3-PHASE POWER INVERTER

Guide to operate the 3-phase inverter experimental setup  
(v.morais@fe.up.pt)

# Features

* The 3-phase 30A@450V power inverter for academic/research purposes;
* This inverter has built-in measurements of AC currents, AC voltages and DC bus voltage;
* The inverter is based on infineon IPM IKCM30F60GA module (a low-cost module, with integrated drivers);
* The control board is based on XMC4500 Relax (lite) kit, a well-known board in UP Laboratory of Power Electronics;

# Safety Issues

This module and all electric equipment’s are under **dangerous voltages**. The operation of this setup may require supervision to avoid injuries as well as destruction of equipment’s.

Next, some advices are listed:

* Keep the “shutdown” button of the DC BUS voltage source easily accessible;
* Always ensure the measurement of the DC bus voltage; A continuous current measurement with an oscilloscope current clamp is recommended.
* Avoid short-circuits with the scope’s ground wire: differential measurements are recommended;
* The isolation transformer is mandatory;
* The heatsink is not grounded. Despite being safe to touch the heatsink it is not recommended. A temperature measurement of the IGBT is available.
* Avoid plug/unplug loads under operation.

# How to use

* SETUP:
  + Download/read IKCM30F60GA datasheets
    - <https://www.infineon.com/dgdl/Infineon-IKCM30F60GA-DS-v02_06-EN.pdf?fileId=5546d4624fb7fef2014fcb83cab8790a>
  + Download and install last version of DAVE and micrium
    - <https://www.infineon.com/cms/en/product/microcontroller/32-bit-industrial-microcontroller-based-on-arm-cortex-m/>
    - <https://infineoncommunity.com/dave-download_ID645>
    - <https://infineoncommunity.com/uC-Probe-XMC-software-download_ID712>
  + Clone github repository for this 3-phase inverter
    - <https://github.com/vitormorais/3phase_inverter>
* FIRST RUN (software)
  + Open Dave, import repository, open main.c
  + Connect to XMC4500 via USB; click on DEBUG: it should compile and flash the microcontroller; press run button on debug environment.
  + Open micrium file “OL\_VSC\_v2.wspx” via DAVE CE workspace
  + If requested, select the .elf binary
  + Put in oscilloscope window and press “play” button
  + Now you can control the modulation index, the frequency, etc
* SETUP HARDWARE
  + Connect to the DC bus a voltage source
    - First use the LAB voltage source (max 30V)
    - Check with the oscilloscope probe the ac voltage of each of the 3phase outputs (with the scope ground connected to the negative side of –VDC\_BUS)
      * You should see the PWM at 10 kHz
  + Now, if all PWM are OK, connect a DC power source (isolation transformer + VARIAC + Rectifier)
  + Connect a 3phase load (RL) to the respective inverter outputs
  + Turn on the DC voltage source (with 30V); Check the LOAD current with a current probe: it should be a 50Hz current;
  + Now test the micrium interface with different frequencies, modulation indexes, etc

# SCHEMATIC

