

## DRV8301-LS12-KIT Get Started

Version 1.0.3

Motor Solutions

The DRV8301-LS12-KIT is a motor control evaluation kit for spinning three phase brushless DC and brushless AC (BLAC) - often referred to as permanent magnet synchronous (PMSM) – motors with examples of both sensorless Field Oriented / Vector Control (FOC) and TI's InstaSPIN-BLDC sensorless BLDC solution. The DRV8301-LS12-KIT is a high-performance, power-efficient, cost-effective platform that speeds development for quicker time to market and features Hercules Safety MCU that is suitable for use in ISO 26262 and IEC 61508 safety applications that may include Electric Power Steering, Power Doors/Roofs, EV/HEV/Railway Propulsion, Dual Clutch Transmissions, Electronic Throttle Control, Fuel/Coolant/Oil pumps, A/C Compressor, and Wipers

### Features

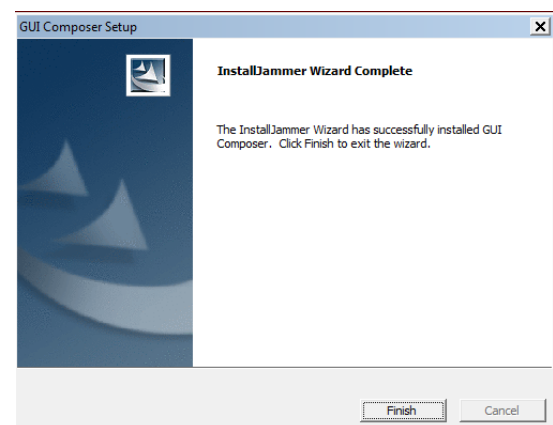
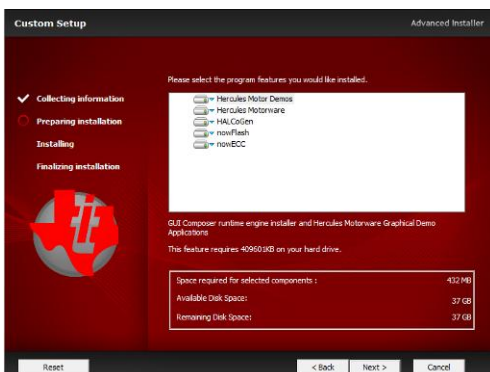
- **Software Support:**
  - Encoder based FOC with redundant sensorless speed estimation
  - Sensorless InstaSPIN™-BLDC
  - Speed & torque control loops
  - Follows TI motor software & HALCoGen conventions
  - Leverages ARM CMSIS Math Library
- **Teknic Motor:** 6,000 rpm, 7.1 A with encoder
- **Hercules controlCARD** includes
  - Isolated xds100v2 and external JTAG connector
  - RJ45 Ethernet connector
- **DRV8301 EVM**
  - 1.7A Pre-driver with 2x internal programmable gain amplifiers for shunt current sensing
  - 1.5A buck converter & 60A+ FETs

### Kit Contents

- DRV8301drive board ( EVM)
- Hercules TMS570LS12 Isolated controlCARD
- Teknic Motor with built-in Encoder
- Motor wiring harness (splits 3 phase power, encoder and hall sensor connectors from Molex)
- 24 V, 2.5 A international wall power supply
- USB Cable
- Getting Started Document
- One DVD that includes TI Code Composer Studio IDE
- One DVD that includes:
  - TI MotorWare CCS5 example projects for:
    - Redundant SMO and Encoder based FOC
    - InstaSPIN™-BLDC
  - TI GUIComposer apps and runtime environment demonstrating the MotorWare projects
  - MotorWare Documentation
  - Hardware Documentation
  - HALCoGen
  - nowFlash
  - nowECC

### Software Installation

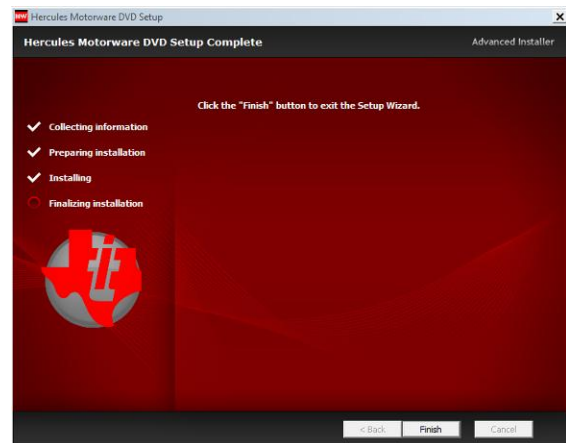
1. Install the Hercules Motor Kit Software. You will also have the option to support additional installations from the DVD. *If the DVD does not autorun, please select the "HMK\_DVD\_vXXX.exe" file.*
  - a. From the TI DVD, select complete or custom software components to install. The custom selections look like
  - b. The GUI Composer unpacking may take some time. This is normal. You will be asked to acknowledge the completion of the TI GUI composer runtime installation as below.



# TI Spins Motors



- c. You may be asked to give the installers permission on a Windows7 PC. A successful DVD installation will ask you to acknowledge completion as shown.
- d. Upon installation and an available internet connection, the software will automatically check for updates. In the future, a manual check for software updates is available from the start menu.
- e. Please note that the PC GUI demo applications are placed in c:\ti\guicomposer\webapps by default when installing from the DVD. Updates to MotorWare and/or the PC demo software are distributed together via the Hercules MotorWare software online update mechanism. A shortcut to check for updates is included in the MotorWare folder in the Start Menu.



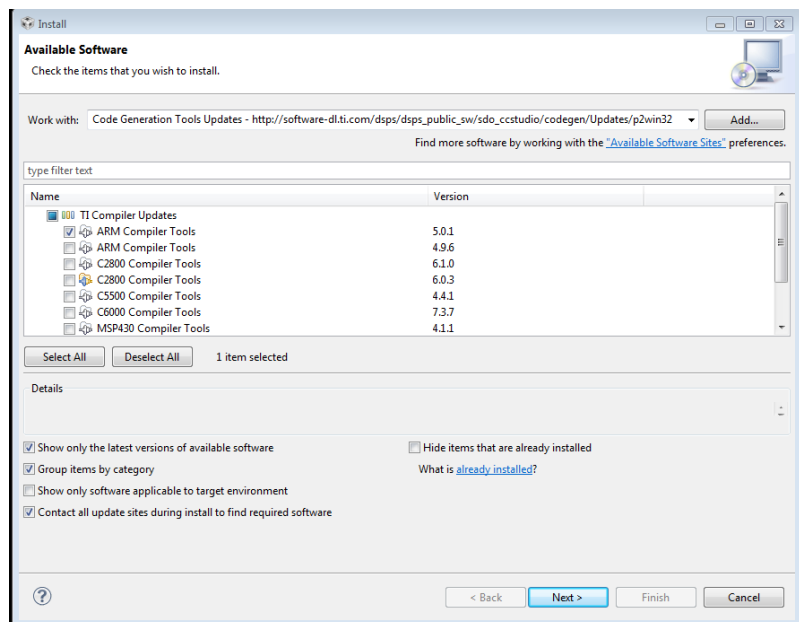
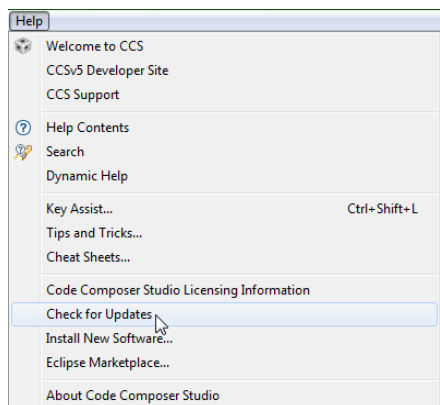
Please note that for online MotorWare Demo updates, if the new webapps are not placed in your

<install directory>\guicomposer\webapps. You will need to copy the MotorWare folders from:

<install directory>\Hercules MotorWare\<vx.xx.xx>\sw\solutions\<proj>\gui\guicomposer\webapps  
to:  
<install directory>\guicomposer\webapps

where <vx.xx.xx> is the latest version and <proj> can be foc\_encoder\_speed or instaspin\_bldc or a future released project.

- 2. If desired, install CCS from DVD or get the latest from [here](#)
  - a. Before building projects please make sure to install the latest ARM Compiler (at least 4.9.6) from **Help → Check for Updates** or “**Help → Install new software**” and select “**Code Generation Tools...**” then select the **ARM 5.0.1 compiler**.



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## Hardware Set-up

1. If the motor in your kit is not already connected to the wiring harness included via the molex connector, please do so now.
2. Ensure that jumper JP2 is in place (as it is shipped from the factory). See Figure 2.
3. Connect the three phase motor wires to the three phase motor out screw terminal as shown below. From left to right: Green (Ground), White (Phase C), Red (Phase B), Black (Phase A). PLEASE NOTE: if you switch the motor phasing (UVW to UWV, etc.) so that the motor rotates in the opposite direction of the positive counting direction of the encoder you will produce an Encoder Fault. You can fix this by connecting the phases properly or by changing the gui variable of gGUIObj.Motor\_Enc\_Dir from 1 to -1.

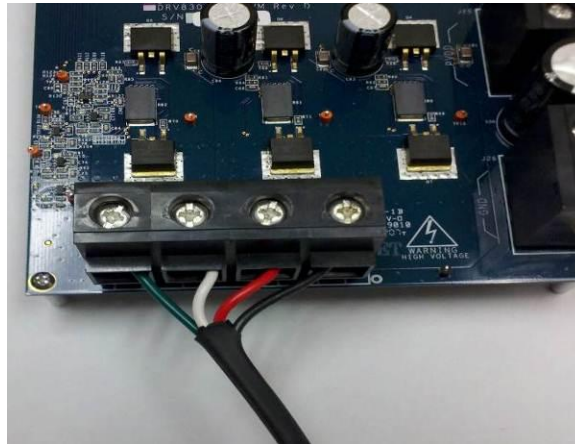


Figure 1 Three phase motor connection from wiring harness

4. Connect the usb cable provided to your PC and directly to the TMS570LS12 controlCARD as shown in Figure 2..
5. Connect the 5 pin SIP connector labeled J4 to jumper J4 on the DRV8301 EVM as also shown in Figure 2. This is for the encoder feedback. Please note that pin one on this connector is indicated by a triangle on the board and should be connected to the **blue** wire in the SIP connector. If you receive a calibration result of 4000 (in the Demo GUI, for example) you may have this connector reversed on your board. If the GUI Encoder Fault LED is red, ensure that the motor encoder pins are properly connected to the DRV83xx board. To reset this fault disable and re-enable the Enable Motor GUI control and Calibrate Enable check box.
6. **Optional:** connect the 5 pin SIP labeled J10 to jumper J10 on the DRV8301 EVM. This is for hall sensor feedback but is not utilized in the projects that come with this kit. Please note that pin one on this connector is indicated by a triangle on the board and should be connected to the **green** wire in the SIP connector.

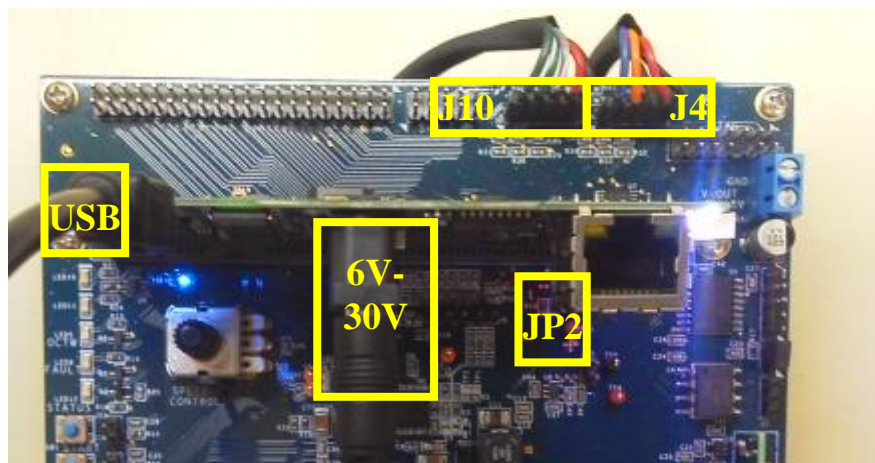


Figure 2 USB debugger port, CNCD Power, encoder and hall sensor feedback

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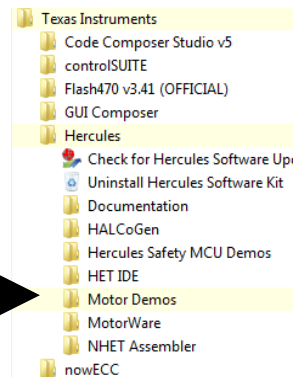


7. Without plugging the included power supply into the wall, attach the red and black banana-type leads to J25 and J26 power interface screw terminals -- Red to PVDD and black to GND.
8. Plug the power supply into the wall using the included AC cable/adaptor for your region of the world.

## Next Steps: Explore the Project

The following references can be found in the c:\ti\hercules\motorware\<<version>> directory assuming the default location was chosen during installation:

1. Review the hardware documentation, if necessary.
  - a. controlCARD:  
\\sw\boards\control\tmdx570LS12cncd\docs
  - b. DRV8301 Drive Board:  
\\sw\boards\drive\drv8301kit\_revD\docs
2. Read the accompanying GUI Solution User Guides
  - a. InstaSPIN-BLDC:  
\\sw\solutions\instaspin\_bldc\gui\docs
  - b. FOC Encoder:  
\\sw\solutions\foc\_encoder\_speed\gui\docs
3. Run the InstaSPIN-BLDC and FOC Encoder demonstrations



- a. C:\ti\hercules\Hercules  
MotorWare\v1.0.2\sw\solutions\foc\_encoder\_speed\gui\guicomposer\webapps\DRV8301\_TMS570LS12\_FOC\_SMO\_wEncoder
- b. C:\ti\hercules\Hercules  
MotorWare\v1.0.2\sw\solutions\instaspin\_bldc\gui\guicomposer\webapps\DRV8301\_TMS570LS12\_BLDC

Run the solution using CCS. Please note that the MotorWare projects were tested based on CCS 5.2.1 (included on the DVD in this kit).

4. Read the accompanying solution documentation
  - a. InstaSPIN-BLDC:  
\\sw\solutions\instaspin\_bldc\boards\drv8301kit\_revD\hercules\tms570ls1227\projects\ccs5\project01\docs
  - b. FOC Encoder:  
\\sw\solutions\foc\_encoder\_speed\boards\drv8301kit\_revD\hercules\tms570ls1227\projects\ccs5\project01\docs