Visible Camera Test Procedure

Procedure #: PFS_VC_PSEFT	**Engineer(s):**
Title: Pre/Post Ship Electronics Functional Test (rev 1.0, SCH, 09/29/2015)	
Instrument: Subaru Prime Focus Spectrograph	
Objective: Verify the electrical integrity of the system	
Start Date & Time:	**End Date & Time:**

1. Scope:

This tests detailed by this procedure are designed to test the post ship functionality of a visible camera electronics chassis and the associated spectrograph rack.

2. References:

- Visible Camera System Diagram.
- Control Software API

3. Prerequisites:

3.1. The following tests shall be conducted at ambient/ambient with the cover removed from the PIE pan, the dummy front bell removed from the cryostat, and the roughing line removed.

3.2. Cabling between the rack and the visible camera shall be connected in accordance with the requirements of the visible camera system schematic.

3.3. Prior to testing LAM temperature sensors shall be installed.

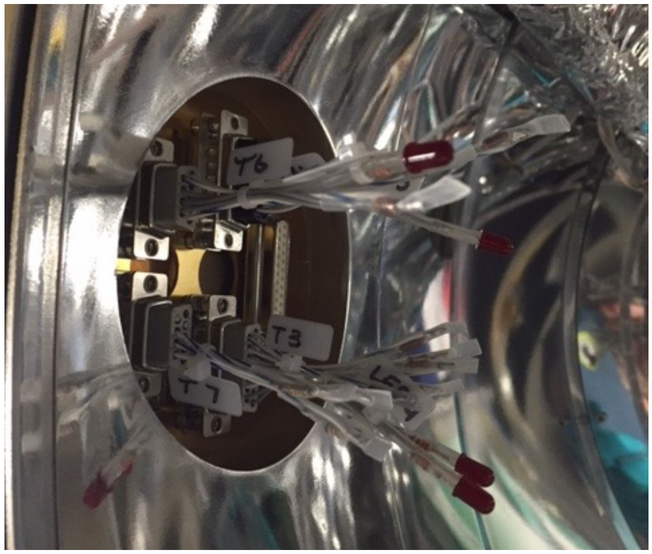
3.4. Prior to testing 75PSI air shall be installed.

3.5. Prior to testing Coolant lines shall be installed.

3.6. Antistatic precautions shall be observed.

4. Procedure:

4.1. Disconnect J-P 3, 4, 6 and 7 from the feed through board and install test connectors T3, 4, 6 and 7 in their place.

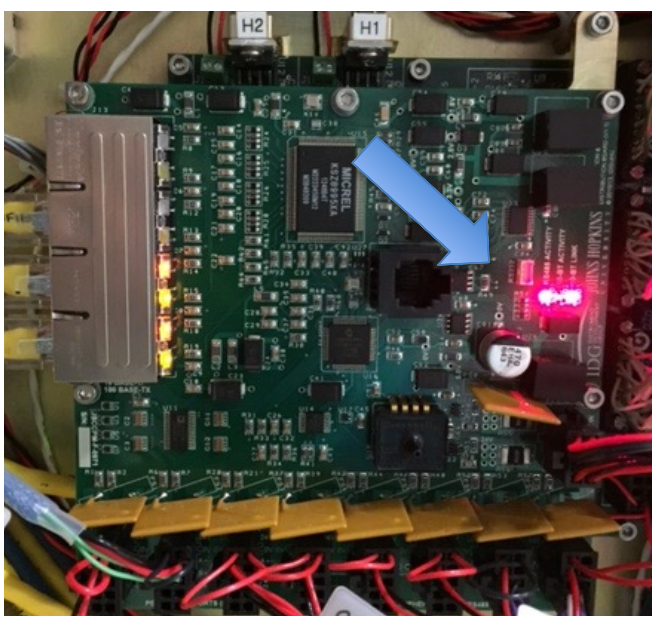


4.2. In the front of control rack, set the AUX DISCONNECT switch to ON and verify the fan at the top of the rack is running.

4.3. In the rear of the control rack, verify that the Ethernet switch is functioning. Note: the switch takes approximately 20 seconds to boot

4.4. In the control rack, set the 24V UPS DISCONNECT switch to ON and verify that the fans in the 24V UPS chassis are running.

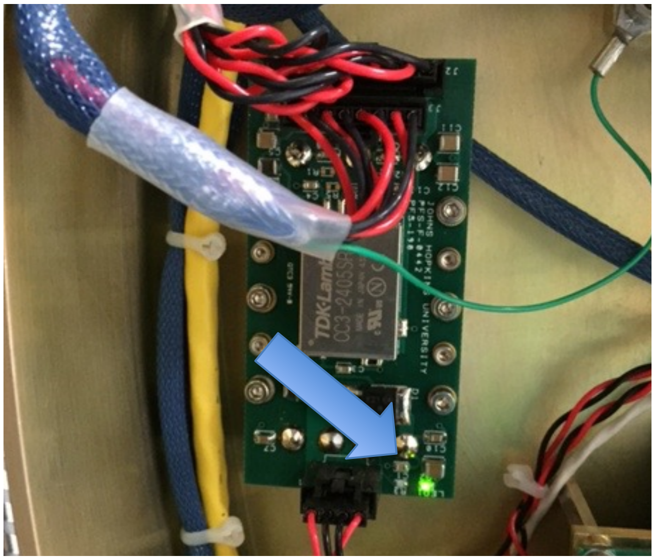
4.5. In the PIE pan, verify that the PCM status indicators are active.



4.6. In the control rack, set the 48V DISCONNECT to ON and verify that the fans in the 48V chassis are running.

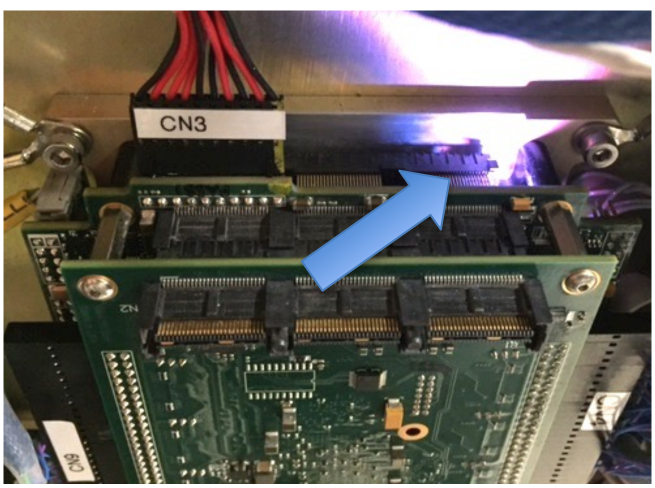
4.7. Using the control software, enable the Back End Electronics Computer (BEE) power. (“core powerBEE cam=r1”). The r1 BEE should automatically connect in about 45s)

4.8. In the PIE pan, verify that the LED on the BEE Supply is illuminated.



4.9. Verify that the Status indicators on the BEE are active.

4.10. Using the control software, capture the PCM voltages.



(“xcu_r1 pcm status”, and look at the pcmPower keyword.)

4.11. Verify that VH and VL are between 24V and 28V. Note the values:

VH: ___________ VL:___________

4.12. In the front of the control rack, set the AUX DISCONNECT to OFF.

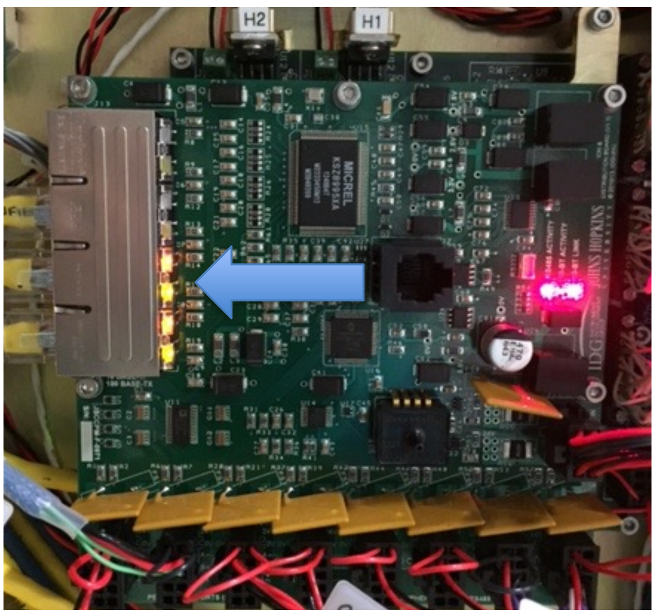
4.13. Verify that the PCM and BEE remain powered.

4.14. In the front of the control rack, set the AUX DISCONNECT to ON.

4.15. Allow the Ethernet switch to reboot, then assess the BEE's reported uptime to verify that the BEE did not reboot when the power was cycled.

4.16. Using the control software, enable the temperature board. ("xcu_r1 power on temps")

4.17. In the PIE pan, verify that the Status LED on the temperature board is active. Note that the temperature board in underneath the PCM. The status lights on the second channel of the PCM switch (highlighted in the picture) also provide indication that the temperature board is active.



4.18. Using the control software, capture the temperature readings for each temperature channel ("xcu_r1 temps test2"). Verify that the values meet the requirements detailed below. Record any discrepancies.

CH1 __146 ±2	CH2 159 ±2	CH3 175 ±2
CH4 __188 ±2	CH5 208 ±2	CH6 225 ±2
CH7 __253 ±2	CH8 284 ±2	CH9 298 ±2
CH10 _322 ±2	CH11 348 ±2	CH12 404 ±2

4.19. Using the control software, enable heater 1 (thermal spider), set the power to 100% ("xcu_r1 heaters spider power=100") and verify that LED1 on test connector T6 is illuminated.

4.20. Using the control software, disable heater 1 (“xcu_r1 heaters spider off”) and verify that LED1 on test connector T6 is extinguished.

4.21. Using the control software, enable heater 2 (detector), set the power to 100% (“xcu_r1 heaters ccd power=100”) and verify that LED2 on test connector T3 is illuminated.

4.22. Using the control software, disable heater 2 (“xcu_r1 heaters ccd off”). And verify that LED2 on test connector T3 is extinguished.

4.23. Using the control software, enable the temperature interlock on the PCM (“xcu_r1 power on heaters”).

4.24. Using the control software, enable High Power Switch 1 (“xcu_r1 HPheaters on one”) on the temperature board and verify that LED3 on test connector T4 is illuminated.

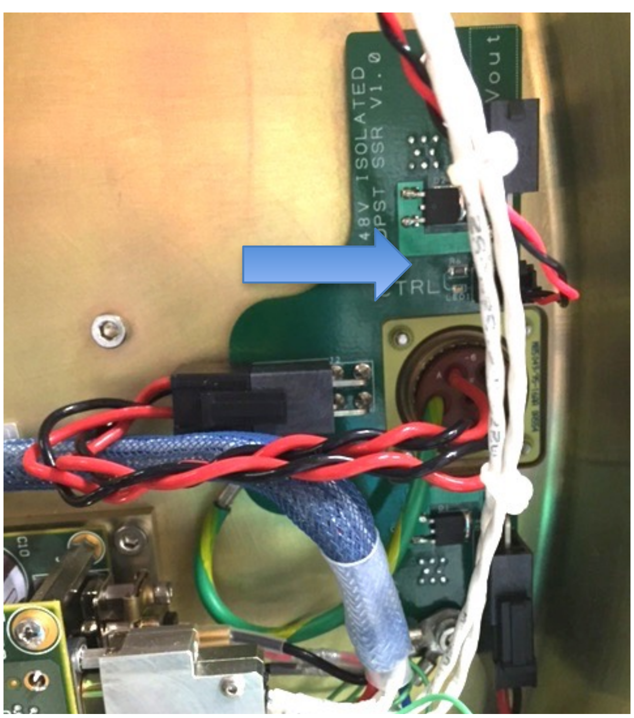
4.25. Using the control software, disable High Power Switch 1 (“xcu_r1 HPheaters off one”) and verify that LED3 on test connector T4 is extinguished.

4.26. Using the control software, enable High Power Switch 2 (“xcu_r1 HPheaters on two”) on the temperature board and verify that LED4 on test connector T3 is illuminated.

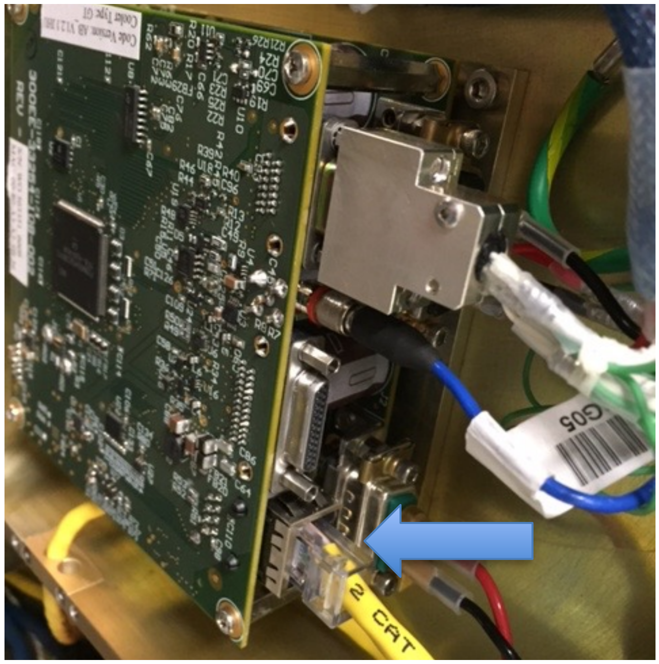
4.27. Using the control software, disable High Power Switch 2 (“xcu_r1 HPheaters off two”) and verify that LED4 on test connectorT3 is extinguished.

4.28. Using the control software, disable the temperature board (“xcu_r1 power off temps”) and verify that the status indicators are extinguished.

4.29. Using the control software, enable power to the Cryocooler controller (“xcu_r1 power on cooler”) and verify that the LED on the 48V SSR in the PIE pan is illuminated.



4.30. Verify that the Status LED on the Cryocooler controller is active.



4.31. Allow 20 seconds for the cooler to boot, then using the control software capture Cryocooler tip and reject temperatures ("xcu_r1 cooler status")

4.32. Verify that the tip temperature is 273 ±1. Note and discrepancies.

4.33. Verify that the reject temperature is between 0 and 25. Note the value, and any discrepancies. Reject Temperature: __________

4.34. Using the control software, disable power to the Cryocooler controller ("xcu_r1 power off cooler").

4.35. Verify that the LED indicator on the 48V SSR is extinguished.

4.36. Verify that the status indicator on the Cryocooler is off.

4.37. Remove the test connectors, T3, 4, 6, 7 from the feed through board, and install J-P 3, 4, 6 and 7.

4.38. Using the control software, enable the temperature board. ("xcu_r1 power on temps")

4.39. Verify that the Status LED on the temperature board is active.

4.40. Using the control software, capture the temperature readings for each channel. ("xcu_r1 temps test2"). Verify that values meet the requirements detailed below. Record any discrepancies. (Note: amb = ambient temperature)

CH1	__amb±2	☐	CH2	amb±2	☐
CH3	__amb±2	☐	CH4	amb±2	☐
CH5	__--- ___	☐	CH6	---	☐
CH7	__--- ___	☐	CH8	amb±2	☐

CH9 __--- ___	☐	CH10 ---	☐
CH11 _amb±2	☐	CH12 amb±2	☐

4.41. Using the control software, enable power to the Cryocooler controller (“xcu_r1 power on cooler”).

4.42. Verify that the LED indicator on the 48V SSR is illuminated

4.43. Verify that the Status LED on the Cryocooler controller are indicating

4.44. Using the control software capture Cryocooler tip and reject temperatures (“xcu_r1 cooler status”).

4.45. Verify that the tip temperature is ambient ±2. Note and discrepancies.

4.46. Verify that the reject temperature is approximately equal to the coolant temperature ±2.

4.47. Using the control software, disable power to the Cryocooler (“xcu_r1 power off cooler”).

4.48. Verify that the LED indicator on the 48V SSR is extinguished.

4.49. Verify that the status indicator on the Cryocooler is off.

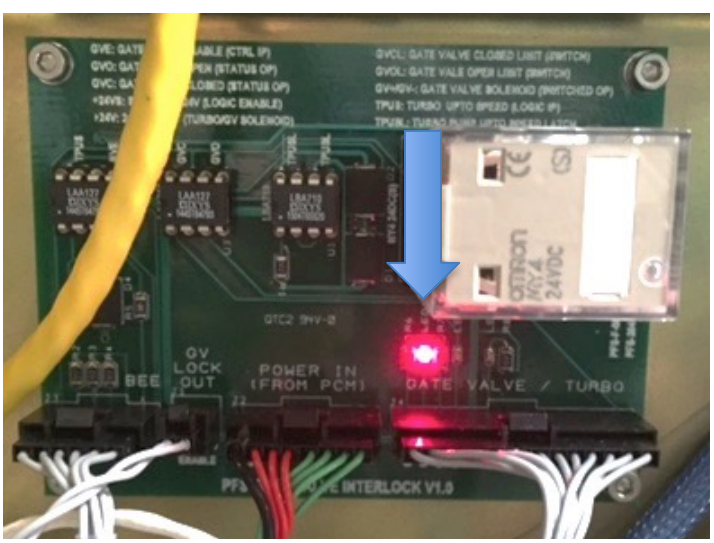
4.50. Using the control software, enable power to the Vacuum Gauge (“xcu_r1 power on gauge”).

4.51. Using the control software, capture the pressure from the Vacuum Gauge (“xcu_r1 gauge status”)..

4.52. Verify that the pressure in Torr is ambient ±20.

4.53. Using the control software, verify that the Gate Valve is closed (“xcu_r1 gatevalve status”).

4.54. In the PIE pan, verify the following Gate Valve Interlock Status:
GVC indicator (LED 1) illuminated: ☐
GVO indicator (LED 2) extinguished: ☐
GV indicator (LED 3) extinguished: ☐



4.55. Using the control software, enable the Gate Valve interlock line on the PCM, ("xcu_r1 power on interlocks"), and then assert the Gate Valve Enable signal ("xcu_r1 gatevalve open").

4.56. Allow 5 seconds for the gate valve to actuate, then verify the following Gate Valve Interlock Status:
GVC indicator (LED 1) extinguished: ☐
GVO indicator (LED 2) illuminated: ☐
GV indicator (LED 3) illuminated: ☐

4.57. Remove J-P6 interlock connector on the bottom of the PIE pan and verify that the Gate Valve closes.

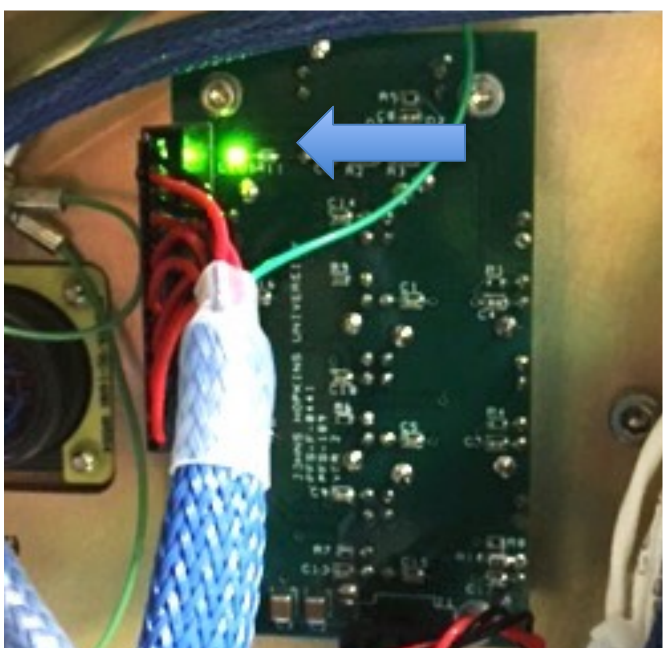
4.58. In the PIE pan, verify the following Gate Valve Interlock Status:
GVC indicator (LED 1) illuminated: ☐
GVO indicator (LED 2) extinguished: ☐
GV indicator (LED 3) extinguished: ☐

4.59. Reinstall J-P6, then using the control software disable the GVE signal ("xcu_r1 gatevalve close"), and verify that the Gate Valve closes.

4.60. In the PIE pan, verify the following Gate Valve Interlock Status:
GVC indicator (LED 1) illuminated: ☐
GVO indicator (LED 2) extinguished: ☐
GV indicator (LED 3) extinguished: ☐

4.61. Using the control software, verify turbo pump communication by requesting its status ("xcu_r1 turbo status").

4.62. Using the control software enable the Front End Electronics power supply ("xcu_r1 power on fee").



4.63. Verify that the indicator on the FEE power supply board is illuminated.

4.64. Using the control software, enable all FEE voltages, and then request the status of all FEE voltages (Requires input from Craig Loomis).

4.65. Verify that the FEE voltages meet the following requirements. Note any discrepancies:

3V3M: 3.3V ±0.1	□	3V3: 3.3V	±0.1	□
5VN: -5.0V ±0.2	□	5VP: 5.0V	±0.2	□
5VNpa: -5.0V ±0.2	□	5VPpa: 5.0V	±0.2	□
12VN: -12.0V ±0.5	□	12VP: 12.0V	±0.5	□
24VN: -24.0V±1.0	□	54VP: 54.0V	±5.0	□

4.66. Using the control software, enable the focus mechanism motor controller (“xcu_r1 power on motors”), and then verify connectivity by requesting motor status (“xcu_r1 motors initCcd”).

4.67. In the front of the control rack, set the power switches for the Ion Pump Controllers to ON and verify that both controllers power up.

4.68. Using the control software, verify communication by requesting status from both ion pump controllers (“xcu_r1 ionpumps status”).

4.69. In the front of the control rack, set the power switches for the Ion Pump Controllers to OFF.

4.70. In the front of control rack, set the 48V DISCONNECT switch to OFF.

4.71. In the front of control rack, set the 24V UPS DISCONNECT switch to OFF.

4.72. In the front of control rack, set the AUX DISCONNECT switch to OFF.

5. Appendix:

5.1 Test connector Parameters

Temperature Channel	Connector/Pin Numbers	Measured Resistance	Measured Temperature
CH1	T7(7,3)	505Ω	146.26K
CH2	T7(8,4)	551Ω	158.59K
CH3	T7(9,5)	616Ω	174.96K
CH4	T6(9,5),	668Ω	188.48K
CH5	T4(13,6)	747Ω	208.43K
CH6	T4((14,7)	812Ω	225.06K
CH7	T4(15,8)	919Ω	252.95K
CH8	T3(15,8)	1038Ω	284.05K
CH9	T3(7,14)	1094Ω	298.16K
CH10	T3(6,13	1186Ω	321.68K
CH11	T3(4,11)	1288Ω	348.23K
CH12	T3(3,10	1505Ω	403.70K
TIP TEMP 1	T6(1,2,6,7)	100Ω	273.15K
*TIP TEMP 2	T4(4,5,11,12)	100Ω	273.15K

* Tip Temp 2, used with NIR camera only.

5.2 T11 Test connector Parameters.
(Note: T11 is not utilized by this procedure)

Temperature Channel	Connector/Pin Numbers	Measured Resistance	Measured Temperature
CH1	T11(42,41)	1775Ω,	474.84K
CH2	T11(39,38)	1625Ω	434.26K
CH3	T11(37,36)	1479Ω	396.66K
CH4	T11(34,33)	1292Ω,	347.96K
CH5	T11(32,31)	1171Ω	317.79K
CH6	T11((29,28)	1084Ω	295.26K
CH7	T11(27,26)	1048Ω	286.63K
CH8	T11(24,23)	901Ω	248.27K
CH9	T11(22,21)	823Ω	228.53K
CH10	T11(19,18)	755Ω	210.77K
CH11	T11(17,16)	685Ω	192.77K
CH12	T11(14,13),	613Ω	174.80K