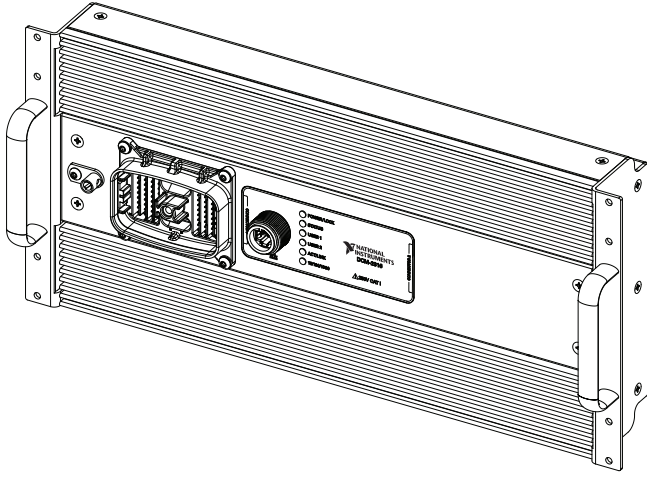# GETTING STARTED GUIDE
NI DCM-23XX

Embedded Direct Injector Control and Measurement (DCM) Device
with Real-Time Processor and Reconfigurable FPGA

Hazardous Voltage This device sources hazardous voltages up to 250V. You must take the following precautions. A hazardous voltage is a voltage greater than 42.4 Vpk voltage or 60 VDC to earth ground.

Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Caution Do not mix hazardous voltage circuits and human-accessible circuits in the same cable unless the cables are properly insulated for min. 250V.

Caution Ensure that devices and circuits connected to the module are properly insulated from human contact.

Caution Except for the isolated RS232, CAN, IGND, IO Lock terminals, and the Ethernet Port, all I/O terminals are hazardous voltage LIVE (> 42.4 Vpk/60 VDC) or could be at hazardous potential. You must ensure that devices and circuits connected to the module are properly insulated from human contact. External protection must be provided to protect any other devices connected to the BATT, DRVP, and MPRD supplies.

NATIONAL INSTRUMENTS

⚠ **Caution** Do not operate the DCM in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

⚠ **Caution** Do not disconnect the power supply wires and connectors from the controller unless power has been switched off.

About This Manual

This document explains how to begin using the National Instruments DCM family of devices. The scope is limited to focus on initial DCM startup and basic operation using the DCM Starter Harness and DSI software. For more detailed information on DCM hardware or software, refer to the *Related Documentation* section of this guide.

Preparing the Environment

Ensure that the environment in which you are using the DCM meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55°C
Operating humidity (IEC 60068-2-56)	10% RH to 90% RH, non-condensing
Pollution Degree (IEC 60664)	2
Maximum altitude	2,000 m

📝 **Note** Refer to the device specifications on `ni.com/manuals` for complete specifications.

Identifying the Hardware

The following section includes identification of DCM kit contents and all other required components.

Verifying Kit Contents

Verify that the following item(s) are included in the DCM kit:

• DCM with rack-mount end plates
• NI DCM-23XX Getting Started Guide
• NI DCM-23XX Specifications Guide

Required Components (Not Included)

The following items are necessary to set up and use the NI DCM using this document:

- Host/Development PC running Windows 7/8.1/10
- DCM Starter Harness
- PDU-2300
- 12 V or 24 V DC power supply, 180 W[1] minimum DC power supply

Software Installation

The DCM may be used with several different software personalities. Each personality requires different software packages to be installed on the host computer which may need to be individually licensed.

NI Powertrain Controls supports the following software personalities for the DCM:

- DCM Default Software Image (DSI)
- NI LabVIEW
- NI VeriStand

DCM Default Software Image (DSI)

Before using the DCM DSI, you must install the following application software and device drivers on the host computer in this order:

- NI CompactRIO Device Drivers 16.0 or later
- Software Calibration Management (SCM) Toolkit 2016 or later (evaluation license)

📝 **Note** The DCM is shipped supporting the latest version of SCM. If you have trouble launching the DCM DSI with the latest available version of SCM on ni.com, the software on your DCM may need to be updated. Refer to the *NI DCM-23XX DSI User Guide* for more information.

For minimum software support information, visit ni.com/info and enter the Info Code swsupport.

DCM With LabVIEW

Before using the DCM with LabVIEW, you must install the following application software and device drivers on the host computer in this order:

- LabVIEW 2016 or later
- LabVIEW Real-Time Module 2016 or later
- LabVIEW FPGA Module 2016 or later

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[1] Minimum power supply requirements assume basic operation; actual power supply requirements will vary depending on hardware and software configuration.

- NI CompactRIO Device Drivers 16.0 or later
- NI Powertrain Controls Device Drivers 2.160.0.0 or later

The NI Powertrain Controls Device drivers may be installed using JKI Software's VI Package Manager. For minimum software support information, visit `ni.com/info` and enter the Info Code `swsupport.`

DCM With VeriStand

Before using the DCM with VeriStand, you must install the following application software and device drivers on the host computer in this order:

- VeriStand 2016 or later
- NI DAQmx 16.0 or later
- NI VISA 16.0 or later
- NI CompactRIO Device Drivers 16.0 or later
- NI Powertrain Controls DCM Custom Device for NI VeriStand

For minimum software support information, visit `ni.com/info` and enter the Info Code `swsupport.`

Hardware Installation

Mounting the DCM

The DCM is designed to be flexible in its mounting position. The following mounting methods are supported by NI Powertrain Controls:

- **Rack-mount**: Rack-mounted in a standard 19-in. chassis, 5U
  – Requires: Rack-mount kit (included, PN: 785246-01)
- **Panel-mount**: Firmly secured on a clean, flat surface with connector facing out or up
  – Requires: Panel mount kit (optional, PN: 785247-01)

Connecting the DCM Chassis Ground Lug to Facility Ground

You must connect the DCM chassis ground lug to the grounding electrode system of the facility.

What to Use

- Wire, 1.63 mm^2 (14 AWG) or larger, or braided grounding strap
- Screwdriver, flat 3/16-in.

What to Do

Complete the following steps to ground the DCM.

1. Remove the screw from the chassis ground lug on the DCM.
2. Insert wire or braided grounding strap into the side of the chassis ground lug
3. Tighten the grounding screw to 1.4 N · m (12 lb · in.) of torque.
4. Attach the other end of the wire to the grounding electrode system of your facility using a method that is appropriate for your application.

For more information about ground connections, visit `ni.com/info` and enter the Info Code `emcground`.

Connecting the DCM Starter Harness

The DCM Starter Harness contains all connections required to begin using the DCM with one solenoid injector and one piezo injector. The DCM Starter Harness should connect with the devices as shown in Figure 1.

What to Use

- DCM Starter Harness
- Hex Driver, 4 mm
- PDU-2300
- Emergency Stop (E-Stop)

What to Do

Complete the following steps to connect the DCM Starter Harness.

1. Ensure that the PDU is disconnected from all power sources.
2. Connect the harness to DCM Connector 1, being sure to orient the connector appropriately.
3. Tighten the DCM connector terminal fastener to 5 N · m (44 lb · in.) of torque using a 4 mm Hex Driver.
4. Ensure your PDU is correctly configured for 12 V or 24 V, whichever is used. Refer to the *Configuring the PDU-2300* section for more information.
5. Connect the harness to the PDU (blue connector).
6. Connect the harness to the emergency stop.

Figure 1. DCM Starter Harness Connections
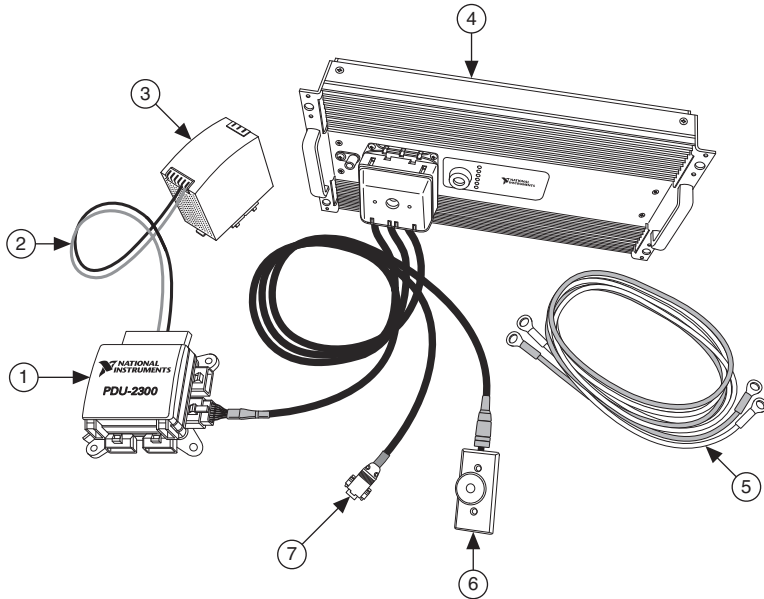
1	PDU-2300	5	Heavy-duty power supply cables
2	Light-duty power supply cables	6	Emergency stop
3	Power supply	7	RS-232
4	DCM		

Note All I/O terminals come unpopulated in the DCM Starter Harness kit. These connections must be populated by the user in order for the relevant functions to be used. For more information about wiring I/O, refer to the *NI DCM User Guide*.

Configuring the PDU-2300

The PDU-2300 may be configured for 12 V or 24 V systems. The PDU ships configured for 12 V systems by default. Complete the following steps to configure the PDU for 24 V systems. See Figure 2 below for illustration of fuse placement for 12 V and 24 V setup.

1. Open the PDU cover to expose the various relays and fuses.
2. Remove 7.5 A fuses from slots F12 and F13 and set aside.
3. Fill slot F14 (empty by default) with one of the 7.5 A fuses removed in the previous step.
4. Save the remaining fuse as a replacement.

⚠️ **Caution** Damage may occur if the PDU-2300 is not appropriately configured for the selected supply voltage before connecting power.

Figure 2. Fuse Placement for 12 V and 24 V Setup

12 V Setup

F12 7.5 A Fuse	F14 Empty	F13 7.5 A Fuse

24 V Setup

F12 Empty	F14 7.5 A Fuse	F13 Empty
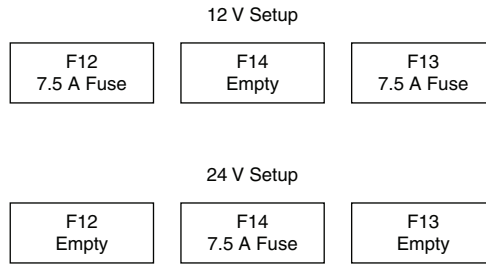
Connecting the DCM to Power

Powering the DCM with the DCM Starter Harness and PDU-2300 requires a 12 V or 24 V, 180 W minimum, external DC power supply. Recommended power supplies are listed in Table 1 below. The light-duty power supply leads (14 AWG) included in the DCM Starter Harness kit are recommended only for bench-top applications which require less than 15 A of current. The heavy-duty leads (8 AWG) included in the DCM Starter Harness kit are recommended for all other applications.

What to Use

- Starter harness light-duty (<15A) or heavy-duty power supply leads
- Wrench, 1/2-in.
- NI recommended power supply

Table 1. Recommended Power Supplies

Power Supply	Part Number
PULS QS10.121 Power Supply (12 VDC, 15 A, 100-240 VAC/110-150 VDC Input)	783168-01
NI PS-17 Industrial Power Supply (24 VDC, 20 A, 100-240 VAC/110-150 VDC Input)	781095-01
Tripp Lite PR 60 (13.8 VDC, 60 A, 120 VAC Input)	PR 60
TDK Lambda Genesys 1500W (0-30 VDC Variable, 0-50 A Variable, 85-265 VAC input)	GEN 30-50

What to Do

Complete the following steps to connect power to the DCM.

- Ensure the DCM Starter Harness is connected as discussed in the *Connecting the DCM Starter Harness* section.
- Connect power supply leads terminated with properly rated ring terminals to the PDU Positive (+) and Negative (-) input studs.
- Tighten terminal fasteners to 10.2 N · m (90 lb · in.) using a 1/2-in. wrench.
- Connect power supply leads to the power supply. If connecting to a battery, always connect the Negative (-) lead last. When disconnecting the battery, always disconnect the Negative (-) lead first.

Connecting the DCM to the Host Computer

Complete the following steps to connect the DCM to the host computer or Ethernet network using the RJ-45 Gigabit Ethernet port.

- Power on the host computer or Ethernet hub.
- Connect the RJ-45 Gigabit Ethernet port on the DCM to the host computer or Ethernet hub using a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable.

> **Caution** To prevent data loss and to maintain the integrity of your Ethernet installation, do not use a cable longer than 100 m (328 ft).

> **Note** The DCM attempts to initiate a DHCP network connection the first time you connect using Ethernet. The DCM connects to the network with a link-local IP address with the form 169.254.x.x if it is unable to initiate a DHCP connection.

Powering on the DCM

When you power on the DCM for the first time, the device boots DCM DSI. The POWER LED illuminates, the STATUS LED illuminates briefly, and then the USER1 LED blinks steadily once the DSI executable has booted. Overall boot time is approximately 60 seconds.

Configuring the DCM in Measurement and Automation Explorer (MAX)

Complete the following steps to find your DCM in MAX.

- Ensure that any anti-virus or firewall software running on the host computer allows connections to the host computer.

> **Note** MAX uses UDP 44525. Refer to the documentation of your firewall software for information about configuring the firewall to allow communication through UDP 44525.

- Launch MAX on the host computer.

- Expand **Remote Systems** in the configuration tree and location your system.
- Select your target.

Setting a System Password

Complete the following steps to set a system password.

📝 **Note** The default username for the DCM is admin. There is no default password for the DCM, so you must leave the password field blank when logging in until you set a system password.

1. Right-click your system and select **Web Configuration**.

📝 **Note** The NI Web-Based Configuration and Monitoring utility opens in your default browser and is where you set the password. If you have not installed Microsoft Silverlight, NI Web-based Configuration & Monitoring prompts you to do so.

2. Enter a unique name for your system in the **Hostname** field.
3. Click the **Security Configuration** icon.
4. Click **Login**.
5. In the **Login** dialog box, enter the username admin and leave the password field blank.
6. Click **OK**.
7. Click **Change Password**.
8. Enter and re-enter a new password.
9. Click **OK**.
10. Click **Save**.
11. Click **OK** to confirm you are changing the password.

⚠️ **Caution** NI cannot recover lost system passwords. If you forget the password, you must contact NI and reformat the controller.

Installing Software on the DCM (LabVIEW or VeriStand Personalities)

Complete the following steps to install software on the DCM for LabVIEW or VeriStand personalities. If using DCM DSI, skip this section.

📝 **Note** The DCM ships with the DSI pre-installed. In order to run non-DSI personalities, the DCM must be formatted. To reinstall the DCM DSI after formatting, refer to the *NI DCM-23XX DSI User's Manual* for more information.

1. In MAX, right-click on your DCM target under Remote Systems.

⚠️ **Caution** Any files, including calibrations, present on the DCM during formatting will be lost. Prior to formatting, any files present on the DCM must be backed up in order to be saved. Files may be copied from the DCM by WebDAV file transfer.

   a.   Select **Format Disk**.

💡 **Tip** You must log in if you set a system password.

   b.   Select **Attempt to restart into safe mode**.
   c.   Select the desired option to manage network adapter settings.
   d.   Click **Format**.
   e.   Wait for the formatting process to finish, then click **OK**.

2.   In MAX, expand your system under Remote Systems.

   a.   Right-click **Software**.
   b.   Select **Add/Remove Software** to launch the LabVIEW Real-Time Software Wizard.

💡 **Tip** You must log in if you set a system password.

   c.   Select the recommended software set for your LabVIEW and NI-RIO Device Drivers versions.
   d.   Click **Next**.
   e.   Verify that the summary of software to install is correct.
   f.   Click **Next**.
   g.   Click **Finish** when the installation is complete.

3.   To install NI VeriStand or NI SCM on the target, continue with the following steps.

   a.   In MAX, right-click **Software** as before**.**
   b.   Select **Add/Remove Software** to launch the LabVIEW Real-Time Software Wizard.

💡 **Tip** You must log in if you set a system password.

   c.   Select **Custom software installation**.
   d.   Click **Yes**.
   e.   Select any additional software to install (VeriStand Engine, SCM, etc.)
   f.   Click **Next**.
   g.   Verify that the summary of software to install is correct.
   h.   Click **Next.**

4.   Click **Finish** when the installation is complete.

Launching DCM DSI

Complete the following steps to launch and begin using DCM DSI.

1. Open NI Software Calibration Management (SCM) Console on the host PC.
2. Select **File»Select Target**.
3. Choose your DCM on the **Select Target** drop-down.
4. Select **Download Files**.
5. Click **OK**.
6. Click **Start Host Application** on the SCM Console.

📝 **Note** The DCM is shipped supporting the latest version of SCM. If you have trouble launching the DCM DSI with the latest available version of SCM on `ni.com`, the software on your DCM may need to be updated. Refer to the *NI DCM-23XX DSI User's Guide* for more information.

Troubleshooting the DCM

Safe Mode and IP Reset

The following figure shows the reset behavior of the DCM.

Figure 3. Reset Behavior
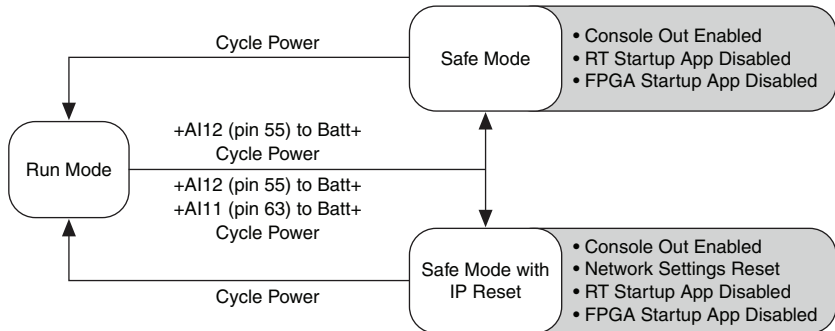
LED Indicators

The following table describes the DCM LED indicators.

Table 2. LED Indicators

LED Name	LED Color	LED Pattern	Indication
POWER/LOCK	Green	Solid	The DCM is powered on and I/O is Unlocked
	Amber	Solid	The DCM is powered on and I/O is Locked
	—	Off	The DCM is powered off
STATUS	Amber	2 Flashes	The DCM has detected an error in its software. This usually occurs when an attempt to update the software is interrupted. Reinstall software on the DCM. Refer to the *Measurement & Automation Explorer Help* for information about installing software on the chassis.
	Amber	3 Flashes	The chassis is in safe mode. Refer to the *Measurement & Automation Explorer Help* for information about safe mode.
	Amber	4 Flashes	The software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the chassis runs out of memory. Review your RT VI and check the memory usage. Modify the VI as necessary to solve the memory usage issue.
	Amber	Continuous Flashing or Solid	The DCM has detected an unrecoverable error. Contact National Instruments.
USER 1 USER 2	—	—	Application dependent
ACT/LINK	—	Off	No Ethernet link
	Green	Solid	Ethernet link established
	Green	Blink	Ethernet activity occurring

Table 2. LED Indicators (Continued)

LED Name	LED Color	LED Pattern	Indication
10/100/1000	—	Off	10 Mbps
	Green	Solid	100 Mbps
	Amber	Solid	1000 Mbps

Related Documentation

Your documentation needs may vary depending on the hardware and software you use for your application.

Hardware Documentation

- *NI DCM-23XX User Guide*—This document explains in detail the hardware and software features of the DCM. This document is available at `ni.com/manuals`.
- *NI DCM-2301 Specifications*—Lists the specifications of the NI DCM-2301 device. This document is available at `ni.com/manuals`.
- *NI DCM-2316 Specifications*—Lists the specifications of the NI DCM-2316 device. This document is available at `ni.com/manuals`.

Software Documentation

- *NI Powertrain Controls Device Drivers User's Manual*
    - After installing the drivers, select **Help»Powertrain Controls»Device Drivers User's Manual** in LabVIEW to view the Device Drivers User's Manual. Browse the **DCM** section in the **Contents** tab for information about the DCM API VIs on the FPGA, Real-Time, and user-interface levels.
- *NI DCM-23XX DSI User Guide*
    - Select the Help icon on the Default Software Image (DSI) user interface panel to view the *NI DCM DSI User's Manual*.

Additional Resources

- For additional resources and support, including up-to-date software downloads, visit the NI Powertrain Controls Users group on `ni.com/community`.
- *National Instruments Example Finder*—For detailed LabVIEW examples which highlight specific features of the DCM and its software API VIs, use the NI Example Finder by selecting **Help»Find Examples** and searching for "DCM" on the **Search** tab.

Worldwide Support and Services

The NI website is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit `ni.com/services` for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit `ni.com/register` to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`. If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For telephone support in the United States, create your service request at `ni.com/support` or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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