ISI Update Jan. 2014

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1 Summary

We are making several updates to the HAM-ISI and BSC-ISI master models. These are an accumulation of small to medium sized changes. They are primarily to add functionality to ISI and update the Watchdogs. The updates are:

1. Implement a 3 sec. delay for the coil driver monitor in the Rogue Excitation before tripping ISI USER DACKILL.
2. Remove the CPS monitor for the ISI USER DACKILL (it is redundant with the ISI USER Watchdog).
3. Make timer in the WD code based on FE rate, rather than hard coded at 4096.
4. Add IOP-WD and HW-WD inputs to ISI-WD.
5. Add a 'previous trigger' output to the ISI WD code and screen.
6. Implement 'ride through' of WD saturations.
7. Make a sub-block for the WD parts of the simulink diagram a la HEPI.
8. Update the WD MEDM screen.
9. Put Rogue Excitation indicator and reset into main WD medm screen.
10. Update the Overview screen so that the loop-controller indicators will be grey if the current state = correct state = turned off.
11. Update controllers in BSC-ISI: FF01, FF12, FF1C, and HAM-ISI: FF to support monitoring.
12. Simplify the automatic reset feature of the isolation loops to only switch the Mask information.
13. Split DAC outputs on ISI overview screens, like we did on HEPI overview screens.
14. Clean up names in ODC block - MASTERSWITCH1 should just be MASTERSWITCH
15. Change the data rate of the Watchdog State channel to the model rate (4096).
16. Replaced several Filter modules used just for monitoring with a testpoint and epics monitor of the same name.
17. Update command scripts so they set the correct state bitwords for the cdsFiltCtrl2 format, and they switch the correct filters modules. This was ECR E1300910.
18. Update HAMISItool with simpler 2-step ramp.
19. Display HAMISItool info via a pop-up xterm window which closes automatically if the script finishes successfully.
20. Update plotting script to change watchdog names from ..._WDMON_... to ..._WD_MON_... .

This technical note complements ECR E1400046, and integration issue 650. This list was created from the list on SEI log 330 and comments therein.
It was first committed to the trunk for testing at MIT in update -rXXXX.

2 Details

2.1 Updates to the Watchdog

We have updated the Watchdog to make the model-only changes as described G1301210 for the systems call on Nov. 6, 2013, which is to say the ISI model has been updated, and the connections to the IOP WD model and the Hardware WD have hooks, but no signals are yet being passed from the IOP-WD or the HW-WD.

2.1.1 C-Code

The c-code for the watchdog is still the same 4-state system. Several updates have been included as they were for HEPI. The c-code is still the same file, {userapps}/release/isi/common/src/ISIWD_GPS.c. The changes

1. Make timer in the WD code based on FE rate, rather than hard coded at 4096.
2. Add IOP-WD and HW-WD inputs to ISI-WD. Naturally, these new bits are monitored and included in the outputs.
3. Add a 'previous trigger' output to the ISI WD code and screen. This output is latched and continues to show the input which triggered the trip after the Watchdog is reset.

We continue to use the same code for both the HAM-ISI and BSC-ISI diagrams. The differences lie in which inputs are attached to the c-block in the simulink diagram. The inputs are listed in table 1.

2.1.2 Diagram

The Simulink diagram for the Master models of the HAM-ISI and BSC-ISI have been changed in a number of ways. In addition, the top level, or 'chamber' models must also have a few changes.

Most of the changes involve the ISI watchdog. We have included new signals to the ISI Watchdog which are designed to come from the IOP-WD and, for the BSC-ISI, the Hardware WD. These are new inputs to the master model, and for the moment these will be grounded at the chamber level of each model. Since the HAM-ISI will not receive HW-WD signals, those inputs are grounded in the master model. This allows us to use the same c-code for both models. The sensor inputs used for the various ISI watchdogs is shown in table 1.

Table 1: Inputs for the ISI c-code

Input	HAM-ISI	BSC-ISI Stage 1	BSC-ISI Stage 2
1	CPS	CPS	CPS
2	GS-13	T-240	GS-13
3	FF L-4C	ST1 L4-C	ST1 flag
4	BIO - coil drive overheat	BIO - coil drive overheat	BIO - coil drive overheat
5	Actuator	Actuator	Actuator
6	Payload flag	Payload flag	Payload Flag
7	IOP-WD	IOP-WD	IOP-WD
8	grounded	HW-WD	HW-WD
9	reset	reset	reset

The signals from the various sensors and actuators have been bussed to make the diagrams easier to understand. The top level of the Watchdog is shown below in figure 1.

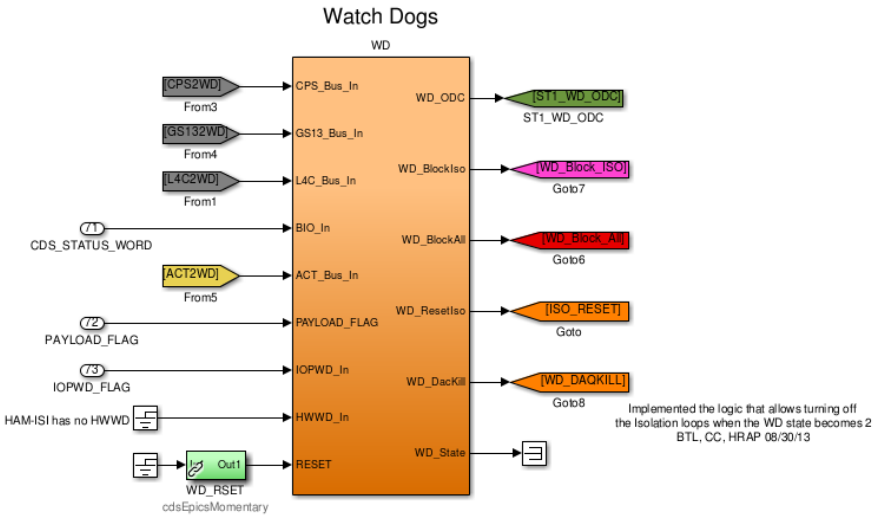

Figure 1: Top level of the HAM-ISI Watchdog block (WD). Sensor and Actuator signal are now bussed. There are new inputs from the IOP-WD and the Hardware WD, and the Hardward WD is grounded in the HAM-ISI model, because the HAM chambers do not have hardware watchdogs. There are several new outputs for controlling isolation loop resets, etc.

The interior of the the WD block can be seen in figure 2. Most of the complex wiring which used to be on the top level of the stage model is now inside this block.

The most complex update to the watchdog is to allow it to 'ride-though' 10 clock cycles with saturations before tripping (about 2.5 msec). This implementation is exactly the same as that used for the HEPI Watchdog, except the ISI model rate is 4096 cycles/ sec, whereas the HEPI model rate is 2048 cycles/ sec.

The CPS block with the counting is shown below in figure 5. This is cumulative for each sensor set. e.g. if the CPS gets funny glitch which saturated the sensor for 1 count, and this happens twice per day, the watchdog will not trip for the first 5 days. An indicator is shown to the operator, and can be reset by the operator without tripping the watchdog. Ten counts or 2.5 msec is somewhat arbitrary. The unity gain frequency for the loops is 10-30 Hz, depending of the control level chosen. We would expect any measurable gain peaking to be at frequencies less than 60 Hz. The characteristic time for a 60 Hz signal is roughly 1/(2*pi*60 Hz) = 2.5 msec, so if something bad starts to happen, the servo should be shut off in a time shorter than a peak of an oscillation.

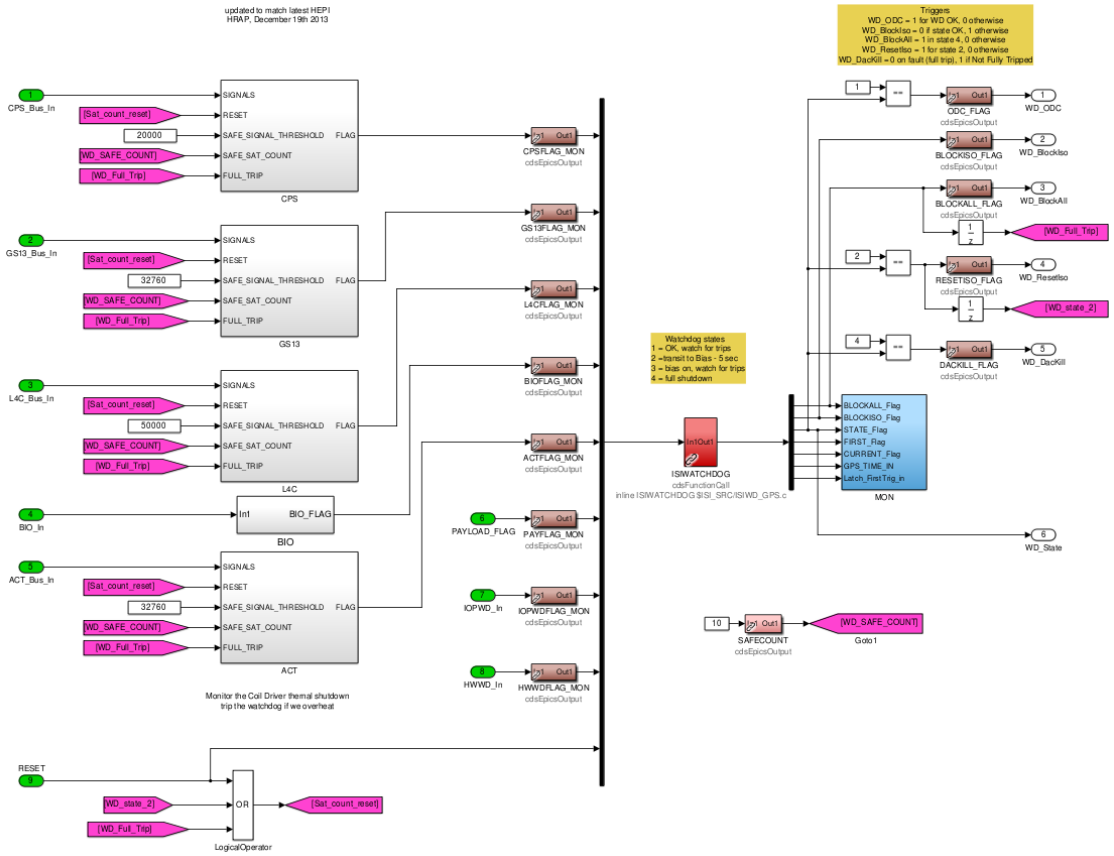

Figure 2: Interior of the new Watchdog block.

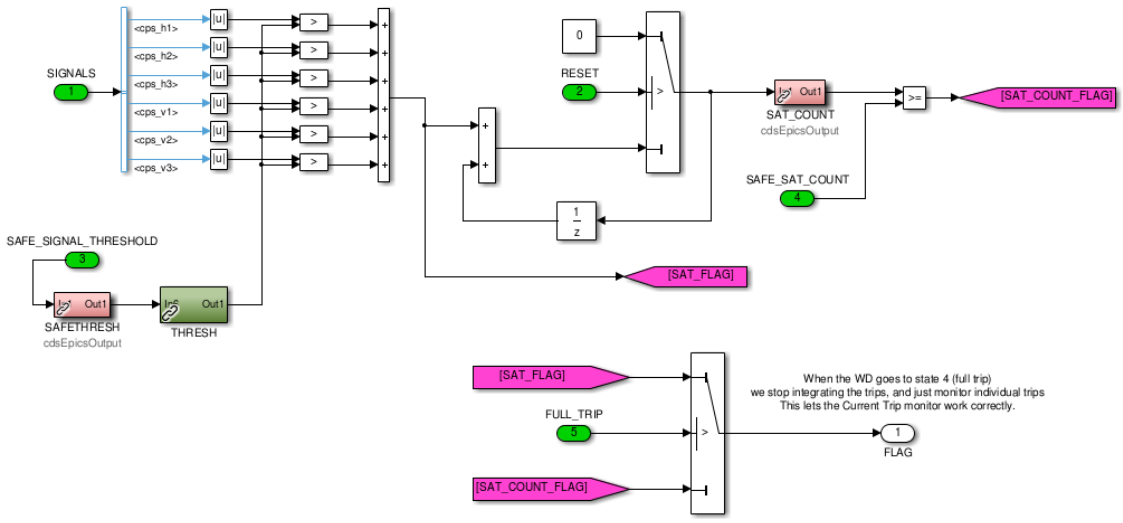

Figure 3: CPS watchdog block showing the new cumulative counting feature.

2.1.3 MEDM screens

Overview Screen

There are 2 main changes to the HAM-ISI overview screen. The DAC for the HEPI has been separated from the DAC for the HAM-ISI to clarify which signals come from the HAM-ISI model and which do not. We have also added a new color to the loop indicators. If the loop is turned off (state_now == 0) and it is supposed to be turned off (state_good == 0), the the indicator is grey. In figure 4 you can see that the feedforward loop for X is set correctly, the feedforward loop for Y is not correct, and the FF controls for Z, rX, rY, and rZ are all turned off.

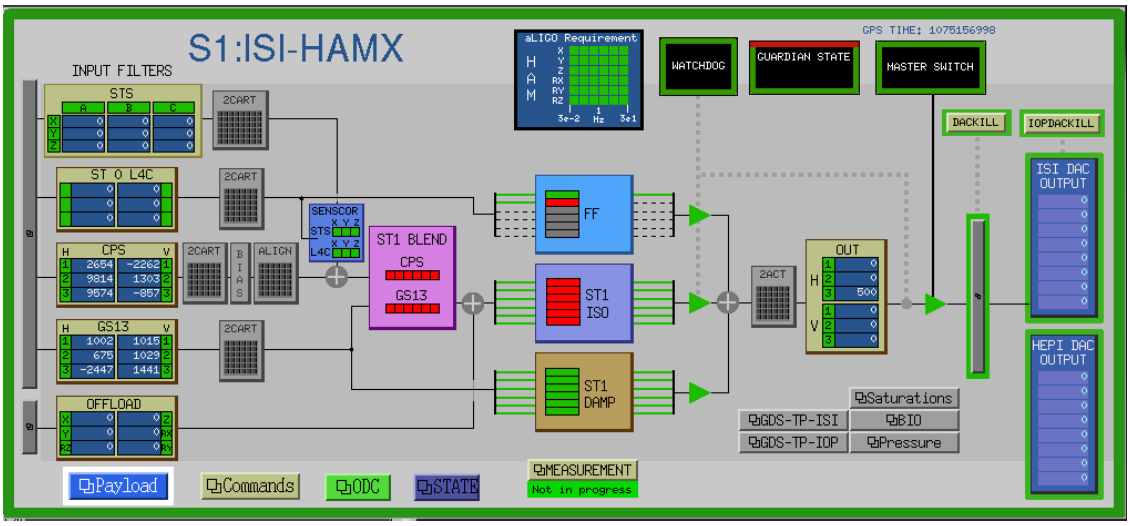

Figure 4: HAM-ISI overview screen. Note the grey boxes in the FF controller and the separated DAC for HEPI.

Watchdog Screen

The Watchdog MEDM screen has been updated so that all the ISI watchdog issues should be gathered into the main screen. There are also seveal changes to support the new features. It looks pretty much the same, but now has a set and reset button for the levels and a button to reset all the levels (which calls the script resetWatchdogThresholds in the isi/common/scripts/ directory). It includes indicators for saturations which have not yet tripped the Watchdog, and it has a new indicator which latches the FirstTrigger of the watchdog trip and holds the value after the WD is reset. This is useful for investigations which happen after the system has been reset and loops are running again. The IOP watchdog is now accessible from the WD screen. The rogue excitation alarm is displayed from the WD screen and can be reset from the WD screen.

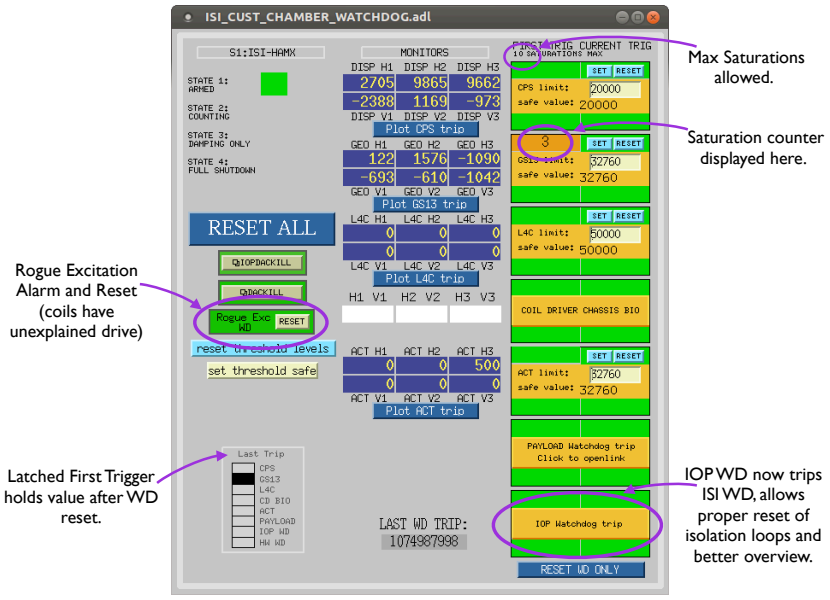

Figure 5: CPS watchdog block showing the new cumulative counting feature.