Quick Start Guide

3-Phase PMSM Motor Control Development Kit

with Qorivva MPC5604P MCU

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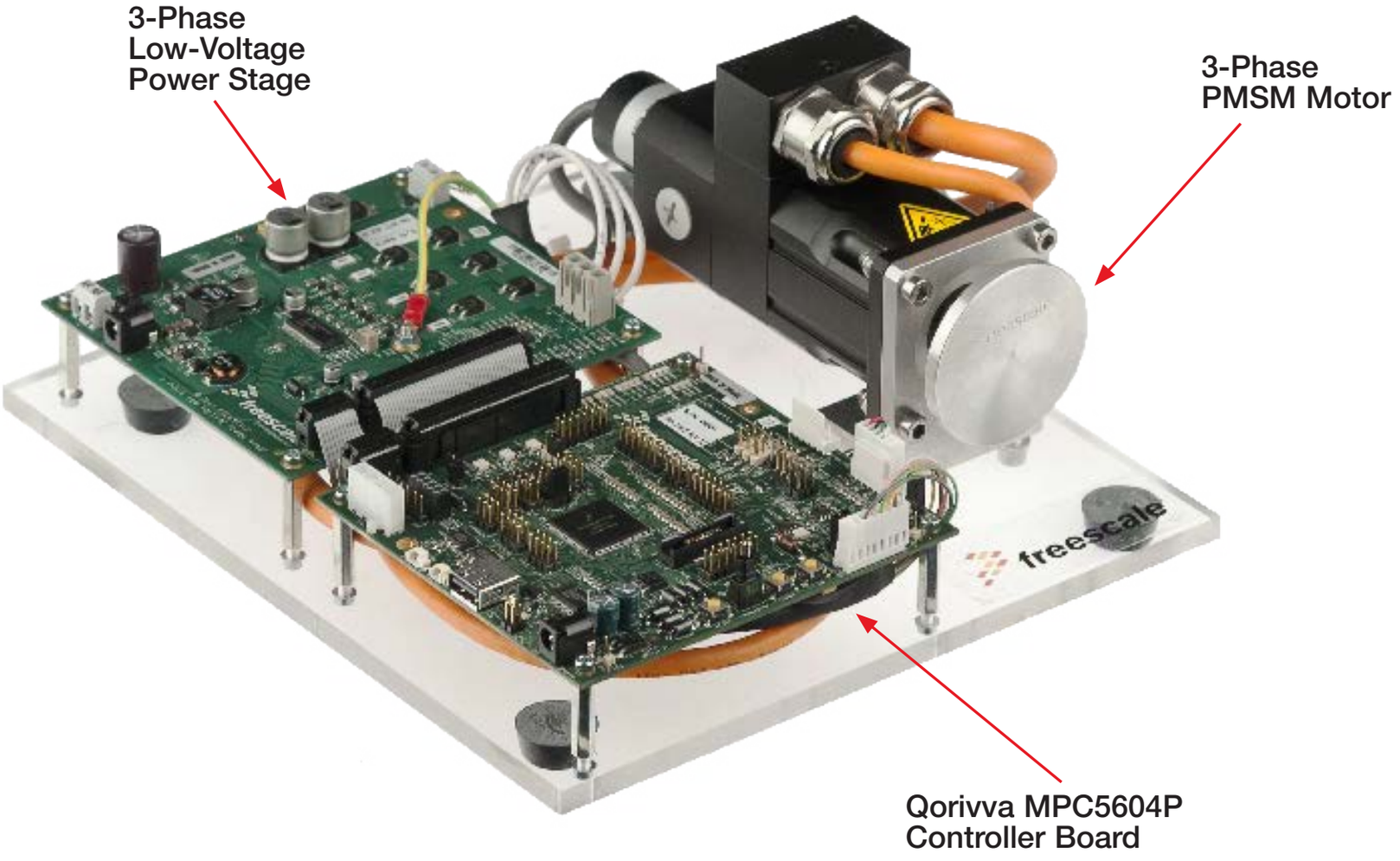
3-Phase PMSM Motor Control Development Kit with Qorivva MPC5604P MCU



3-Phase PMSM Motor Control Development Kit with Qorivva MPC5604P MCU Contents

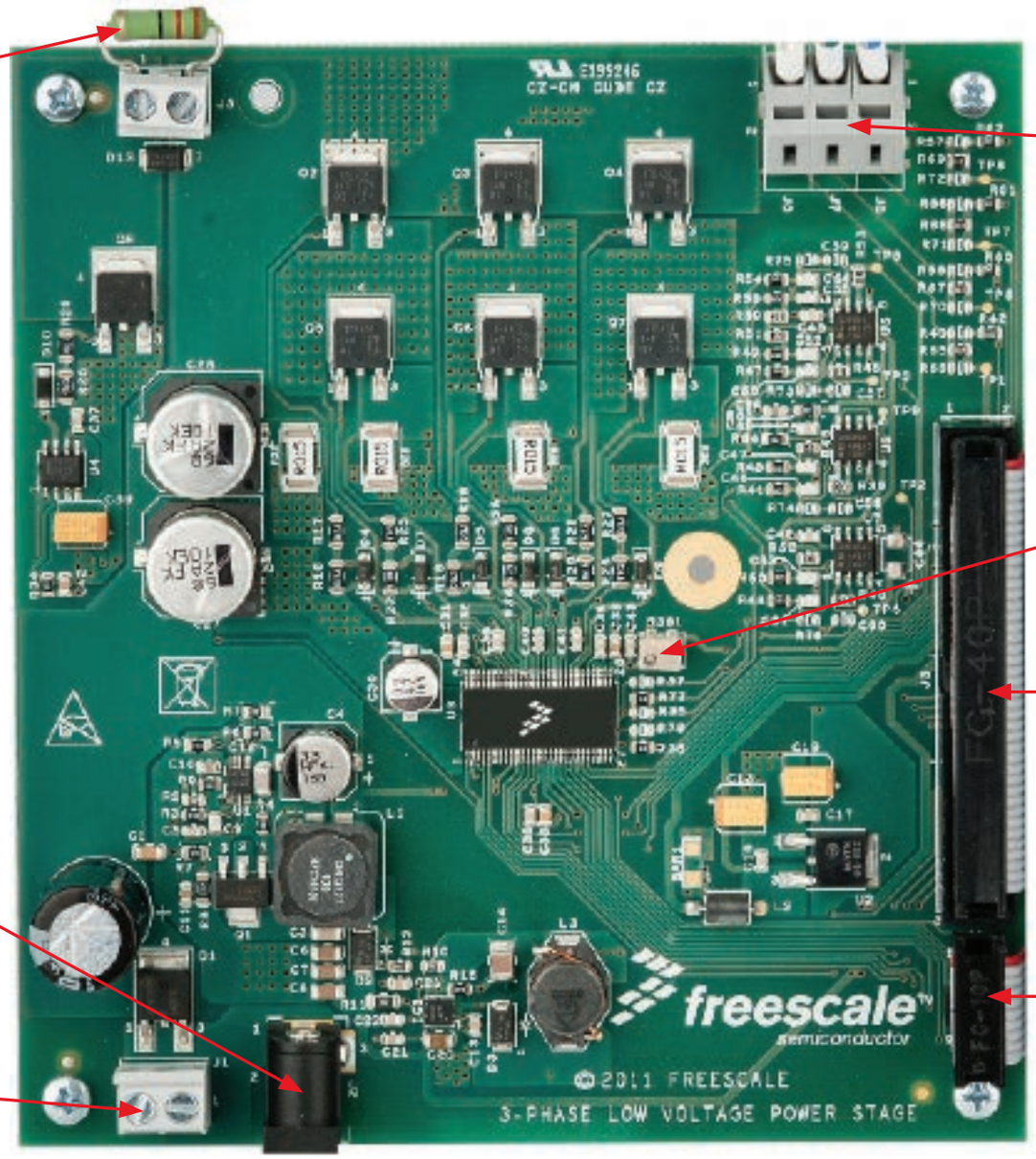
Hardware

- Qorivva MPC5604P controller board
- 3-phase PMSM/BLDC low-voltage power stage based on the MC33937A pre-driver integrated circuit
- 3-phase PMSM motor, 25 V per phase, 3000 RPM, 0.54 Nm, TGN2-0054-30-36
- USB cable
- +24 VDC power supply

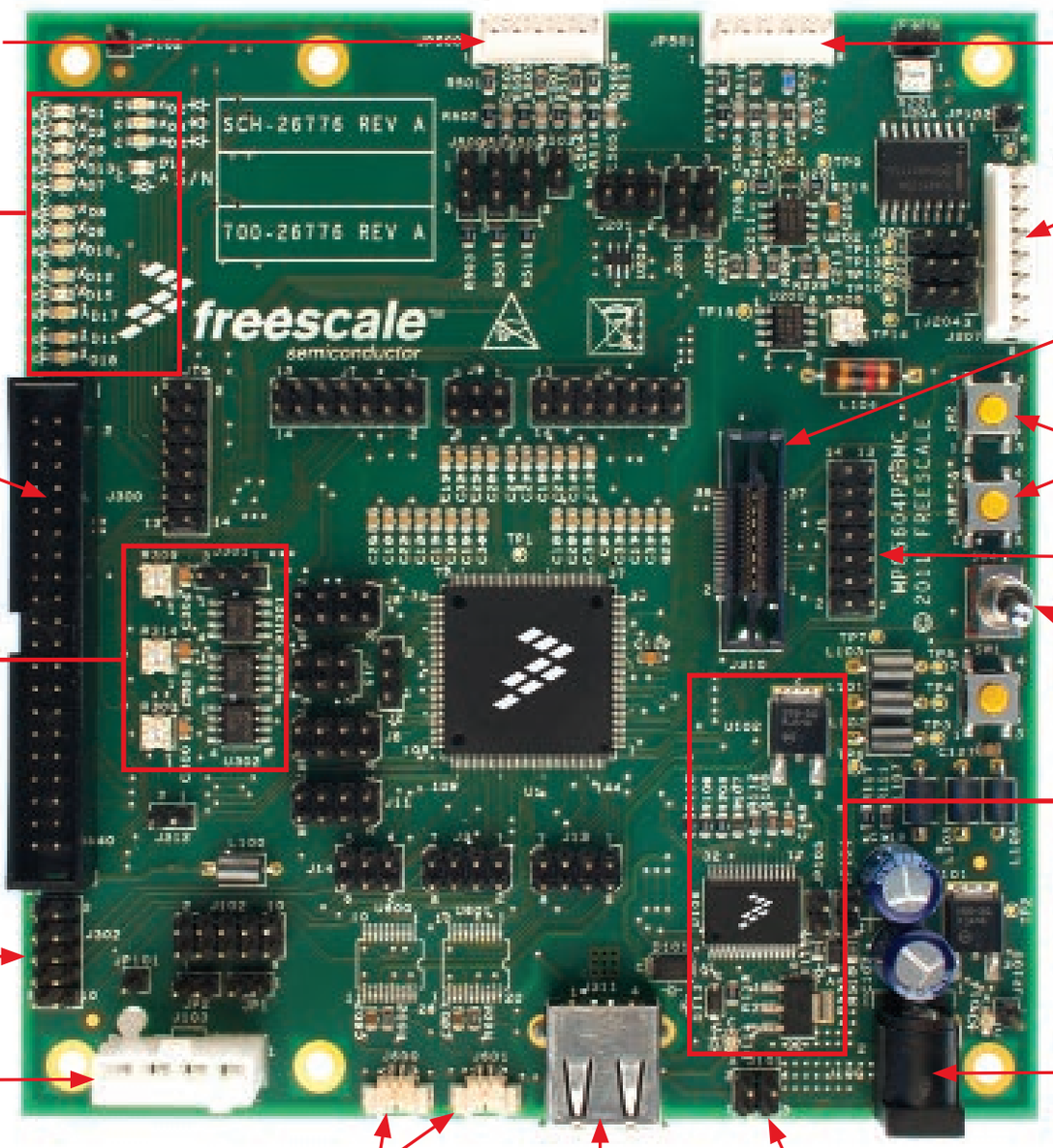
Resources

- PMSM development kit application source code
- Automotive math and motor control library set for MPC5604P installation package
- FreeMASTER installation pack
- FreeMASTER project
- 3-phase PMSM development kit quick start guide
- 3-phase PMSM development kit fact sheet
- 3-phase PMSM development kit application note
- Qorivva MPC5604P controller board user guide
- 3-phase BLDC/PMSM low-voltage power stage user guide

3-Phase Low-Voltage Power Stage



Qorivva MPC5604P Controller Board



Encoder/Hall 1 Connector

LEDs

M1 UNI-3

Fault Logic

MC33937A Interface

CAN Connectors

FlexRay™ Connectors

USB Connector

LIN Header

Encoder/Hall 2 Connector

Resolver Connector

Nexus Interface

Buttons

JTAG Interface

Switch

MC33905 SBC

Power Supply Connector

Software Tools Installation

1 Install the FreeMASTER debugging tool. For FreeMASTER application download, please visit **freescale.com/freemaster**.

2 Install the CP210x virtual COM port driver. For the CP210x virtual COM port driver installation file, please visit **freescale.com/automcdevkits** Downloads section.

3 Run “Device Manager” on your system and check which COM port was assigned to the CP210x COM port driver.

Kit Installation

1. Connect the USB cable to the Qorivva MPC5604P controller board and the host PC.

2. Connect the power supply to the power stage. The controller board power supply is taken from the power stage. The PMSM motor is designed for phase voltage = 25 V.

3. Download and unzip the application software for the MTRCKTSPS5604P available at **freescale.com/automcdevkits**.

Note: Please make sure the development kit is updated with the downloaded application software before proceeding to step 4.

4. Start the FreeMASTER project **MPC5604P_PMSM.pmp** located in the **MTRCKTSPS5604P\SW\MPC5604P_PMSM** project directory.

5. In FreeMASTER \Project\Options, choose the RS232 COM port number that was assigned to the CP210x driver and set the communication speed to 38400 Bd.

6. Enable communication by pressing the “STOP” button in the FreeMASTER, or by pressing “CTRL+K.”

7. Successful communication is signalized in the status bar. If the communication is not established, check the USB connection between the PC and Qorivva MPC5604P controller board and the communication port and speed as described in step 5.

Application Control

1 GPIOA13 is switched ON at the beginning of the calculation step and switched OFF at the end. Period of calculation is 100 µs so the LED D18 on the Qorivva MPC5604P controller board shall be flashing (with period of 10 kHz) if the application runs correctly.

2 Functionality of GPIO12 (LED D11 on the Qorivva MPC5604P controller board) is as follows:

- OFF if the application is in READY, INIT states
- ON if the application is in RUN, CALIB, ALIGN states
- Flashing if the application is in FAULT state (flashing with period 1–2 Hz, clearly visible by naked eye)

3 If no actual faults are present in the system, all LED-like indicators on the FreeMASTER control page shall be dark red. If there is a fault present, identify source of the fault and remove it. Successful removal is signalized by switching off the respective LED-like indicator on the FreeMASTER control page.

4 Fault condition is also signalized by blinking LED diode D11 on the Qorivva MPC5604P controller board. Press UP + DOWN buttons (SW2/SW3 on the Qorivva MPC5604P controller board) simultaneously to clear fault status register once in a FAULT state. Application can be restarted by positioning RUN/STOP switch (SW4 on MPC5604P controller board) to RUN position (transition from STOP to RUN in case the switch was in RUN state when fault event occurred).

Application Control (continued)

5 If all LED-like indicators on the FreeMASTER control page are off, clear pending faults by pressing green circled button “FAULT CLEAR” on the FreeMASTER control page or alternatively by pressing UP+DOWN buttons (SW2/SW3 on the Qorivva MPC5604P controller board) simultaneously. RUN/STOP switch (SW4 on MPC5604P controller board) must be in the STOP position.

6 Start the application by pressing 1-APP_ON on the flip/flop (APP_ON/APP_OFF) switch on the FreeMASTER control page or by positioning RUN/STOP switch (SW4 on the Qorivva MPC5604P controller board) to the RUN position (transition from STOP to RUN in case the switch was in RUN state when fault event occurred).

7 Enter required speed by assigning this value to “Nreq” variable in variables watch window. Value is in revolutions per minute. Alternatively, rotor speed can be increased/decreased by pressing UP/DOWN switches on the Qorivva MPC5604P controller board. RUN/STOP switch (SW4 on MPC5604P controller board) must be in the START position.

8 Stop the application by pressing 0-APP_OFF on the flip/flop (APP_ON/APP_OFF) switch on the FreeMASTER control page or by positioning RUN/STOP switch (SW4 on MPC5604P controller board) to STOP position.

9 RESET the application anytime by pressing red circled button “APP_RESET” on the FreeMASTER control page.

:5604P Controller Board Jumper Options

Jumper	Selector	Function	Connections
JP1, JP2	CAN	Terminate CAN bus node	closed
JP104	MC33905 Debug Mode	Enter SBC driver MC33905 to debug mode	closed
JP105	MC33905 Save Mode	Enter SBC driver MC33905 to safe mode	closed
JP200	Resolver Enable	Resolver reference input signal from MCU disabled	open
		Resolver reference input signal from MCU enabled	
J203	Resolver REFSIN Input	Positive input for SIN OPAM is DC offset voltage set up by trimmer R209	closed
		Positive input for SIN OPAM is REFSIN input of resolver	
J204	Resolver COS Input	Positive input for COS OPAM is DC offset voltage set up by trimmer R209	1–2
		Positive input for COS OPAM is REFCOS input of resolver	
J205	Phase A Digital Signal	Resolver Phase A signal is connected to GPIO F[13]	2–3
		SIN/COS Phase A signal is connected to GPIO F[13]	
J206	Phase B Digital Signal	Resolver Phase A signal is connected to GPIO A[5]	1–2
		SIN/COS Phase A signal is connected to GPIO A[5]	
J2	Resolver Input Signal	Resolver reference signal is generated by GPIO C[11]	2–3
		Resolver reference signal is generated by GPIO C[12]	
J301	FAULT1 Selection	UNI-3 Phase A overcurrent signal is connected to FAULT1 input G[9]	1–2
		UNI-3 DC-bus overcurrent signal is connected to FAULT1 input G[9]	
J312	BOOT Selection	MPC5604P boot from internal flash	closed
J500	Encoder 0 Phase A	Encoder0 JP500 pin three PHASE A input signal is connected to GPIO A[0]	1–2
		UNI-3 BEMFZCA input signal is connected to GPIO A[0]	2–3

ᵖC5604P Controller Board Jumper Options *(continued)*

Jumper	Selector	Function	Connections
J501	Encoder 0 Phase B	Encoder0 JP500 pin four PHASE B input signal is connected to GPIO A[1]	1–2
		UNI-3 BEMFZCB input signal is connected to GPIO A[1]	2–3
J502	Encoder 0 Index	Encoder0 JP500 pin five INDEX input signal is connected to GPIO A[2]	1–2
		UNI-3 BEMFZCC input signal is connected to GPIO A[2]	2–3
J503	Encoder 0 Home	Encoder0 JP500 pin six HOME input signal is connected to GPIO A[3]	closed
	DC BUS Voltage	DC BSUS Voltage signal from UNI-3 is connected to GPIO B[13], ADC 1 input zero	R315 populated
	DC BUS Current	DC BUS Current signal from UNI-3 is connected to GPIO B[15], ADC 1 input two	R316 populated
	Analog Input 11	UNI-3 Phase A current is connected to GPIO B[9], ADC 0/1 input 11	R318 populated
		UNI-3 Phase A Back-EMF Voltage is connected to GPIO B[9]m ADC 0/1 input 11	R320 populated
	Analog Input 12	UNI-3 Phase B current is connected to GPIO B[10], ADC 0/1 input 12	R322 populated
		UNI-3 Phase B Back-EMF Voltage is connected to GPIO B[10]m ADC 0/1 input 12	R324 populated
	Analog Input 13	UNI-3 Phase C current is connected to GPIO B[11], ADC 0/1 input 13	R325 populated
		UNI-3 Phase C Back-EMF Voltage is connected to GPIO B[11]m ADC 0/1 input 13	R326 populated
	TEMP	UNI-3 Temperature signal is connected to ADC0 input zero	R328 populated
	SERIAL	UNI-3 Serial signal is connected to GPIO D[5]	R330 populated
	BRAKE	UNI-3 Brake output signal is connected to GPIO C[3]	R333 populated
	PFC	UNI-3 PFC output signal is connected to GPIO G[6] (PWMA3)	R334 populated
	PFC_EN	UNI-3 PFC Enable signal is connected to GPIO G[7] (PWMB3)	R335 populated
	PFC_ZC	UNI-3 PFC zero current signal is connected to GPIO G[5] (PWMX3)	R336 populated

Support

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

Warranty

Visit **freescale.com/warranty** for complete warranty information.

For more information, visit
freescale.com/automcdevkits

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