Fujitsu Semiconductor Europe
User Guide

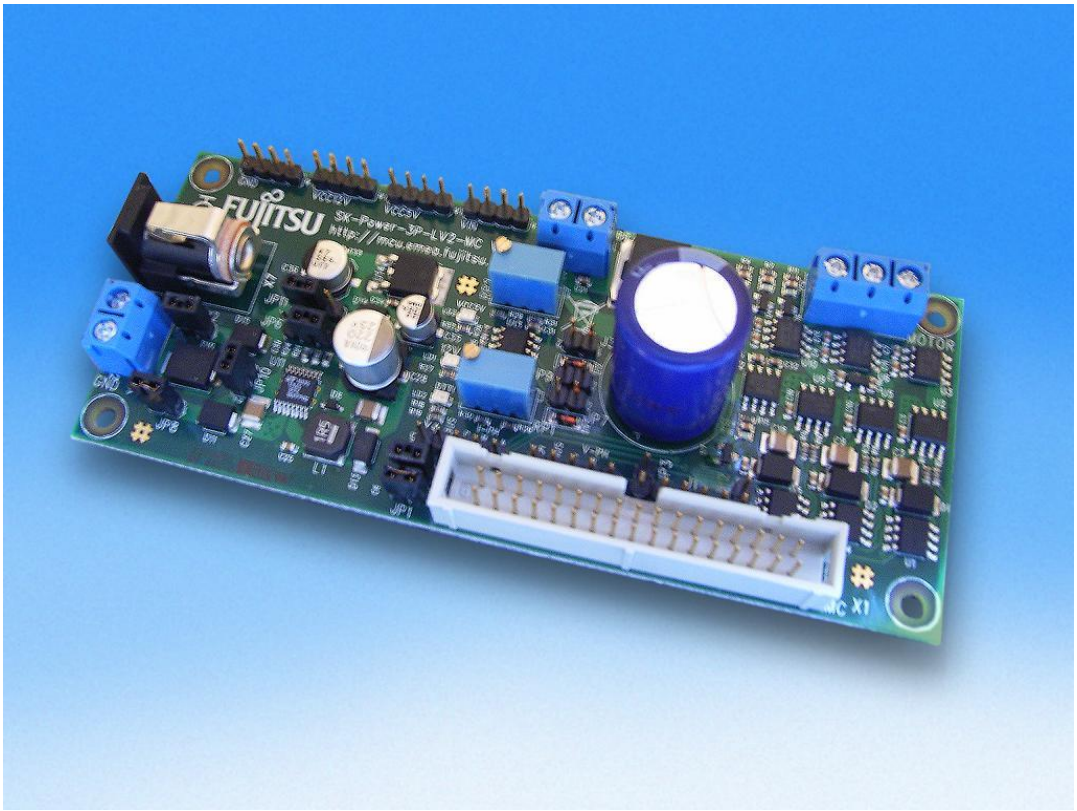
FMEMCU- UG-910093-10

MOTOR CONTROL

STARTER KIT

SK-POWER-3P-LV2-MC

USER GUIDE



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Revision History

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1. Overview

1.1 Abstract

The SK-Power-3P-LV2-MC is a StarterKit for low power motor control applications by using brushless DC or permanent magnet synchronous motors.

Software development is possible by connecting e.g. the SK-91580-001-MC via the motor drive connector (MC) to the SK-Power-3P-LV2-MC.

1.2 Features

- Low power electronic with gate drivers for three-phase motors up to 24V 8A
- Current measurement of all three phases and the power supply with hall sensors
- Voltage measurement of all three phases and the power supply
- Onboard overcurrent- and overvoltage-detection with LED and DTTI signal to connected StarterKit
- Onboard temperature sensor
- Extern attachable brake resistor control for motor brake
- 34 pin MC connector with all for motor control important signals
- Power supply via unregulated voltage of 9-15V or via DC link input (24V 8A max)

This board must only be used for test applications in an evaluation laboratory environment.

1.3 General Description

The SK-Power-3P-LV2-MC supports all Fujitsu StarterKits with –MC suffix, such as the SK-91580-001-MC.

The board can be used for development of automotive motor control applications in combination with a StarterKit such as the SK-91580-001-MC. The MC connector allocates for motor control important signals e.g. PWM and phase-current measurement signals. Additional a via the MC connector attached StarterKit (SK) can be powered with this connector.

By connecting an unregulated DC voltage of 12-15V to the connector X7 the onboard voltage regulators generate 12V and 5V voltage supply. If the connected motor depends to a voltage up to 24V a power supply via the two pin DC link X6 is necessary.

The board includes hall sensors, which delivers a proportional voltage to the measured current of the three phases and the power supply of the board. This voltage can be connected via the MC connector to analogue digital converter (ADC) pins of a microcontroller unit (MCU). The same measurement can be made with the voltage of each phase and the power supply.

The onboard overcurrent- and overvoltage detection has two potentiometers to adjust the voltage and current barrier suitable for the motor. If an overcurrent or overvoltage occurs the dead time timer interrupt (DTTI) signal deactivates the pulse width modulation (PWM) signal of the attached SK.

The temperature sensor located near the MOSFETs delivers a temperature proportional voltage which can be interpreted by the attached SK. That affords a detection of overheating.

An external brake resistor can get attached to brake the connected motor via a chopper output.

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2. Installation

Carefully remove the board from the shipping carton.

First, check if there are any damages before powering up the StarterKit.

For the power supply a DC input voltage of 12V – 15V is recommended. The positive voltage (+) must be connected to the center and ground (GND) must be connected to the shield of the connector X7!

If using a motor which depends more than 12V (up to 24V 8A max) a DC input voltage on X6 is necessary. The positive voltage (+) must be connected on Pin1 and ground (GND) must be connected to Pin2.

After power-on, the green power-on LED for VCC5V (LD3) and the green power-on LED for VCC12V (LD1) should illuminate. If the LEDs do not light switch off the power supply and check input polarity as well as the settings of JP6, JP8, JP10, JP11 and JP12.

3. Default Jumper Settings

The following table shows the default jumper settings. Check these jumper settings before powering the board.

Jumper	Description / Function	Type	Default Setting	Coordinates
JP1	VCC12V – MC Pin10,11	Jumper 2pin	closed	G9
JP2	OPT1 (Brake)	Jumper 2pin	open	K8
JP3	OPT6 (Temp)	Jumper 2pin	open	J8
JP4	GND - MC	Jumper 2pin	closed	G8
JP5	GND - PGND	Solder Jumper 2pin	closed	Bottom under connector X6
JP6	DCin = 12V / DCin > 12V	Jumper 3pin	1-2	E7
JP7	Overcurrent-DTTI	Jumper 2pin	open	H7
JP8	Vin (motor voltage) – logic power	Jumper 2pin	closed	C8
JP9	Overvoltage-DTTI	Jumper 2pin	open	H6
JP10	X6 – X7 (power supply)	Jumper 2pin	closed	D8
JP11	5V regulator input VCC12V/X7	Jumper 2pin	2-3	E6
JP12	X7 connected	Jumper 2pin	closed	C7

Table 1: Default jumper settings

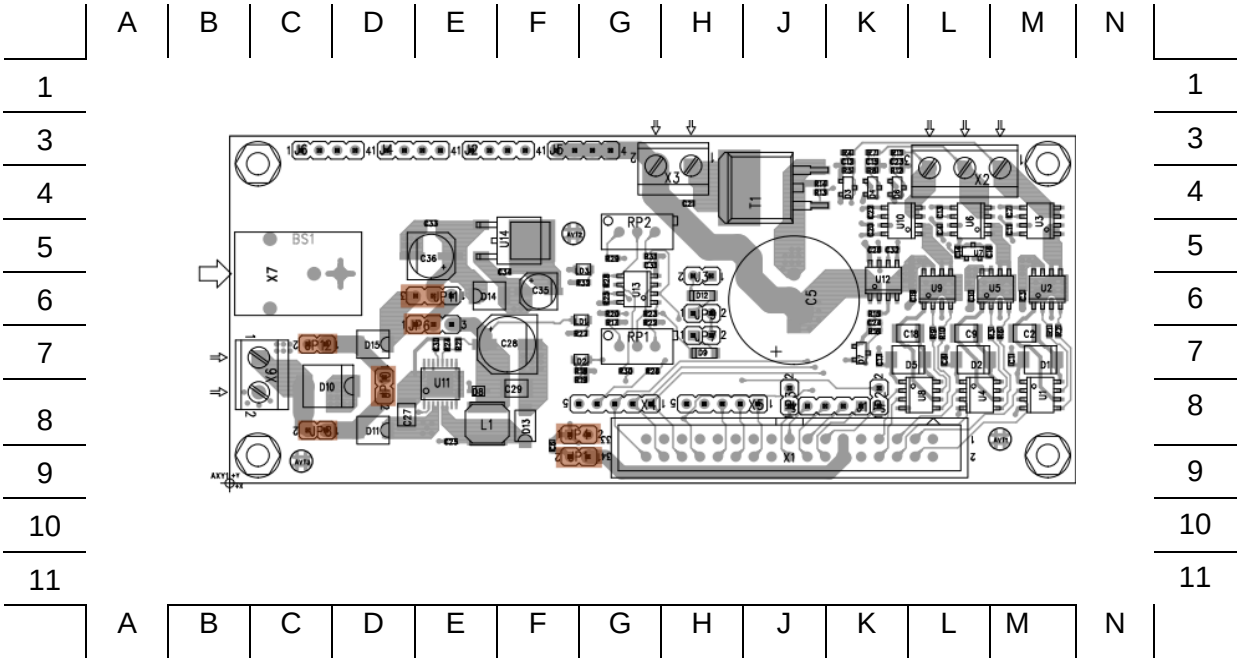

Figure 1: Jumper settings SK-Power-3P-LV2-MC

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4. Jumpers and Switches

This chapter describes the jumpers and switches which can be modified on the StarterKit. The default settings are shown in a grey shaded area.

4.1 Power Supply (JP6, JP8, JP10, JP11, JP12)

The onboard voltage regulators provide stabilized 12V and 5V.

JP5 Connects the logic power supply ground (GND) with the power supply ground (PGND).

JP6 Connects the VCC12V power supply of the board with the attached supply of the board (connected power supply 12V) or with the output of the 12V voltage regulator.

JP8 Connects the screw connector X6 with the logic power supply of the board. The logic can be powered via X7 and the motor apart via X6 by opening this jumper.

JP10 Connects the power supply via X7 with the motor supply Vin (12V motor).

JP11 Connects the input of the 5V voltage regulator with VCC12V or with the attached supply of the board.

JP12 Connects the connector X7 with the logic power supply of the board.

Jumper	Setting	Description
JP5	Closed	GND connected to PGND
	Open	GND and PGND separated
JP6	1-2	Board powered with 12V supply
	2-3	Board powered with >12V supply (24V max)
JP8	Closed	Logic power is connected to motor power
	Open	Logic power and motor power separated
JP10	Closed	X7 connected to motor supply (12V motor)
	Open	X7 power not used for motor supply
JP11	1-2	VCC12V connected to input 5V regulator
	2-3	X7 power connected to input 5V regulator
JP12	Closed	X7 power connected to logic power supply
	Open	X7 disconnected from board

Table 2: Power supply

4.2 Overcurrent and overvoltage Detection (JP7, JP9)

The overcurrent and the overvoltage detection signals are connected via the MC connector to the DTTI pin of the microcontroller. Each of both signals can get disconnected with a jumper.

JP7 Connects the overcurrent detection to the DTTI.

JP9 Connects the overvoltage detection to the DTTI.

Jumper	Setting	Description
JP7	Open	Overcurrent detection (DTTI) is disabled
	Closed	Overcurrent detection (DTTI) is enabled
JP9	Open	Overvoltage detection (DTTI) is disabled
	Closed	Overvoltage detection (DTTI) is enabled

Table 3: Overcurrent and overvoltage detection

With the potentiometer RP1 and RP2 the barrier of overcurrent and overvoltage detection can be adjusted. RP1 is for overcurrent and RP2 for overvoltage.

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5. Connectors

5.1 Power Connectors (X6, X7)

Figure 2 shows the power connector X7. An unregulated DC power supply of 12-15V can be attached to power the board. The anode of the power connector is the center pin and the ground is connected to the shield. The board is protected against an interchange of the pins.

Via this connector it is possible to power the logic on the board and a small 12V DC motor.

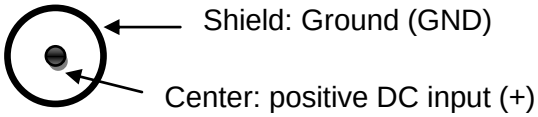

Figure 2: Power connector X7

To power a DC motor up to 24V 8A a power supply attached on the screw connector X6 shown in Figure 3 is necessary. Pin1 on the left (view from the connection side) is the VCC-pin and Pin2 the ground (PGND). On the board is a shottky diode which protects the external power supply against reverse current generated by the rotation of the motor.



Figure 3: Power connector X6

5.2 Brake Resistor Connector (X3)

The brake resistor connector is a two pin screw connector. A resistor can be attached to get a braking function of the motor. This could be necessary if the connected motor works in a generator mode and a heavy load is fixed on it. By braking the motor the DC link voltage rises. The capacities have to store this voltage and can get destroyed. A brake resistor protects the capacities by turning the energy of rotation into heat. The value of the power rating depends on the DC link voltage, the possible current generated by the motor and the load and the braking cycle in which braking can occur. The braking current should not exceed 6A in average and 15A peak to limit power dissipation of T1. Additional the switching frequency for T1 should not exceed 2-3 kHz to limit switching losses, especially at higher braking currents (low resistance, high voltage). T1 can be driven at 100% duty cycle (no bootstrap circuit).

5.3 Current- and Voltage-Measurement Connector (X4, X5)

For easy measuring each current and voltage of the phases the header connectors are attached on the board. On X4 the currents and on X5 the voltages can be gripped.

X4 pin	Signal	X5 pin	Signal
1	I Phase A	1	V Phase A
2	I Phase B	2	V Phase B
3	I Phase C	3	V Phase C
4	I DC Bus	4	V Bus Sense
5	GND	5	GND

Table 4: Current- and voltage-measurement connector

5.4 Motor Drive Connector MC (X1)

By using the motor drive connector (MC) X1 a StarterKit such as the SK-91580-001-MC can be connected for automotive applications e.g. brushless DC motor control. With pin 3-8 the motor is controlled by using pulsed signals from the MCU. The currents and voltages of each phase are delivered back to the MCU via this connector. The optional pins (OPT2-5) are connected to J1 for optional applications. Additional OPT6 can be used to get information about the temperature on the power electronic and OPT1 can be used to switch on an external attached brake resistor.

X1 pin	Signal	X1 pin	Signal
1	GND	**2**	GND
3	PWM1H	**4**	PWM1L
5	PWM2H	**6**	PWM2L
7	PWM3H	**8**	PWM3L
9	GND	**10**	GND
11	VCC12V	**12**	VCC12V
13	OPT1 (Brake)	**14**	OPT2
15	OPT3	**16**	OPT4
17	OPT5	**18**	OPT6 (TEMP)
19	Fault	**20**	DC bus voltage sense
21	Shield ground	**22**	Phase A voltage sense
23	Shield ground	**24**	Phase B voltage sense
25	Shield ground	**26**	Phase C voltage sense
27	Shield ground	**28**	DC Bus current sense

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29	Shield ground	**30**	Phase A current sense
31	Shield ground	**32**	Phase B current sense
33	Shield ground	**34**	Phase C current sense

Table 5: Motor drive connector

5.5 Motor Connector (X2)

Figure 4 shows the motor connector X2. The three phases of the motor can be attached to this connector.

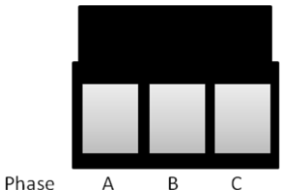

Figure 4: Motor connector

X2 pin	Signal
1	Phase A
2	Phase B
3	Phase C

Figure 5: Motor connector

6. Related Products

- SK-91580-001-MC — StarterKit with Fujitsus MB91580 microcontroller series and MC connector for motor control
- SK-91470-144PMC1-MC — Evaluation board with Fujitsus MB91470 microcontroller series and MC connector for motor control

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7. Information on the World Wide Web

Information about FUJITSU MICROELECTRONICS Products
can be found on the following Internet pages:

Microcontrollers (8-, 16- and 32bit), Graphics Controllers
Datasheets and Hardware Manuals, Support Tools (Hard- and Software)

http://mcu.emea.fujitsu.com/

Power Management Products

http://www.fujitsu.com/emea/services/microelectronics/powerman/index.html

Media Products: SAW filters, acoustic resonators and VCOs

http://www.yuden.co.jp/us/product/device/device00.html

For more information about FUJITSU MICROELECTRONICS

http://emea.fujitsu.com/semiconductor

8. China-RoHS regulation

Evaluation Board评估板

Emulation Board 仿真板

根据SJ/T11364-2006

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Consumables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consumables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures.

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Table of hazardous substances name and concentration

部件名称 Component Name	有毒有害物质或元素 Hazardous substances name					
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SK-Power-3P-LV2-MC	x	o	o	o	o	o

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下

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9. Recycling

Gültig für EU-Länder:

Gemäß der Europäischen WEEE-Richtlinie und deren Umsetzung in landesspezifische Gesetze nehmen wir dieses Gerät wieder zurück.

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