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FP-PWM-520 and cFP-PWM-520

Eight-Channel, 5 V or 10–30 V PWM Output Module

These operating instructions describe how to install and use the National Instruments FP-PWM-520 and cFP-PWM-520 pulse-width modulation modules (referred to inclusively as the [c]FP-PWM-520). For details on configuring and accessing the [c]FP-PWM-520 over a network, refer to the user manual for the FieldPoint network module you are using.

Features

The [c]FP-PWM-520 is a FieldPoint pulse-width modulation (PWM) output module with the following features:

- Eight PWM sourcing output channels
- 0 to 100% duty-cycle capability with 12-bit resolution
- Short-circuit protection for outputs
- Outputs source 5 VDC or 10–30 VDC
- Independent configuration of the output period for each channel from 1 to 65,535 ms in 1 ms increments
- On/Off LED indicators
- 2,300 V_{rms} transient overvoltage protection
- –40 to 70 °C operation
- Hot swappable

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NATIONAL INSTRUMENTS

Installing the FP-PWM-520

The FP-PWM-520 mounts on a FieldPoint terminal base (FP-TB-*x*), which provides operating power to the module. Installing the FP-PWM-520 onto a powered terminal base does not disrupt the operation of the bank.

To install the FP-PWM-520, refer to Figure 1 and complete the following steps:

1. Slide the terminal base key to either position X, used for any module, or position 4, used for the FP-PWM-520 module.
2. Align the FP-PWM-520 alignment slots with the guide rails on the terminal base.
3. Press firmly to seat the FP-PWM-520 on the terminal base. When the module is firmly seated, the terminal base latch locks it into place.

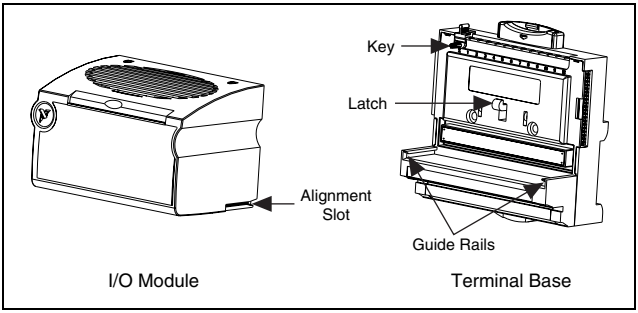


Figure 1. Installing the FP-PWM-520

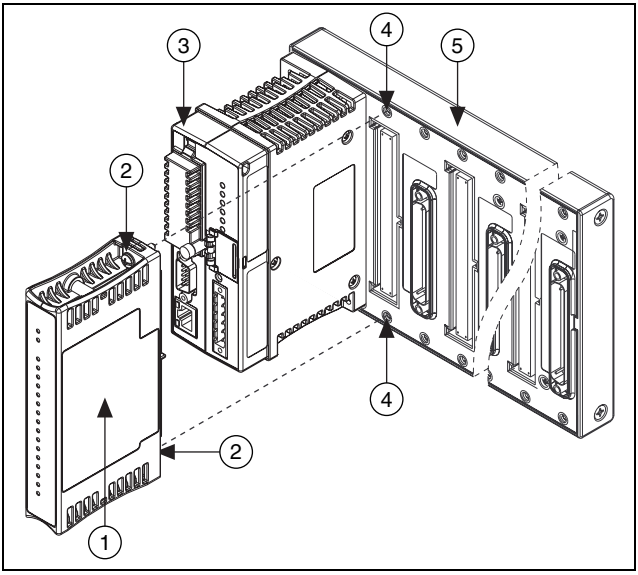
Installing the cFP-PWM-520

The cFP-PWM-520 mounts on a FieldPoint backplane (cFP-BP-*x*), which provides operating power to the module. Installing the cFP-PWM-520 onto a powered backplane does not disrupt the operation of the bank.

To install the cFP-PWM-520, refer to Figure 2 and complete the following steps:

1. Align the captive screws on the cFP-PWM-520 with the holes on the backplane. The alignment keys on the cFP-PWM-520 prevent backward insertion.

2. Press firmly to seat the cFP-PWM-520 on the backplane.
3. Using a number 2 Phillips screwdriver with a shank of at least 64 mm (2.5 in.) length, tighten the captive screws to 1.1 N · m (10 lb · in.) of torque. The nylon coating on the screws prevents them from loosening.



1 cFP I/O Module	4 Screw Holes
2 Captive Screws	5 cFP Backplane
3 cFP Controller Module	

Figure 2. Installing the cFP-PWM-520

Wiring the [c]FP-PWM-520

The FP-TB-*x* terminal base has connections for each of the eight output channels and for an external power supply to power the output channels and field devices. The cFP-CB-*x* connector block provides the same connections. Each channel has one output terminal (V_{OUT}), one supply terminal (V_{SUP}), and two common terminals (COM). All eight channels are referenced to the COM terminals. The V and V_{SUP} terminals are all internally connected, as are the C and COM terminals.

Use a 5 VDC or 10–30 VDC external power supply for the output channels. The power supply must provide enough current to power all of the loads on the output channels, up to a maximum of 1 A per channel. Connect the external power supply to multiple V and V_{SUP} terminals and to multiple C and COM terminals as needed to ensure that the maximum current through any terminal is 2 A or less.

Install a 2 A maximum, fast-acting fuse between the external power supply and the V_{SUP} terminal on each channel. Install a 1 A maximum, fast-acting fuse suitable for the load at the V_{OUT} terminal. Figure 3 shows fuses where appropriate.

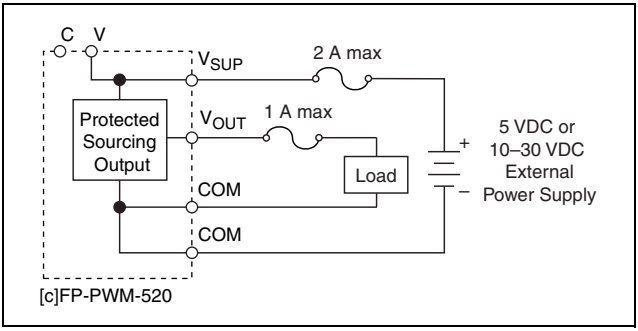


Figure 3. Wiring the [c]FP-PWM-520

Caution Maximum output current for the cFP-PWM-520 is lower than 1 A if the module is operating in the 50–70 °C temperature range. Refer to the *Specifications* section for more information, and select fuses for the V_{OUT} terminals accordingly.

Table 1 lists the terminal assignments for the signals of each channel. Terminal assignments are also listed on the side panel of the cFP-PWM-520 and under the slide-in card on the front of the FP-PWM-520.

Table 1. Terminal Assignments

Channel	Terminal Numbers		
	V_{OUT}[1]	V_{SUP}[2]	COM
0	1	17	2, 18
1	3	19	4, 20
2	5	21	6, 22
3	7	23	8, 24
4	9	25	10, 26
5	11	27	12, 28
6	13	29	14, 30
7	15	31	16, 32

[1] Install a 1 A maximum, fast-acting fuse on each V_{OUT} terminal.
[2] Install a 2 A maximum, fast-acting fuse on each V_{SUP} terminal.

Pulse-Width Modulator Output Circuit

The [c]FP-PWM-520 output channels are optically isolated from the rest of the FieldPoint bank. The channels are sourcing outputs with short-circuit protection circuitry. Sourcing current means that the V_{OUT} terminal provides a path to a voltage supply. In the ON state of the output period, a transistor is turned on between V_{SUP} and V_{OUT}. In the OFF state, this transistor is turned off, allowing only a small leakage current to flow.

In the ON state, the effective resistance between V_{OUT} and V_{SUP} is typically 0.3 Ω. This resistance causes a voltage drop between the external supply voltage and the output voltage. For example, if the external supply voltage is 5 V and the output current is 1 A, the output voltage is 4.7 V:

$$5\ V - (1\ A \times 0.3\ \Omega) = 4.7\ V$$

Short-Circuit Protection

If the protection circuitry detects a short-circuit condition on an output channel, it disables the output. If the protection circuitry disables an output that would otherwise be in the ON state, the status indicator for that channel is still lit, but the output transistor is turned off.

Detecting a Short-Circuit Condition

To determine whether a channel is in a short-circuit condition, complete the following steps:

1. In FieldPoint software, set the duty cycle to 100% for the channel in question. Refer to the *Configuring the Output Channels* section for more information about configuring the duty cycle.
2. Measure the voltage between the V_{OUT} and V_{SUP} terminals for that channel.

   Under normal load conditions, the V_{OUT}-to-V_{SUP} voltage is less than 1 V when the output is ON continuously. Any voltage higher than 1 V indicates a short circuit. Typically, the V_{OUT}-to-COM voltage is almost zero if the protection circuitry is activated.

Resetting a Channel in a Short-Circuit Condition

To reset a channel in a short-circuit condition, determine the cause of the condition and disconnect the load from the channel. The channel resets automatically when the load is removed.

Alternatively, if completely removing the channel load is not convenient, reset the channel in any of the following ways:

- In FieldPoint software, set the duty cycle to 0%. The channel resets immediately.
- Disconnect the external power supply from the [c]FP-PWM-520.
- Remove the [c]FP-PWM-520 from the terminal base or backplane.
- Power off the network module connected to the [c]FP-PWM-520.

Normal operation can resume after you correct the short-circuit condition.

Configuring the Output Channels

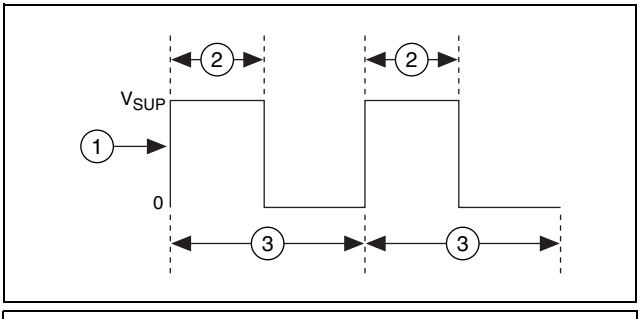
A [c]FP-PWM-520 output channel uses period and duty-cycle settings to determine when the channel is on or off. To configure the period, complete the following steps in the FieldPoint software:

1. In the Channel Configuration dialog box, select **Period** from the Attribute menu.
2. Enter an integer between 1 ms (1 kHz) and 65,535 ms (0.01525 Hz) in the Value field.

To configure the duty cycle, write to the channel for which you want to set the duty cycle. The duty cycle is the proportion of time that the PWM signal is ON over the period.

$$Duty\ Cycle = \frac{On\ Time}{Period} \times 100$$

Enter a value from 0 to 100 to set the duty cycle. The duty cycle has 12-bit resolution (4,096 discrete duty-cycle settings).



1 PWM Output 2 On Time 3 Period

Figure 4. Period and Duty Cycle of a PWM Output

Status Indicators

Figure 5 shows the status indicator LEDs on the [c]FP-PWM-520.

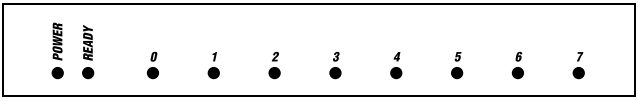


Figure 5. Status Indicators

The [c]FP-PWM-520 has two green status LEDs, **POWER** and **READY**. After you insert the FP-PWM-520 onto a terminal base or the cFP-PWM-520 onto a backplane and apply power to the connected network module, the green **POWER** indicator lights and the [c]FP-PWM-520 informs the network module of its presence. When the network module recognizes the [c]FP-PWM-520, it sends initial configuration information to the [c]FP-PWM-520. After the [c]FP-PWM-520 receives this initial information, the green **READY** indicator lights and the module is in normal operating mode.

In addition to the green **POWER** and **READY** indicators, each channel has a numbered, green status LED that lights when the channel is in the ON state.

Upgrading Your FieldPoint Firmware

You may need to upgrade your FieldPoint firmware when you add new I/O modules to your FieldPoint system. For information on determining which firmware you need and how to upgrade your firmware, go to `ni.com/info` and enter `fpmatrix`.

Isolation and Safety Guidelines

Caution Read the following information before attempting to connect the [c]FP-PWM-520 to any circuits that may contain hazardous voltages.

This section describes the isolation of the [c]FP-PWM-520 and its compliance with international safety standards. The field wiring connections are isolated from the backplane and the inter-module communication bus. The isolation is provided by the module, which has optical and galvanic isolation barriers designed and tested to protect against transient fault voltages of up to 2,300 V_{rms}.

Follow these guidelines to ensure a safe total system.

- The [c]FP-PWM-520 has a safety isolation barrier between the I/O channels and the inter-module communication bus. There is no isolation between channels unless otherwise noted. If any of the channels on a module are wired at a hazardous potential, make sure that all other devices or circuits connected to that module are properly insulated from human contact.
- Do *not* share the external supply voltages (the V and C terminals) with other devices (including other FieldPoint devices), unless those devices are isolated from human contact.
- For Compact FieldPoint, you *must* connect the protective earth (PE) ground terminal on the cFP-BP-*x* backplane to the system safety ground. The backplane PE ground terminal has the following symbol stamped beside it: ⏚. Connect the backplane PE ground terminal to the system safety ground using 14 AWG (1.6 mm) wire with a ring lug. Use the 5/16 in. panhead screw shipped with the backplane to secure the ring lug to the backplane PE ground terminal.
- As with any hazardous voltage wiring, make sure that all wiring and connections meet applicable electrical codes and commonsense practices. Mount terminal bases and backplanes in an area, position, or cabinet that prevents accidental or unauthorized access to wiring that carries hazardous voltages.
- Operate the [c]FP-PWM-520 only at or below Pollution Degree 2. Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Refer to the FieldPoint product label for regulatory certification under hazardous location standards. If the FieldPoint product is not certified for operation in hazardous locations, do not operate it in an explosive atmosphere or where there may be flammable gases or fumes.

Specifications

The following specifications are typical for a range of –40 to 70 °C unless otherwise noted.

Output Characteristics

Number of channels 8

Output type ..... Sourcing

Output voltage ..... *Supply voltage* – (*Output current* × *Output impedance*)

Supply voltage ..... 5 VDC or 10 to 30 VDC, user-provided

Maximum output current

Per channel

Module	Temperature Ranges		
	–40 to 50 °C	**50 to 60 °C**	**60 to 70 °C**
cFP-PWM-520	1 A	0.75 A	0.5 A
FP-PWM-520	1 A	1 A	1 A

Output impedance ..... 0.3 Ω typical

Pulse-width accuracy ..... –1, +3 µs, any period and duty cycle

Physical Characteristics

Indicators ..... Green **POWER** and **READY** indicators, eight green output state indicators

Weight

FP-PWM-520 ..... 140 g (4.9 oz)

cFP-PWM-520 ..... 110 g (3.9 oz)

Power Requirements

Power from network module ..... 1 W

Isolation Voltage

Channel-to-channel isolation ..... No isolation between channels

Transient overvoltage ..... 2,300 V_{rms}

Environmental

FieldPoint modules are intended for indoor use only. For outdoor use, they must be mounted inside a sealed enclosure.

Operating temperature ..... –40 to 70 °C

Storage temperature ..... –55 to 85 °C

Humidity ..... 10 to 90% RH, noncondensing

Maximum altitude..... 2,000 m; at higher altitudes the isolation voltage ratings must be lowered

Pollution Degree 2

Shock and Vibration

These specifications apply only to the cFP-PWM-520.
NI recommends Compact FieldPoint if your application is subject to shock and vibration.

Operating vibration, random (IEC 60068-2-64)..... 10–500 Hz, 5 g_{rms}

Operating vibration, sinusoidal (IEC 60068-2-6)..... 10–500 Hz, 5 g

Operating shock (IEC 60068-2-27)..... 50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 3121-1, UL 61010C-1
- CAN/CSA C22.2 No. 1010.1

For UL, hazardous location, and other safety certifications, refer to the product label or to `ni.com`.

Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) Compliant

Emissions ..... EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity ..... EN 61326:1997 + A2:2001, Table 1

Note For EMC compliance, you *must* operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE Marking, as follows:

Low-Voltage Directive (safety) 73/23/EEC

Electromagnetic Compatibility Directive (EMC) 89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declarations of Conformity Information** at `ni.com/hardref.nsf/`.

Mechanical Dimensions

Figure 6 shows the mechanical dimensions of the FP-PWM-520 installed on a terminal base. If you are using the cFP-PWM-520, refer to your Compact FieldPoint controller user manual for the dimensions and cabling clearance requirements of the Compact FieldPoint system.

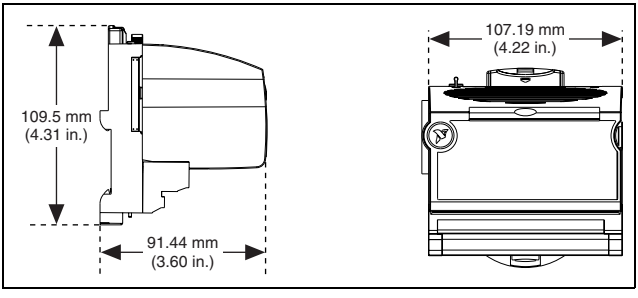


Figure 6. FP-PWM-520 Mechanical Dimensions

Where to Go for Support

For more information about setting up the FieldPoint system, refer to these National Instruments documents:

- FieldPoint network module user manual
- Other FieldPoint I/O module operating instructions
- FieldPoint terminal base and connector block operating instructions

Go to `ni.com/support` for the most current manuals, examples, and troubleshooting information.

For telephone support in the United States, create your service request at `ni.com/ask` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

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Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24,
Germany 49 0 89 741 31 30, Greece 30 2 10 42 96 427,
India 91 80 51190000, Israel 972 0 3 6393737,
Italy 39 02 413091, Japan 81 3 5472 2970,
Korea 82 02 3451 3400, Malaysia 603 9131 0918,
Mexico 001 800 010 0793, Netherlands 31 0 348 433 466,
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Poland 48 0 22 3390 150, Portugal 351 210 311 210,
Russia 7 095 238 7139, Singapore 65 6226 5886,
Slovenia 386 3 425 4200, South Africa 27 0 11 805 8197,
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