HamSCI

Personal Space Weather Station (PSWS)

Tangerine SDR
Magnetometer Modules
Specification

Preliminary Rev 0.1

11 July 2019

VERSION HISTORY

Version Number	Implemented By	Revision Date	Approved By	Approval Date	Description of Change
0.1	T. McDermott	July 11, 2019			Original Issue.

1. Introduction

The Personal Space Weather Station (PSWS) Magnetometer Module provides 3-axis magnetic field measurements for input to the PSWS Tangerine SDR Data Engine (DE) module. It consists of 3 modules:

- A magnetometer measurement module: PNI Sensor RM-3100.
- A local range extender module.
- A remote range extender module.

The measurement module is an assembled and tested module made by PNI Sensor Inc., model RM-3100. This module can use I2C or SPI to interface to a computer. It will need to be remotely mounted away from the space weather station to avoid distortion of the magnetic field by nearby metallic objects. For this project the SPI interface will be utilized.

The local extender module plugs onto to the Tangerine SDR Data Engine module and provides a means to extend the SPI interface and power through a cable to the remote range extender module. It sources low-voltage current-limited DC power and four RS-485 format range-extended SPI signals on an external cable to the remote module. It provides ESD protection on the cable interface. The local extender module uses phantom powering to provide DC power to the cable.

The remote range extender module terminates the cable coming from the local range extender module, derives and regulates received power, terminates the extended SPI connection from the cable, and provides a socket for the measurement module to plug onto. The remote module loops-back SPI SCLK to compensate for propagation delay along the cable. The two receivers in each direction will be terminated in 100 ohms (the characteristic differential impedance of each twisted pair).

Figure 1 is a block diagram of the Magnetometer and range extension modules.

The interconnecting cable will utilize Cat 5e or Cat 6 Unshielded twisted-pair (UTP) copper cable, 24 gauge or larger. It will be connectorized with RJ-45 plugs. This allows the use of off-the-shelf Ethernet cables. The format is not Ethernet, nor is it compatible with Ethernet. It will be designed to minimize the potential of damage if inadvertently connected to an Ethernet device.

If radiated interference from the cable is an issue then Shielded twisted-pair (STP) Cat 6a Ethernet cable will be utilized instead. The local and remote modules shall provide shield-grounding RJ45 connectors in either case.

The maximum allowable length of the cable shall be TBD meters.
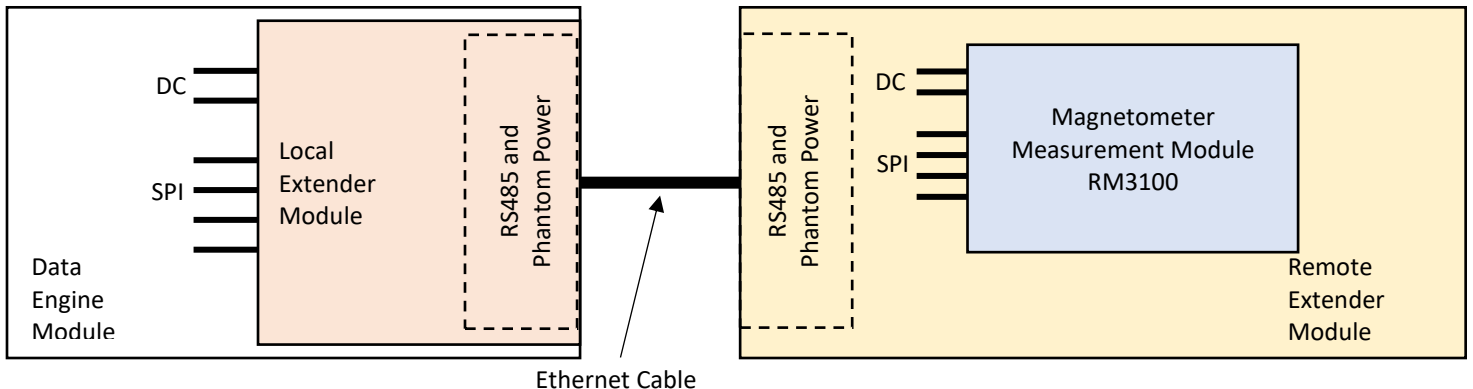
Figure 1 – Block Diagram of the three Magnetometer Modules

(Measurement, Local Extender, Remote Extender)

1.1.   Cost Goal

The cost goal (parts cost) of the three modules, not including interconnecting cable is $60.

1.2.   References

PNI Sensor RM-3100 User manual – downloadable from:
https://www.pnicorp.com/download/rm3100-user-manual/
PNI Sensor RM3100 Sales Sheet (datasheet) – downloadable from:
https://www.pnicorp.com/rm3100/
Texas Instruments Application Note on SPI range extension:
http://www.ti.com/lit/an/slyt441/slyt441.pdf

2. Power Supply

The Local Extender Module shall be powered by TBD VDC by the Tangerine SDR Data Engine module connector.

The Remote module will be powered via the interconnecting cable. The DC voltage on the cable shall nominally be TBD VDC.

The Measurement module will be powered and signaled by the remote module via a connector on the remote module.

3. Local Module Outputs

The local module connects to both the Tangerine SDR DE module and the external cable RJ-45 connector. The external cable has 8 pins arranged as 4 pairs. The 4 RS-485 signals occupy all 8 wires in the cable. So the DC power will be sourced via phantom powering on the two SCLK signal lines. Since these lines are always active they can be AC coupled at both ends using signal transformers. Then the DC power shall be sourced between the common mode SCLK transmit and common mode SCK receive pairs. This is similar to how Power-over-Ethernet provides phantom power.

4. Magnetometer Module Performance Requirements

The detailed performance requirements of the magnetometer are determined by the specifications of the measurement module. Those specifications are contained in the RM-3100 datasheet from the manufacturer.

5. Other Use Cases

It is not anticipated that the combination of the three modules will support any other alternative use cases.