Interface Specification between UWM controller and UND Dispatch Agent

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The microgrid controller being tested by Odyssian Technologies under contract W9132T-10-C-0008 has a hierarchical structure. The bottom layer of the hierarchy consists of the UWM (University of Wisconsin, Madison) controllers [1] and the top layer of the hierarchy consists of the UND (University of Notre Dame) dispatch agents [2]. The UWM controller uses a microprocessor to generate the switching signals for the power inverter connecting a generator to the microgrid's feeder lines. The UND controller is implemented as a single-board computer with a radio module. This document specifies the hardware and data interface between the UWM controller and the UND dispatch agent.

Figure 1 uses a simPower model to illustrate the interconnections between microsource, UWM controller, and dispatch agent. This block diagram has four blocks. The microsource (generator) takes inputs Vpk and w from the UWM controller. The UWM controller uses the measured terminal voltage and currents (v_meas and i_meas) and the requested voltage (E_req) and power (P_req) to determine the voltage (Vpk) and frequency (w) command to the microsource. The requested voltage is set to 1 pu. The dispatch agent supplies the requested power (P_req) input. To compute the requested power, the dispatch agent needs to access the measured real power (P_meas) and commanded frequency (w). For diagnostic reasons, it will also be convenient for the dispatch agent to access the measured reactive power (Q_meas), measured RMS voltage (V_meas), and voltage command (Vpk). The required data that is passed between the dispatch agent and UWM controller is therefore seen in figure 1.
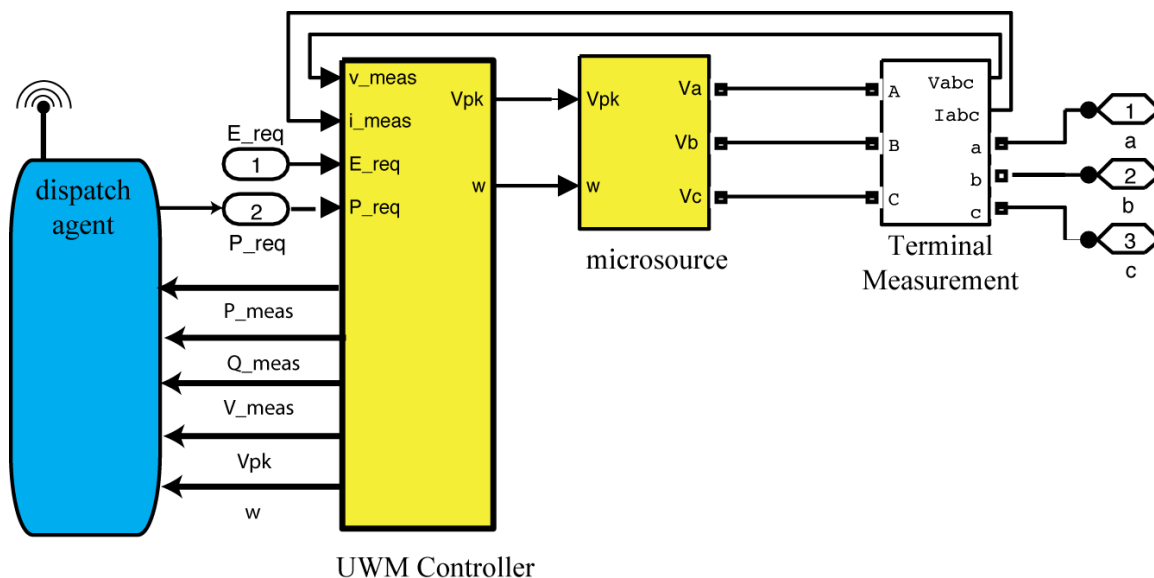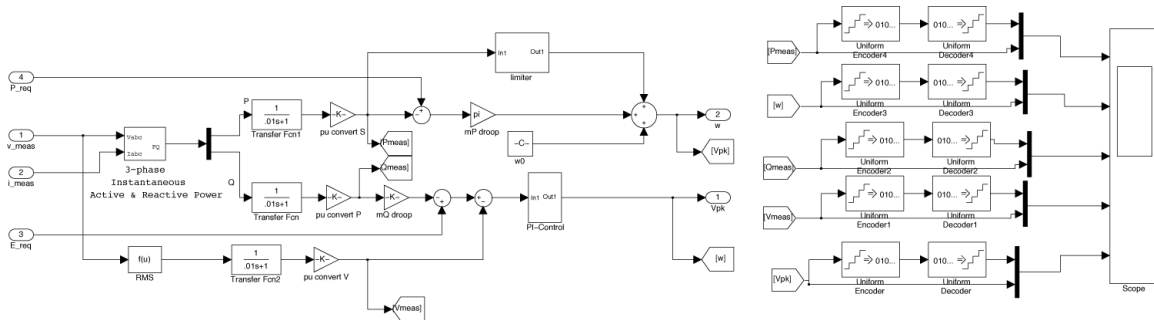

UWM Controller

Figure 2 identifies the signals within the UWM controller are required by the dispatch agent.   This figure shows the simulink block diagram for the UWM controller.   The signals to be passed over the interface are

- P_meas :   This is the measured real power after it has been filtered and scaled to power units. This variable should be transmitted every 10 msec. Variable should be uniformly quantized to sixteen bits as a signed fixed-point number between -10 and 10.
- Q_meas : This is the measured reactive power after it has been filtered and scaled to power units. This variable should be transmitted every 10 msec. Variable should be uniformly quantized to sixteen bits as a signed fixed-point number between -10 and 10.
- V_meas : This is the measured RMS voltage after it has been filtered and scaled to power units. This variable should be transmitted every 10 msec. Variable should be uniformly quantized to sixteen bits as a signed fixed-point number between -10 and 10.
- Vpk :   This is the voltage command sent to the microsource in units of volts. This variable should be transmitted every 10 msec. Variable should be uniformly quantized to sixteen bits as a signed fixed point number between -1000 and 1000 volts.
- w :   This is the frequency command sent to the microsource in units of radians/second. This variable should be transmitted every 10 msec. Variable should be uniformly quantized to sixteen bits as a signed fixed-point number between -1000 and 1000 radians per second.

The interface will therefore transmit 16*5=80 data bits every 0.01 seconds. This corresponds to a minimum data rate of 8000 bits per second (bps).

The physical interface between the UWM controller and the UND dispatch agent will adhere to a traditional RS-232 serial computer interface standard.   It is recommended that a 9-pin connector be used with a baud rate of 115.2 kbps.   Raw data bits obtained from the quantization should be transmitted, rather than transmitting as ASCII characters.