Science Operations

- HARPS Alarms

User Manual

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1 Introduction

The stability of HARPS is of paramount importance to achieve the goal accuracy in the Radial Velocity (RV) measurement of 1m/s. The term "stability" includes mechanical stability, which translates in very careful handling of the instrument (fibers, adapter etc), as well as thermal stability and pressure stability within the spectrograph. Moreover the CCD temperature and pressure have to be strictly monitored to insure that the detector is in the proper operational range.

In some cases there are not clear procedures on how to operate in case a specific alarm is triggered. We need to gain experience with the hardware of this still young instrument. In several cases procedures are dictated by the successful strategy applied to solve a specific problem.

1.1 Purpose

This manuals describes the alarms defined in the alarm display and the diagnostic and recovery procedures. At times consultation with a system expert is required.

1.2 Scope

This manual is intended for all people involved with HARPS operation and maintenance.

1.3 Applicable documents

The following documents, of the exact issue shown, form a part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall be considered as a superseding requirement:

1.4 Reference documents

The following documents are referenced in this document:

1.5 Abbreviations and acronyms

The following abbreviations and acronyms are used in this document:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFC</td>
<td>Continuous Flow Cryostat</td>
</tr>
<tr>
<td>DU</td>
<td>Detector Unit</td>
</tr>
<tr>
<td>ESO</td>
<td>European Southern Observatory</td>
</tr>
<tr>
<td>HARPS</td>
<td>High Accuracy Radial velocity Planet Searcher</td>
</tr>
<tr>
<td>HCFA</td>
<td>HARPS Cassegrain Fibre Adapter</td>
</tr>
<tr>
<td>HE</td>
<td>HARPS Enclosure</td>
</tr>
<tr>
<td>IB</td>
<td>Isolation Box</td>
</tr>
<tr>
<td>LIN</td>
<td>La Silla Instrumentation team</td>
</tr>
<tr>
<td>LSO</td>
<td>La Silla Observatory</td>
</tr>
<tr>
<td>RV</td>
<td>Radial Velocity</td>
</tr>
<tr>
<td>SciOp</td>
<td>Science Operations</td>
</tr>
<tr>
<td>VV</td>
<td>Vacuum Vessel</td>
</tr>
</tbody>
</table>
1.6 Glossary

1.7 Stylistic conventions

The following styles are used:

- **bold** in the text, for commands, filenames, etc., as they have to be typed.
- *italic* for parts that have to be substituted with real content.
- `teletype` for examples.

**Bold** and *italic* are also used to highlight words.
2 Overview

For convenience the alarms are divided in three sections:

- "Detector alarms": alarms related with detector or CFC temperatures and pressure;
- "Environment alarms": alarms related to the HARPS rooms and the exterior of the Vacuum Vessel.
- "Optical bench alarms": alarms related to temperatures in the optical bench;

For each section the alarm thresholds as well as the average values and their RMS will be presented. Recovery actions will be described in each case.

The case of power failures will be discussed separately.

3 Power failures

Frequently, after a power failure, the PREMAs loose their calibrations and display wrong temperature measurements which might cause several alarms to be triggered. If such a misbehaviour is suspected the PREMA(s) should be power cycled. At start up the unit will read the calibrations from its permanent memory. Only the affected PREMA should be power cycled. The units do not have a power button, so they have to be unplugged. The PREMAs are located in the DU/VV rack, in the HARPS Coude’ room, in the back, behind the HARPS enclosure. A label distinguishes the PREMA A from the PREMA B.

4 Detector alarms

In this chapter alarms related with detector or CFC temperatures and pressure will be discussed. Averages and RMSs are extracted from the statistics over one year. Temperatures are expressed in degrees Celsius, pressure in mbar. An exception are the CCD temperatures which are expressed in degrees Kelvin.

Contact persons for this type of alarms are the La Silla detector group.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Average</th>
<th>RMS</th>
<th>Serious low</th>
<th>Warning low</th>
<th>Warning high</th>
<th>Serious high</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFC inside VV</td>
<td>16.943</td>
<td>0.056</td>
<td>16.650</td>
<td>16.800</td>
<td>17.100</td>
<td>17.250</td>
</tr>
<tr>
<td>Det. head body back</td>
<td>16.450</td>
<td>0.078</td>
<td>16.150</td>
<td>16.300</td>
<td>16.600</td>
<td>16.750</td>
</tr>
<tr>
<td>Det. head holding ring</td>
<td>17.038</td>
<td>0.085</td>
<td>16.700</td>
<td>16.880</td>
<td>17.200</td>
<td>17.350</td>
</tr>
<tr>
<td>CCD control reference</td>
<td>148.150</td>
<td>0.013</td>
<td>148.090</td>
<td>148.120</td>
<td>148.180</td>
<td>148.210</td>
</tr>
<tr>
<td>CCD secondary</td>
<td>148.209</td>
<td>0.015</td>
<td>148.150</td>
<td>148.180</td>
<td>148.240</td>
<td>148.270</td>
</tr>
<tr>
<td>CCD temp. 2</td>
<td>150.700</td>
<td>0.350</td>
<td>149.000</td>
<td>150.000</td>
<td>151.400</td>
<td>152.000</td>
</tr>
<tr>
<td>CFC pressure</td>
<td>1.3 \times 10^{-6}</td>
<td>0.3 \times 10^{-6}</td>
<td>-</td>
<td>-</td>
<td>5 \times 10^{-6}</td>
<td>10^{-5}</td>
</tr>
</tbody>
</table>

4.1 CFC inside VV

This temperature has been seen varying while changing the Nitrogen dewar. A warning might be seen in such cases for a short time. This is normal. If the temperature goes out of range verify that there is enough Nitrogen in the Nitrogen dewar and that the Nitrogen flow is fine.
4.2 Detector head body back and Detector head holding ring

If any of these alarm goes off:

1. verify the Nitrogen flow;
2. verify the heater is working (DU-VV rack).

4.3 CCD temperatures

1. Verify PULPO is working fine.
2. Verify the Nitrogen flow.
3. Call LIN.

4.4 CFC pressure

This alarm might be fatal. Call immediately LIN.

5 Environment alarms

In this chapter alarms related to the HARPS rooms and the exterior of the Vacuum Vessel. will be discussed. Averages and RMSs are extracted from the statistics over one year.

Temperatures are expressed in degrees Celsius, pressure in mbar.

This kind of alarms are generally triggered in case of a failure of the climatization system. It is mandatory to react immediately, to avoid the spectrgraph to loose stabilization (optical bench alarms going off). An example of a climatization problem can be seen in the page:

http://www.ls.eso.org/lasilla/sciops/esoonly/harps/temperature_rise.html

These problems might occur after a power cut, in case the pumps do not start properly and all the three safety levels fail. It could also be the case that one of the pumps (or both) has a malfunction. The HE climatization pumps are located inside the West Coude’ room, near the calibration unit rack of HARPS. Problems might also arise if the air conditioning (water cooling circuit) of the 3.6m building stops working.

The La Silla climatization expert (L. Wendegass) should be contacted immediately.
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<table>
<thead>
<tr>
<th>Sensor</th>
<th>Average</th>
<th>RMS</th>
<th>Serious low</th>
<th>Warning low</th>
<th>Warning high</th>
<th>Serious high</th>
</tr>
</thead>
<tbody>
<tr>
<td>VV outside foot S2</td>
<td>17.038</td>
<td>0.038</td>
<td>16.800</td>
<td>16.920</td>
<td>17.160</td>
<td>17.280</td>
</tr>
<tr>
<td>VV outside det. side</td>
<td>17.058</td>
<td>0.016</td>
<td>16.960</td>
<td>17.010</td>
<td>17.110</td>
<td>17.160</td>
</tr>
<tr>
<td>VV outside coll. side</td>
<td>17.111</td>
<td>0.012</td>
<td>17.030</td>
<td>17.070</td>
<td>17.150</td>
<td>17.190</td>
</tr>
<tr>
<td>Scrambler outside VV</td>
<td>16.972</td>
<td>0.027</td>
<td>16.850</td>
<td>16.910</td>
<td>17.030</td>
<td>17.090</td>
</tr>
<tr>
<td>IB control reference</td>
<td>17.005</td>
<td>0.005</td>
<td>16.985</td>
<td>16.995</td>
<td>17.015</td>
<td>17.025</td>
</tr>
<tr>
<td>IB secondary</td>
<td>17.004</td>
<td>0.010</td>
<td>16.940</td>
<td>16.970</td>
<td>17.030</td>
<td>17.060</td>
</tr>
<tr>
<td>Air IB</td>
<td>17.061</td>
<td>0.012</td>
<td>17.000</td>
<td>17.030</td>
<td>17.090</td>
<td>17.120</td>
</tr>
<tr>
<td>Air throu fan 4 IB</td>
<td>17.349</td>
<td>0.023</td>
<td>17.200</td>
<td>17.280</td>
<td>17.430</td>
<td>17.500</td>
</tr>
<tr>
<td>Air HE</td>
<td>15.238</td>
<td>0.030</td>
<td>15.060</td>
<td>15.150</td>
<td>15.330</td>
<td>15.420</td>
</tr>
<tr>
<td>Air Coude’ room W</td>
<td>15.520</td>
<td>0.600</td>
<td>12.500</td>
<td>14.000</td>
<td>17.000</td>
<td>18.500</td>
</tr>
<tr>
<td>VV pressure</td>
<td>0.005</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen %</td>
<td></td>
<td></td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.1 VV outside...

1. Verify HE and IB climatization;
2. verify Nitrogen flow, if too much might lower the temperatures on the detector side;
3. verify the amount of time the vacuum pump is running, it could increase the temperature in the detector side;
4. call LSO climatization expert (L. Wendegass).

5.2 Scrambler outside VV

A high temperature warning could be seen after pumping the VV due to a slight temperature increase in the area. This is normal. The warning should disappear in few (5) hours. A low temperature alarm could be seen in case of an increase in the Nitrogen flow. In this case the Nitrogen flow should be checked and the reason for the increase understood.

5.3 IB control reference and secondary, Air IB, Air throu fan 4 IB

1. Verify HE and IB climatization;
2. verify fans and heater are working;
3. call LSO climatization expert (L. Wendegass).

5.4 Air HE

1. Verify HE climatization;
2. call LSO climatization expert (L. Wendegass).
5.5 Air Coude’ room W

1. Verify room climatization;
2. verify all doors are closed.
3. call LSO climatization expert (L. Wendegass).

5.6 VV pressure

Pump the Vacuum Vessel for up to 2 hours (no more).

5.7 LN%

Refill the Nitrogen dewar.

6 Optical bench alarms

In this chapter alarms related to temperatures in the optical bench will be discussed. Averages and RMSs are extracted from the statistics over one year.

Temperatures are expressed in degrees Celsius, pressure in mbar.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Average</th>
<th>RMS</th>
<th>Serious low</th>
<th>Warning low</th>
<th>Warning high</th>
<th>Serious high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echelle grating</td>
<td>17.073</td>
<td>0.013</td>
<td>17.000</td>
<td>17.030</td>
<td>17.110</td>
<td>17.140</td>
</tr>
<tr>
<td>Grism</td>
<td>17.060</td>
<td>0.022</td>
<td>16.910</td>
<td>16.990</td>
<td>17.130</td>
<td>17.210</td>
</tr>
<tr>
<td>Opt. bench top-right</td>
<td>17.082</td>
<td>0.025</td>
<td>16.930</td>
<td>17.010</td>
<td>17.160</td>
<td>17.230</td>
</tr>
<tr>
<td>Opt. bench top-left</td>
<td>17.130</td>
<td>0.030</td>
<td>16.930</td>
<td>17.030</td>
<td>17.230</td>
<td>17.330</td>
</tr>
</tbody>
</table>

The alarms described in this section should be consequence of events generated either in the detector area or in the environment. Therefore they should be triggered afterwards detector alarms or environment alarms went off. In case any of these alarms is triggered, the stability of the instrument is seriously compromised. Recovery time is about one week. Instrument scientist should be warned immediately.

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