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Hanford EPICS Vacuum Controls 75 l/s Ion Pump Test Specifications

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Hanford CDS, Operators, Vacuum and PSI

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Hanford EPICS Vacuum Controls Test Specifications

SYSTEM TESTED: _____

SOFTWARE TESTED: _____

HARDWARE CONFIGURATION:

Equipment List	Date	Revision	Serial Number

TESTED BY:

Name	Title	Date

TESTS COMPLETED:

Test Name	Sign Off	Date

APPROVED BY:

Signature	Date

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1 Introduction

The Varian 75l/s ion pump (75IP) is used in most of the Hanford Vacuum Areas as a low capacity manifold and secondary volume vacuum pump.

Each 75l/s pump supplies one analog analogue signal;

- Ion Pump Current (0-10V representing 0 - 10mA)

There is no EPICS control of the pump.

1.1. Signal Conversions

The conversion from 75IP current to vacuum follows a roughly linear log-log relationship. The 75l/s pumps follow the same conversion as the 25l/s ion pumps, except for the same vacuum, the 75l/s pumps provide 3 times the current as the 25l/s ion pumps.

1.2. Purpose

This document is the test specification for the EPICS controls of this device. With the EPICS system running in simulation mode, this test spec. allows the user to fully test the control system functionality with no impact on PSI. In non-simulation mode, both the EPICS controls, the PSI interface and the Ion Pump itself can be tested.

1.3. Test Description

The Ion Pump database will be tested in three phases:

- Simulation mode.
- Non-simulation mode, not connected to PSI wiring (Emulation Mode).
- Non-simulation mode, fully connected to PSI wiring (Real Mode).

THE TEST MAY ONLY BE RUN FULLY CONNECTED TO PSI WIRING WHEN PSI AND CALTECH VACUUM MANAGEMENT HAVE GIVEN EXPRESS PERMISSION TO DO SO. Ignoring this warning may cause damage to the Ion Pump and the Vacuum System. **Remember, the ion pump contains potentially lethal voltages.**

In simulation mode the user can only test the basics of database execution. In non-simulation mode the user will inject voltages to emulate the PSI wiring. Output voltages and/or currents will be measured.

When running directly to the PSI vacuum system, the actual operation of the ion pump will be tested. These tests will be performed with the Hanford Vacuum team and PSI.

This document will show the testing of a Right Mid Station 75IP. Replace this name with the name of the pump you are testing.

1.4. Test Initialization

The user must have booted the IOC with the correct EPICS database for the system to be tested. It is assumed throughout this document that the user is familiar with EPICS configuration and operation.

The 75IP does not use any sequencers.

Run the Alarm Handler for the system containing the 75IP under test.

1.4.1. Simulation Mode

EPICS.

The database file and its simulation database file for the 75IP under test have been loaded and initialised.

MEDM.

The 75l/s Ion Pump MEDM screen and its simulation screen are running. All widgets are connected to the database.

SAMMI.

The Ion Pump Sammi formats and its simulation screen are running. All DDOs are connected to the database.

1.4.2. Non-Simulation Mode, Not Connected to PSI Wiring

Ensure all signals are disconnected to PSI. The user is required to inject DC voltages into the Ion Pump controls (0 - 5V range), emulate a relay contact closure and measure output voltages in the 0 - 24V range.

(QT) Tests marked with this symbol and are underlined define a Quick Test. Quick Tests allow the user to just test the hardware interface to the EPICS controls, and not test the control logic itself.

1.4.3. Non-Simulation Mode, Full Connection to PSI Wiring

These tests will be performed with Hanford Operators, Hanford Vacuum management and PSI. They will be fully coordinted with these teams and will only proceed with the express permission of all parties. Full lock and tag procedures will be followed.

THIS TEST WILL ONLY PROCEED WHEN IT IS DEEMED SAFE TO DO SO.

All PSI wiring will be attached to the PSI interface wiring block.

THESE TEST SPECS ARE TO BE DETERMINED.

1.4.4. Data Tables

Attached to this Test Spec are two data tables:

PSI Signal Matrix for Hanford 75l/s Ion Pumps. This specifies the PSI interface connectors used by all the Ion Pumps at the Hanford site.

Signal Data Matrix for Hanford 75/s Ion Pumps. This specifies Ion Pump input and output signal limits, units, engineering conversions and alarm limits.

	PASS	FAIL	COMMENTS

2 Testing in Simulation Mode

2.1. Test Setup

2.1.1. Run the Alarm Handler with the alarm configuration file appropriate for the 75l/s Ion Pump being tested.

- Acknowledge all outstanding alarms (e.g. simulation alarms).. Refer to Table 2: Signal Data Matrix for Hanford 75l/s Ion Pumps.

2.1.2. On the simulation screen, switch the database into simulation mode by pushing the Sim On button.

- Verify simulation is on, and the simulated signals have entered the SIMULATION alarm state (foreground colours set to YELLOW and a MINOR alarm on the alarmhandler).

2.2. Test Pump Current Alarms and Vacuum Conversion.

In the following tests the user will simulate the input of various voltages from PSI and check that the screens show the correct currents corresponding to these voltages.

Voltages representing pump current below 0.0V or above 10.0V are out of the operating range of the 75l/s Ion Pump and will be flagged by a major alarm.

2.2.1. Simulate invalid vacuum voltage from the Ion Pump (below valid range).

2.2.1.a You will check the following during this test;

- Verify the Pump Current reading on the main screen shows zero and a major alarm
- Verify the Pump Vacuum reading on the main screen shows zero and a major alarm
- Verify the Pump Current reading on the alarm handler shows a major alarm

2.2.1.b Type in 0.0 into the Pump Current entry widget on the Simulation Screen to start the test.

2.2.2. Simulate valid pump current from the Ion Pump (middle of valid range).

2.2.2.a You will check the following during this test;

- Verify the Pump Current reading on the main screen shows 5.0 and a simulation alarm
- Verify the Pump vacuum reading on the main screen shows 6.4e-06 and a simulation alarm
- Verify the Pump current signal on the alarm handler shows a simulation alarm

2.2.2.b Type in 5.0 into the Pump Current entry widget on the Simulation

	PASS	FAIL	COMMENTS
Screen to start the test. 2.2.3. Simulate invalid vacuum voltage from the Ion Pump (above valid range). 2.2.3.a You will check the following during this test; • Verify the Pump Current reading on the main screen shows 10.0 and a major alarm • Verify the Pump vacuum reading on the main screen shows 1.2e-05 and a major alarm • Verify the Pump Current signal on the alarm handler shows a major alarm 2.2.3.b Type in 10.0 into the Pump Current entry widget on the Simulation Screen to start the test.			

	PASS	FAIL	COMMENTS

3 Testing in Non-simulation Mode, Not Connected to PSI

Items needed to perform these tests; 1 DC voltage source with range 0.00 to 10.00 V (resolution 2 decimal places), cables necessary to connect to PSI DIN-rail connectors. Refer to Table 1: PSI Signal Matrix for Hanford 75l/s Ion Pumps for the PSI DIN-rail connector numbers for each signal.

Complete test setup requires the voltage source to be connected to the PSI connectors for the Pump Current. A voltage range from 0.0V to 11.00V will be needed.

3.1. Test Pump Current Alarms and Vacuum Conversion.

In the following tests the user will generate the input of various voltages at the PSI interface and check that the screens show the correct currents corresponding to these voltages.

Voltages representing pump current below 0.0V or above 10.0V are out of the operating range of the 75l/s Ion Pump and will be flagged by a major alarm.

3.1.1. Test invalid vacuum voltage from the Ion Pump (below valid range).

3.1.1.a You will check the following during this test;

- Verify the Pump Current reading on the main screen shows -1.0 mA (+/- 0.1) and a major alarm
- Verify the Pump Vacuum reading on the main screen shows zero and a major alarm
- Verify the Pump Current reading on the alarm handler shows a major alarm

3.1.1.b Generate -1.0V into the Pump Current PSI connectors to start the test.

(QT) 3.1.2. Test valid pump current from the Ion Pump (middle of valid range).

3.1.2.a You will check the following during this test;

- Verify the Pump Current reading on the main screen shows 5.0mA (+/- 0.1) and NO_ALARM.
- Verify the Pump vacuum reading on the main screen shows 6.4e-06 (+/- 0.1) and NO_ALARM.
- Verify the Pump current signal on the alarm handler shows NO_ALARM.

3.1.2.b Generate 5.0V into the Pump Current PSI connectors to start the test.

3.1.3. Test invalid vacuum voltage from the Ion Pump (above valid range).

3.1.3.a You will check the following during this test;

- Verify the Pump Current reading on the main screen shows 10.0mA (+/- 0.1) and a major alarm
- Verify the Pump vacuum reading on the main screen shows 1.2e-05 (+/-

	PASS	FAIL	COMMENTS
0.1) and a major alarm			
• Verify the Pump Current signal on the alarm handler shows a major alarm			
3.1.3.b Generate >10.0V into the Pump Current into the PSI connectors to start the test.			

	PASS	FAIL	COMMENTS

1 Testing in Non-simulation Mode, Fully Connected to PSI

To be Determined

Table 1: PSI Signal Matrix for Hanford 75l/s Ion Pumps.

Left End	**II411**																	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	004	005																
Right End	**II511**																	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	004	005																
Left Mid	**II211**																	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	004	005																
Right Mid	**II311**																	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	004	005																
LVEA Y	**II181**		**II186**		**II193**		**II195**		**II197**									
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	010	011	013	014	016	017	019	020	025	026								
LVEA X	**II141**		**II171**		**II185**		**II187**		**II188**		**II191**							
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	001	002	007	008	013	014	016	017	019	020	025	026						
Mechanical Room	**II111**		**II115**		**II117**		**II121**		**II125**		**II127**		**II131**		**II135**		**II137**	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
	001	002	004	005	007	008	013	014	016	017	019	020	025	026	028	029	031	032

Table 2: Signal Data Matrix for Hanford 75l/s Ion Pumps.

Signal	Type	Signal Value Limits					Engineering Value Limits.				Alarm Limits				
		OFF/ Invalid	Low/ OFF	High/ ON	Tolerance	Units	Low/ OFF	High/ON	Units	Tolerance	Src	LO-LO/ ZSV	LOW/ ZSV	HIGH\ OSV	HIHI/ OSV
Current	ai	<0.0	0.0	10.0	+/- 0.1	V	0	10	mA	+/- 0.1	Eng		0.0	10.0	

Hanford LIGO EPICS Test Specification Comments Sheet.

Comment ID: | Sheet | of

Raised By: | Test Spec ID:

Date: | Change Request Raised:

☐ **Hardware related** ☐ **Software related**

☐ **High priority, no work around exists** ☐ **Low priority**

☐ **High priority, work around exists** ☐ **For information only.**