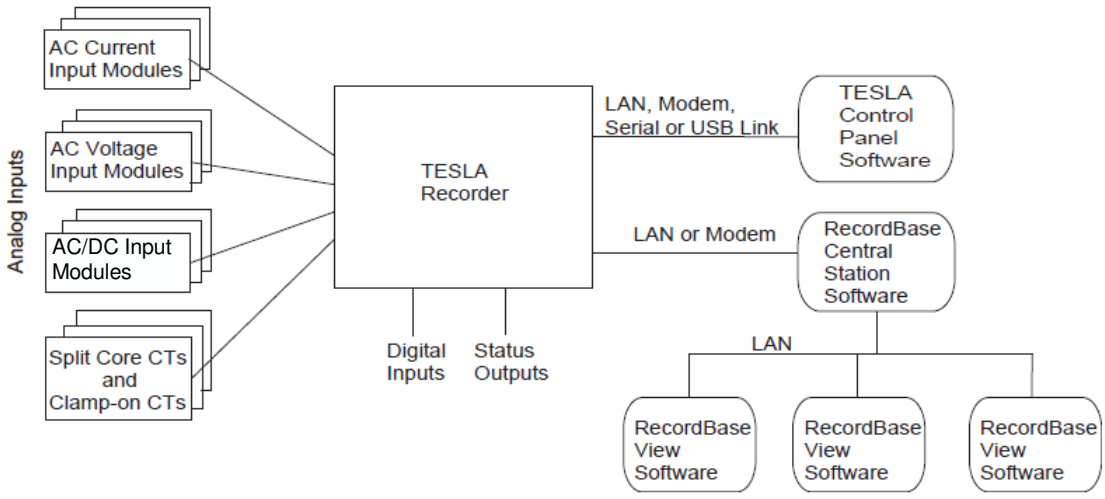
Role of Input Modules for TESLA DFR

Understanding input module needs

The TESLA DFR was not designed for direct connection to analog secondary quantities such as CT and PT inputs. CT and PT secondary signals should not be connected directly to TESLA's rear analog terminal inputs. Instead, separate input modules are needed to transform the instrument transformers' output to signals that are compatible with the TESLA's inputs levels. This application note describes the role of TESLA's input modules. It also introduces the module options available to use as inputs for standard signals (such as secondary ac voltage and current, as well as low level dc voltage).

Input Module Introduction

The input module is a separate unit from the TESLA Disturbance Fault Recorder, providing conditioning and isolation between the main CT/PT secondary and the input of the recorder. These modules step down the input level to TESLA's acceptable range at its rear terminal. There are 4 types of input modules: AC current input, AC voltage input, split core CT, and AC/DC input, which users may choose based on the needs of their specific application. The figure below shows a typical TESLA system:



Input Module Types

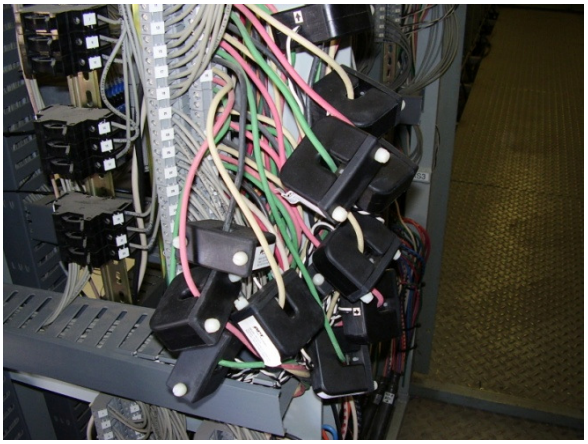
Each AC current input module has 4 isolated AC current input channels.

Each AC voltage input module has 3 isolated voltage input channels.

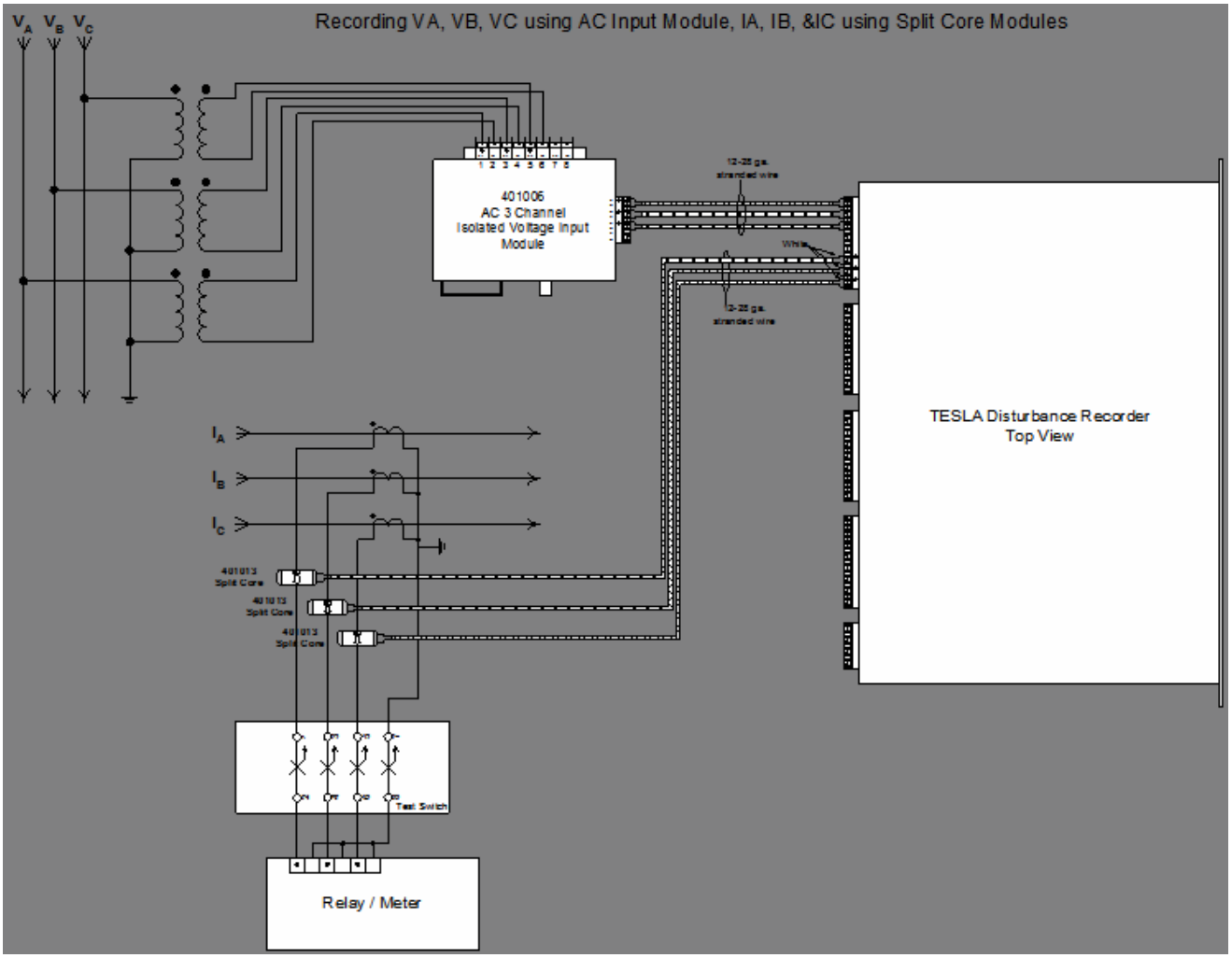
The AC/DC input module has 4 isolated inputs, which can be configured to take either AC/DC voltage or AC/DC current with a different input range based on the configuration of the resistors that are wired externally on its input.

These types of input modules are din-rail mounted and can be installed on the same panel as the TESLA DFR or separated away from the TESLA DFR by up to 4000 feet. The picture below shows the input module installed on a panel with a TESLA DFR.

The split core CT is a single channel current input, where the CT secondary cable goes through the center of the split core and the output will be wired directly to TESLA's analog input. The benefit of using the split core CT is that it does not require a power outage or disconnection of the CT during the installation. The picture below shows a typical split core CT installation. A separate split core CT mounting bracket is also available to have the CTs DIN rail mounted.



The following connection diagram shows a voltage input module and split core CT connection to TESLA 4000's rear analog input terminals.



More information about the modules and connections can be found in the TESLA user manual Appendix F, and in the input modules datasheets on the following page of our website:

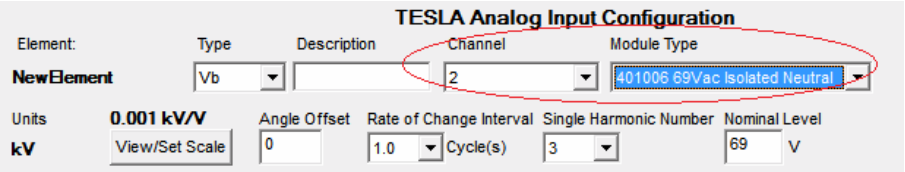
http://www.erlphase.com/support.php?ID=documents

Input Module Selection

The type and the number of input modules should be calculated according to system needs. For instance, for a 36 channels TESLA DFR, if a system contains a bus with 11 transmission lines on its inputs and line PTs are not required, the user can choose 1 PT module to monitor the bus voltage and 9 current modules to monitor the transmission line's currents. Or they can choose 11 current modules to match the number of transmission lines and keep 1 spare channel for each current module.

Any analog channel at TESLA's rear terminal can be configured to either AC/DC voltage or current; therefore, it is very flexible for the user to arrange the input connection according to their preference. To define the type of input, the user needs to set it up on the channel configuration by selecting the correct module type and by defining its channel number. The module type and channel number selection in the configuration should exactly match with the physical input module that is connected to the TESLA's rear analog input terminal with

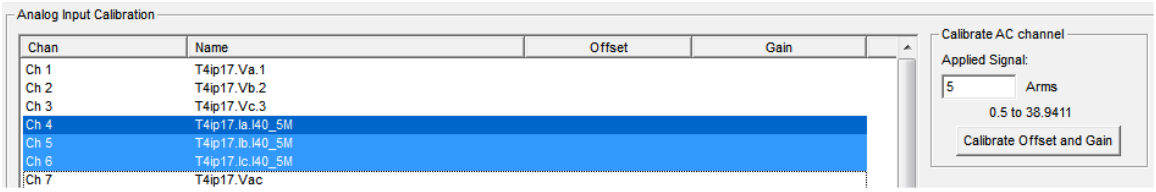
the same channel number. Below is an example showing setting of a voltage channel's configuration:



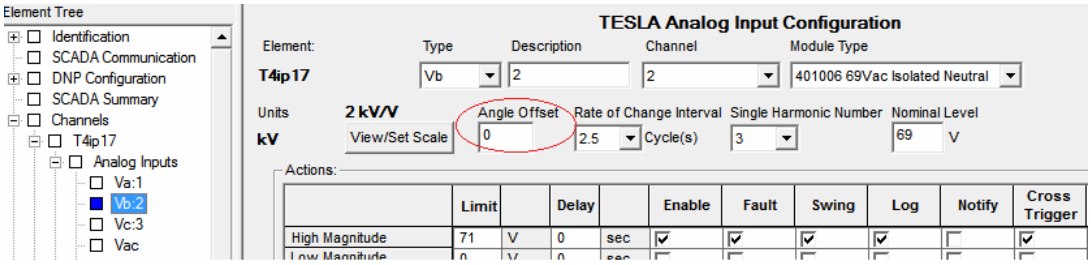
Analog Input Calibration

Analog input calibration is required after a successful installation of the input modules. Any changes to the input module's connection, replacing the module or changing its location far away from the original will require a recalibration of those input channels.

AC signal calibration requires both magnitude and angle calibration. In order to do magnitude calibration, the user can feed the AC signal using a test set. Log in to the unit using TESLA Control Panel under "Utilities -> Analog Input Calibration" and calibrate the input gain and offset using the applied the signal from the test set. The same type of input can be multi-selected and calibrated at once as shown:



Angle calibration needs to be done under each individual analog channel's configuration using angle offset setting as follows:



Users must manually correct the angle measurement by comparing the applied signal's phase angle to the metering screen displayed angle. This Angle Offset setting is used to adjust the angle error due to the measurement until the angle in the metering screen matches with the applied signal's phase angle.

The DC signal does not require angle calibration, only magnitude calibration (under Analog Input Calibration screen). It requires two different set points on its measurement range to define its characteristic slope. Therefore, two different levels of applied signals must be given to calibrate the DC input.