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Power Cube Stepping Motor Drive with Pulse and Direction
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GE Fanuc Automation

Programmable Control Products

Power Cube™ Stepping Motor Drive with Pulse and Direction Interface

User's Manual

GFK-2210

July 2002

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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Content of this Manual

This manual applies to the following Motion product:

IC800PCUB00300A

Related Publications

Additional information about Motion solutions is available at
<http://www.gefanuc.com/support/plc/m-MotionSolutions.htm>.

Motion

IC800PCUB00300A

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Power Cube™ Stepping Motor Drive with Pulse and Direction Interface

This document provides reference information, and setup and installation procedures for the Power Cube Stepping Motor Drive equipped with Pulse and Direction Interface.

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1. Specifications

Table 1. Specifications for Power Cube Stepping Motor Drive

Pulse and Direction Inputs	
Input Format	+4 Vdc Pulse/Direction; +24 Vdc Pulse/Direction differential, optically isolated
Input Voltage Range	3.5 – 4.2 Vdc for +4 V input; 12 – 30 Vdc for +24 V input
Maximum Input Pulse Rate	50 kHz
Minimum Pulse Width	5 microseconds
Digital Inputs and Outputs	
Dedicated Inputs	Enable, power save
Dedicated Outputs	OK, Stall
Operating Range	4 – 24 Vdc, 30 Vdc maximum
Interface Format	optically isolated, source/sink user configurable
Maximum Off Input Voltage	1 Vdc
Minimum On Input Voltage	4 Vdc
Input Load	1K Ohms
Maximum On Output Resistance	35 Ohms
Maximum Load Output Current	100 mA
Maximum Off Output Leakage Current	200 nA
Step Size Selection	200, 400, or 1000 steps/revolution (See table 3.)
DC Input Power Requirements	
Drive	24 Vdc +/- 20% @ 3.1 Amps max. ^(a) 48 Vdc +/- 10% @ 3.1 Amps max. ^(a)
Overvoltage Threshold	54 Vdc +/-2 Vdc
Undervoltage Threshold	18 Vdc +/-2 Vdc
Output Power	
Voltage range	17 to 38 Vrms 2 phase
Frequency	0 – 8 KHz fundamental (16.4 KHz PWM)
Current ^(b)	4 A rms per phase
Environmental Specifications	
Operating Temperature, Free Air Ambient	0 to 50 degrees C. @ 3 Amps 0 to 45 degrees C. @ 4 Amps
Storage and Shipping Temperature	-40 to 80 degrees C.
Enclosure Type	Encapsulated

Notes: (a) DC input power has undervoltage and overvoltage detection.

(b) The outputs are provided with internal overload protection.

2. Installation and Set-up

Installation

Location

For best performance, install the Power Cube in a location that provides natural convection airflow. If the operating environment is likely to exceed the normal operating temperature range, use fan cooling to maintain full current output.

Wiring

The I/O pinout and power connections are included in “User Connections.”

General Wiring Considerations

All power must be in accordance with Class I, Division 2 wiring methods as defined in Article 501-4(b) of the National Electrical Code, NFPA 70 for installations within the United States, or as specified in Section 18-152 of the Canadian Electrical Code for installation within Canada.

Attach wiring connections for the main circuit according to table 2 while observing the following cautions:

Caution

- Never connect AC main power to any terminal.
- Never allow wire leads to contact the enclosure.
- Never operate the unit without an earth ground.

Warning

When using this equipment in a Hazardous (classified) location:

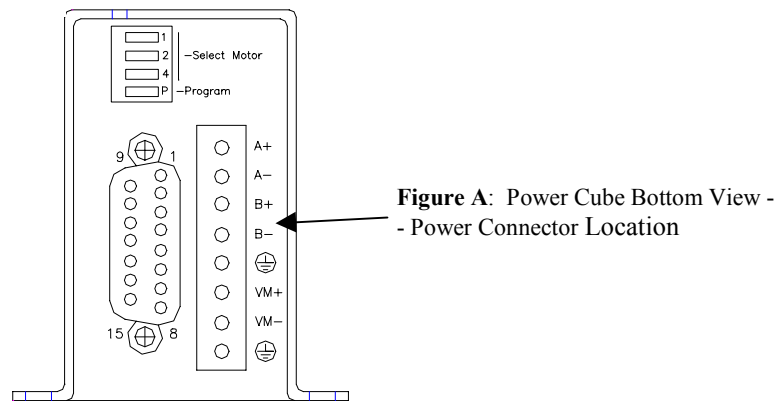
- A. **WARNING--Explosion hazard--substitution of components may impair suitability for Class I, Division 2;**
- B. **WARNING--Explosion hazard--when in hazardous locations, turn off power before replacing or wiring modules;**
- C. **WARNING--Explosion hazard--do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.**

Power

Table 2. Power Cube Wiring Connections for Main Circuit

Terminal Symbol	Description	Connect to	Wire Size AWG ¹
A+	Phase A Positive	Phase A Positive Motor Connection	18
A-	Phase A Negative	Phase A Negative Motor Connection	
B+	Phase B Positive	Phase B Positive Motor Connection	
B-	Phase B Negative	Phase B Negative Motor Connection	
⊕	Earth Ground	System Power Earth Ground	
VM+	System Power +	System Power Positive Connection	
VM-	System Power -	System Power Negative Connection	
⊕	Earth Ground	System Power Earth Ground	

¹ Suggested maximum AWG size (i.e., minimum wire diameter) for stranded copper wire, 20m. max. Consult *National Electrical Code Handbook* ampacities tables for proper wire size.



System Power Wiring and Grounding

The DC power input connections are made to the connector located on the bottom of the Power Cube (see figure A). The unit is designed to operate with input voltages of 24 Vdc or 48 Vdc.

Motor Power Wiring

Power Cube motor power cables are available and from GE Fanuc as CBL-13-MD-xx (standard motors) and CBL-13-MP-xx (splash-proof motors), where xx indicates the cable length of 10, 20, or 30 feet. To connect Power Cube motor power, connect the flying leads from the motor power cable to the power connector on the bottom of the unit. Connect the opposite end of the cable to the mating connectors on the motor. GE Fanuc motor power cables ship with flying leads labeled with their appropriate connections: A+, A-, B+, B-, and Ground (see table 2 for connection descriptions).

DB15 Logic Wiring

The pulse input and the direction input offer interface flexibility by providing inputs for either +24V or +4V operation. For example, when wiring for an input voltage operating range of +4V, pin 9 would connect to the pulse source output positive and pin 2 would connect to the pulse source output negative, while pin 1 would be left floating. Logic I/O cables are available prewired for 200, 400, or 1000 steps/revolution, and the power save function activated.

Warning

Do not connect a +24 Vdc signal to a +4 Vdc input. Circuit damage will result.

Observe input voltage range specifications from table 1.

Table 3. Motor Cube Wiring Connections for DB15 Logic I/O

Pin	Label	Description	Connect to	Wire Size AWG ^a
1	Pulse + (24V)	+24 Vdc Pulse Input Positive	+24 Vdc Pulse Source Output Positive	28
2	Pulse -	Pulse Input Negative	Pulse Source Output Negative	28
3	Direction + (4V)	+4 Vdc Direction Input Positive	+4 Vdc Direction Source Output Positive	28
4	Input Common	Input Common	Common for Power Save and Enable Inputs	28
5	Power Save ^b	Power Save Input	Apply +4 to +24 Vdc with respect to Pin 4 or float	28
6	Stall Output ^c	Stall Output	Stall Output to User, Referenced from Pin 14	28
7	Step Size Select A ^d	Step Size Select A	Either Short to Pin 8 or leave open	28
8	Step Size Common ^d	Step Size Common	Pin 7 or Pin 15. DO NOT CONNECT TO INPUT COMMON.	28
9	Pulse + (4V)	+4 Vdc Pulse Input Positive	+4 Vdc Pulse Source Output Positive	28
10	Direction + (24V)	+24 Vdc Direction Input Positive	+24 Vdc Direction Source Output Positive	28
11	Direction -	Direction Input Negative	Direction Output Negative	28
12	Enable Input	Enable Input	Apply +4 to +24 Vdc with Respect to Pin 4 to Enable. Sink or source current per discrete I/O diagram shown in “User Connections” to enable the drive. If open, or floating, the drive is disabled.	28
13	OK Output ^c	OK Output	OK Output to User Referenced from Pin 14	28
14	Output Common	Output Common	Common Ground for OK and Stall Outputs	28
15	Step Size Select B ^d	Step Size Select B	Either short to Pin 8 or leave open	28

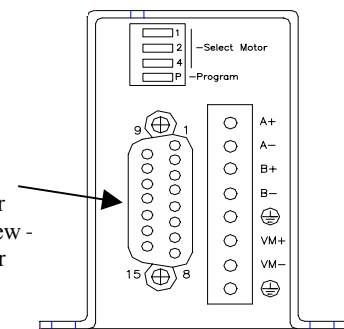
Notes:

- a. Suggested maximum AWG size (i.e., minimum wire diameter) for stranded copper wire. Consult National Electrical Code Handbook ampacities tables for proper wire size.
- b. For 100% continuous current, sink or source current per discrete I/O diagram shown in “User Connections.” If open, or floating, current is reduced to 60%.
- c. Output on, or true, = internally shorted to pin 14;
Output off, or false = internally open to pin 14.
- d. Step Size Selection:

A	B	Step Size	Logic I/O Cable
open	open	Full Stepping (200 steps/rev)	IC800PCUB02Sxxx
open	short	Half Stepping (400 steps/rev)	IC800PCUB04Sxxx
short	open	Microstepping (1,000 steps/rev)	IC800PCUB10Sxxx

Short = Connect to Step Size Common
xxx=030 for 3meter or 050 for 5-meter cable

Figure B: Power Cube Bottom View - DB-15 Connector



Motor Direction

Determine motor direction by viewing the motor shaft from the front of the motor. The motor shaft rotates clockwise under the following conditions:

Clockwise voltage applied to +4V direction input is < 3.5 Vdc
 voltage applied to +24V direction input is < 12 Vdc

The motor shaft rotates counterclockwise under the following conditions:

Counterclockwise voltage applied to +4V direction input = $3.5 - 4.2$ Vdc
 voltage applied to +24V direction input = $12 - 30$ Vdc

Direction inputs are located on the DB15 connector shown in figure B.

Power Save

The Power Save feature allows the user to select 100% or 60% continuous current. The 60% current power save setting will reduce motor heating and input power consumption. You can apply 60% current selectively or continuously. Selective 60% continuous current, for example, could be applied when the motor is stopped yet enabled. Continuous 60% continuous current would result in reduced torque performance. See table 3 on the previous page for Power Save wiring connections.

Front Panel LED

LEDs located on the front of the unit indicate power and drive status.

Table 4 Power Cube LEDs

Power Status		
GREEN	OK	--
FLASHING GREEN	Wiring Fault	Cable run too long; Motor wiring not connected.
RED	Over Voltage	Check power supply & wiring
YELLOW	Under Voltage	
OFF	No Power	Check voltage supply & wiring
Drive Status		
GREEN	OK	--
RED	Over Current	Check motor wiring
YELLOW	Stall	Check motor load; use slower accel/decel. Check motor wiring. Verify correct Dip switch setting for motor (see table 5).
OFF	Disabled	--

Location of LEDs



The Undervoltage, Over Current, Over Voltage, Wiring Fault, and Lost Enable fault conditions disable the drive in the Power Cube.

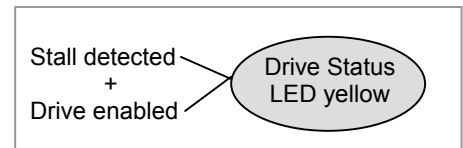
Stall Output Behavior

Stall output is triggered when both of the following conditions exist for a minimum duration of 100 milliseconds:

Motor is commanded at a velocity greater than the minimum velocity (stall velocity threshold) listed in table 5.

Motor must be stalled (i.e., not moving while being commanded to move).

A STALL CONDITION DOES NOT DISABLE THE DRIVE. During a stall condition, the stall output is turned on, but the drive remains enabled. The Status LED turns yellow to indicate that a stall has occurred. Monitor the stall output at your discretion.



Dip Switch Settings

DIP switches located on the bottom of the unit set up the Power Cube to operate with the proper stepping motor. **On power up**, the Power Cube reads the DIP switches and configures the firmware to run with the selected motor. If you change DIP switch settings on-the-fly, you must cycle power before your settings will be recognized by the Power Cube. Ensure that the selected motor is wired with the proper connection, either parallel or series, as indicated in table 5. The unit will operate at the designated current for the selected motor.



Warning

The motor you select with the Power Cube DIP Switches must match the actual motor that you are using both in model number and in wiring for either parallel or series. Selecting the wrong motor can cause motor failure and damage.

Table 5. Power Cube Motor Selection Settings

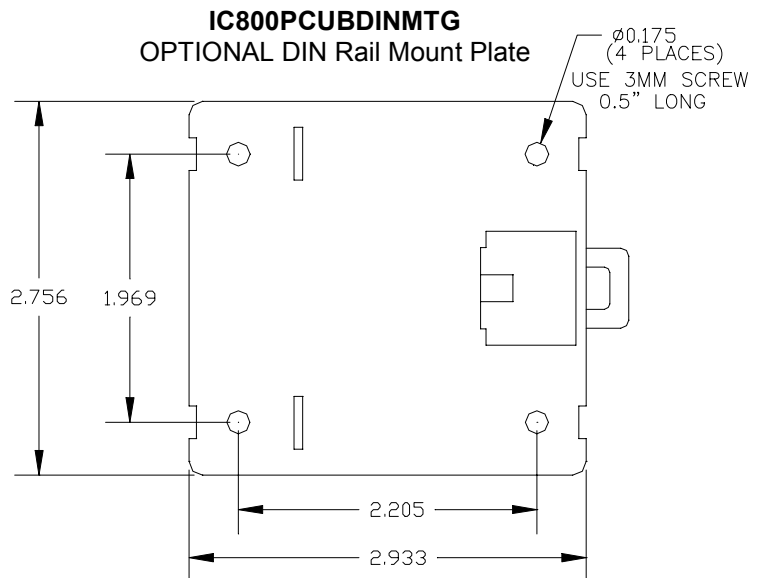
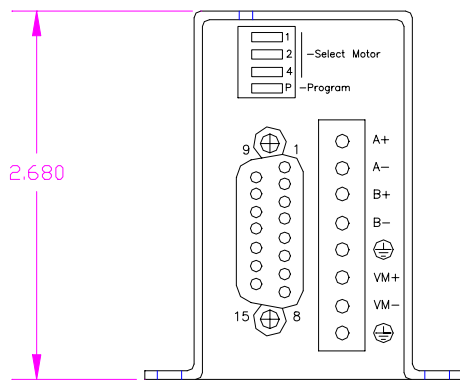
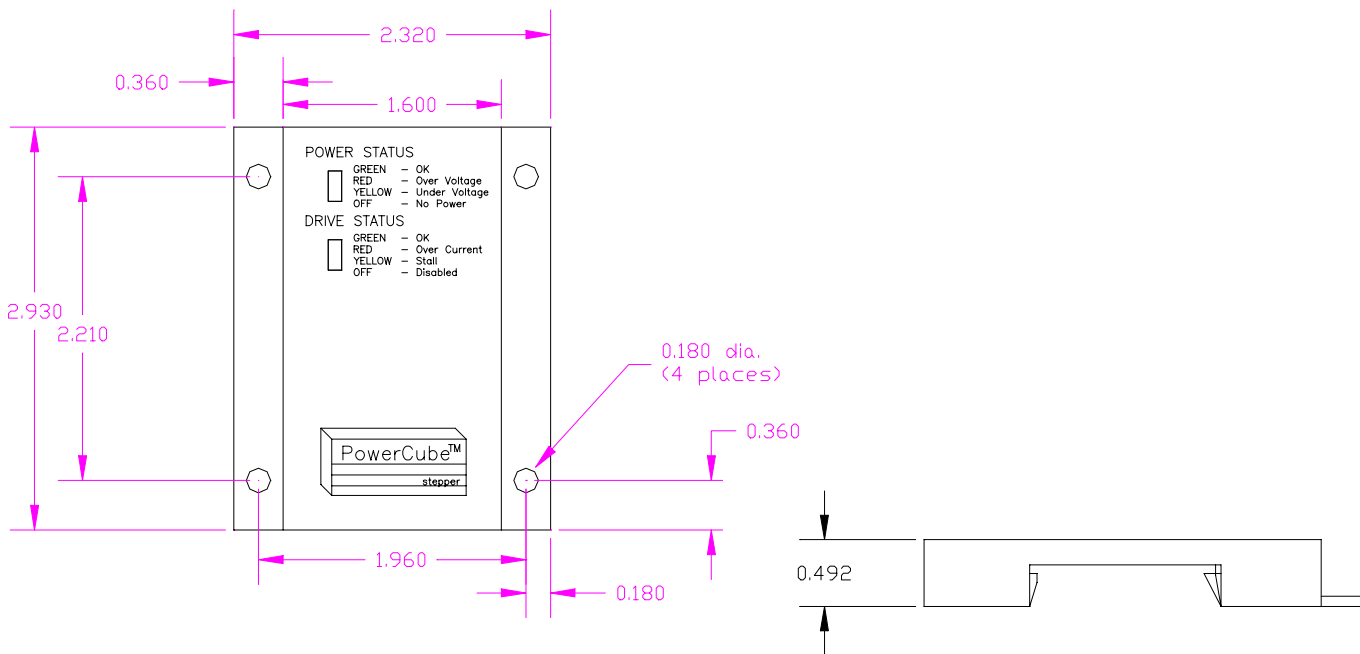
GE Fanuc Motor	Switch Location				Connection	Amps RMS at 100% Current	Amps RMS at 60% current	Stall Velocity Threshold RPS
	1	2	4	PRG				
MTR-1216-_-A	Off	Off	Off	Off	Parallel	2.5	1.5	9
MTR-1220-_-D	On	Off	Off	Off	Series	2.5	1.5	4
Reserved	Off	On	Off	Off	—	—	—	—
MTR-1235-_-D	On	On	Off	Off	Series	3.0	1.8	3
Reserved	Off	Off	On	Off	—	—	—	—
MTR-1331-J-_-D	On	Off	On	Off	Series	4.0	2.4	4
MTR-1N31-I-_-D	Off	On	On	Off	Series	4.0	2.4	4
Reserved	On	On	On	Off	—	—	—	—

3. Mechanical Drawing

Mechanical Specifications

The Power Cube is available from GE Fanuc as model IC800PCUB00300A. An optional adapter is available to convert the Power Cube's DB15 connector to a 15 pin screw terminal. Contact your GE Fanuc sales representative or distributor and reference part number IC800PCUBDB15ADP for further information. The optional IC800PCUBDINMTG adapter allows the Power Cube to be easily mounted to a DIN rail.

Weight: 12 oz.



4. User Connections

Power Cube with Pulse and Direction Interface User Connections

