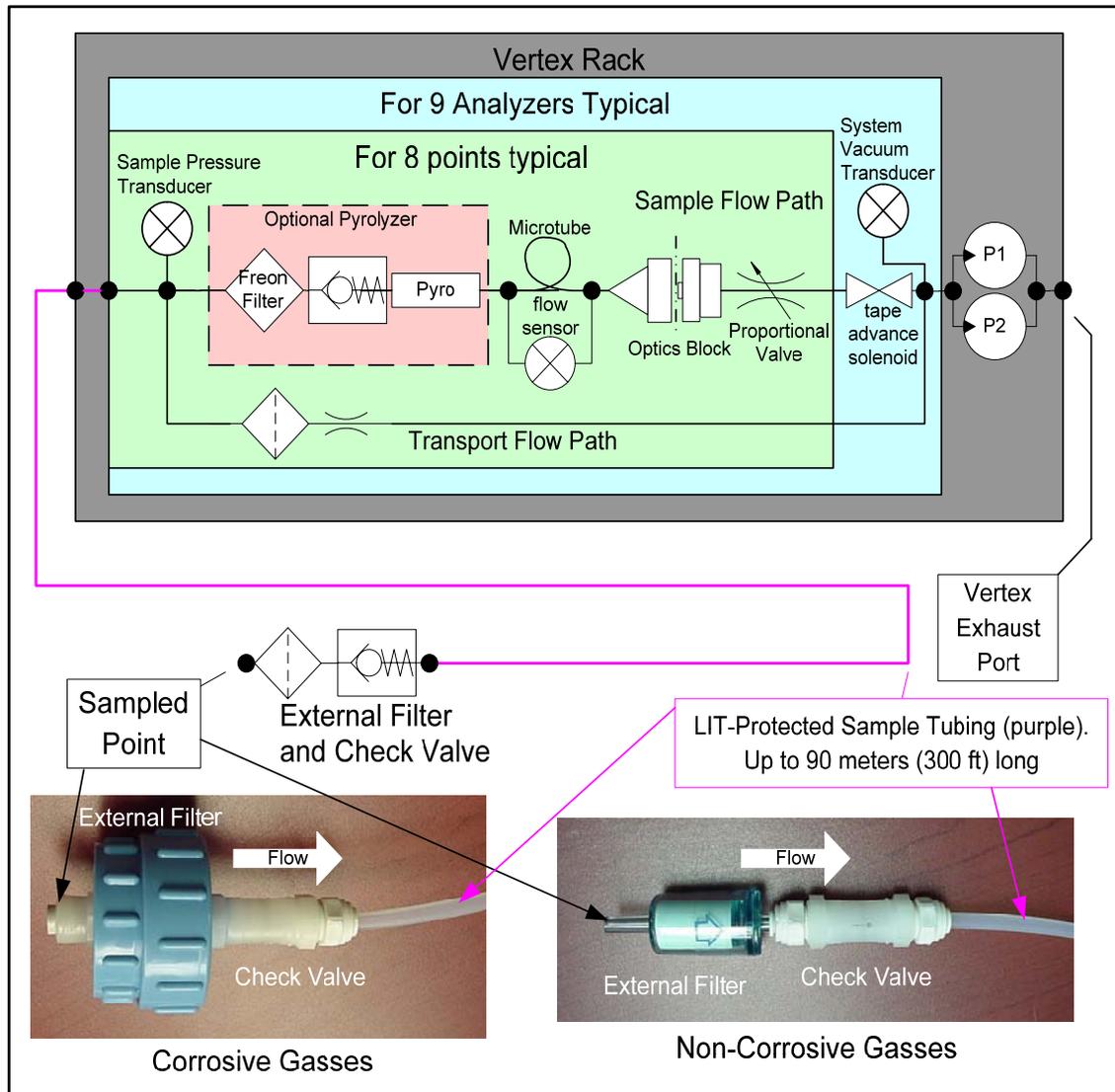


Figure 1 -- Simplified Pneumatic Schematic

In practice, the sample pressure measurements are made as a differential measurement with the pump on and then off. This eliminates the effect of any transducer offset. However, since analyzers share a pump, performing the LIT requires that all analyzers stop monitoring. Pressures throughout the Vertex™ are allowed to stabilize for 30 seconds before taking any measurements. A LIT causes monitoring to be interrupted for about two minutes because of synchronization delays.

The test is not compatible with shared sample lines.

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The use of external filters is mandatory with Vertex™ LIT as it is with all Vertex points. Section B.2 of the Vertex Technical Handbook contains guidance on filter selection.

Quantitative Performance

The pressure at the pump inlet must be less than -7.0 in-Hg or the test will be inhibited. The sample line must be 4.8 mm ID [thin wall or 0.190 inch ID] and have a length of 90 meters or less. Pneumatic performance is reduced if a substantial length of the tube are coiled because this reduces the cross-sectional area.

The total gas flow (transport plus sample) is typically 1.3 liters per minute per point. This results in a differential pressure of about 1.2 in-Hg with the maximum tubing length. The check valve increases the differential pressure by an additional 1.0 in-Hg for a total of about 2.2 in-Hg.

During characterization the differential pressure must be 0.8 in-Hg or more or a fault will be issued. During LI testing the differential pressure must be at least 70% of the characterization differential pressure or more or a fault will be issued. Leaks with area greater than 1 mm² will cause a sufficient pressure drop to cause the generation of a fault.

The LIT measurement requires that the total pressure variance of the sampled point, the Vertex™ rack and the exhaust outlet must be less than 0.3 in-Hg. for correct operation (see Figure 1).

Software Overview

Automatic LI tests can be scheduled to take place at any of the times when a time weighted average (TWA) is recorded. TWAs are recorded every eight hours so that up to three LI tests can be performed per day. As with previous software, the time of the TWA can be shifted up to eight hours so that the LI test time can be any time of day. The LI test can be disabled on a per-point basis to permit a rack with LIT to have some tube configurations that are incompatible with LIT.

Buttons are provided to start an LI characterization or an unscheduled test. These two buttons are on the RS View “Authorized Service” screen.

Four new maintenance faults and three informational events have been created. These will notify the user of numerous details relating to the LI characterization and test.

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Details of Changes to Configuration Utility

1. A new checkbox has been added to the Configure Point screen as highlighted by the red rectangle in Figure 2. This is checked by default. Clearing this checkmark prevents the generation of LIT-related faults for the associated point. Otherwise, nuisance faults may be generated for points with incompatible external components. Examples include tubes longer than 90m, medium-walled tubing, and shared sample lines.

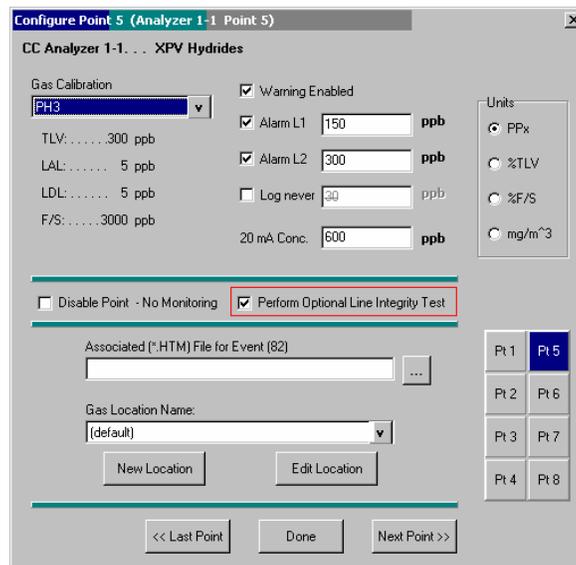


Figure 2 -- New Checkbox

2. A new button has been added to the "Optional Features" tabsheet as highlighted by the red rectangle in Figure 3. Pressing this button causes the form shown in Figure 4 to appear.

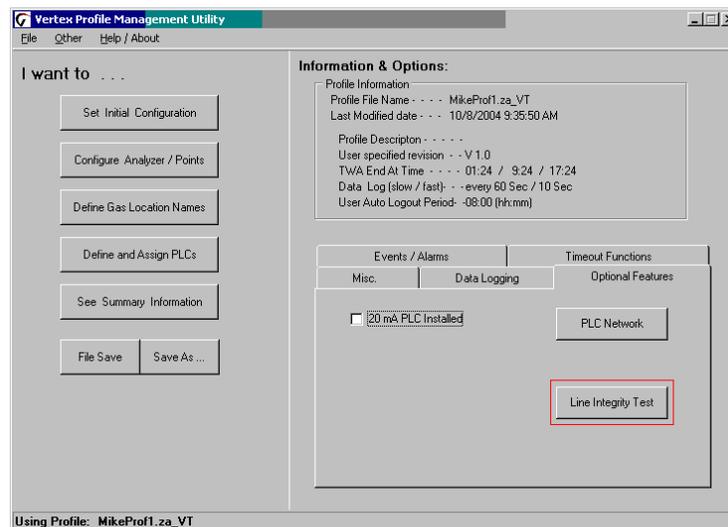


Figure 3 -- Configuration Editor New Button

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3. A new page has been added to the configuration editor as highlighted by the red rectangle in Figure 4. This appears when the “Line Integrity Test” button shown in Figure 3 is pressed.

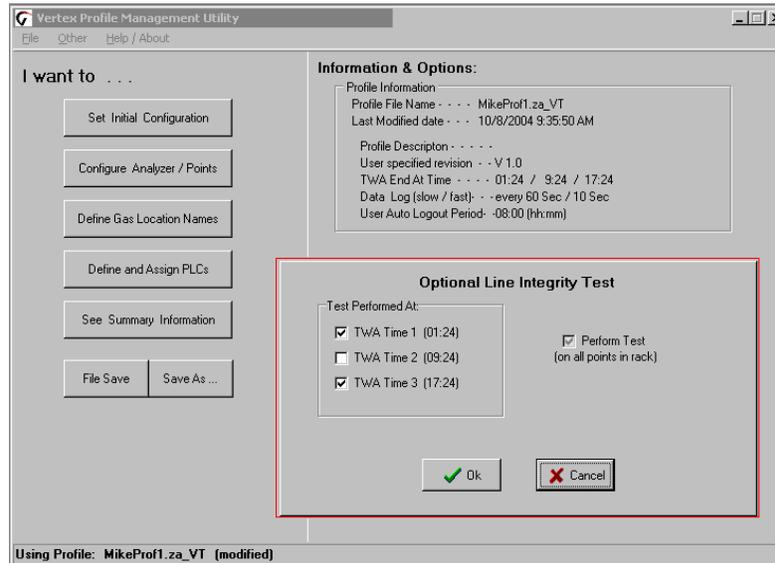


Figure 4 -- Configuration Editor New Page

The three times displayed on the left of the new tabsheet indicate the TWA times. (TWA times are set on Data Logging tabsheet.) The three checkboxes on the left default to cleared.

The checkbox and labels on the right of the new page will become black if any of the left-side checkboxes are checked. Otherwise the right-side items will become gray.

The checkmark itself indicates the status of the point-specific checkboxes shown in Figure 2. The checkmark can be scrolled through 2 or 3 states (set, cleared and possibly gray). If the point-specific LIT checkboxes are all set, this checkmark will be set. If they are all cleared, then this checkmark will be cleared. Otherwise, this checkmark will be gray.

Setting or clearing this checkbox will affect the LIT enable bit for all the points in the rack. Clicking on the “Cancel” button cancels all of the changes made on this form.

4. The Configurations utility’s “Summary Information Page” has been modified to show the times of the LI tests and to report the enabled or disabled status of the test on each point.

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Detail of changes to RSView

RSView now has two new buttons and nine new events.

5. New Buttons -- Two buttons are changed in the Authorized Service screen as shown in Figure 5. When the associated analyzer is in Monitor mode this will appear as shown in Figure 6.

Access to the Authorized Service screen is restricted to RSView users with the “E” permission code turned on for their account. RSView permission codes are discussed in 4.6.6 of the Vertex Technical Handbook.



Figure 5 -- New Buttons out of Monitor

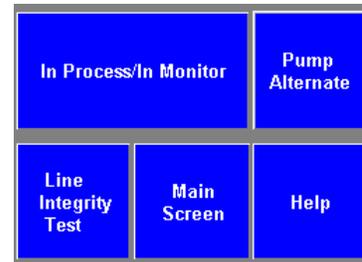


Figure 6 -- New Buttons in Monitor

Pressing the “Record Known Good LITC” button will cause a characterization to be performed on all analyzers in the rack. Similarly, pressing the “Line Integrity Test” button will cause a line integrity test to be performed immediately. This is in addition to the LITs which are scheduled by the checkboxes in Figure 4.

During a LIT test or characterization, the RSView analyzer status display will change from “MONT” or “IDLE” to “LIT” with short delays between the analyzer status changes.

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New Events

The Vertex™ is now capable of creating four new Maintenance Faults as shown in Table 1.

Event No.	Event List Desc. (Short)	Event History Description	Data Field	Problem	Possible Cause	Recovery
122	LIT NO REF	LIT has no reference	0.0	Analyzer has no record of correct cracking pressure for this point	Point was disabled in configuration when previous LIT characterization performed.	Perform characterization or disable LIT test for Pt in configuration
123	LIT CHAR. FAIL	LIT Characterization Failed	Observed cracking pressure (in-Hg)	Inadequate cracking pressure measured during characterization. (< 0.8 in-Hg)	Check valve not installed	Install check valve.
					Pressure at sampled point differs from Vertex exhaust by more than 0.3 in-Hg (1.0 KPa)	Disable LIT for affected point
						Revise installation
					Sample tubing cut or leaking	Replace tubing.
124	LINE FAIL	Sample Line Leak Detected	Observed cracking pressure (in-Hg)	Inadequate cracking pressure measured during monitoring by the optional Line Integrity Test. (< 70% or char.)	Sample tubing cut or leaking *(See Note 2)	Replace tubing
					Ambient pressure at sampled point differs from Vertex exhaust by more than 0.3 in-Hg (1.0 KPa)	Revise installation
						Disable LIT for affected point
					Check valve not seating	Replace check valve
125	LIT COORDINATION	Coordination Failure During LIT	Error code 1.0 – 11.0	Analyzer peer-peer coordination failure. No further LIT tests until Flt is reset	Some analyzers were in CCLD or other special mode	Reset the Fault
					Software anomaly	If repeated, notify Honeywell service

Table 1 -- New Maintenance Faults



If the LIT generates Event 124, care must be taken to inspect the integrity of the sample line tubing along its length as the monitored sample may be taken from the break in the tubing, not from the intended area.

No new Instrument Faults are defined in this software.

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The Vertex™ is also capable of five new informational events as listed in Table 2.

Event Type in History	Event History Message	Possible Cause
INFO	Command – Perform LIT Char.	User pressed “Record Known Good LITC”.
INFO	LIT Characterization Performed	Analyzer completed LIT characterization. If Data Field non-zero, this indicates the observed cracking pressure in inches Hg.
INFO	Command – User Requested LIT	User pressed “LINE INTEGRITY TEST”
INFO	Line Integrity Test Performed	Analyzer completed an integrity test. The data field contains the observed cracking pressure in inches Hg.
INFO	Analyzer Lacks LIT	Other analyzers in the rack performed a Line Integrity Test but this analyzer was purchased without the option

Table 2 -- New Informational Events

Note 2: If additional or replacement Vertex Analyzers are purchased without specifying the LIT option, no faults will be generated for the lack of the option in the new analyzer. However, an “INFO” message will be logged in the Event History each time the LIT option is invoked. Existing analyzers configured for LIT will be unaffected.



Integrity of the Vertex system requires that all components have the same revision of software loaded. This includes the DAqPC, the PLC and all of the analyzers. Whenever an analyzer is installed in a rack the revision of firmware must be checked and updated if necessary. Failure to have the software revisions at the proper levels may result in the operations not being preformed.

The Line Integrity Test feature requires rack software V1.21.1 or later. This includes all analyzers at firmware V1.09 (min).

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Procedure for using LIT

1. Confirm that the sample lines of interest are suitable for LIT:
 - a. Tube lengths less than 90 meters,
 - b. Tubing is thin wall, not medium wall
 - c. No sample lines are shared
 - d. Pressure differential between sampled point, exhaust point and rack area is less than 0.3 in-Hg.
2. Contact your Honeywell Analytics representative to purchasing the LIT option. (Part Number 1295-0510) for the affected analyzers. Analyzers with LIT may be mixed freely with analyzers lacking LIT within the same rack.
3. Confirm that the rack has V1.21.1 or later software.
4. Confirm that ***all*** of the analyzers are loaded with the appropriate firmware which is included with the rack software. For rack software V1.21.1 the analyzer firmware is V1.09 (minimum).
5. Select the time of day when the LIT test is to be performed by selecting the checkboxes shown in Figure 4. The LIT test may be performed one, two or three times per day. However, each LIT test causes monitoring to be stopped for about two minutes.
6. Select which points should have the LIT test performed. This is shown in Figure 2 and Figure 4. It may be desirable to disable the LIT test to avoid superfluous faults for points which do not meet the criterion listed in step 1 above.
7. If not already installed, install the end of line filters and check valves as shown in Figure 1 on the LIT-enabled points. Be sure to perform an Auto Balance after installing check valves to compensate for the change in flow with the valves attached.
8. Confirm that all points are leak-free by plugging the sample line and confirming that the flow goes to zero.
9. Press the button “Perform Known Good LITC” as shown in Figure 5.
10. Examine the event history. Confirm that an informational event should be created for every point which has the LIT test enabled. This informational event will be labeled “LIT Characterization Performed”. Note the number in the Conc/Data field – this is the observed cracking pressure in in-Hg.
11. Start normal monitoring.

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12. Check the event history occasionally for LIT-related events. An event should be created for each LIT-enabled point and each test time – up to 216 per day. The event should be “Line Integrity Test Performed.” Note the observed cracking pressure which is recorded in the Conc/Data field of this event.

13. Perform a manual leak check (Step 8 above) and a LIT characterization (Step 9 above) annually.

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