



TWR-KV46F150M Quick Start Guide for Motor Control

Development Kit for
Kinetis KV4x Family

Tower System
Development Board
Platform



Get to know the TWR-KV46F150M

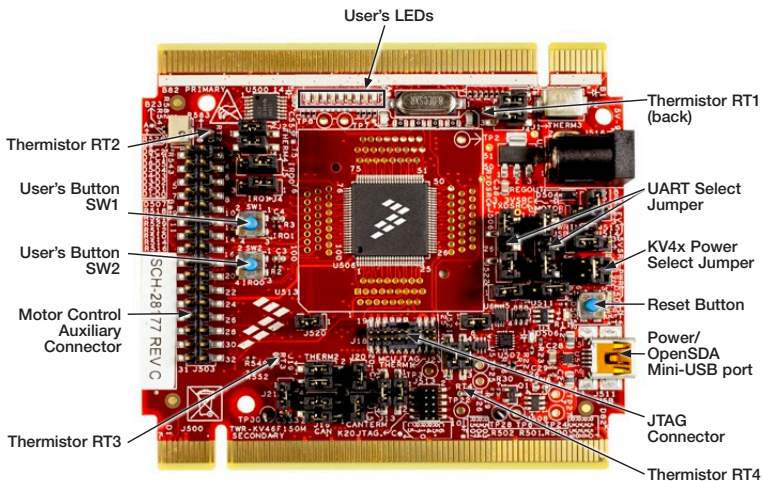


Figure 1: Front side of TWR-KV46F150M

TWR-KV46F150M Tower System Module Freescale Tower System

The TWR-KV46F150M module is part of the Freescale Tower System, a modular development platform that enables rapid prototyping and tool reuse through reconfigurable hardware. Take your design to the next level and begin constructing your Tower System platform today.

Introduction to TWR-KV46F150M Tower System Module

The TWR-KV46F150M Tower System Module is a standalone development kit that can be used in conjunction with the Tower System development platform and the TWR-MC-LV3PH motor control module. To watch a video on how to configure the board, go to [freescale.com/TWR-KV46F150M](https://www.freescale.com/TWR-KV46F150M).

This Quick Start Guide will teach you to:

- Easily program precompiled examples for the KV4x MCU
- Run an IAR Embedded Workbench project featuring an ADC/FIR filter application
- Spin the 3-phase motor included in the TWR-MC-LV3PH kit with a PMSM sensorless FOC control algorithm using eFlexPWM while monitoring the motor with the FreeMASTER tool

Note: TWR-KV46F150M Tower System Module is also compatible with TWR-SMPS-LVFB development board for Switch Mode Power Supply. Please refer to [freescale.com/TWR-SMPS-LVFB](https://www.freescale.com/TWR-SMPS-LVFB) for more information on TWR-SMPS-LVFB.

TWR-KV46F150M Tower System Module Features

- MKV46F256VLL16 MCU (ARM® Cortex®-M4 168 MHz, 256 KB flash, dual 12-bit ADCs up to 4.1MSPS, 3x FlexTimers and 1x eFlexPWM with 260ps resolution, up to 30x PWM channels, 100 LQFP)
- OpenSDA¹ debug circuit with Mini USB connector and virtual serial port
- Nine LEDs with connected buffers to PWM channels for dimming
- Two pushbuttons for user input or interrupts
- Four thermistors
- FlexCAN interface
- Motor control and auxiliary signal connectors

Tools Required

- IAR Embedded Workbench V7.30.4 or higher
- Freescale FreeMASTER for real-time debug monitoring and data visualization

⁽¹⁾ Refer to the OpenSDA User Guide available at [freescale.com](https://www.freescale.com)

Software Installation Instructions

1 Download Software and Tools

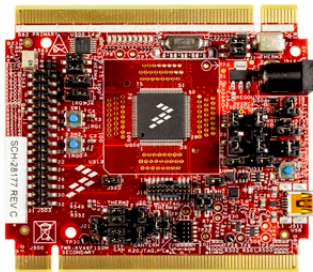
Download installation software and documentation under **“Jump Start Your Design”** at freescale.com/TWR-KV46F150M.



2 Install the Software and Tools

- Install the IDE toolchain IAR Embedded Workbench® for ARM® v7.30.4 or later, 30-day free evaluation license, at iar.com/Freescale.
- Install the PEMicro Windows® USB Drivers at pemicro.com/OpenSDA.

- Install the free debug monitoring and data visualization tool Freescale FreeMASTER v1.4, or later, at freescale.com/FreeMASTER.



TWR-KV46F150M Tower System Module Initial Configuration

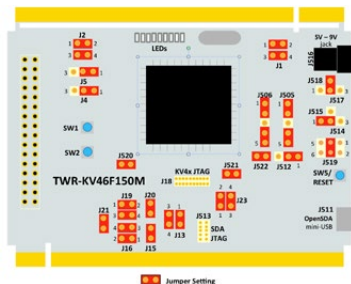
3 Default Jumper Settings

See the default jumper settings in the table below. Refer to the TWR-KV46F150M User Guide at freescale.com/TWR-KV46F150M for detailed jumper descriptions.

Option	Setting	Option	Setting
J1	1-2, 3-4	J505	1-2, 4-5
J2	1-2, 3-4	J506	1-2, 4-5
J4	1-2	J512	1-2
J5	1-2	J517-518	J518 J517-2
J13	1-2, 3-4	J514-515	J514-1 J514-2
J15	ON	J519	3-4
J16	1-2, 3-4	J520	ON
J19	1-2, 3-4	J522	ON
J20	ON		
J21	ON		
J23	1-2, 3-4		

4 Verification of Jumper Setting

TWR-KV46F150M comes preloaded with the P&E OpenSDA Applications (MSD flash programmer and debug) and the LED demo. Plug in the USB cable and watch LED's powering ON/OFF alternately.



TWR-KV46F150M Jumper Map

TWR-KV46F150M Tower System Module Demo

5 Program a Precompiled Example Using the OpenSDA MSD Application

1) Launch the Bootloader Mode

Press and hold the reset (SW5) button while plugging in the USB cable; then release it. Windows will detect a new BOOTLOADER drive and automatically install requested drivers.

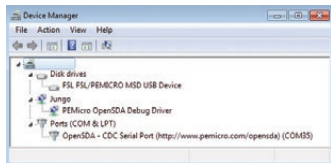
2) Load the OpenSDA P&E Applications

Copy and paste MSD-DEBUG-TWR-KV46F150M_Pemicro.SDA from OpenSDA Applications folder in quick start package to the BOOTLOADER drive in my computer/disk drive. Unplug and plug back the USB cable.



Windows will detect a new TWR-KV46F15 drive, a PEmicro OpenSDA Debug peripheral, an OpenSDA CDC Serial Port and will automatically install the requested drivers.

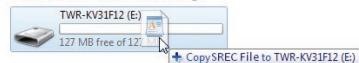
Note: TWR-KV46F15 drive contains backup drivers for the OpenSDA-CDC Serial Port.



3) Program a Precompiled Example for the KV4x

In the TWR-KV46F15 drive, copy any SREC file from the Precompiled Examples folder of the Quick Start Package. Demo will start automatically when the download is complete. To program a new demo, just copy any other SREC file. It is not necessary to disconnect the USB cable.

• Devices with Removable Storage



6 Debug Your First IAR Project

1) Load the OpenSDA P&E Debug Application

If you followed the previous exercise, you can jump directly to the following instruction; otherwise, follow section 5 “Program a Precompiled Example Using the OpenSDA MSD Application” to load the OpenSDA P&E applications.

2) Launch IAR EWARM and Build the Thermistor Project

Open the IAR project file Thermistor_ lab. ieww following the path Project Labs\build\iar\kv46\Thermistor_lab in the Quick Start Package.

Clean the project before selecting the action Rebuild All.

Note: The compilation may return warning messages without consequence.

3) Run IAR EWARM, or later Debug Mode

From the toolbar, click on Download and Debug.

Note: If a Connection Manager window appears, check that your board is configured with the OpenSDA P&E Debug Application, then connect to the Interface OpenSDA Embedded Tower Debug-USB Port.

Start the debug session by selecting the GO option from the toolbar. LEDs D1 to D9 will blink. Touch thermistor RT1, RT2, RT3 or RT4 located in the corners of the board to heat. An affected pair of LEDs will blink faster. From the toolbar, suspend the demo using Break option, select Stop to return to the Editing Mode.

5-Phase PMSM Motor

7 TWR-KV46F150M and TWR-MC-LV3PH Set Up

1) Load the OpenSDA P&E Debug Application

If you followed the previous exercise, you can jump directly to the following instruction; otherwise, follow Step 5 in the Program a Precompiled Example Using the OpenSDA MSD Application section to load the OpenSDA P&E applications.

2) Connect the boards and the motor

Connect TWR-KV46F150M and TWR-MC-LV3PH with the jumper setup shown in the table below following the black and white markings on the Tower System elevators.

Connect the motor to the three-prong connectors (J5) of the motor module.

First, plug the 24 V power supply included in the TWR-MC-LV3PH kit into the barrel connector (J1) of the motor module. Then, connect the USB cable to TWR-KV46F150M and the computer.

TWR-KV46F150M: Jumper Settings

Option	Setting	Option	Setting
J1	Open, Open	J21	Open
J2	Open, Open	J23	Open, Open
J4	2-3	J505	3-4
J5	1-2	J506	3-4
J13	1-2, 3-4	J512	1-2
J15	ON	J517-518	J517-2, J517-3
J16	Open, Open	J514-515	J514-2, J514-3
J19	Open, Open	J519	3-4
J20	ON	J520	ON
		J522	ON

TWR-MC-LV3PH: Jumper Settings

Option	Setting	Option	Setting
J2	1-2	J12	1-2
J3	1-2	J13	1-2
J10	1-2	J14	1-2
J11	1-2		

Note: R37 potentiometer must remain in the maximum threshold over current position as represented in the following TWR-MC-LV3PH graphic. Always turn it counterclockwise.

8 Working with IAR EWARM

1) Compile the PMSM Sensorless FOC Demo with eFlexPWM with IAR EWARM

Open the IAR project file PMSM_Sensorless_FOC_eFlexPWM following the path Project Labs\build\iar\kv46\PMSM_Sensorless_FOC_eFlexPWM in the Quick Start Package.

Clean the project before selecting the action Rebuild All.

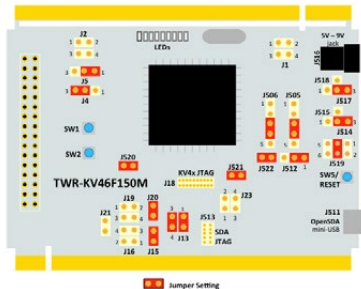
Note: The compilation may return warning messages without consequence.

2) Run IAR EWARM Debug Mode

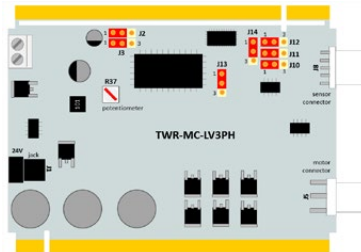
From the toolbar, click on Download and Debug.

Start the debug session by selecting the GO option.

TWR-KV46F150M: Jumper Map



TWR-MC-LV3PH: Jumper Map



9 Monitor the Project with FreeMASTER

Launch Freescale FreeMASTER from the Windows Start menu.

Note: At first start-up, you may have an error message regarding the COM connection.

Open the FreeMASTER project file PMSM_FOC_KV4x_eFlexPWM.pmp following the path Project Labs\Freemaster\PMSM_Sensorless_FOC in the Quick Start Package. The application interface, PMSM Sensorless Vector Control on Kinetis, will appear in FreeMASTER. The speed, position, voltage and current consumption of the motor can be monitored and controlled.



In the Project->Options, set the COM port affected to the OpenSDA -CDC Serial Port (info available in Device Manager) and set the baud rate/speed to 19200 bps (check the option "Do not Open Port" at Startup to avoid error messages at FreeMASTER startup).

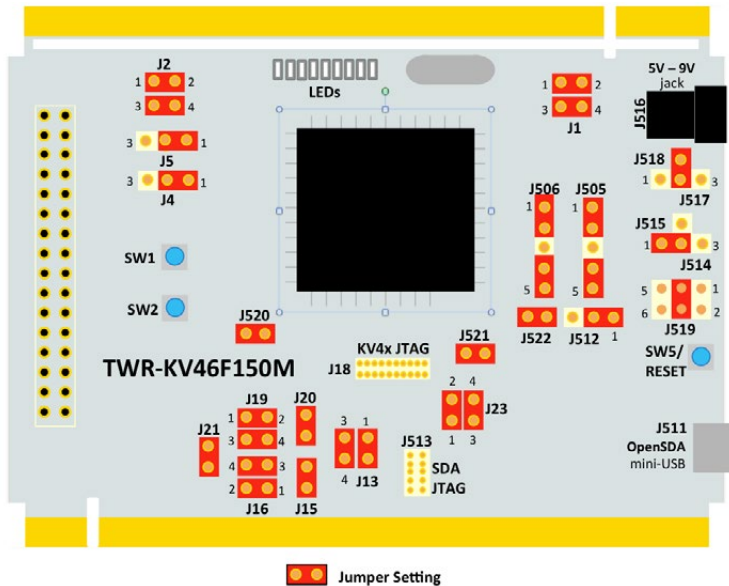
From the toolbar, select the action File->Start the communication.

Press button SW1 of the TWR-KV46F150M board to spin the motor counterclockwise. Press the SW1 button again to increase the speed of the motor. Press button SW2 to decrease the speed and stop the motor.

Or, in FreeMASTER speedometer or speed selector box, select the requested speed and the motor will spin automatically counterclockwise or clockwise.

In IAR EWARM, from the toolbar, suspend the demo using the Break option, or select Stop to return to the Editing Mode.

TWR-KV46F150M Jumper Map





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Download installation software and documentation under
“**Jump Start Your Design**” at freescale.com/TWR-KV46F150M.

Support

Visit freescale.com/support for a list of phone numbers within your region.

Warranty

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For more information, visit
freescale.com/TWR-KV46F150M,
freescale.com/Kinetis or freescale.com/Tower

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