HDice RF Attenuation and Switching Unit Fabrication and Upgrades

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This note presents the hardware and software work completed for the HDice RF Attenuation and Switching Units.

The HDice target setup uses in-house designed and fabricated RF Attenuation and Switching Units, Fig. 1. The splitter in the unit divides the incoming RF signal into three parts, two of which go to attenuators that are connected to input ports J1 and J4 of a switch. Based on the selected mode, NMR or AFP, the switch sends the signal such that the RF signal from the attenuator of the selected mode is routed to the transmit coil through output J2 while the RF signal from the other attenuator is routed to the RF dump through output J3.

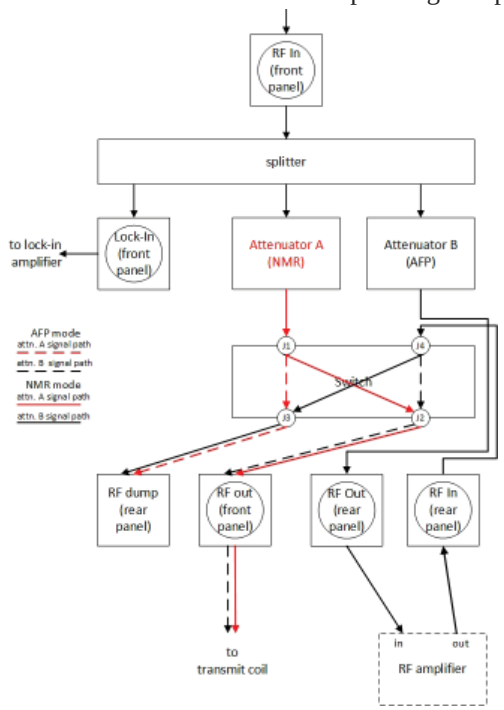

FIG. 1. Block diagram of RF Switching and Attenuation Unit, showing signal paths for attenuators A and B for each mode, NMR or AFP.

Initially, two units were designed and built. Later, it was determined that a third unit, with upgrades, would be needed. The original wiring diagram was revised to include the upgrades that were to be made (Appendix).

Each unit has four ICP DAS I-7000 series digital input/output modules as part of the control system, Fig. 2. Around 20 VISA drivers were written for the modules to update the new unit from GPIB drivers to National Instruments VISA code and thereby enable easier communication with a variety of instrumentation buses. The VISA drivers written were also used to update the HDice NMR code, as well as in a test program developed to troubleshoot the units.

FIG. 2. Four digital input/output modules inside the RF Attenuation and Switching unit.

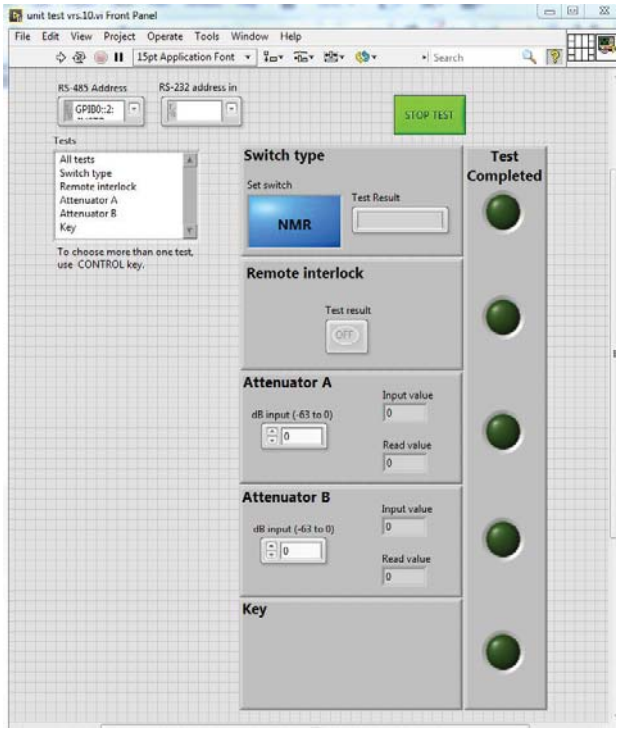

FIG. 3. LabVIEW user interface for testing an RF Attenuation and Switching unit.

Figure 3 shows the portion of LabVIEW code that indicates unit testing results, where the user can test any combination of the NMR/AFP switch, remote interlock, attenuator A, attenuator B, and/or keys. A pop-up indicates a test failure.

In addition to software changes, updates were made to the hardware of the two initial units: the front panel LCD screens were replaced with newer model screens and the RF cabling was replaced with newer cabling, Fig. 4.

Debugging and repairs were done: broken LEDs were replaced and one older unit which was no longer working was debugged and repaired by replacing one of the digital input/output modules.

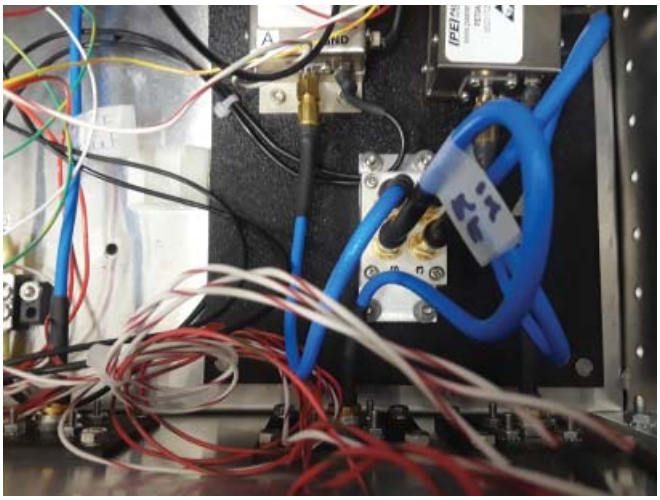

FIG. 4. Example of newer, replacement, RF cable (blue).

To summarize, software and hardware updates were made to two HDice RF Attenuation and Switching Units and a new unit was fabricated. The three units are available for use in the HDice setup.

APPENDIX: WIRING DIAGRAMS FOR RF ATTENUATION AND SWITCHING UNIT

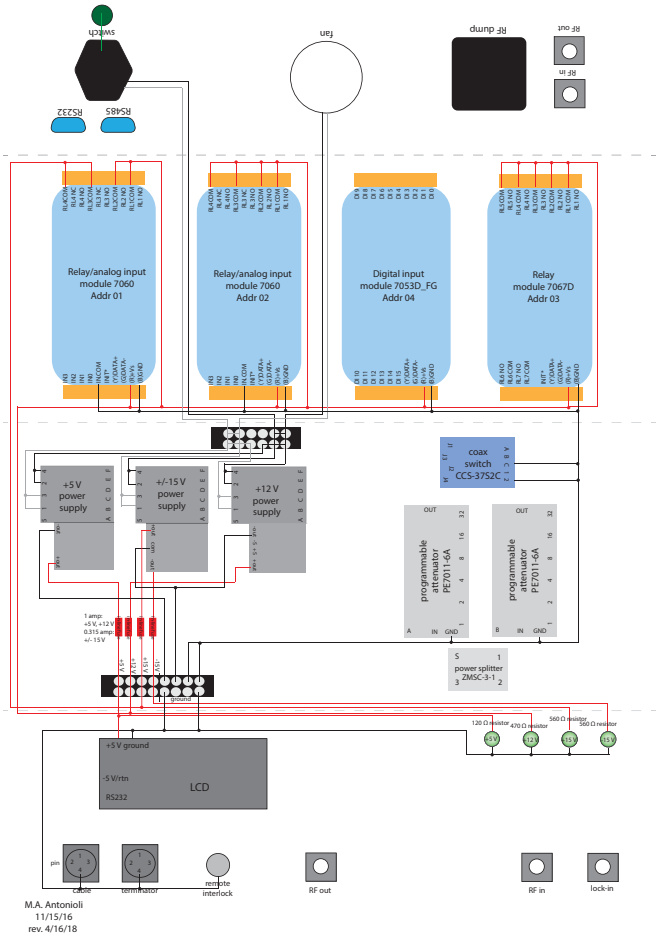

Diagram of power wiring.

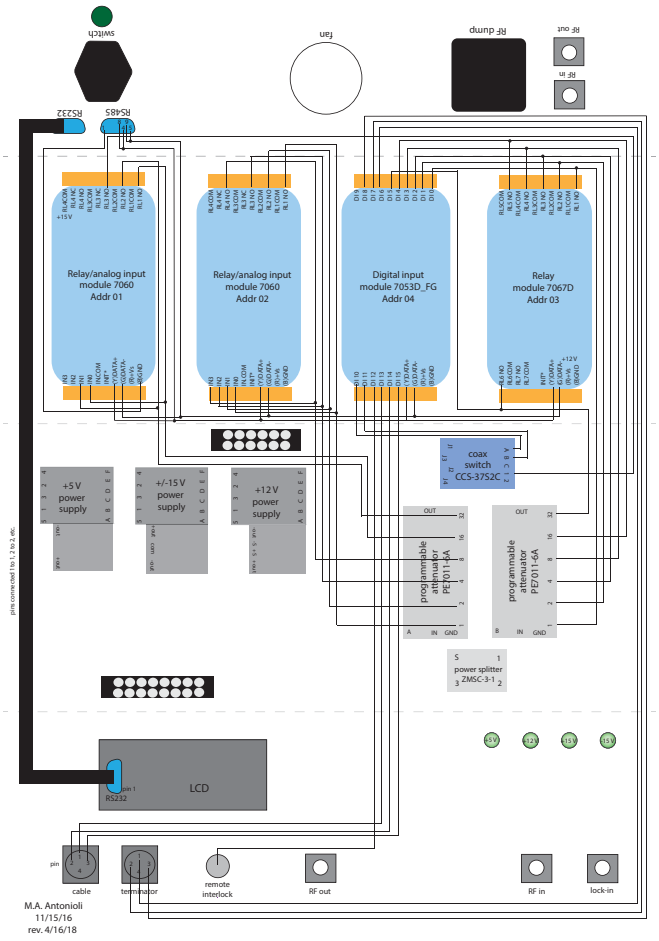

Diagram of control wiring.

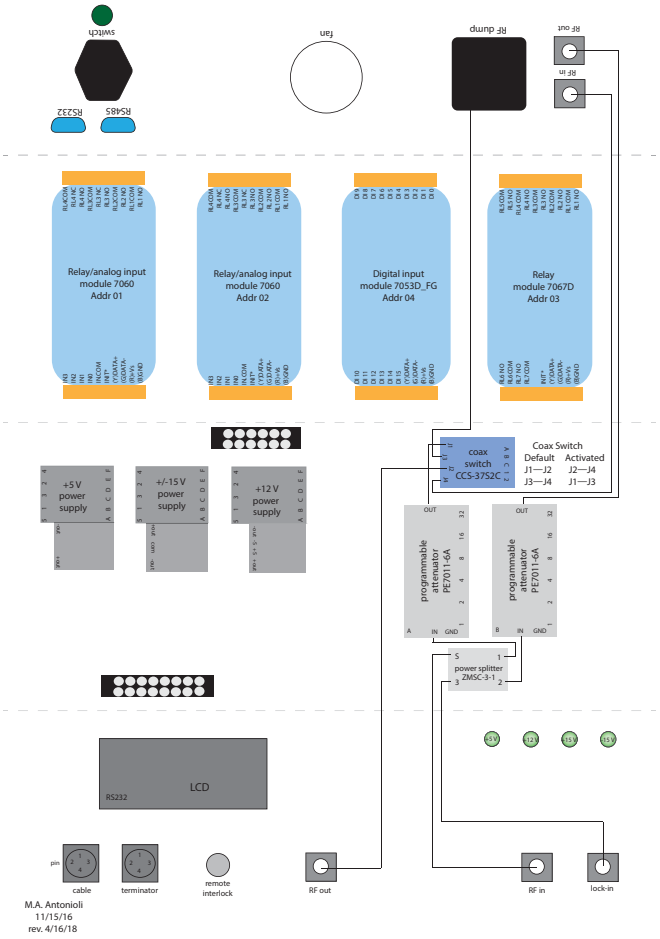

Diagram of RF wiring.