Controller Module

CM0410

User Guide

UG-CM0410-1014001-201512-003

Parker Hannifin Canada

Electronic Controls & Motion Division

www.parker.com/ecm

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Contents

Publication History

The following table provides an overview of the changes made to this document over the course of its publication history.

Release Date	Description of Change
Rev. 004	Division name update
Rev. 003	Edits from Product Eng. and addition of standalone variant
Rev. 002	Minor edits based on AE feedback 10/22/2014
Rev. 001	First release of this document

Safety

Do not perform the procedures in this manual unless you are experienced in the handling of electronic equipment.

Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.

The term "manufacturer" refers to Parker Hannifin Corporation.

Safety symbols

The following symbols are used in this document to indicate potentially hazardous situations:

Danger! Risk of death or injury.

Warning! Risk of damage to equipment or degradation of signal

When you see these symbols, follow the instructions carefully and proceed with caution.

General safety regulations

Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine, and its safety regulations.

Follow the manufacturer's regulations when mounting, modifying, repairing, and maintaining equipment. The manufacturer assumes no responsibility for any accidents caused by incorrectly mounted or incorrectly maintained equipment. The manufacturer assumes no

responsibility for the system being incorrectly applied, or the system being programmed in a manner that jeopardizes safety.

⚠ Do not use the product if electronic modules, cabling, or connectors are damaged or if the control system shows error functions.

⚠ Electronic control systems in an inappropriate installation and in combination with strong electromagnetic interference fields can, in extreme cases, cause an unintentional change of speed of the output function.

Welding after installation

Complete as much as possible of the welding work on the chassis before the installation of the system. If welding has to be done afterwards, proceed as follows:

⚠ Do not place the welding unit cables near the electrical wires of the control system.

1. Disconnect the electrical connections between the system and external equipment.
2. Disconnect the negative cable from the battery.
3. Disconnect the positive cable from the battery.
4. Connect the welder's ground wire as close as possible to the place of the welding.

Construction regulations

The vehicle must be equipped with an emergency stop which disconnects the supply voltage to the control system's electrical units. The emergency stop must be easily accessible to the operator. If possible, the machine must be built so that

the supply voltage to the control system's electrical units is disconnected when the operator leaves the operator’s station.

Safety during installation

Incorrectly positioned or mounted cabling can be influenced by radio signals, which can interfere with the functions of the system.

Safety during start-up

Danger! Risk of death or injury. Do not start the machine's engine before the control system is mounted and its electrical functions have been verified.

Do not start the machine if anyone is near the machine.

Safety during maintenance and fault diagnosis

Before performing any work on the hydraulics control electronics, ensure that

- The machine cannot start moving.
- Functions are positioned safely.
- The machine is turned off.
- The hydraulic system is relieved from any pressure.
- Supply voltage to the control electronics is disconnected.

1. About the CM0410

The Controller Module (CM) 0410 is a general purpose input / output controller that includes a single CAN interface, 4 inputs, 1 high side current measurement pass-through, and 10 high side outputs with error checking. The main function of the module is to provide a means of controlling mechanical relays or low current loads. Enhancements have been included to support things like open bulb detection and some limited solenoid PWM control.

The CM0410 is available in 2 versions:

- The first is a CAN slave module only and does not support standalone operation. However, it does support limited configurability, to specify things like input configurations, and update rates for the messages presented on the CAN bus. The configuration tool is available from our website, www.parker.com/ecd under 'Support'.
- The second CM0410 version is a standalone controller and is programmed using VMMS ladder logic software.

The CM0410 is designed to communicate through a J1939-based Controller Area Network (CAN) and can be used in any CAN 2.0B application.

The CM0410 has many features, as follows:

- The CM0410 can monitor up to 4 inputs:
  - 1 general purpose type 1 inputs (can be used as power control, digital, full VBATT range analog, or frequency).
  - 3 general purpose type 2 inputs (can be used as digital, 5V range analog, resistive, or frequency).
- The CM0410 can monitor one current input:
  - 1 low accuracy current measure pass-through (can be used to detect burnt out bulbs).
- The CM0410 has 10 outputs:
  - up to 2 configured as high-drive outputs.
  - the balance are configured as low-drive outputs.
- The CM0410 has one 20-pin Molex MX150 connector that is used to interface with the inputs, outputs, and CAN.

This manual describes the hardware components of the CM0410, but does not explain how to configure the software. For more information about software, refer

to the appropriate software manual or contact your Parker Vansco Account Representative.

1.1. System Overview

The CM0410 I/O is illustrated below:

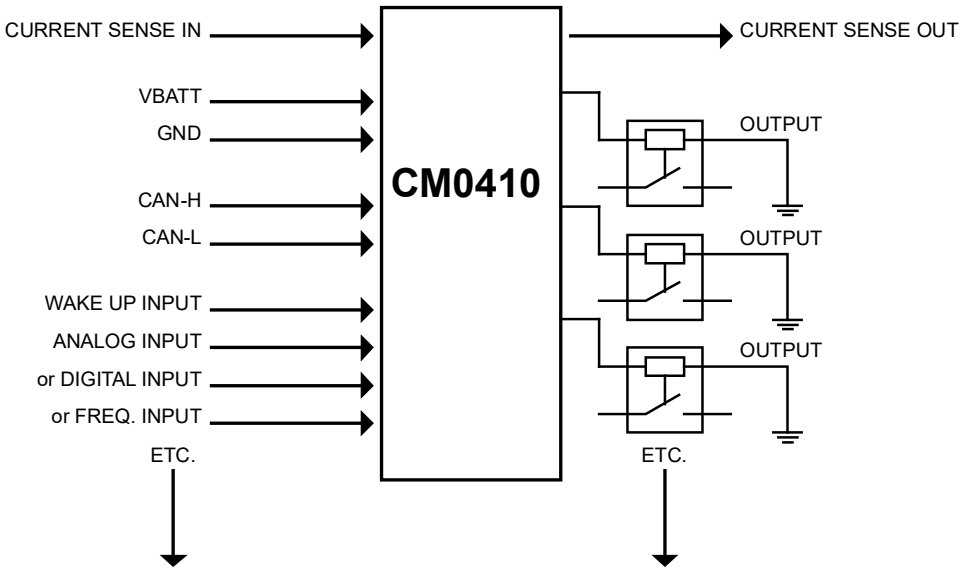
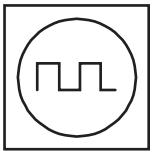
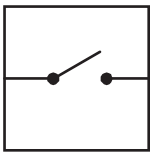


Figure 1: Inputs and outputs

1.2. Diagram conventions

The following symbols are used in the schematic diagrams in this document:

Symbol	Meaning
	General input
	General output
	Frequency input
	Analog input
	Frequency sensor
	Pulse sensor
	Resistive sensor
	General sensor
	Application switch
	Load
	Pull-down resistor

Symbol	Meaning
	Pull-up resistor
	Battery
	Fuse
	Resistor
	Ground
	Chassis ground

2. Quick Start

This section provides step-by-step instructions on how to connect the CM0410 standalone controller to a development system, install the required software tools, and download the application software.

2.1. Gather Required Materials

The following materials are required for the procedures in this section:

- CM0410 standalone controller
- personal computer (PC)
- controller I/O board
- controller I/O harness (connects the CM0410 to the controller I/O board)
- evaluation kit power harness (connects the controller I/O board to the power supply)
- Data Link Adapter (DLA) kit (comes with cables needed for connecting the DLA to your PC and to the rest of the system)
- desktop power supply compatible with the CM0410 and controller I/O board loads (a 12 V DC, 3 A fixed voltage supply is generally suitable, unless driving more significant loads)
- procurement drawing for the version of CM0410 you are using, indicating the configuration options for your variant of the product.
- software tools and files required for programming and downloading software for the CM0410.

Note: With the exception of the PC and desktop power supply, all materials and software are available from Parker Vansco. Please consult your Parker Vansco Account Representative for specific details and pricing information.

2.2. Install the Required Software Tools

Before using the CM0410 standalone controller, install the following software tools onto your PC:

- Data Link Adapter (DLA) drivers
  - The DLA acts as the interface between the PC and the CM0410. Before using the DLA, you must install the DLA drivers.
- Parker Vansco Software Tools
  - Parker Vansco provides the VMMS software tool to create and download software for the CM0410 standalone controller. Contact your Parker Vansco Account Representative, or visit the Parker website to get further information on how obtain a product key.

2.2.1. Install the Data Link Adapter Driver Software

A Data Link Adapter (DLA) is needed when connecting the CM0410 standalone controller in a development system.

Note: Parker Vansco provides the latest DLA software releases through its web site. Please contact your Parker Vansco Account Representative for details on how to download the latest DLA driver software.

The Parker Vansco DLA requires the installation of drivers on your PC. To install the Parker Vansco DLA drivers:

1. Download the driver, run the extracted file, and follow the Install Wizard. Do not connect the USB-DLA until the driver installation is completed.
2. Connect the USB-DLA to a USB port on your PC. The Found New Hardware screen opens.
3. Select **Install the software automatically (Recommended)**, and then click **Next**. If the driver is not detected automatically, you can browse to the folder containing the driver.
4. After installation is finished, click **Finish**. The USB-DLA is now recognized and ready to be used.

See the Parker Vansco USB-DLA kit user manual for more detailed instructions.

2.3. Connect the CM0410 standalone controller to a Development System

It is a good idea to connect the CM0410 standalone controller to a development system (PC, Controller I/O Board, power source, and DLA) to verify your application. The development system is an ideal environment for creating and downloading software applications.

The following shows how to connect the CM0410 standalone controller in a development system:

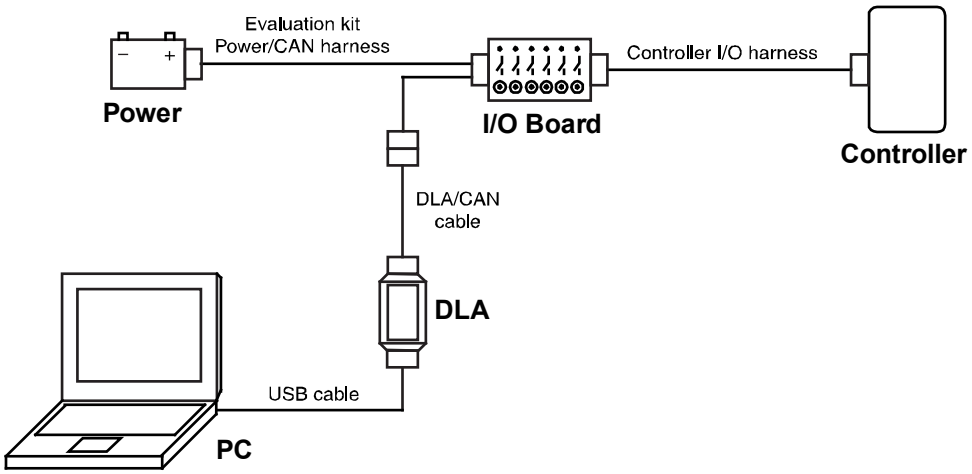


Figure 2: Development system connection

To connect the CM0410 standalone controller in a development system, do the following:

Note: Before connecting anything in the development system, ensure that the power supply is set to a voltage that is less than 32 V DC.

1. Connect the Controller I/O harness to the CM0410 standalone controller.
2. Connect the Controller I/O harness to the controller I/O board connectors.
3. Connect the evaluation kit power/CAN harness to the controller I/O board's JP3 connector.
4. Do **not** connect the power wire (RED) from the evaluation kit power/CAN harness to the power supply (+) terminal at this time.
5. Connect the ground wire (BLACK) from the evaluation kit power/CAN harness to the power supply (-) terminal.
6. Connect the CAN connector from the evaluation kit power/CAN harness to the corresponding mating connector and harness on the DLA.

   Note: Do not proceed to the next step before the DLA drivers have been installed. See *Install the Data Link Adapter Driver Software* on page 15.
7. Connect the DLA to a personal computer via the USB port.

2.3.1. Power Up the Development System

To power up the CM0410 standalone controller:

1. Ensure that all controller I/O board digital inputs, jumpers, and dip switches are properly configured for your module type. Refer to the *Controller I/O Board Reference Manual* for further details.
2. Ensure that the power wire (RED) on the controller I/O board is **not** connected to the power supply (refer to the *Controller I/O Board Reference Manual* for details).
3. Turn the power supply on.
4. If using a variable power supply, set the voltage to a value between 10 to 28 V DC.
5. Turn the power supply off.
6. Connect the power wire (RED) on the connector I/O board to the power supply.
7. Turn the power supply on.

Note: If an input e.g. INPUT_1 is configured as a power control input, you must turn on the corresponding digital input switch on the controller I/O board (e.g. Digital Input 1). Refer to the *Controller I/O Board Reference Manual* for further details.

2.4. Create and Download Ladder Logic Applications

Software applications can be created and downloaded to the CM0410 standalone controller.

The software applications for the CM0410 can be created with the Vansco Multiplexing Module Software (VMMS) tool, using ladder logic.

Consult your Parker Vansco Account Representative for information about your software programming options.

3. General Purpose Inputs

The CM0410 has 4 general purpose inputs.

General purpose inputs can be programmed to be analog, digital, or frequency.

- Analog inputs are typically used for variable voltages.
- Digital inputs are typically used for electrical signals that are either on or off.
- Frequency inputs are typically used for reading pulse signals.

There are 2 types of general purpose inputs, Type 1 and Type 2.

3.1. Type 1 Input Capabilities

There is a single Type 1 input (INPUT1). This input provides a fixed attenuation with a software selectable wetting current option.

The primary function of the Type 1 input is to provide a wake on ignition feature as a digital input. The 'Wake Up' functionality is software configurable.

A secondary function is to interface with active voltage analog and frequency sensors in an application.

The following table provides specifications for the general purpose input Type 1:

Type 1 Input Specifications - programmable as digital, analog or frequency				
Item	**Min**	**Nom**	**Max**	**Unit**
Input voltage range	0		32	V
Over-voltage			36	V
Input resistance		80		kΩ
Pull-down resistance (software selectable)		2.74	open	kΩ
Wetting current (12V/24V)		4.4/8.8		mA
Inductive load protection		50		Ω
Analog configuration				
Operating voltage range	0		32	V
Resolution		52		mV/bit
Offset error			52	mV
Drift error			6	%
Digital or Frequency configuration				
Input range			10,000	Hz
High threshold		3.8		V
Low threshold		3.6		V

3.2. Type 2 Input Capabilities

There are three Type 2 inputs (`INPUT2-INPUT4`). This input type provides a fixed attenuation with a software selectable pull-up current option.

The function of this type of input is to interface with active voltage analog sensors, resistive sensors, or measure frequency in an application.

The following table provides specifications for the general purpose inputs Type 2:

Type 2 Input Specifications - programmable as digital, analog or frequency				
Item	**Min**	**Nom**	**Max**	**Unit**
Input voltage range	0		32	V
Over-voltage			36	V
Input resistance		72		kΩ
Pull-up voltage		12/24		V
Pull-up current (INPUT3)		2.4		mA
Pull-up current (INPUT2, INPUT4)		0.4		mA
Wetting current (12V/24V)		N/A		mA
Analog configuration				
Operating input range	0		5	V
Resolution		6.5		mV/bit
Offset error (-40 °C to +85 °C)			15	mV
Drift error (-40 °C to +85 °C)			6	%
Digital or Frequency configuration				
High threshold		2.6		V
Low threshold		2.4		V

3.3. Digital inputs connections

A digital input is typically connected to a switch that is either open or closed.

- When an active-high switch is open, the pull-down resistor ensures that no voltage exists on the input signal, which will be interpreted by the CM0410 as inactive.
- When the switch is closed, the input is connected to battery voltage, which will be interpreted by the CM0410 as active.

For an input that is active-high

- It must be connected to battery power so that there is a battery connection when the state of the input changes.
- The power provided to the digital switch connected to the input must be provided through a fuse in the wire harness.

A typical active-high digital input connection is shown below:

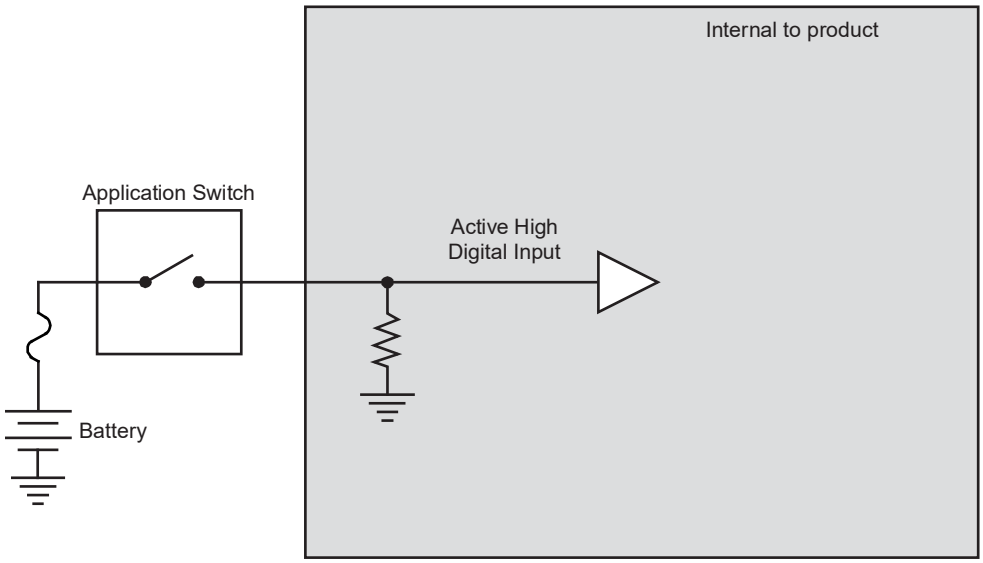


Figure 3: Active high digital input

3.4. Active-Low Digital Input Connections

An active-low digital input is typically connected to a switch that is either open or closed.

- When the switch is open, the pull-up resistor will ensure no signal exists on the input pin, which will be interpreted by the CM0410 as inactive.
- When the switch is closed, the input is connected to ground, which will be interpreted by the CM0410 as active.

The active-low input must be connected to ground to ensure there is a ground connection when the state of the input changes.

The following shows a typical active low digital input connection:

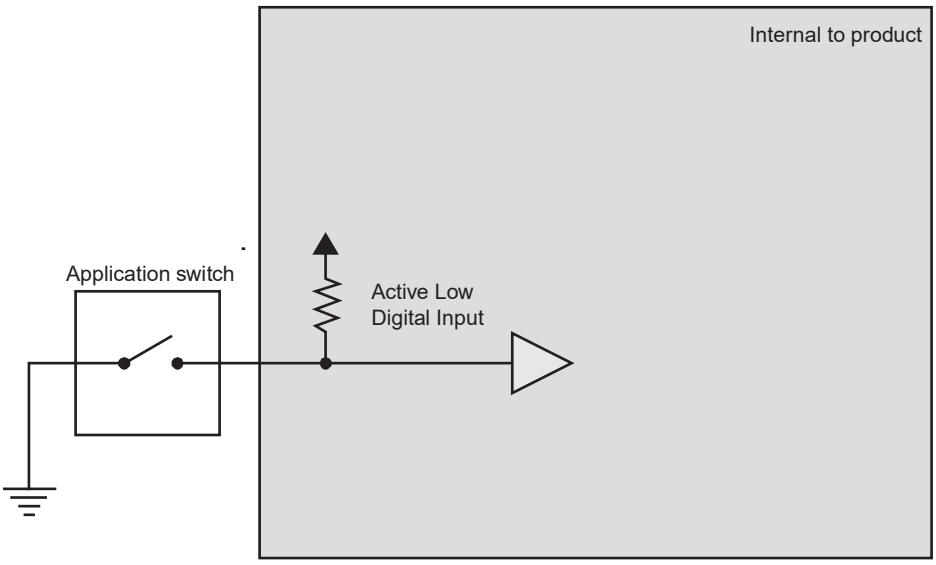


Figure 4: Active low digital input connections

3.5. Analog Inputs Connections

Analog inputs are susceptible to system noise, which can affect the accuracy of the signal. Signal accuracy can also be affected by ground level shift, which can cause inputs to activate when they shouldn't.

System noise

To prevent noise pickup on the sensors,

- Use the shortest possible wires when connecting analog inputs to sensors.

The following shows how to connect an analog input to reduce system noise:

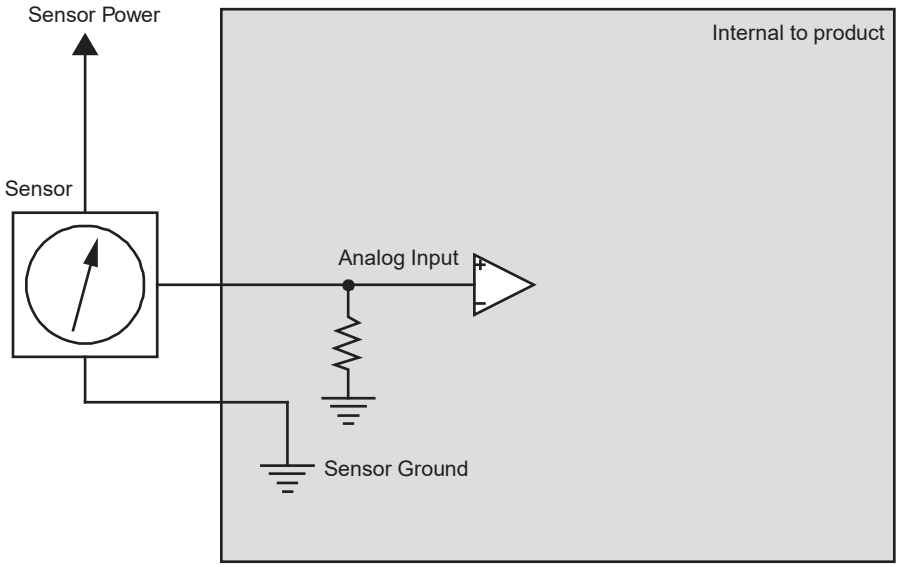


Figure 5: Analog input for system noise reduction

Ground level shift

To reduce ground level shift:

1. Dedicate one of the system ground inputs (GND) to sensors that have dedicated ground wires, and connect all sensor grounds to this system ground input.
2. Splice the other system ground inputs together in the vehicle harness (close to the connector) to provide a better ground for the noisier low-side outputs and digital circuits.
3. Position the sensor's ground connection near the system ground connections to ensure that the signal remains within the digital activation range of the input.

Note 1: The system ground inputs are rated for low-current signals, which ensures the sensor's ground is very close in voltage potential to the system ground.

Note 2: Sensors that don't have a dedicated ground wire are typically grounded to the vehicle chassis through the sensor's body.

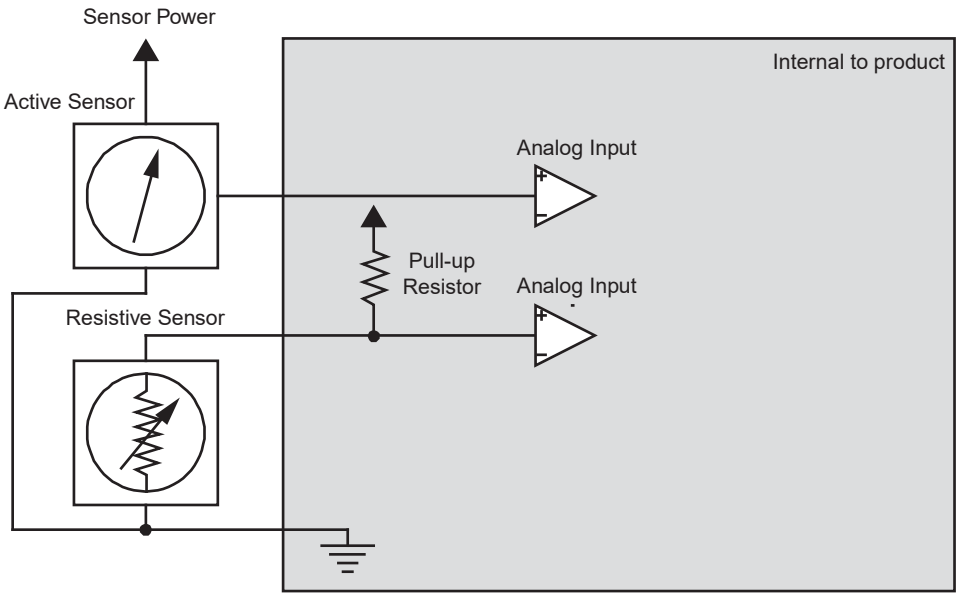


Figure 6: Analog input ground shift connection for sensors that have dedicated ground wires

3.6. Direct-Coupled Frequency Inputs Connections

As with analog inputs, direct-coupled frequency inputs are also susceptible to system noise and ground shift.

To reduce system noise,

1. Connect direct-coupled frequency inputs to sensors that produce signals with no DC offset.
2. To prevent noise pickup on the sensors, use the shortest possible wires when connecting direct-coupled frequency inputs to sensors.

To reduce ground shift:

1. Dedicate one of the system ground inputs (labeled GND) to sensors that have dedicated ground wires, and connect all sensor grounds to this system ground input.
2. Provide a better ground for the noisier low-side outputs and digital circuits by splicing the other system ground inputs together in the vehicle harness (close to the connector).
3. Locate the sensor's ground connection close to the system ground connections. This will help ensure the signal remains within the digital activation range of the input.

The CM0410 system ground inputs are rated for low-current signals, ensuring that the sensor's ground is close in voltage potential to the system ground.

Sensors that don't have a dedicated ground wire are typically grounded to the vehicle chassis through the sensor's body.

The following shows a typical direct-coupled frequency input connection:

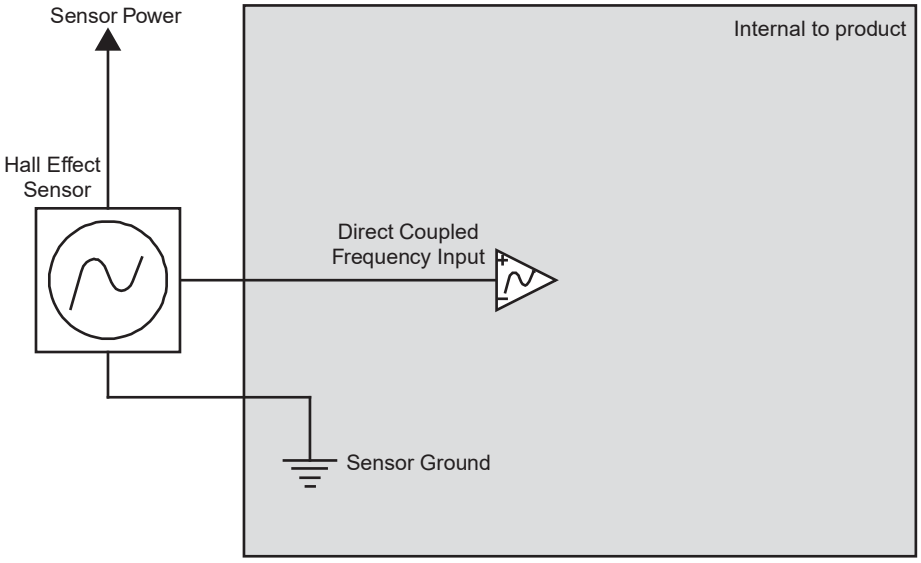


Figure 7: Direct coupled frequency input connections

4. Current Sense Pass Thru

The CM0410 provides a current sense resistor and the circuitry to measure the high side current passing through on pin 9 (`CS1_IN`) and pin 10 (`CS1_OUT`). As the CM0410 has no driver on these pins, the protection to limit current surges on the sense resistor must be provided externally. The primary function of this circuit is to discriminate the change in current when a bulb is not functional.

4.1. Current Sense Pass Thru Capabilities

The following table provides the specifications of the current sense pass thru input.

Current Sense Pass Thru Specifications				
Item	**Min**	**Nom**	**Max**	**Unit**
Input resistance		0.01		Ω
Operating voltage range	9		32	V
Operating current range	0.2		11	A
Resolution		14.6		mA/bit
Offset error (-40 to +85 °C)	10	40	150	mA
Tolerance	-10		8	%
Tolerance (-40 to +85 °C)	-20		10	%
Tolerance (-40 to +85 °C @ 80 V/m)	-50		30	%

Unless otherwise stated, all specifications are based on an ambient temperature of 25 °C.

> ***Damage to equipment!*** The current sense resistor MUST be externally protected to limit the current in the event of a single failure to a maximum of 32A for a maximum of 5 seconds.

More resolution of open bulb detection may be possible by calibrating the unit with the expected system load.

4.2. Current Sense Pass Thru Connections

Current is sensed in the supply path of the power connection to the monitored load (i.e. lamps).

The connection for sensing high-side current is as shown.

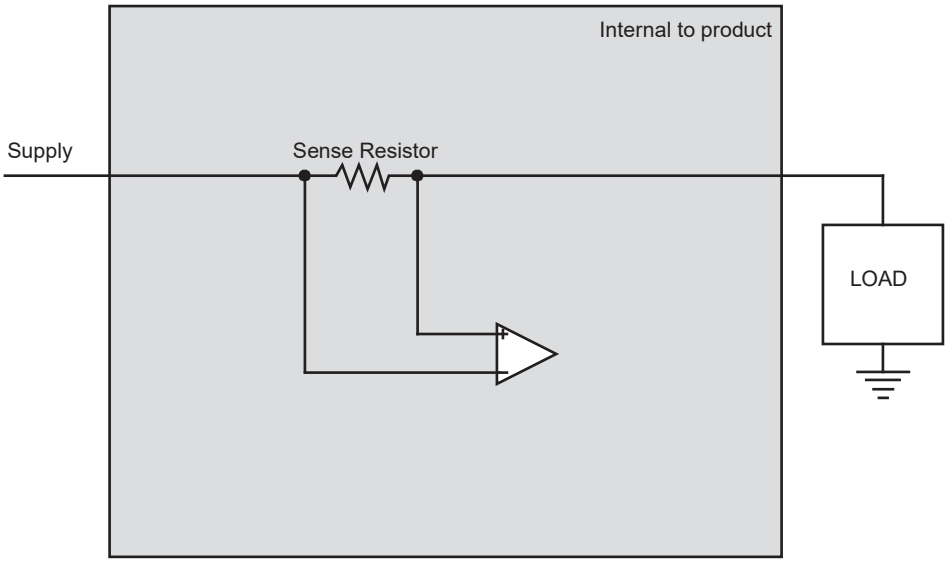


Figure 8: Current Sense connection

5. Outputs

There are 2 types of outputs on the CM0410. There are ten high-side outputs total.

- 5 high-side, software configurable, on-off digital or PWM outputs: `OUTPUT1`, `OUTPUT3`, `OUTPUT5`, `OUTPUT7`, `OUTPUT9`.
- 5 high-side, on-off digital outputs: `OUTPUT2`, `OUTPUT4`, `OUTPUT6`, `OUTPUT8`, `OUTPUT10`.

5.1. Output Capabilities

The nominal system voltage should be either 12V or 24V. Based on the operating voltage, use the table below to determine current limits.

Up to 2 of the outputs may be used in High Drive Mode. The 2 outputs that are chosen for High Drive Mode may *not* be on channels with adjacent numbers. The balance of the channels are restricted to Standard Drive Mode limits.

The maximum current rating with all outputs on must not be exceeded at any time.

The following table provides specifications for the CM0410's output connections.

Output Capabilities				
Item	**Min**	**Nom**	**Max**	**Unit**
Operational voltage range	9		32	V
Output resistance/GND (output off)		73.3		kΩ
Output resistance/VBATT (output on)		140	230	mΩ
Output resistance/VBATT (strobe on)		10		kΩ
Leakage current (output off - strobe off)			5	µA
Turn on delay (off to on)		100	250	µs
Turn off delay (on to off)		100	270	µs
Turn on/off slew rate	0.2			V/µs
PWM frequency			250	Hz
PWM resolution		0.1		%
Output pin capacitance		5		nF
High drive 12V characteristics				
Voltage range	0	12	16	V
Load current range			2	A
Standard drive 12V characteristics				
Voltage range	0	12	16	V
Load current range			0.250	A
High drive 24V characteristics				
Voltage range	0	24	32	V
Load current range			1	A
Standard drive 24V characteristics				
Voltage range	0	24	32	V
Load current range			0.125	A

Unless otherwise stated, all characteristics are based on an ambient temperature of 25°C.

6. Power

The CM0410 operates in a 12 V or 24 V system and is powered by a direct battery (VBATT) connection. The controller is turned on by applying power to the wake-up input or a CAN message. The direct battery input is protected against vehicle transients such as load dump and inductive load switching, etc. It is also protected against reverse battery voltage of -42 V through the use of a high-current path that will cause an external fuse to blow.

The following table provides specifications for the CM0410's power connections.

Power (VBATT) Specifications				
Item	**Min**	**Nom**	**Max**	**Units**
Input voltage for normal operation	9	-	32	V
Minimum cranking voltage	6	-	-	V
Over voltage protection (DC)	-	-	42	V
Reverse battery protection (note 1)	-	-	-42	V
Maximum current - 24V (all outputs on)	-	-	3	A
Maximum current - 12V (all outputs on)	-	-	6	A
Off state current	-	-	5	mA
Recommended fast acting external fuse	-	-	15	A

Note 1: The unit is protected against a reverse battery condition by causing an external fuse to blow.

7. Communication

The only type of communication available to the CM0410 is Controller Area Network (CAN) communication.

7.1. J1939 CAN Capabilities

The CAN communicates information at a rate of 250 kbps. Lack of regular CAN communication is an indication that there is either a problem with a module in the network, or a problem with the CAN bus.

CAN communication provides a feature called Wake on CAN, which is a way to provide power control to the CM0410.

Wake on CAN provides a low-current sleep mode that turns on the CM0410 when a CAN message is received by the module.

It is not possible to filter messages that are used to turn on the CM0410 using Wake on CAN. For this reason, any message will turn on the CM0410. The application software must be written to determine how the CM0410 will behave when it is turned on.

The following table provides specifications for the CAN:

CAN Specifications				
Item	**MIN**	**NOM**	**MAX**	**UNIT**
Baud rate limitations (hardware)	-	-	1000	kbps
Baud rate limitations (software)	-	250	-	kbps
Wake on CAN current draw	-	-	500	uA
Termination resistor	120	-	-	Ω

7.2. J1939 CAN Installation Connections

The CAN connection for the CM0410 should conform to the J1939 standard.

For a list of J1939 connection considerations, refer to the SAE J1939 specifications available through the Society for Automotive Engineers. SAE J1939-11 covers the physical aspects of the CAN bus including cable type, connector type, and cable lengths.

Note: The CM0410 does not have a CAN termination resistor, which is based on the assumption that the CAN bus is terminated in the harness.

The following lists the elements that are required for a J1939 CAN connection:

- CAN Cable: A shielded twisted-pair cable should be used when connecting multiple modules to the CAN bus. The cable for the J1939 CAN bus has three wires: CAN High, CAN Low, and CAN Shield (which connect to the corresponding CAN_HIGH, CAN_LOW, and CAN_SHIELD pins on the connector). When a module does not have a CAN_SHIELD pin, the CAN Shield should be connected to an available ground terminal attached to the negative battery. The CAN cable must have an impedance of 120 Ω.
- The CAN cable is very susceptible to system noise; therefore, CAN shield must be connected as follows:
  a. Connect CAN Shield to the point of least electrical noise on the CAN bus.
  b. Connect CAN Shield as close to the center of the CAN bus as possible.
  c. Use the lowest impedance connection possible.

Note: Ground loops can damage electronic modules. The CAN Shield can only be grounded to one point on the network. If grounded to multiple points, a ground loop may occur.

- CAN Connectors: Industry-approved CAN connectors are manufactured by ITT Cannon and Deutsch, and come in either T or Y configurations.
- CAN Harness: The CAN harness is the main backbone cable that is used to connect the CAN network. This cable cannot be longer than 40 meters and

must have a 120 Ω terminating resistor at each end. The 120 Ω terminating resistors eliminate bus reflections and ensure proper idle-state voltage levels.

- CAN Stubs: The CAN stubs cannot be longer than 1 meter, and each stub should vary in length to eliminate bus reflections and ensure proper idle state voltage levels.
- Max Number of Modules in a System: The CAN bus can handle a maximum of 30 modules in a system at one time.

The following shows a typical CAN connection using the SAE J1939 standard:

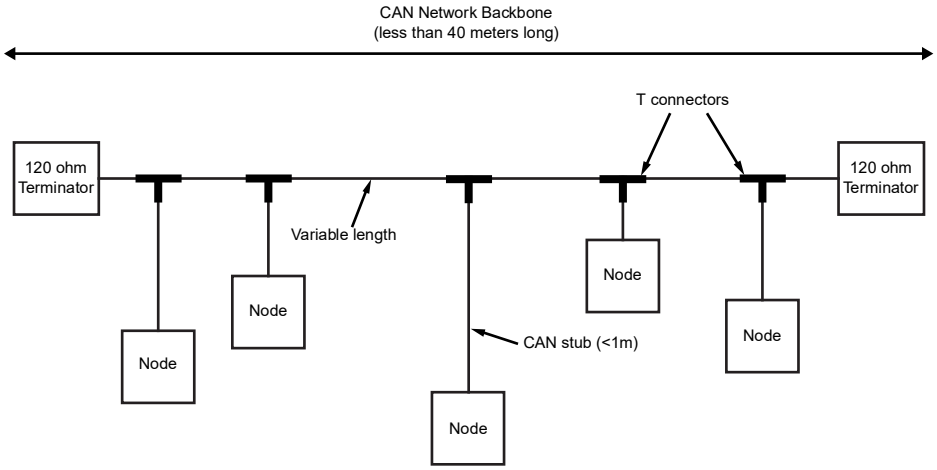


Figure 9: J1939 CAN connection

8. Connector

The connector on the top of the CM0410 is;

- MX150 – Vehicle Harness Connectors

The Molex MX150 connector is used to interface the CM0410 to the vehicle.

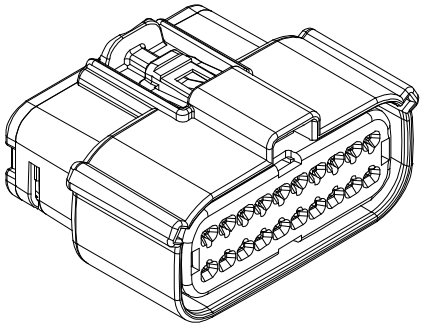


Figure 10: MX150 20-pin connector

Mating Connector Part Numbers			
Connector	**Shell part no. with locking clip**	**Shell part no. without locking clip**	**Terminals**
J1 connector (gray), 20-pin, key option B	33472-2007	33472-2002	33001-2004

8.1. Pinout

The pins in connector position J1 connects to inputs, outputs, power and CAN communication channels.

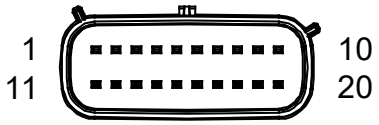


Figure 11: MX150 Key B 20 position connector

The following table shows the pin-out for the connector:

J1 Connector Pin-out		
Pin	**Name**	**Function**
1	VBATT	Positive battery
2	GND_POWER	Negative battery
3	CAN1_LO	CAN 1 low
4	CAN1_HI	CAN 1 high
5	INPUT4	Input 4 (type 2)
6	INPUT3	Input 3 (type 2)
7	INPUT2	Input 2 (type 2)
8	INPUT1	Input 1 (type 1)
9	CS1_IN	Current sense input
10	CS1_OUT	Current sense output
11	OUTPUT9	High-side output 9
12	OUTPUT10	High-side output 10
13	OUTPUT7	High-side output 7
14	OUTPUT8	High-side output 8
15	OUTPUT5	High-side output 5
16	OUTPUT6	High-side output 6
17	OUTPUT3	High-side output 3
18	OUTPUT4	High-side output 4
19	OUTPUT1	High-side output 1
20	OUTPUT2	High-side output 2

9. Installation

Because every system is different, it is not feasible to provide detailed installation instructions that will be suitable for every assembly. This chapter therefore provides only high-level guidelines on installing the CM0410.

The vehicle manufacturer is responsible for creating procedures for mounting the CM0410 in a vehicle during production assembly.

9.1. Mounting the CM0410 to a Vehicle

It is up to the original equipment manufacturer (OEM) to ensure the product is securely mounted to the vehicle.

The following guidelines are related to physically attaching the CM0410 to a vehicle:

- Secure the CM0410 with bolts in all bolt holes using Hex Head or equivalent metric size (M6) bolts.
- The bolts should be tightened according to the recommended installation torque of 2.5 Nm (22 in-lbs).

9.2. Mechanical Requirements

Review the following mechanical requirements before selecting a mounting location for the CM0410:

- The CM0410 should be mounted vertically so moisture will drain away from it.
- The wire harness should have drip loops incorporated into the design to divert water away from the CM0410.

- The harness should be shielded from harsh impact.
- The harness should connect easily to the connector and have adequate bend radius.
- The labels should be easy to read.
- The CM0410 should be in a location that is easily accessible for service.

9.3. Dimensions

The following shows the dimensions of the CM0410 in millimeters:

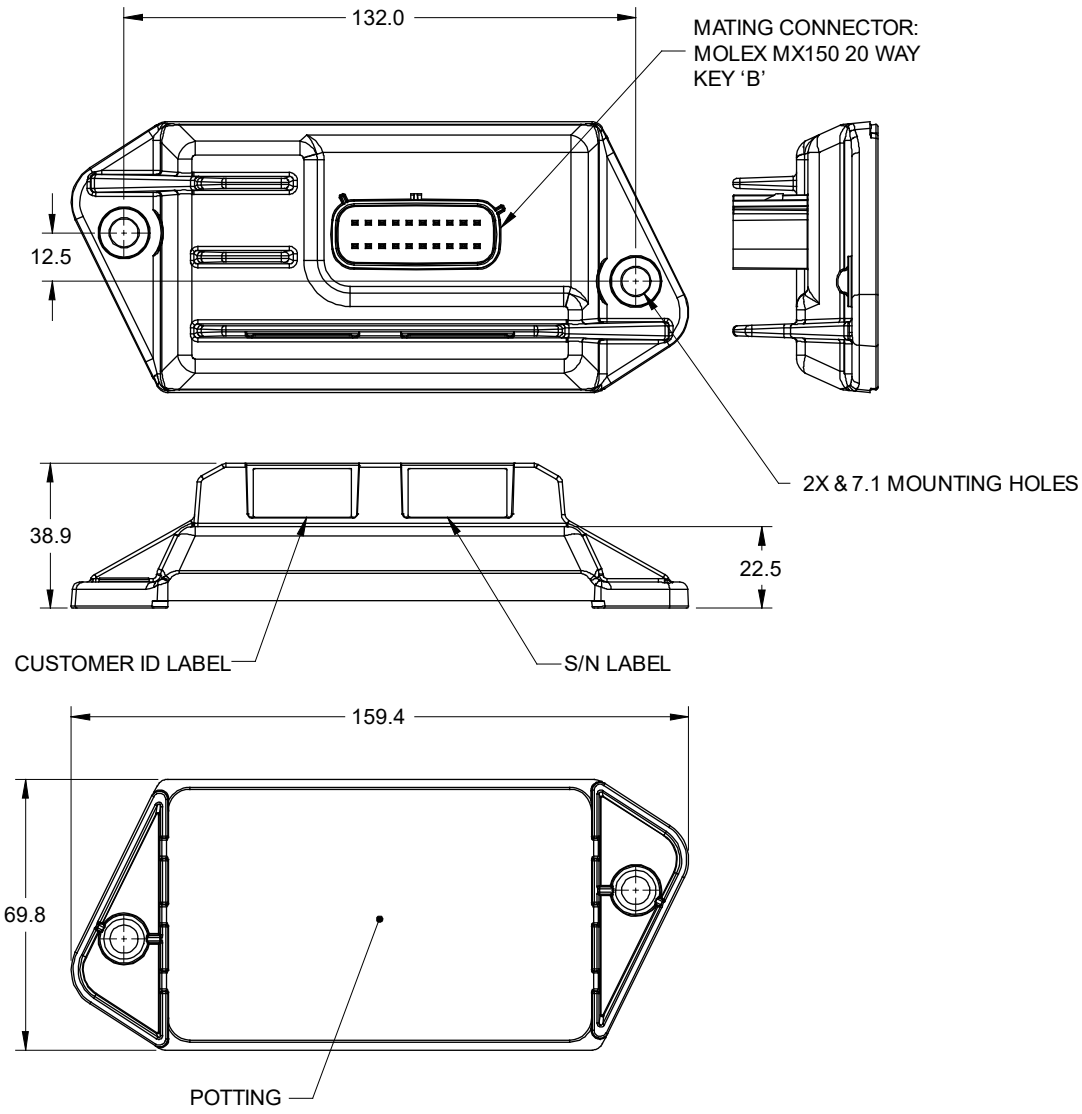


Figure 12: CM0410 dimensions

10. Glossary

active high

Input type that is on when it reads a battery voltage level, and off when it is floating or grounded.

active low

Input type that is on when it reads a ground voltage level, and off when it is floating or connected to battery voltage.

analog input

An input that allows a voltage level to be read and converted to discrete digital values within a microprocessor.

CAN high

The positive wire in a shielded twisted-pair cable, which, when connected with a CAN low, provides a complete CAN differential signal.

CAN low

The negative wire in a shielded twisted-pair cable, which, when connected with a CAN high, provides a complete CAN differential signal.

CAN shield

The shielding that wraps around the CAN high and CAN low wires in a shielded twisted-pair cable.

controller area network (CAN) bus

A communications network bus that permits data from sensors and other equipment within a motor vehicle to communicate with each other and, through telltales and other diagnostic tools, with the operator.

DC-coupled

DC coupling passes the full spectrum of frequencies including direct current. The signal being read by this circuit must fall within the detection threshold range specified for the input.

digital input

An input that is typically controlled by an external switch that makes the input either active (on), or inactive (off).

frequency input

An input that allows a frequency value to be read from an oscillating input signal.

general purpose input

An input that can be used as an analog, digital, or frequency input.

high-side output

An output that provides switched battery voltage to an external load.

hysteresis

The tendency, either by nature or design, for a device or system to remain temporarily (lag) in one state before switching to another. Hysteresis might be intentionally added to electronic circuits prevent unwanted rapid switching. A furnace, for example, is designed to remain on or off for some time after the room temperature reaches the thermostat's set point.

ladder logic

A programming language often used in industrial-control settings to control electromechanical devices in a relay. Programs written in this language resemble ladders: two vertical rails with a series of horizontal rungs—each representing a logical rule—between them. Ladder programs for Parker Vansco products are written using Vansco Multiplexing Module Software (VMMS).

low-side output

An output that provides a switched ground voltage to an external load.

open load

The disconnection of a load from an output, often because of a broken or worn wire or connector pin.

overcurrent

A fault state that occurs when a load draws more current than specified for an output, which results in the output shutting down to protect the circuitry of the product.

overvoltage

A situation in which the voltage in a circuit rises above its upper design limit.

pull-down resistor

A resistor that connects an input to a ground reference so that an open circuit can be recognized by the microprocessor, which is typically used on active-high digital inputs or analog inputs.

pull-up resistor

A resistor that connects an input to a voltage reference so that an open circuit can be recognized by the microprocessor, which is typically used on active-low digital inputs or analog inputs.

pulse-width modulation (PWM)

A digital logic circuit programmed to produce a pulse having any desired period or duty cycle. It is a means of controlling variable speed motors. See also duty cycle.

shielded twisted-pair cable

A type of cable used for CAN communication that consists of two wires (CAN high and CAN low) twisted together. These wires are covered by a shield material (CAN shield) that improves the cable's immunity against electrical noise.

short-to-battery

A fault state that occurs when an input or output pin is connected to battery power, potentially resulting in high current flow.

short-to-ground

A fault state that occurs when an input or output pin is connected to system ground, potentially resulting in high current flow.

transient

A short-lived burst of energy caused by a sudden change of state. Compare *steady state*.

transient voltage suppressor

A Zener diode engineered for high-power current switching. See also *Zener diode*.

wake on CAN

A method of power control that makes the product turn on when a CAN message is received from another module in the system, and turn off as determined by the application software.

11. Index

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