A Converter-Based Hardware Testbed Hybrid Microgrid Emulator of a Flexible Manufacturing Plant

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INTRODUCTION

- Increasing interest in DC microgrids has grown, due to the high demand for electronics and other high-tech loads that require DC power.
- Most of the existing infrastructure, including power generation and distribution, is based on AC.
- 24% of the total energy was consumed by the manufacturing sector in the U.S in 2018.
- A hybrid microgrid combining DC and AC sub-grids for an example flexible manufacturing plant (FMP) is examined using a hardware testbed (HTB).
- The deployed converter HTB models the FMP system.

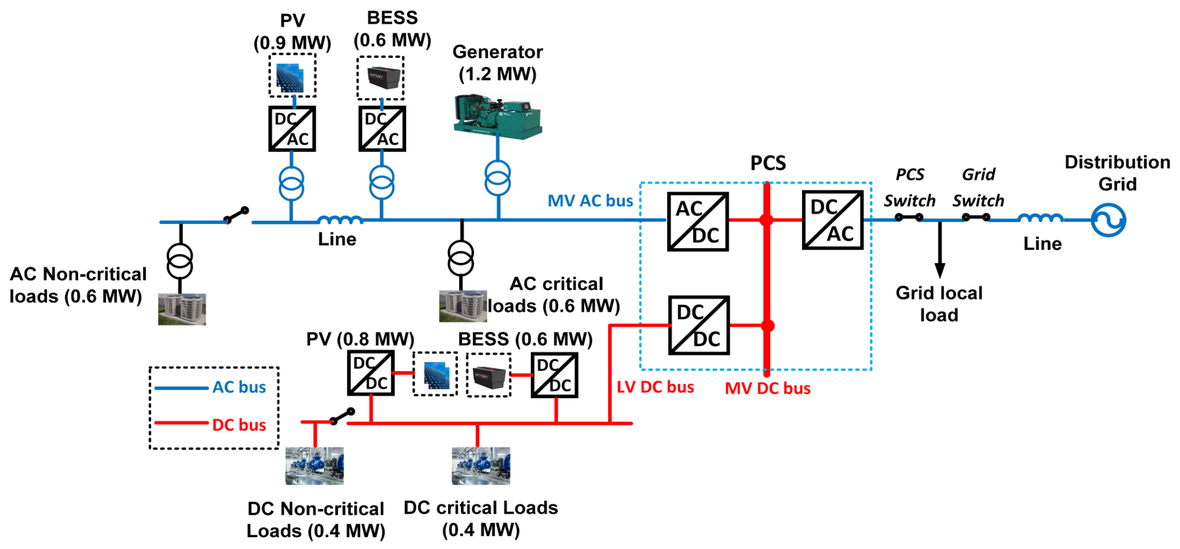

Figure 1: Example FMP hybrid microgrid topology

HARDWARE TESTBED

- Six two-level, three phase converters are used to emulate the FMP system.
- A DC power supply is used to form the DC link and supplies the power losses of the system.
- A CAN bus communication protocol is used between the central controller and the local controllers.

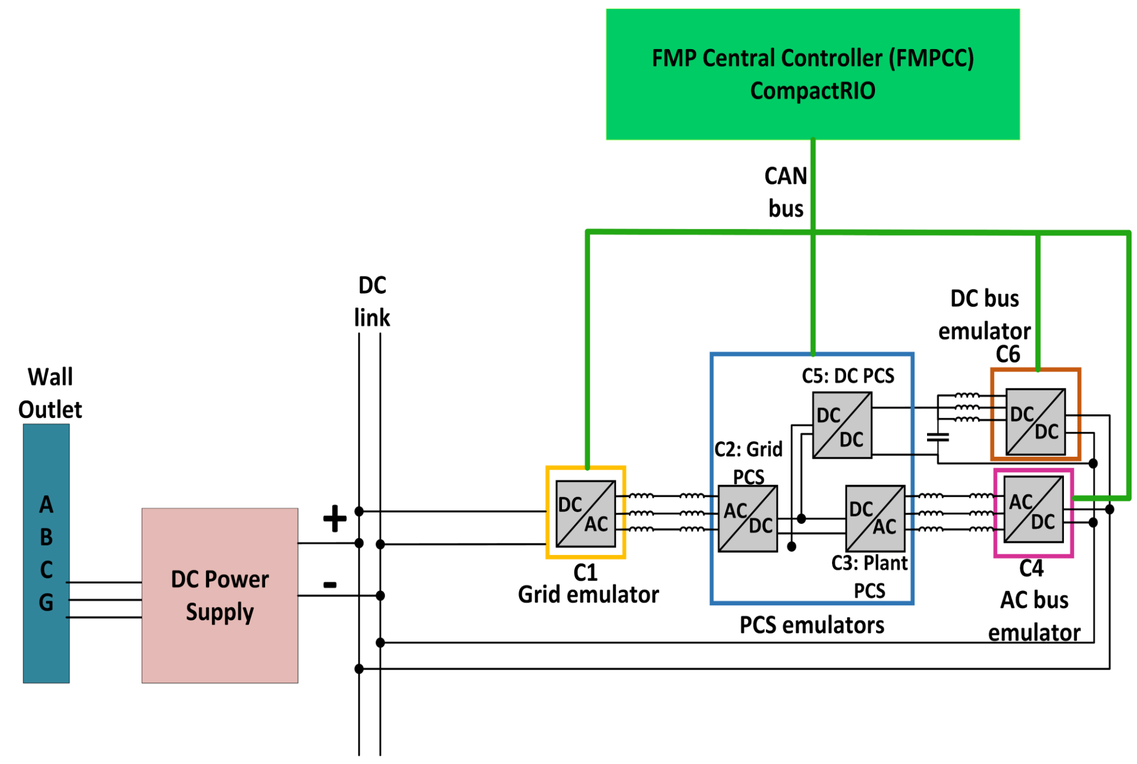

Figure 2: HTB system architecture to emulate FMP system

OBJECTIVES

- Accurately depict the FMP system behavior to demonstrate different power flow scenarios.
- Allow for real-time measurements and flexibility in testing.
- Test control strategies and algorithms to address challenges before system deployment.

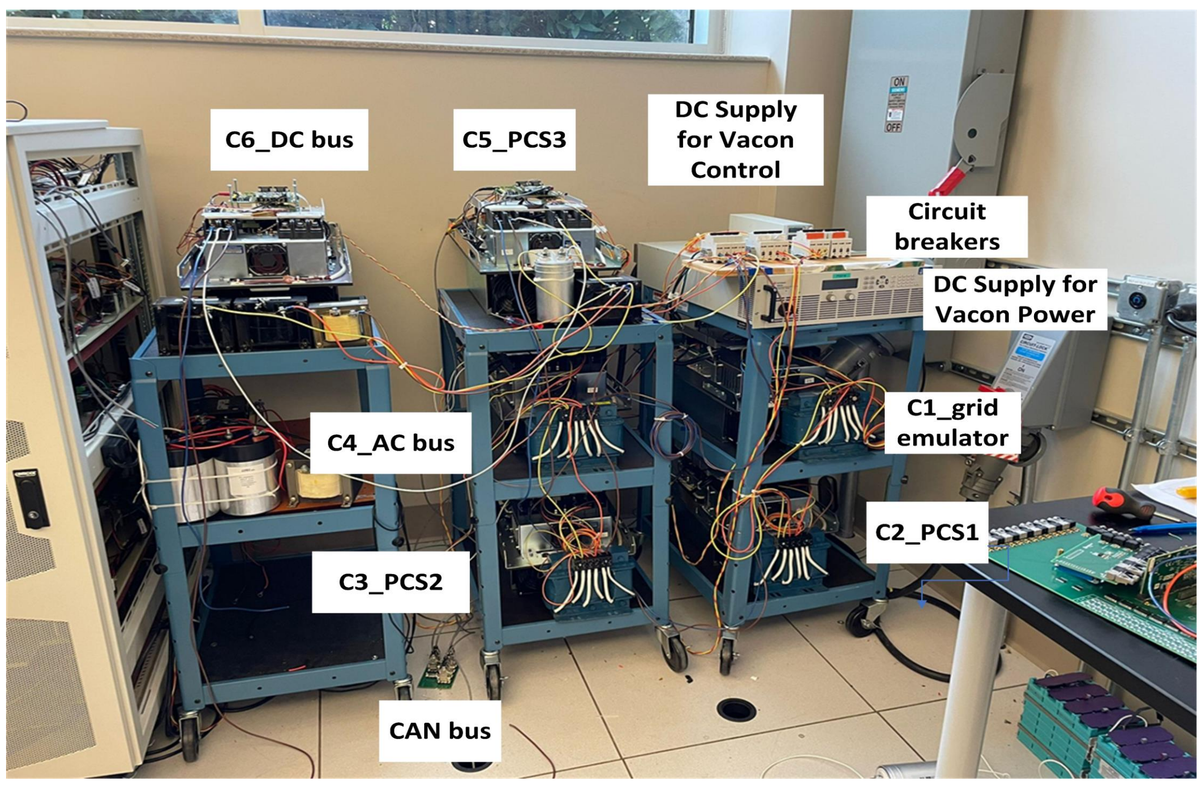

Figure 3: Hardware testbed

EXPERIMENTAL RESULTS

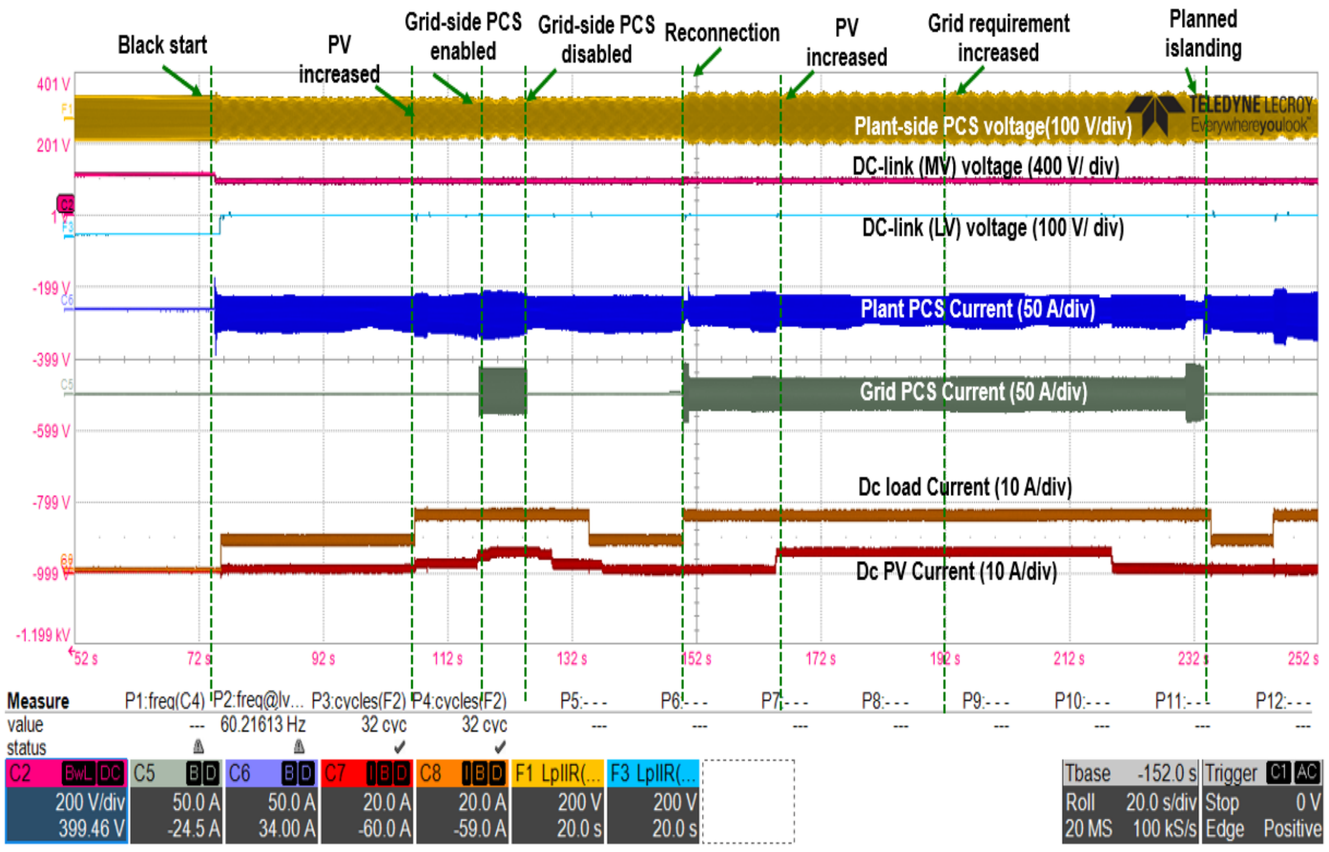

Figure 4: Dynamic waveform illustrating different conditions of operation of FMP system.

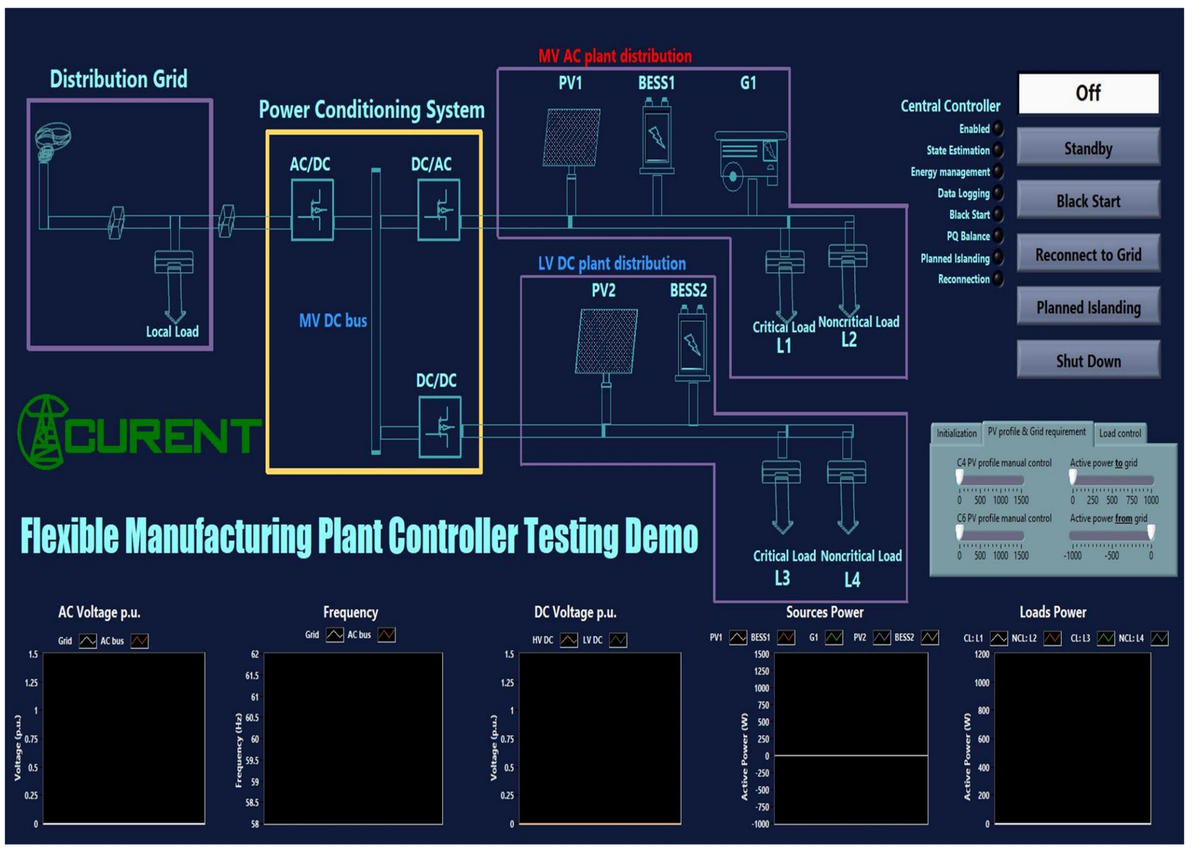

Figure 5: Human-Machine Interface to control HTB.