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To maintain power system operation in a balanced and stable condition, the frequency deviation and the rate of frequency change information are highly desired in monitoring and protection applications of the power grid. How to obtain frequency information more accurately and efficiently has been the topic discussion for decades. PMUs (Phasor Measurement Unit) are the most widely-used devices for measuring phase angle differences and they also provide very accurate frequency information. However, the high installation cost of PMUs limits their applications for wide area control and stability analysis of power system.

Thanks to commercial GPS receivers and the fast developments in Ethernet networks, an affordable wide area, quasi real-time, GPS synchronized frequency measurement is now possible. This paper introduces a portable networked Frequency Disturbance Recorder (FDR) device, which can be used at any 110V wall outlet and transmit measured frequency data remotely via the Ethernet. The practical issues and challenges of the device design and implementation are analyzed and discussed. Based on these low cost FDRs, a US-wide Frequency Network (FNET) has been implemented at Virginia Tech and some power system monitoring applications are being developed by taking fully advantage of the FDRs.



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