NSERC SMART MICROGRID NETWORK
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Project 2.2

Generalized Control of Multi-DER Microgrids

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NSERC CRSNG

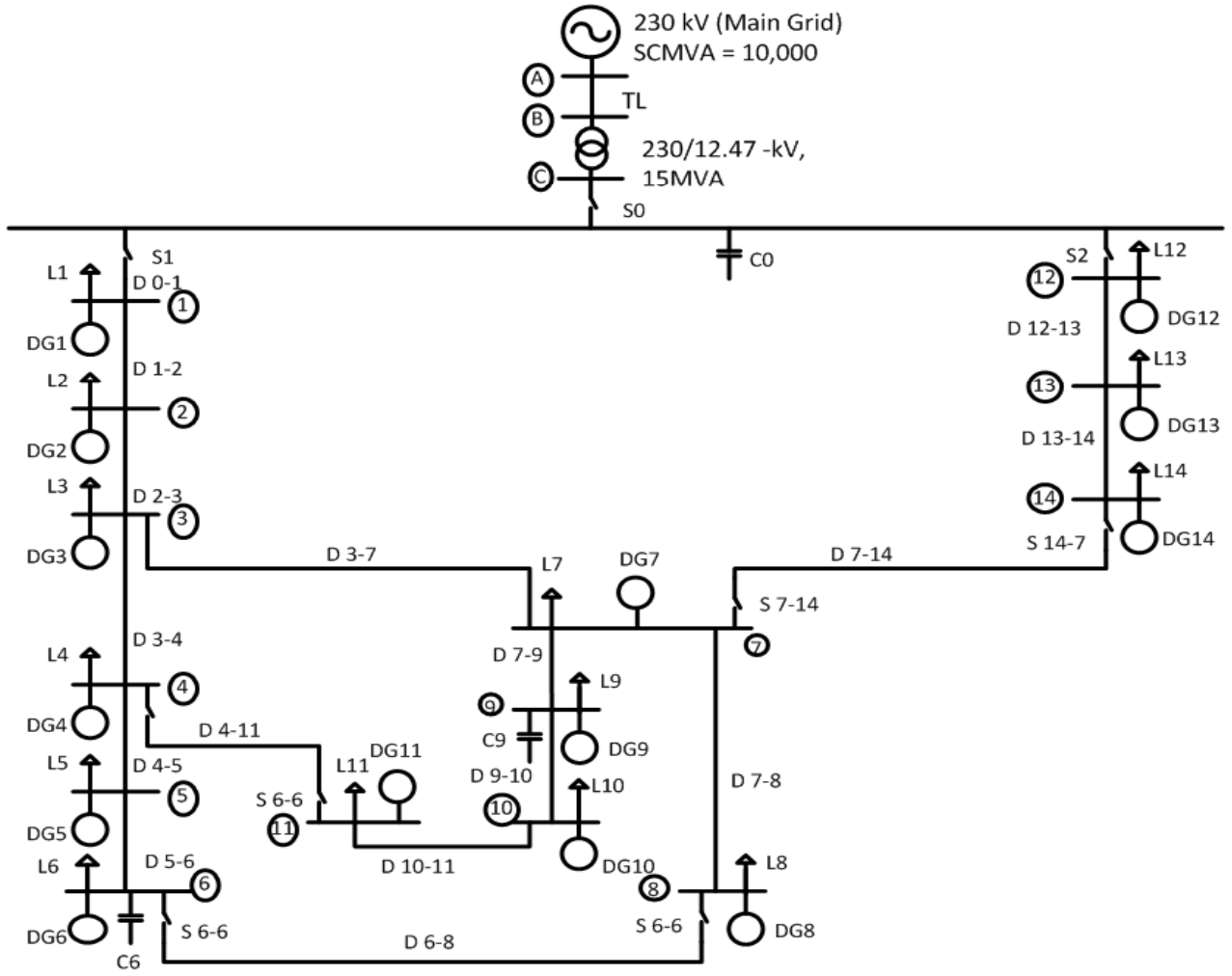
Objectives:

R&D of an Energy Management Strategy (EMS) and a control system for multi-DER microgrid to enable:

- **robust performance**
- **simultaneous operation of voltage-controlled, power-controlled and non-dispatchable DER units**
- **transition between grid-connected and islanded modes**
- **transition between various control modes, e.g., voltage-controlled to/from power-controlled**
- **imposition of prescribed load-sharing among units**

Hardware realization of algorithms for control- hardware-in-the-loop evaluation/verification

Microgrid System I



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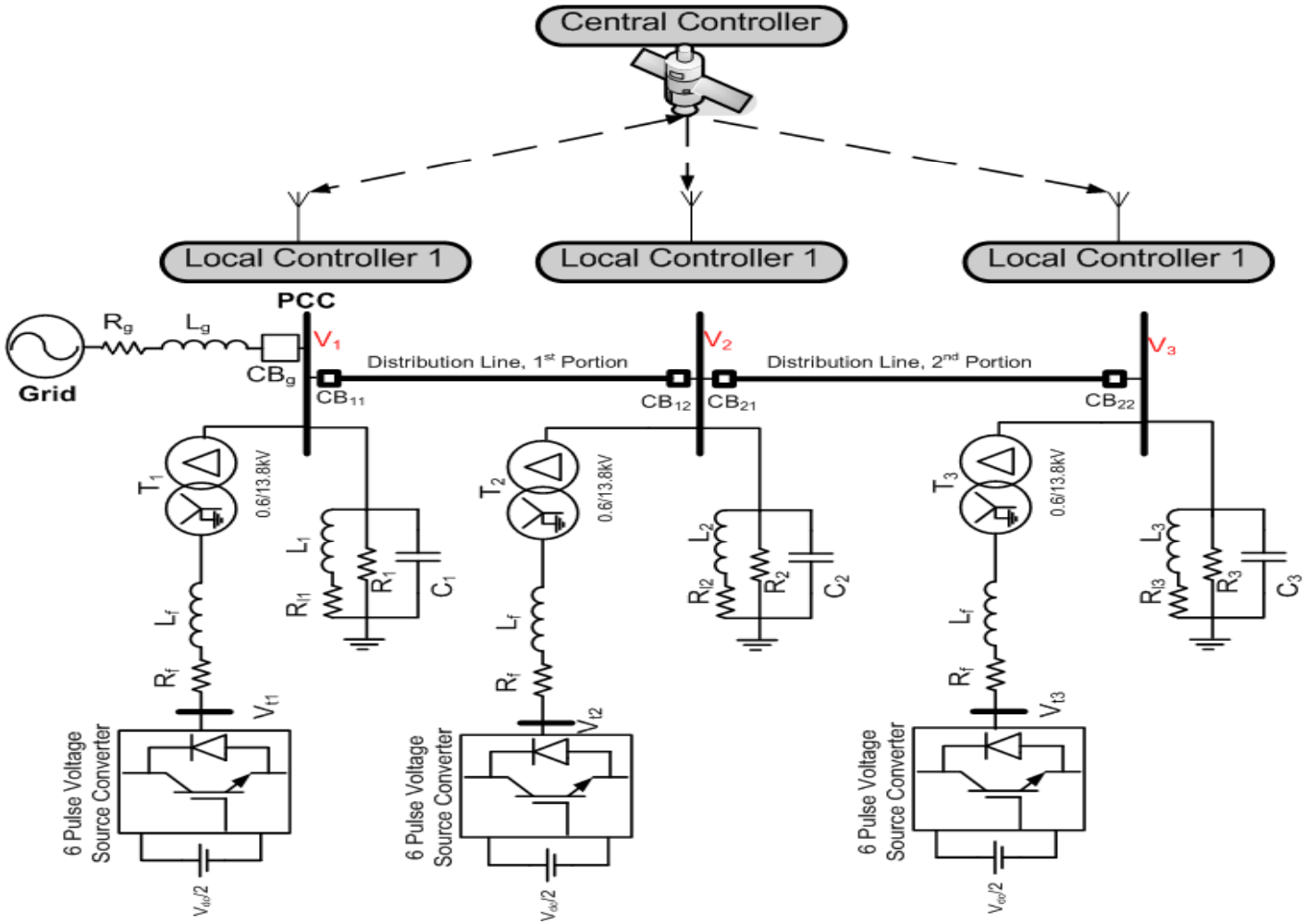
Microgrid System II



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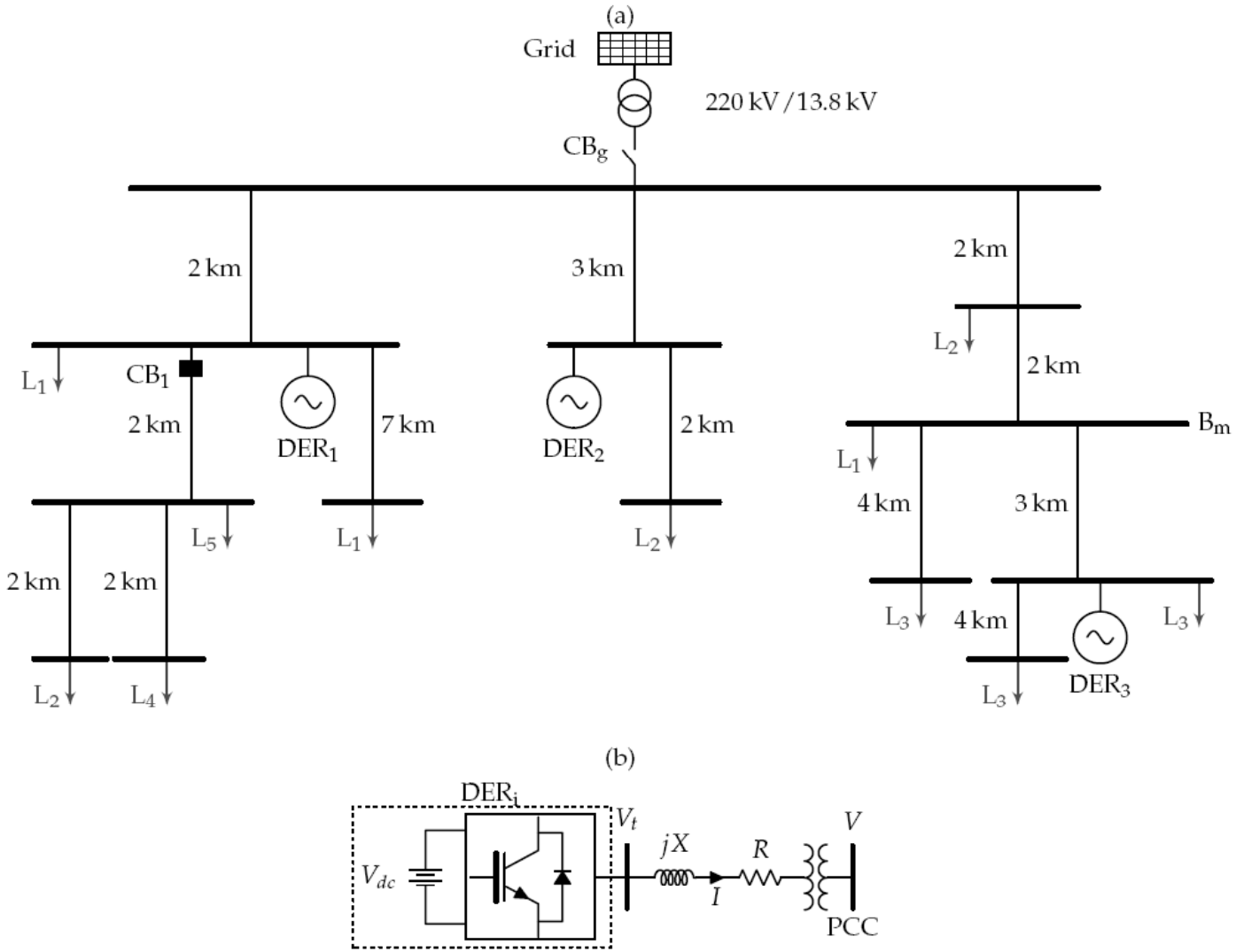
Microgrid System III



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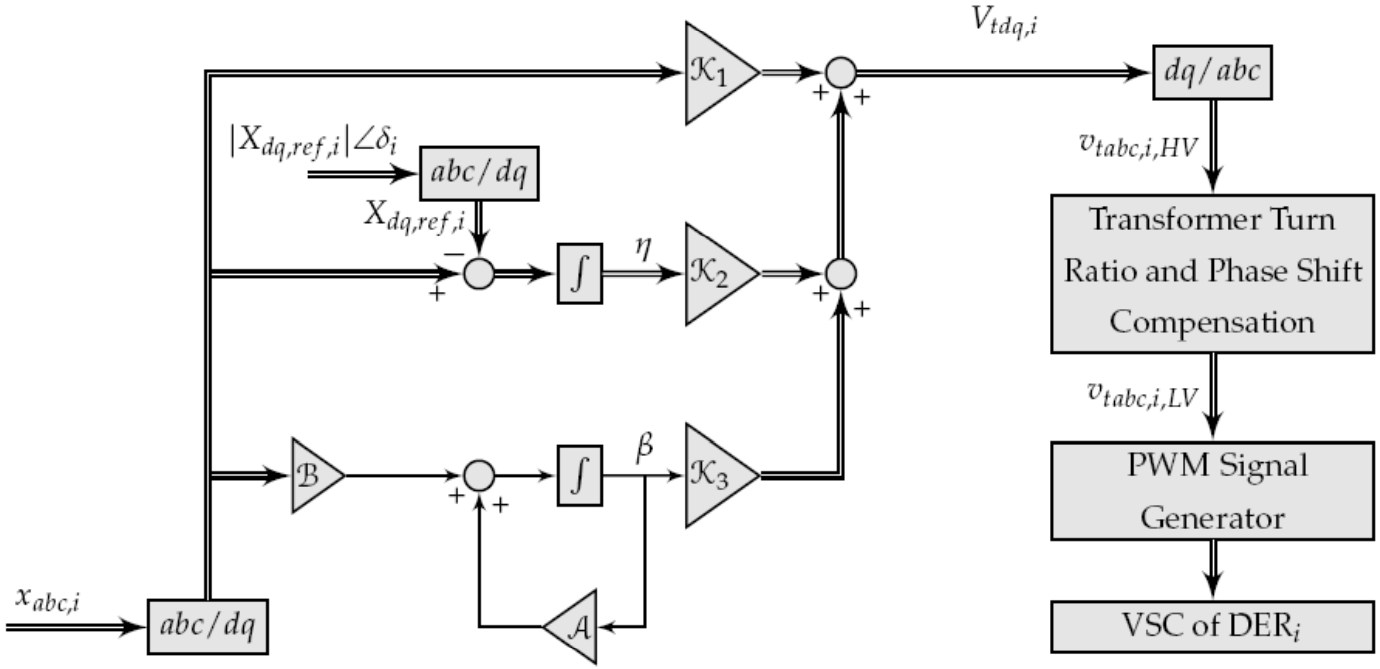
Control System Structure



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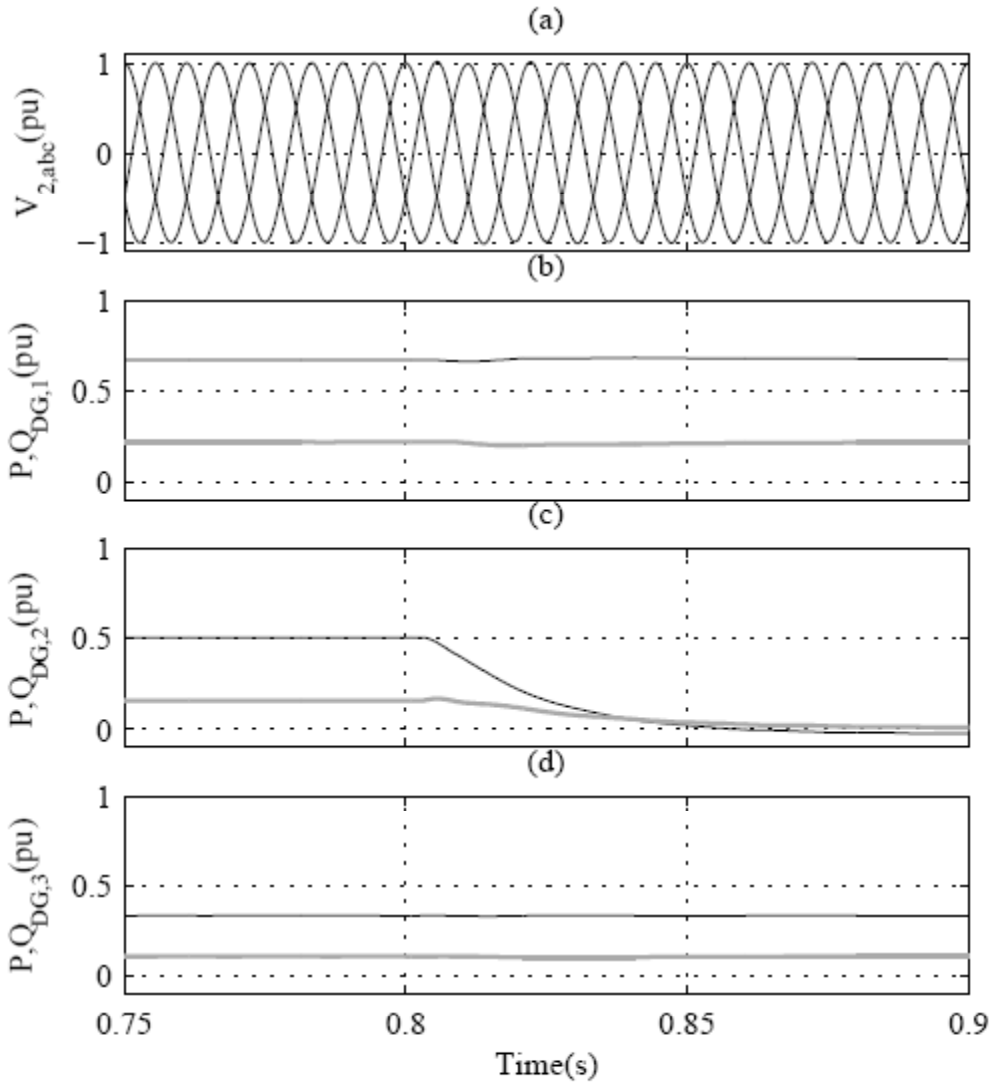
Microgrid Response to CB opening



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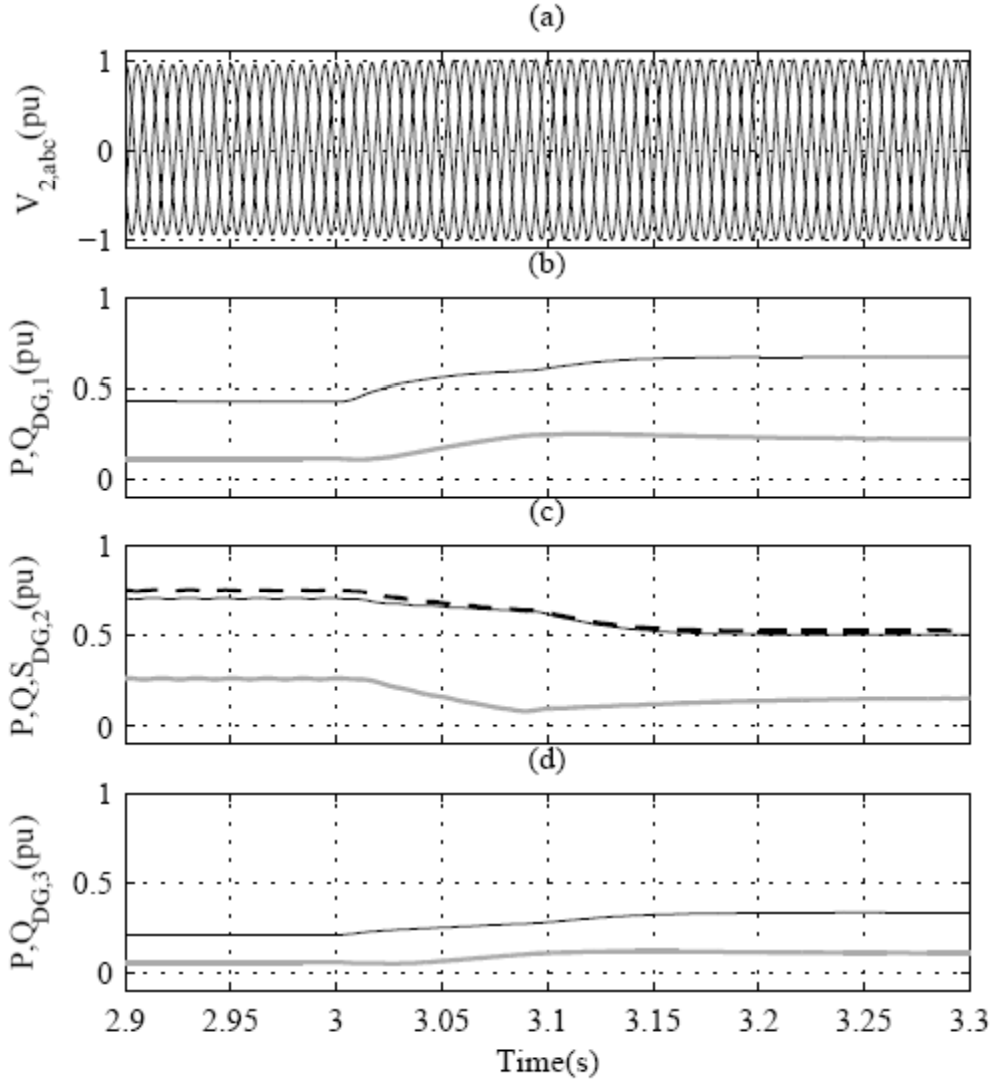
Restoration of a feasible operating point to prevent overload ER2



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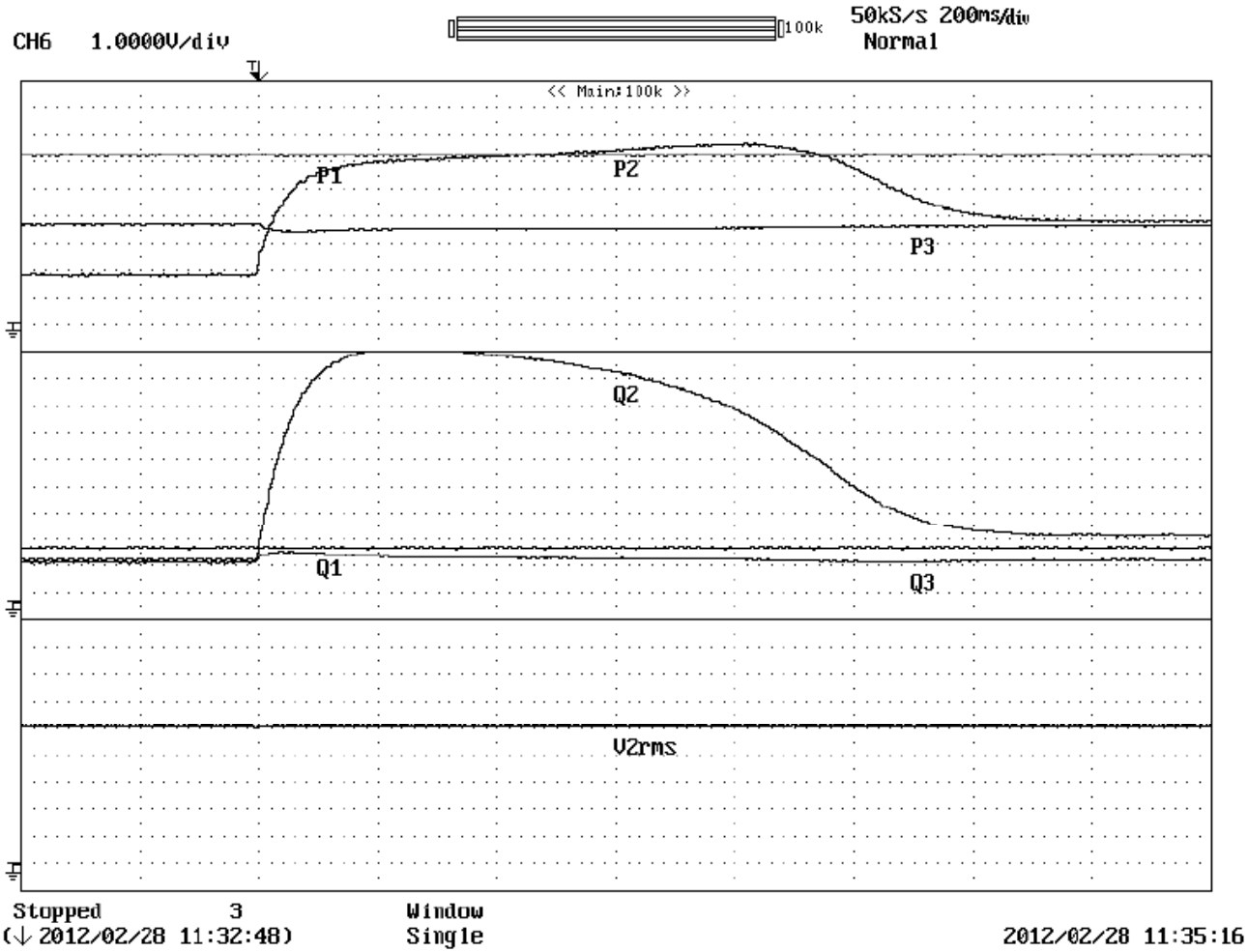
Motor start-up behavior (Control-Hardware-in-the-loop results)



Conclusions:

A decentralized robust control strategy and a PMS for a multi-DER unit has been developed and tested (3-DER system).

The developed methods provide robustness to sudden changes in operating point, topology, nonlinear transients and restores the system to a feasible operating point subsequent to any small- and large-signal disturbance.

The algorithms were digitally implemented in a production grade hardware platform and tested/verified in an RTDS-based hardware-in-the-loop environment.

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