Configuration check after thermistor failure
File: H_CRP_TCS_THMR.xls
Author: E. Picallo

Procedure Summary

Objectives

This procedure describes the checks to be performed after an onboard detection of a thermal control loop thermistor failure.

This failure occurs when one of the three thermistors used in a control loop is inconsistent with the other two. The CDMS ASW discards it for the cycle where the failure has been detected, though will try to use it again in the next cycle to prevent spurious erroneous measurements.

In case the failure of this thermistor is confirmed the Ground may choose to remove it from the thermal control loop by modifying the settings in the Thermal Control Table.

Summary of Constraints

It is first necessary to assess if this failure is permanent or due to a spurious measurement.

In case the error is confirmed and a given Thermistor is to be discarded permanently, one needs to remove it from all control loops where it was previoulsy used.

Spacecraft Configuration

Start of Procedure

CDMU in default configuration;
Thermal Control Management function active;
Reception of a Thermistor failure event packet.

End of Procedure

CDMU in default configuration;
Thermal Control Management function active;
If deemed necessary TCT table updated.

Reference File(s)

Input Command Sequences

Output Command Sequences

Referenced Displays

ANDs   GRDs   SLDs

Doc No.   :PT-HMOC-OPS-FOP-6001-OPS-OAH
Fop Issue :   3.0
Issue Date: 13/04/10

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ZAZ84999
ZAZ85999
ZAZ86999
ZAZ87999
ZAZ88999
ZAZ89999
ZAZ8A999
```
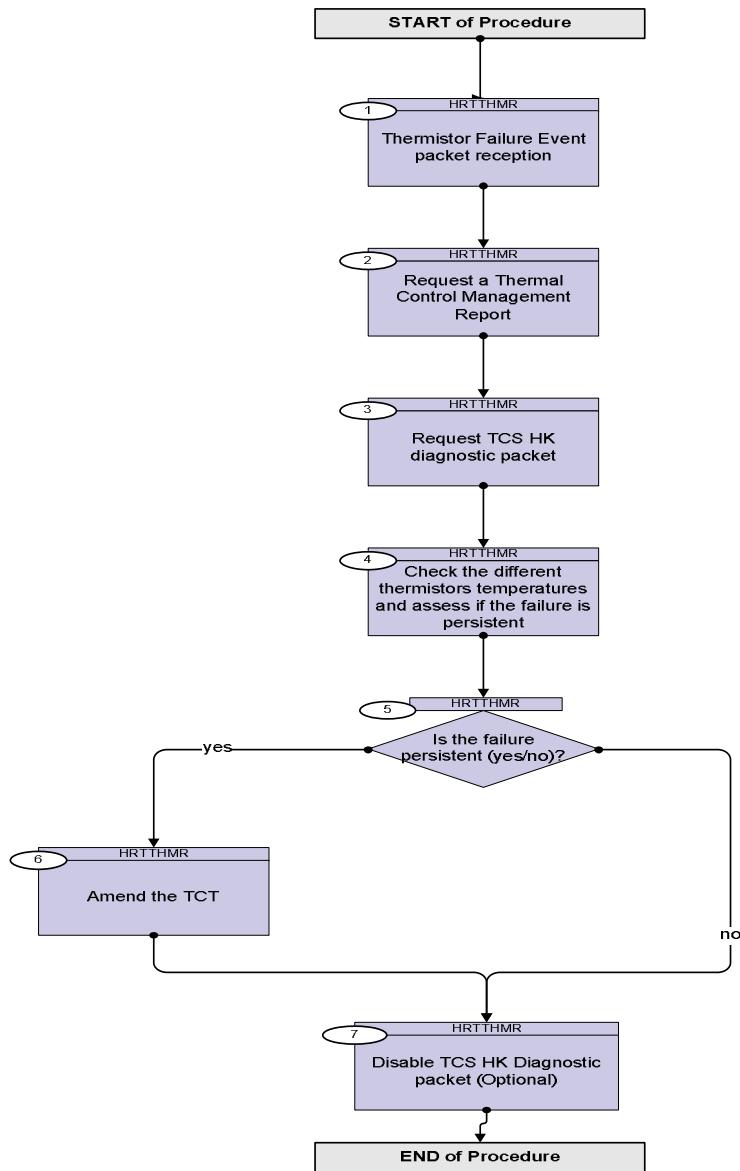
Configuration Control Information

DATE	FOP ISSUE	VERSION	MODIFICATION DESCRIPTION	AUTHOR	SPR REF
28/07/08	1	1	Created	E. Picallo	
08/12/08		2	Update AND statements added comments that tolerance is control loop specific	E. Picallo	
09/01/09	2	3	CDMU ASW V3.8 and BSW V2.4 alignment	E. Picallo	
18/03/09		3.01	Validation : Minor correction (call to H_CRP_TCS_TCT updated)	E. Picallo	
24/03/09	2.2	4	Thermistors temperatures descriptions updated	E. Picallo	

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Procedure Flowchart Overview

START of Procedure

1 HRTTHMR
Thermistor Failure Event
packet reception

2 HRTTHMR
Request a Thermal
Control Management
Report

3 HRTTHMR
Request TCS HK
diagnostic packet

4 HRTTHMR
Check the different
thermistors temperatures
and assess if the failure is
persistent

5 HRTTHMR
Is the failure
persistent (yes/no)?

yes

no

6 HRTTHMR
Amend the TCT

7 HRTTHMR
Disable TCS HK Diagnostic
packet (Optional)

END of Procedure

```
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HERSCHEL PLANCK   esa

Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Beginning of Procedure		
		TC Seq. Name :HRTTHMR (Check THM failure) Configuration check after thermistor failure *TimeTag Type: N* *Sub Schedule ID:*		
1		*Thermistor Failure Event packet reception*		Next Step: 2
		The event identifies: **- Thermal control loop that caused the anomaly (DE172170)** **- Thermistor which was discarded (DE172170)** **- Failed thermistor's temperature (DE174170)** **- Average temperature of other thermistors within the loop (DE173170)**		
		A different event is received for: **- Class A active control loop;** **- Class B active control loop;** **- Disabled control loop.** **The different events have been referenced in the sub steps 1.1 to 1.3, though the subsequent configuration checks are the same in all cases thus have been treated as a single case.**		
		Note that Control Loop 12 will never raised such an event as it does not use THM-52, THM-100, THM-148 for loop control . The thermistors THM-52, THM-100 are used for monitoring only.		
1.1		*Class A active control loop Thermistor failure Event*		
		Class A Thermistor Failure event is generated when the average temperature calculation of an enabled class A loop suggests a failed thermistor.		

		Verify Packet Reception
		    CdmuAsw Event 5-4 Class A Thermistor Failure
		Packet Details:
		                           APID:
		                           Type:
		                    Subtype:
		                           PI1:
		                           PI2:
			D_EvRp_087
			
			16
			5
			4
			29189
			0	

		Verify Telemetry **TM5xEventID** **DEZSJ170**	**= ClassAThFail**	(None)
		Verify Packet Telemetry (Pkt = D_EvRp_087) **LoopIndex** **DE151170**		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_087) **ThrmstParamId** **DE172170**		(None)

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Verify Packet Telemetry (Pkt = D_EvRp_087) **Temperature** DE174170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_087) **AvgTemp** DE173170		(None)
1.2		*Class B active control loop Thermistor failure Event*		
		Class B Thermistor Failure event is generated when the average temperature calculation of an enabled class B loop suggests a failed thermistor.		

		Verify Packet Reception
		    CdmuAsw Event 5-4 Class B Thermistor Failure
		Packet Details:
		                    APID:
		                    Type:
		                    Subtype:
		                    PI1:
		                    PI2:
			D_EvRp_7060
			
			16
			5
			4
			29190
			0	

		Verify Telemetry **TM5xEventID** DEZSJ170	**= ClassBThFail**	(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7060) **LoopIndex** DE151170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7060) **ThrmstParamId** DE172170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7060) **Temperature** DE174170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7060) **AvgTemp** DE173170		(None)
1.3		*Disabled control loop Thermistor failure Event*		
		Disabled Loop Thermistor Failure event is generated when the average temperature calculation of a disabled thermal control loop suggests a failed thermistor.		

		Verify Packet Reception
		CdmuAsw Event 5-4 Disabled Loop Thermistor Failure
		Packet Details:
		                    APID:
		                    Type:
		                    Subtype:
		                    PI1:
		                    PI2:
			D_EvRp_7061
			
			16
			5
			4
			29191
			0	

		Verify Telemetry **TM5xEventID** DEZSJ170	**= DisLoopThFail**	(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7061) **LoopIndex** DE151170		(None)

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Verify Packet Telemetry (Pkt = D_EvRp_7061) ThrmstParamId DE172170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7061) Temperature DE174170		(None)
		Verify Packet Telemetry (Pkt = D_EvRp_7061) AvgTemp DE173170		(None)
2		*Request a Thermal Control Management Report*		Next Step: 3
		Retrieve the current loop settings and identify any other loops using that same thermistor.		
		Execute Procedure: **H_FCP_TCS_REPO Thermal Control Status Report**		
3		*Request TCS HK diagnostic packet*		Next Step: 4
		Call Procedure H_FCP_DHS_3033 - Verify if TCS diagnostic packet (HK ID = 100) is enabled. - If TCS diagnostic packet (HK ID = 100) is not Enable then Enable it.		
		Execute Procedure: **H_FCP_DHS_3033 Enable or disable the generation of an housekeeping or diagnostic packet**		
4		*Check the different thermistors temperatures and assess if the failure is persistent*		Next Step: 5
		The checkforms attached to the procedure identify the initial association thermistors/control loops. **If the thermistors are flagged as 'No Control Loop' they are not allocated to any Control Loop, though used to monitor other units outside the Thermal Control function.** **If the thermistors are flagged as 'Not used' they are not used at all.**		
4.1		*Check the temperature of all thermistors within the control loop*		

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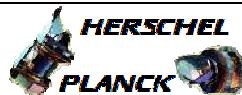
Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		A thermistor is declared as failed if its temperature wrt to the 2 others is not within twice the specified tolerance for the given Control Loop.		
		Refer to Checkform ZAZ84999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ85999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ86999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ87999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ88999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ89999 at the back of this document		**ANDCK**
		Refer to Checkform ZAZ8A999 at the back of this document		**ANDCK**
5		*Is the failure persistent (yes/no)?*		Next Step: yes 6 no 7
6		*Amend the TCT*		Next Step: 7
		The failed thermistor needs to be removed from all control loops which were previously using it. **This is achieved by modifying the Thermal Control Table. The failed thermistor is replaced by any of the two remaining ones.** **Repeat substeps 6.1 to 6.3 as many times as requested to replace all references to the failed thermistor i.e. one command per control loop previously using it.**		
6.1		*Disable the loop which needs to be modified*		
		Call H_CRP_TCS_TCT and select the 'DISABLE' control loop branch of the procedure for the affected thermal control loop(s).		
		Execute Procedure: **H_CRP_TCS_TCT Thermal Control Table maintenance**		
6.2		*Replace the failed thermistor*		

Status   : Version 4 – Unchanged
Last Checkin: 24/03/09

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Call H_CRP_TCS_TCT and and select the 'Modify Thermistor' branch of the procedure for the affected thermal control loop.		
		Select the Monitored Thermistor Parameter which is currently set to faulty thermistor and replace it for a valid thermistor of this Control Loop (which will be used instead of the faulty one). **WARNING: Do not change the configuration of the pair Monitored Thermistor/Thermistor ID of the other two healthy thermistors on the Control Loop.**		
		Execute Procedure: H_CRP_TCS_TCT Thermal Control Table maintenance		
6.3		*Enable the loop which was modified*		
		Call H_CRP_TCS_TCT and select the 'ENABLE' control loop branch of the procedure for the affected thermal control loop.		
		Execute Procedure: H_CRP_TCS_TCT Thermal Control Table maintenance		
7		*Disable TCS HK Diagnostic packet (Optional)*		Next Step: END
		Call Procedure H_FCP_DHS_3033 to disable the TCS diagnostic packet (HK ID = 100)		
		Execute Procedure: H_FCP_DHS_3033 Enable or disable the generation of an housekeeping or diagnostic packet		

End of Procedure

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ZAZ84999 / Thermal control loop 1 of 7							
ID	DESCRIPTION	VALUE	UNIT	ID	DESCRIPTION	VALUE	UNIT
TM050601	THM_50_XPND_2			TM049601	THM_49_XPND_1		
TM098601	THM_98_XPND_2			TM097601	THM_97_XPND_1		
TM146601	THM_146_XPND_2			TM145601	THM_145_XPND_1		
DEA79170	ATemp02_XPND_2			DEA7D170	ATemp06_XPND_1		
WM11B565	Xpnd2_G1H2_S			WM11F565	Xpnd1_G1H6_S		
WMA1B565	XPND2_G18H2_S			WMA1F565	XPND1_G18H6_S		
TM087601	THM_87_FCV_A1B			TM089601	THM_89_FCV_C1B		
TM135601	THM_135_FCV_A1B			TM137601	THM_137_FCV_C1B		
TM183601	THM_183_FCV_A1B			TM185601	THM_185_FCV_C1B		
DEA7A170	ATemp03_FCV_A1B			DEA7F170	ATemp08_FCV_C1B		
WM11C565	FcvA1B_G1H3_S			WM21B565	FcvC1B_G2H2_S		
WMA1C565	FcvA1B_G18H3_S			WM91H565	FcvC1B_G17H2_S		
TM088601	THM_88_FCV_C2B			TM090601	THM_90_FCV_A2B		
TM136601	THM_136_FCV_C2B			TM138601	THM_138_FCV_A2B		
TM184601	THM_184_FCV_C2B			TM186601	THM_186_FCV_A2B		
DEA7B170	ATemp04_FCV_C2B			DEA80170	ATemp09_FCV_A2B		
WM11D565	FcvC2B_G1H4_S			WM21C565	FcvA2B_G2H3_S		
WMA1D565	FcvC2B_G18H4_S			WM91J565	FcvA2B_G17H3_S		
TM059601	THM_59_RCSPipe2			TM091601	THM_91_FCV_C4B		
TM107601	THM_107_RCSPipe2			TM139601	THM_139_FCV_C4B		
TM155601	THM_155_RCSPipe2			TM187601	THM_187_FCV_C4B		
DEA7C170	ATemp05_RCSPipe2			DEA81170	ATemp10_FCV_C4B		
WM11E565	RCSpipG1H5_S			WM21D565	FcvC4B_G2H4_S		
WMA1E565	RCSpipG18H5_S			WM91K565	FcvC4B_G17H4_S		

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ID	DESCRIPTION	VALUE	UNIT	ID	DESCRIPTION	VALUE	UNIT
TM053601	THM_53_FPSPU			TM056601	THM_56_FPDECMEC		
TM101601	THM_101_FPSPU			TM104601	THM_104_FPDECMEC		
TM149601	THM_149_FPSPU			TM152601	THM_152_FPDECMEC		
DEA82170	ATemp11_FPSPU			DEA86170	ATemp15_FPDECMEC		
WM21E565	FpdFps_G2H5_S			WM21J565	FPMECDEC_G3H3_S		
WM91L565	FpdFps_G17H5_S			WM91C565	FPMECDEC_G16H3s		
TM052601	THM_52_PropTank			TM057601	THM_57_RCSPipe1		
TM100601	THM_100_PropTank			TM105601	THM_105_RCSPipe1		
TM148601	TCS_THM_148			TM153601	THM_153_RCSPipe1		
DEA83170	ATemp12_PropTank			DEA87170	ATemp16_RCSPipe1		
WM21F565	tanks_G2H6_S			WM21K565	RCSpipG3H4_S		
WM91M565	tanks_G17H6_S			WM91D565	RCSpipG16H4_S		
TM054601	THM_54_FPBOLC			TM058601	THM_58_CCU		
TM102601	THM_102_FPBOLC			TM106601	THM_106_CCU		
TM150601	THM_150_FPBOLC			TM154601	THM_154_CCU		
DEA84170	ATemp13_FPBOLC			DEA88170	ATemp17_CCU		
WM21G565	FPBOLC_G3H1_S			WM21L565	CcuHsdHsfG3H5_S		
WM91A565	FPBOLC_G16H1_S			WM91E565	CcuHdHf_G16H5_S		
TM055601	THM_55_CRS_1			TM086601	THM_86_GYRO		
TM103601	THM_103_CRS_1			TM134601	THM_134_GYRO		
TM151601	THM_151_CRS_1			TM182601	THM_182_GYRO		
DEA85170	ATemp14_CRS_1			DEA89170	ATemp18_GYRO		
WM21H565	CRS1_G3H2_S			WM21M565	GYRO_G3H6_S		
WM91B565	CRS1_G16H2_S			WM91F565	GYRO_G16H6_S		

Configuration check after thermistor failure
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ZAZ86999 / Thermal control loop 3 of 7							
ID	**DESCRIPTION**	**VALUE**	**UNIT**	**ID**	**DESCRIPTION**	**VALUE**	**UNIT**
TM060601	THM_60_FHWOV			TM094601	THM_94_RCSPipe7		
TM108601	THM_108_FHWOV			TM142601	THM_142_RCSPipe7		
TM156601	THM_156_FHWOV			TM190601	THM_190_RCSPipe7		
DEA8B170	ATemp20_FHWOV			DEA8F170	ATemp24_RCSPipe7		
WM31B565	FHWOV_G4H2_S			WM31F565	RCSpipG4H6_S		
WM81H565	FHWOV_G15H2_S			WM81M565	RCSpipG15H6_S		
TM093601	THM_93_RCSPipe6			TM012601	THM_12_CRS_2		
TM141601	THM_141_RCSPipe6			TM020601	THM_20_CRS_2		
TM189601	THM_189_RCSPipe6			TM036601	THM_36_CRS_2		
DEA8C170	ATemp21_RCSPipe6			DEA90170	ATemp25_CRS_2		
WM31C565	RCSpip_G4H3_S			WM31G565	CRS2_G5H1_S		
WM81J565	RCSpipG15H3_S			WM81A565	CRS2_G14H1_S		
TM077601	THM_77_FCV_A1A			TM066601	THM_66_FHHRH		
TM125601	THM_125_FCV_A1A			TM114601	THM_114_FHHRH		
TM173601	THM_173_FCV_A1A			TM162601	THM_162_FHHRH		
DEA8D170	ATemp22_FCV_A1A			DEA91170	ATemp26_FHHRH		
WM31D565	FcvA1A_G4H4_S			WM31H565	FHHRH_G5H2_S		
WM81K565	FcvA1A_G15H4_S			WM81B565	FHHRH_G14H2_S		
TM078601	THM_78_FCV_C2A			TM063601	THM_63_FHWEV		
TM126601	THM_126_FCV_C2A			TM111601	THM_111_FHWEV		
TM174601	THM_174_FCV_C2A			TM159601	THM_159_FHWEV		
DEA8E170	ATemp23_FCV_C2A			DEA92170	ATemp27_FHWEV		
WM31E565	FcvC2A_G4H5_S			WM31J565	FhWevlcuG5H3_S		
WM81L565	FcvC2A_G15H5_S			WM81C565	FhWevlcuG14H3_S		

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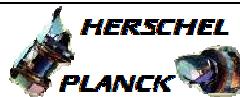
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ID	DESCRIPTION	VALUE	UNIT	ID	DESCRIPTION	VALUE	UNIT
TM092601	THM_92_FCV_C3B			TM071601	THM_71_RWL_1		
TM140601	THM_140_FCV_C3B			TM119601	THM_119_RWL_1		
TM188601	THM_188_FCV_C3B			TM167601	THM_167_RWL_1		
DEA93170	ATemp28_FCV_C3B			DEA98170	ATemp33_RWL_1		
WM31K565	FcvC3B_G5H4_S			WM41C565	RWA1_G6H3_S		
WM81D565	FcvC3B_G14H4_S			WM71J565	RWA1_G13H3_S		
TM095601	THM_95_RCSPipe8			TM072601	THM_72_RWL_3		
TM143601	THM_143_RCSPipe8			TM120601	THM_120_RWL_3		
TM191601	THM_191_RCSPipe8			TM168601	THM_168_RWL_3		
DEA94170	ATemp29_RCSPipe8			DEA99170	ATemp34_RWL_3		
WM31L565	RCSpipG5H5_S			WM41D565	RWA3_G6H4_S		
WM81E565	RCSpipG14H5_S			WM71K565	RWA3_G13H4_S		
TM096601	THM_96_LV_1_2			TM076601	THM_76_FHIFV		
TM144601	THM_144_LV_1_2			TM124601	THM_124_FHIFV		
TM192601	THM_192_LV_1_2			TM172601	THM_172_FHIFV		
DEA95170	ATemp30_LV_1_2			DEA9A170	ATemp35_FHIFV		
WM31M565	PtLfLv12_G5H6_S			WM41E565	FHWIV_G6H5_S		
WM81F565	PtLfLv12G14H6_S			WM71L565	FHWIV_G13H5_S		
TM070601	THM_70_RWL_4			TM069601	THM_69_RWL_2		
TM118601	THM_118_RWL_4			TM117601	THM_117_RWL_2		
TM166601	THM_166_RWL_4			TM165601	THM_165_RWL_2		
DEA97170	ATemp32_RWL_4			DEA9B170	ATemp36_RWL_2		
WM41B565	RWA4_G6H2_S			WM41F565	RWA2_G6H6_S		
WM71H565	RWA4_G13H2_S			WM71M565	RWA2_G13H6_S		

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ID	**DESCRIPTION**	**VALUE**	**UNIT**	**ID**	**DESCRIPTION**	**VALUE**	**UNIT**
TM075601	THM_75_STRs			TM079601	THM_79_FCV_C1A		
TM123601	THM_123_STRs			TM127601	THM_127_FCV_C1A		
TM171601	THM_171_STRs			TM175601	THM_175_FCV_C1A		
DEA9C170	ATemp37_STRs			DEAA0170	ATemp41_FCV_C1A		
WM41G565	STR_G7H1_S			WM41L565	FcvC1A_G7H5_S		
WM71A565	STR_G12H1_S			WM71E565	FcvC1A_G12H5_S		
TM051601	THM_51_Battery			TM080601	THM_80_FCV_A2A		
TM099601	THM_99_Battery			TM128601	THM_128_FCV_A2A		
TM147601	THM_147_Battery			TM176601	THM_176_FCV_A2A		
DEA9D170	ATemp38_Battery			DEAA1170	ATemp42_FCV_A2A		
WM41H565	BATTconG7H2_S			WM41M565	FcvA2A_G7H6_S		
WM71B565	BATTconG12H2_S			WM71F565	FcvA2A_G12H6_S		
TM064601	THM_64_FHWOH			TM061601	THM_61_FHHRV		
TM112601	THM_112_FHWOH			TM109601	THM_109_FHHRV		
TM160601	THM_160_FHWOH			TM157601	THM_157_FHHRV		
DEA9E170	ATemp39_FHWOH			DEAA2170	ATemp43_FHHRV		
WM41J565	FHWOH_G7H3_S			WM51A565	FHHRV_G8H1_S		
WM71C565	FHWOH_G12H3_S			WM61G565	FHHRV_G11H1_S		
TM065601	THM_65_FHWEH			TM082601	THM_82_FCV_C3A		
TM113601	THM_113_FHWEH			TM130601	THM_130_FCV_C3A		
TM161601	THM_161_FHWEH			TM178601	THM_178_FCV_C3A		
DEA9F170	ATemp40_FHWEH			DEAA3170	ATemp44_FCV_C3A		
WM41K565	FHWEH_G7H4_S			WM51B565	FcvC3A_G8H2_S		
WM71D565	FHWEH_G12H4_S			WM61H565	FcvC3A_G11H2_S		

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Author: E. Picallo

ID	DESCRIPTION	VALUE	UNIT	ID	DESCRIPTION	VALUE	UNIT
TM083601	THM_83_RCSPipe3			TM074601	THM_74_Tank_-Y		
TM131601	THM_131_RCSPipe3			TM122601	THM_122_Tank_-Y		
TM179601	THM_179_RCSPipe3			TM170601	THM_170_Tank_-Y		
DEAA4170	ATemp45_RCSPipe3			DEAA9170	ATemp50_Tank_-Y		
WM51C565	RCSpipG8H3_S			WM51H565	tank-Y_G9H2_S		
WM61J565	RCSpipG11H3_S			WM61B565	tank-Y_G10H2_S		
TM084601	THM_84_STR2_Baf			TM081601	THM_81_FCV_C4A		
TM132601	THM_132_STR2_Baf			TM129601	THM_129_FCV_C4A		
TM180601	THM_180_STR2_Baf			TM177601	THM_177_FCV_C4A		
DEAA5170	ATemp46_STR2_Baf			DEAAA170	ATemp51_FCV_C4A		
WM51D565	STR2baffG8H4_S			WM51J565	FcvC4A_G9H3_S		
WM61K565	STR2baffG11H4_S			WM61C565	FcvC4A_G10H3_S		
TM085601	THM_85_RCSPipe5			TM068601	THM_68_FHLSU		
TM133601	THM_133_RCSPipe5			TM116601	THM_116_FHLSU		
TM181601	THM_181_RCSPipe5			TM164601	THM_164_FHLSU		
DEAA6170	ATemp47_RCSPipe5			DEAAB170	ATemp52_FHLSU		
WM51E565	RCSpipG8H5_S			WM51K565	FHLSU_G9H4_S		
WM61L565	RCSpipG11H5_S			WM61D565	FHLSU_G10H4_S		
TM067601	THM_67_FHLCU			TM062601	THM_62_STR1_Baf		
TM115601	THM_115_FHLCU			TM110601	THM_110_STR1_Baf		
TM163601	THM_163_FHLCU			TM158601	THM_158_STR1_Baf		
DEAA7170	ATemp48_FHLCU			DEAAC170	ATemp53_STR1_Baf		
WM51F565	FHLCU_G8H6_S			WM51L565	STR1baffG9H5_S		
WM61M565	FHLCU_G11H6_S			WM61E565	STR1baffG10H5_S		

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Configuration check after thermistor failure
File: H_CRP_TCS_THMR.xls
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ID	DESCRIPTION	VALUE	UNIT	ID	DESCRIPTION	VALUE	UNIT
TM073601	THM_73_Tank_+Y						
TM121601	THM_121_Tank_+Y						
TM169601	THM_169_Tank_+Y						
DEAAD170	ATemp54_Tank_+Y						
WM51M565	tank+Y_G9H6_S						
WM61F565	tank+Y_G10H6_S						

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