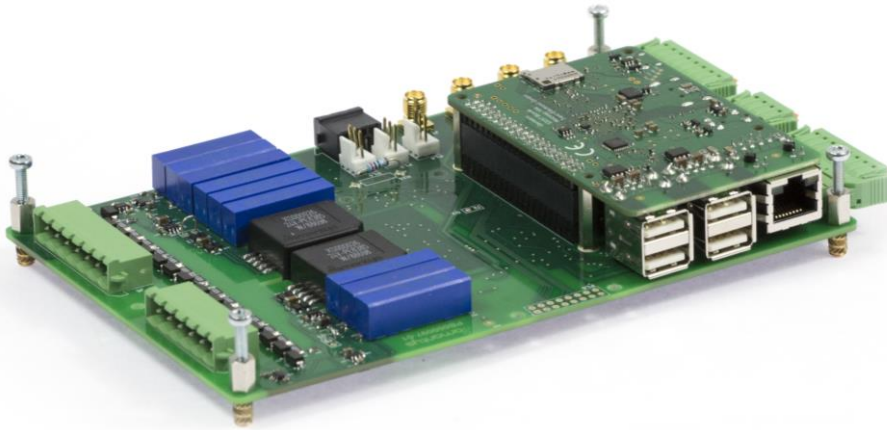


### Junction Temperature (Tj) Estimation Evaluation System



#### Technology Benefits

- Converter rating boost (reduced margins)
- Dynamic rating control
- Optimised current balancing of parallel stacks
- Condition monitoring
- Enhanced converter validation
- Improved temperature monitoring

The Tj Estimation Evaluation System is an exciting new measurement system developed at Amantys Power Electronics, which can estimate accurately both IGBT and diode junction temperatures to within  $\pm 5$  °C in an operational converter. It has advanced measurement, data logging and processing capability, designed for evaluating Amantys Tj Estimation technology and acting as a general-purpose data acquisition system for inverter stack testing.

Benefits to the converter manufacturer of the Tj Estimation technology are **optimised performance** (rating / efficiency) vs cost, e.g. through reduction of margins, and to the end user / operator the early detection of abnormal operation and potentially **reduced operating costs**.

#### Applications

- Evaluation of Amantys Tj Estimation technology
- Inverter stack design and characterisation
- Laboratory test and product validation
- Field test and on-site diagnostics
- Application engineering
- Inverter technology development

#### Features

- Monitoring of key operating parameters in a half-bridge (phase leg)
- Tj estimation for IGBT and diode available in real time
- Accurate measurements of IGBT and diode on-state voltages  $V_{CE(on)}$ ,  $V_F$
- Works in any application:
  - Compatible with any gate drive
  - Compatible with Si and SiC
- Supports modules up to 3300 V
- Flexible software platform: designed for future upgrades and new features

## Rapid Evaluation

The Tj Estimation Evaluation System has been designed as a flexible platform to allow users to get started quickly with extensive data logging of the inverter stack operation and junction temperature estimation. This is ideal for use in a laboratory or field-testing environment.

It takes isolated measurements of the IGBT and diode temperature-sensitive electrical parameters (TSEPs), and processes them locally to make a real time estimation of the junction temperature.

It is compatible with any gate drive, including third-party and Amantys products, and is simply attached to the switching devices with appropriate cables. No control signals are required from the gate drives. The Evaluation System is suitable for all device modules up to and including 3300 V rating.

It is designed to work with hall-effect phase current sensors. Either an existing sensor may be used (in feed-through mode) or a dedicated sensor may be used.

In addition to being logged on a USB memory stick, the measurements may be observed on an oscilloscope attached to up to 4 analogue outputs.

## Compatibility

- All IGBT modules up to 3300 V rating:
  - Half-bridge modules, e.g. nHPD<sup>2</sup>, XHP, LV100, LinPak, PrimePack, EconoDual (1 or more in parallel)
  - Pair of single switch modules, e.g. 140 x 190 mm devices
  - Reinforced insulation withstand (hipot) up to 7400 V rms
- Compatible with Si and SiC devices, including:
  - Si IGBTs and PiN diodes
  - SiC MOSFETs and schottky diodes
- Compatible with different switching schemes:
  - Sinewave PWM
  - Third harmonic injection PWM
  - Space vector modulation
  - Discontinuous PWM (incl. over-modulation)
  - Irregular PWM (including hysteresis, DTC)
  - Square-wave switching (at AC frequency)
  - DC chopper

## Outline Specification

- Single power supply input (15 V)
  - Internal isolation for measurement circuits
- Simple connections to IGBTs/diodes
- Measurements of upper and lower switches logged at 1 ms rate to USB memory stick
- Measurement variables recorded:
  - $V_{CE(off)}$ , IGBT  $V_{CE(on)}$ , diode  $V_F$  for upper and lower switches
  - Phase current, using external current sensor
  - Switching pattern information (pulse timings)
  - Module NTC temperature (if present)
  - Baseplate temperature (up to 2 external lug mounted sensors)
- Selected measurements and Tj signals delivered to 8 external analogue outputs
- Algorithms on the processing platform calculate:
  - Junction temperature of all 4 devices (upper and lower IGBTs and diodes)
  - Continuous calibration of devices
- Configurable from USB memory stick
  - Allows stand-alone operation
- Software upgradeable
  - Measurement software (default)
  - Tj Estimation algorithms
  - Auto-calibration algorithms
  - Future upgrades, e.g. condition monitoring

## Applications

- Evaluation of Amantys Tj Estimation technology
- Dedicated inverter stack data logger for test, validation and diagnostics
- Laboratory testing of converters
- Field testing of converters
- Condition monitoring system for retrofit applications

## Want to know more...?

For more information, please contact us at [info@amantys.co.uk](mailto:info@amantys.co.uk).

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