

# Application Note

## Getting to know the Amantys Data Logger Hardware

### 1 Introduction

The Amantys Data Logger enables accurate synchronous measurements of on state voltage and current, datalogging functions and processing capabilities for both the IGBT and diode devices in an operational converter.

This Application Note presents its physical and signal interfaces, connections to external equipment and power semiconductor modules, and an example of a basic setup.

### 2 Interfaces

The Data Logger is designed to work with a single-phase leg (half-bridge) from a 2-level voltage source inverter. The IGBT module(s) may be half-bridge types (e.g. EconoDual, PrimePack, nHPD<sup>2</sup>/LV100/LinPak/XHP) or single-switch types (e.g. 140 x 190 mm modules such as IHM or HiPak). Phase legs comprising parallel modules are allowed, with the Data Logger being directly connected to the switching devices with appropriate cables.

The system has an Ethernet interface that provides real-time measurement data using the industry standard SCPI protocol. The Amantys Configurator application software, which runs on a standard Windows PC, can be used in conjunction with the Data Logger to provide data visualisation and simplified configuration functionality.

In addition to logging data on a USB memory stick, electrically isolated analogue outputs are available for convenient connection to an oscilloscope or other analogue data channels.

An overview of the Data Logger connections to the phase leg under test is shown in Figure 1.

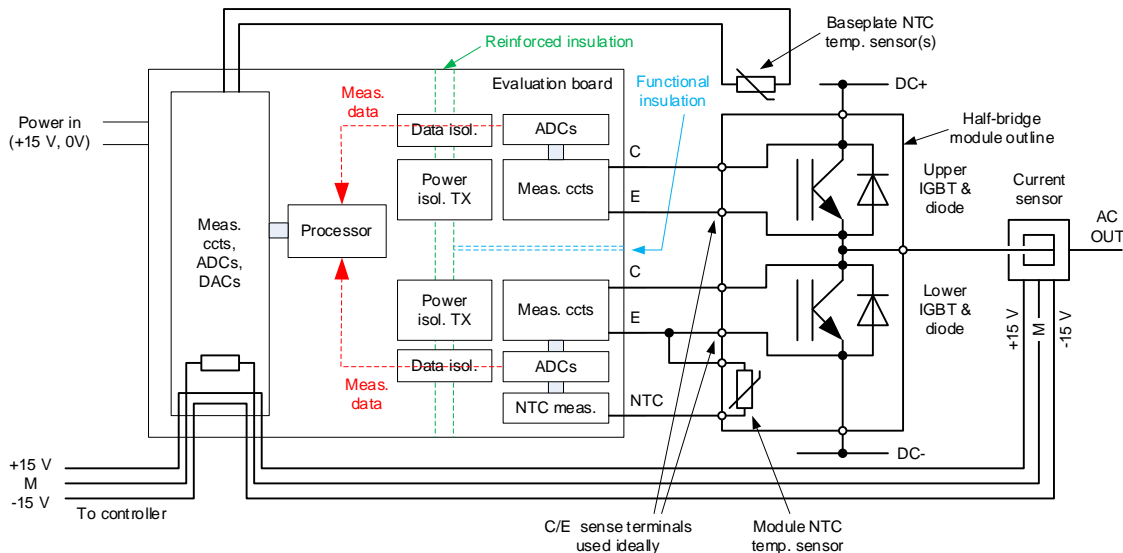


Figure 1. Overview of all connections to the Data Logger, shown for the case where the current sensor is shared with the converter and is a current-output type

### 3 Connections

#### 3.1 Overview

Three basic sets of connections are required for correct operation of the Data Logger, and their location is shown in Figure 2:

- Upper  $V_{CE}$ , connecting to upper IGBT C/E sense terminals
- Lower  $V_{CE}$ , connecting to lower IGBT C/E sense terminals
- Phase current  $I_{ph}$ , connecting to phase leg hall-effect current sensor

Optionally, the semiconductor module internal NTC thermistor and external base-plate sensor(s) can also be connected.

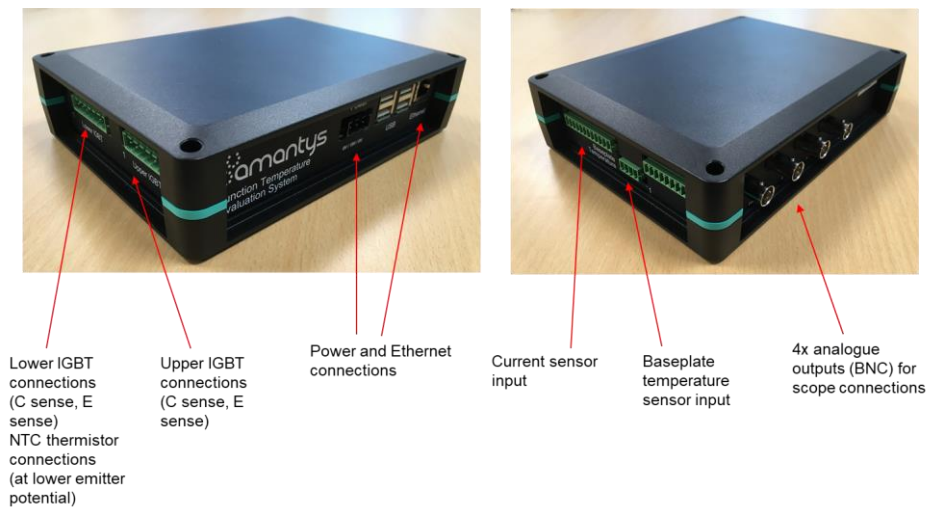


Figure 2. Location of Data Logger connections

#### 3.2 Power Semiconductors connections

Connections to the IGBT module are shown in Figure 3. It is important to use sense (kelvin) connections if available because these allow the most accurate measurement of the forward voltage drop. Because these are high-voltage connections, suitably insulated wire is required. In order to minimise inductive pickup, it is also recommended to use twisted pairs of wire to connect to each IGBT, with the minimum length of cable possible.

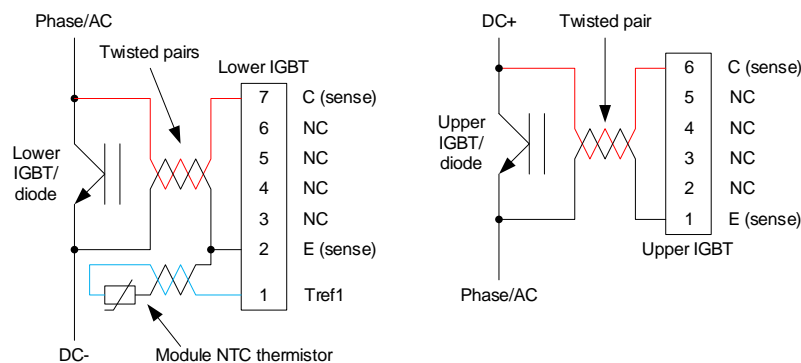


Figure 3. Connections to the upper and lower power semiconductors

#### 3.3 Current Sensor connections

A hall-effect current sensor signal is required and may be either a current- or voltage-output type. An existing sensor may be used, with signal feeding through the Data Logger on its way to the converter controller, or an extra (dedicated) sensor may be added. The sensor is assumed to be at earth potential, i.e. isolated from the power

circuit, and depending on the specific model used either a burden resistor or input resistors are required, located on the Data Logger connector. The scaling of the sensor reading is set in the software.

Connection to the current sensor is shown in Figure 4 and Figure 5 for current- and voltage-output sensors respectively. The burden resistor  $R_B$  and turns ratio  $N_{sense}$  values are entered into the software. For a voltage-output sensor, these effective values depend on the input resistor  $R_{in}$  and sensitivity  $\alpha$  defined in Figure 5.

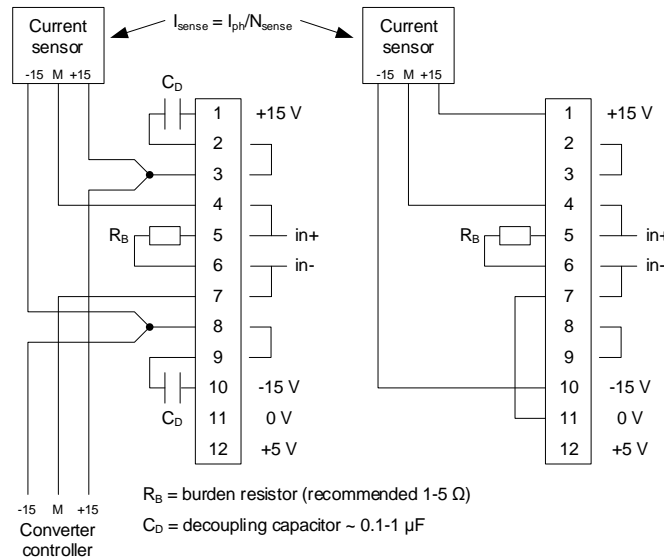


Figure 4. Connection options for a current-output hall-effect sensor.

Left: feed-through sensor (shared with the converter), right: separate sensor (dedicated to the Data Logger)

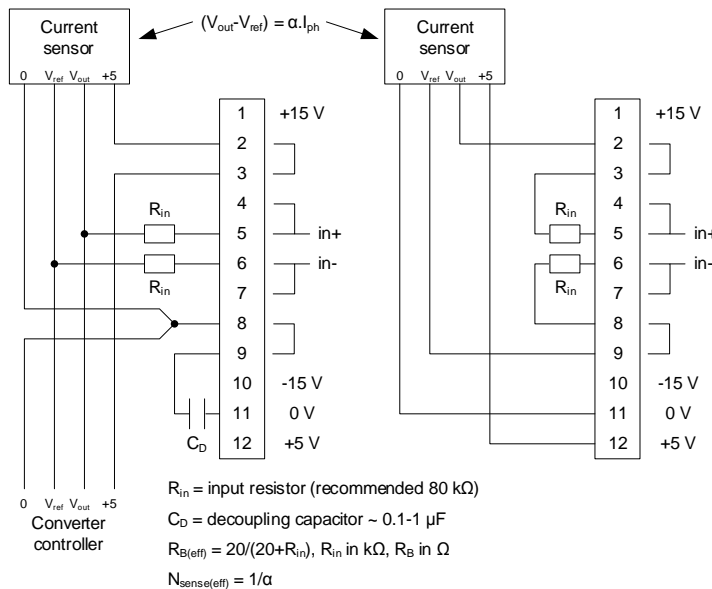


Figure 5. Connection options for a voltage-output hall-effect sensor.

Left: feed-through sensor (shared with the converter. Right: separate sensor (dedicated to the Data Logger)

### 3.4 Temperature Sensor connections

The drive current for each of the temperature sensors is supplied by the Data Logger, so if an existing measurement is made of the internal module NTC thermistor - e.g. on a gate drive - it must be removed to avoid interaction. A separate twisted pair cable must be used to connect to the module NTC thermistor, with the lower IGBT emitter connection being made at the Lower IGBT connector, as in Figure 3. Temperature sensor characteristics are set in the operating parameter configuration.

Up to two temperature sensors, typically attached to the IGBT module base-plate, may be connected to the base-plate temperature sensor inputs. Figure 7 shows the connector pin-out. If the module is a half-bridge type, typically only one is required. If the module is a single-switch type, two are required (one for the lower module and one for the upper module). Each sensor should be located as close as possible to the centre of the module. The recommended sensor is a lug-mounted NTC thermistor, e.g. Vishay NTCALUG01T or Epcos B57703M, attached to the bolt attaching the module to the heat sink. The sensor inputs can be configured to be either NTC or PTC thermistors.

### 3.5 Analogue Output connections

The Analogue outputs AO1-4 are available on the 8-way connector, while analogue outputs AO5-8 are available at the separate BNC connectors. The pin-out of the AO1-4 connector is shown in Figure 6.

### 3.6 Power Supply input and earthing

The +15 V power supply input connector pin-out is shown in Figure 6. Note that two 0 V connections are available: one for connection to the power supply itself, and another for referencing to the local earth. **A local earth is required**, unless earthed equipment (e.g. a scope) is used to connect to any of the analogue outputs.

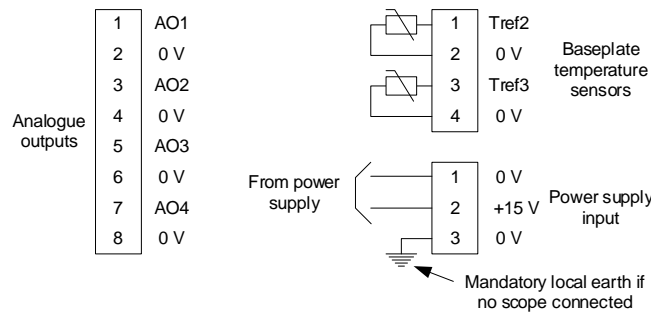


Figure 6. Connection pin-outs for the analogue outputs, base-plate temperature sensors and power supply input

## 4 Basic Setup

An example of a full basic setup is shown in Figure 7 where all the Data Logger connections to an IGBT module, thermistor, and current sensor are illustrated.

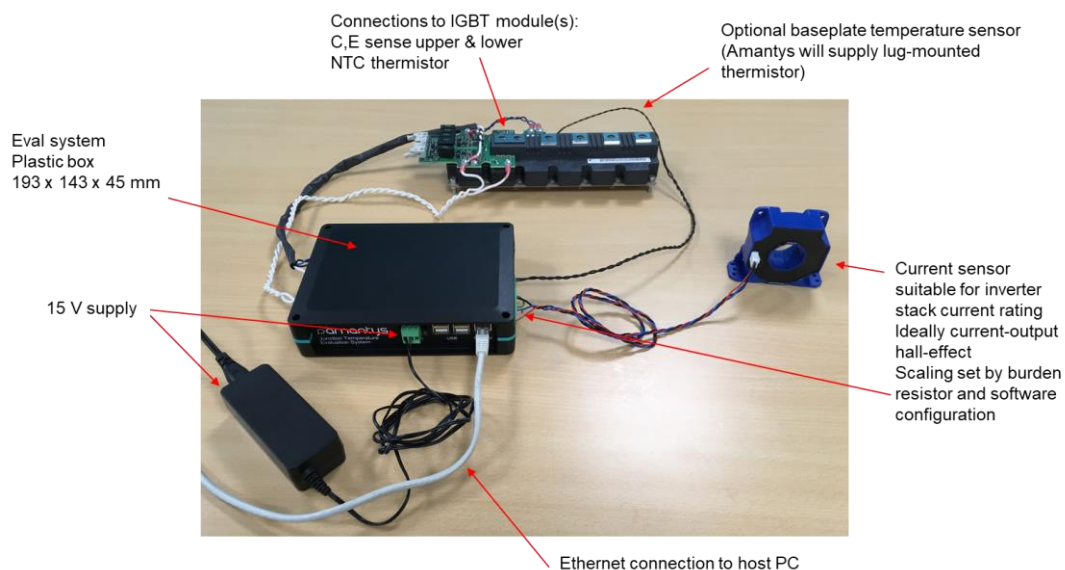


Figure 7. Basic setup for the connection of the Data Logger to a half-bridge IGBT module

## Modification Record

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Date	Rev	Author	Reason for Change
21/06/2021	1	Jorge Gonçalves	Original Issue

### Want to know more...?

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

Amantys Power Electronics Ltd, Compass House, Vision Park, Histon, Cambridge CB24 9AD, United Kingdom;  
+44 (0)1223 652530. [www.amantys.com](http://www.amantys.com)