12V PDM (Power Distribution Module) Field Troubleshooting Guide

1) Description

This guide is specific to marine applications however can be used to troubleshoot other applications as well since the PDM hardware is the same between the 12VPDM and the IX3212 models.

The PDM is typically connected through the CAN port to a display or other type of controller from which it receives commands to turn its outputs on or off.

The PDM continually sends switch input status and analog input status out the CAN port for the display or controller to act on.

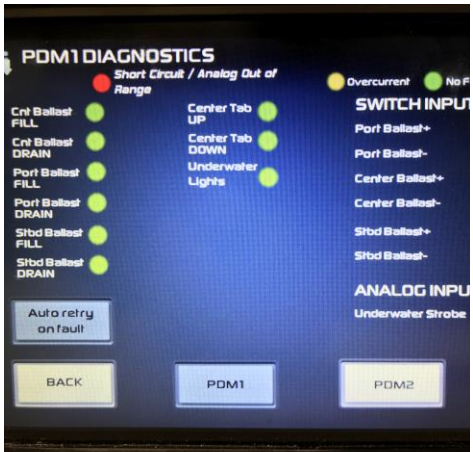
In Enovation Controls designed marine applications the display sends configuration data to the PDM every time it powers up to configure how the outputs work and their current limits. In some applications the PDM is configured one time at the factory. It should not be necessary to ever reprogram the PDM firmware unless directed to by the OEM.

2) Input /Output Assignment

Consult with the OEM to get a list of what each input and output is connected to in order to properly diagnose problems.

3) Diagnostics Screen

Some Enovation Controls OEM displays will have a PDM diagnostic screen the shows the status of all the inputs and outputs. Use this screen first if available to pinpoint the problem area to start troubleshooting.



4) CAN Port Troubleshooting

If the display or controller does not indicate any switch status from the PDM or none of the outputs are responding verify the CAN bus connections. If at least one output or input responds then we know the CAN port is working. The communication link will receive all data or nothing.

a) Unplug the green connector
b) Some versions of the PDM go to sleep after a minute of inactivity so measure the voltages right after turning power on.
c) Measure Can Hi (pin 12) on the PDM to a good ground. Voltage should be between 2.5Vdc to 3.5Vdc.
d) Measure CAN low (pin 1) on the PDM to a good ground. Voltage should be between 1.5Vdc and 2.5Vdc
e) If any voltage is significantly low then the CAN port has been damaged and PDM needs to be replaced.
f) Repeat the same measurements on the harness connector wires to determine if a signal is missing or backwards in the harness. The voltages will be the same as in test d) and e).

5) Switch Input Troubleshooting

The switch inputs can be either a ground input, a positive input, or floating when in the off position.
Typically the switch status is sent to a controller or display over the CAN bus to decide what action to take. If connected to a display verify the associated function changes state on the screen when you activate the switch. For example, an icon may turn green when you turn a pump on from a switch.

Note: The following voltage references are approximate for a 12v system, 24V systems will be double the voltage levels.

a) When no switch is activated the digital input will float at half of the battery volts, or about 6Vdc.
b) When the digital input is connected to a grounding switch the input will be zero Vdc.
c) When the digital input is connected to positive switch the input will be about 12Vdc.
d) Back probe the pin on the connector corresponding to the input in question to measure switch input voltage.

0Vdc	Switched to ground
6Vdc	Floating – no switch input
12Vdc	Switched to battery power

e) If the input is not switching to the desired voltage level unplug the connector and run a jumper wire from ground or battery positive to the input of the PDM and verify the voltage on the PDM input follows the jumper wire signal and verify the display or controller responds accordingly.

f) If the input switches correctly in test e), then check the wiring to the switch and verify the switch itself is working properly.
g) If test e) fails then turn power off and measure resistance of the switch input pin on the PDM. The resistance should be 1.1K Ohms. Anything significantly different than that indicates a failure.

6) Output Troubleshooting

If the following tests do not identify the issue with an output, contact the OEM to check for possible issues with the PDM output configuration.

Single Outputs

a) Measure voltage on the PDM output pin
b) Activate the output, voltage should be 0 when off and 12Vdc when on. In some instances the output will be Pule Width Modulated for dimming lights in which case the voltage will measure less than 12Vdc.
c) If there is no output voltage, verify the switch used to activate the output is functioning, see section 5.
d) If switches are functioning and there is no output voltage, proceed to section 7 to check for overcurrent conditions.

Motor Mode Dual Outputs

In a reversible motor or valve application two outputs are used, one will provide 12Vdc while the other will switch to ground when commanded to turn on in one direction. When commanded to go the other direction the outputs will switch polarities.

a) Verify the switches used to control the output are functioning correctly, see section 5.
b) Activate the output in one direction.
c) Measure voltage on the output pair, one of them should measure 0Vdc and the other 12Vdc.
d) If both measure 12Vdc then the negative side is not switching to ground.
e) If both measure 0Vdc the positive side is not switching on.
f) Activate the output in the opposite direction and repeat the previous voltage measurements. The polarities should be opposite.

7) Overcurrent

When an output exceeds the circuits programmed current limit the output will turn off. To reset the output it will either automatically retry after a few seconds or it will require a power cycle. The OEM will provide the current limits for each output circuit.
If there is a suspect output, perform the following test.

a) Disconnect the wire from the PDM output.
b) Verify the output turns on by measuring voltage on the PDM output, it should be 12Vdc. See section 6.
c) Check the load for abnormal current draw like a stalled or binding motor, plugged up pump, or too many optional devices like lights added to the circuit.
d) You can test the load manually by applying power to the wire however you must fuse it for the size wire gage you have to prevent melting the insulation if there is a short in the load.
e) Verify the load current does not exceed what the PDM output is programmed for.

8) Analog Input Troubleshooting

The analog inputs on the 12V PDM are configured to measure a resistive input such as a fuel level sender or an air temperature thermistor. Check the OEM literature for input assignments. The resistive sender will have one wire connected to the PDM analog input and the second wire connected to ground. The IX3212 has Analog 1 & 2 configured as resistive the remainder are 0-5V inputs.

1) Unplug the connector from the PDM that the sender is connected to.
2) With Ignition power turned on measure voltage between the sender input wire and ground. There should be no voltage on a resistive sender. If there is voltage check the wiring to the sender, there is probably a miss-connected wire.
3) Turn ignition power back off and measure the resistance between the sender input wire and ground. Confirm this resistance matches the sender type. Fuel senders are typically 240 ohms empty to 33 ohms full.
4) If resistance is high check the sender ground connection or for an open wire connection or failed sender.
5) If resistance is low there is a short in the wiring or sender.
6) If the sender and associated wiring is correct then take the following measurements on the PDM with the connector unplugged.
7) Turn ignition power on and measure voltage on the analog input pin of the PDM. It should be 5Vdc. If it is not there is an issue with the PDM.
8) Turn ignition power off and measure the resistance of the analog input. It should be 1.2K Ohms. If the resistance is much different there is a problem with the PDM.

9) Common Marine Installation Problems

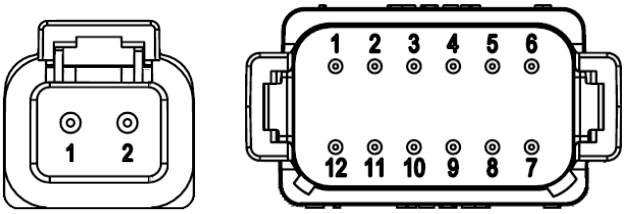
Connector water Intrusion is a common cause of many issues with PDM functionality.
Check for water splash on the PDM or harness connectors from bilge water or deck/seating drain holes. Tab actuators tend to pump pressurized water up through the inside of the wires and into the connector body causing corrosion. The PDM connector system is waterproof however water coming in through the wire cannot be stopped. Wire must be large enough to make a good seal with the grommet and there must be a hole plug in unused contacts.

Disconnect and disassemble all connectors associated with the PDM and inspect the inside for signs of wetness and/or corrosion. Check for corrosion on the pin contacts of the PDM as well.

Another area water can cause issues is with dash mounted switches that control PDM functions. Verify water has not entered the switch body which will cause erratic operation ie. Devices start to operate by themselves.

PDM Connector Layout

(Pin numbers and Connector Color are embossed in the plastic housing)



View looking into PDM

PDM Pinout Functions

Note: Voltages referenced are for a 12V system, on a 24V system the voltages will be double except for the CAN voltages.

J3	GRAY	FUNCTION	VOLTAGE
1	5V_RTN	ANALOG GND REF	GND
2	DIG12	INPUT	0, 6, OR 12VDC
3	CH7	OUTPUT	0 OR 12VDC**
4	CH8	OUTPUT	0 OR 12VDC**
5	CH9	OUTPUT	0 OR 12VDC**
6	CH10	OUTPUT	0 OR 12VDC**
7	AN8	RESISTIVE INPUT	0 – 5VDC
8	AN7	RESISTIVE INPUT	0 – 5VDC
9	AN6	RESISTIVE INPUT	0 – 5VDC
10	AN5	RESISTIVE INPUT	0 – 5VDC
11	AN4	RESISTIVE INPUT	0 – 5VDC
12	5V_EXT	5V REF OUTPUT	5VDC

J4	BLACK	FUNCTION	VOLTAGE
1	CH1	OUTPUT	0 OR 12VDC**
2	CH2	OUTPUT	0 OR 12VDC**
3	CH3	OUTPUT	0 OR 12VDC**
4	CH4	OUTPUT	0 OR 12VDC**
5	CH5	OUTPUT	0 OR 12VDC**
6	CH6	OUTPUT	0 OR 12VDC**
7	AN3	RESISTIVE INPUT	0 – 5VDC
8	AN2	RESISTIVE INPUT	0 – 5VDC
9	AN1	RESISTIVE INPUT	0 – 5VDC
10	DIG11	INPUT	0, 6, OR 12VDC
11	DIG2	SOURCE ADDRESS 32	0 OR 6VDC
12	DIG1	SOURCE ADDRESS 31	0 OR 6VDC

J5	GREEN	FUNCTION	VOLTAGE
1	CAN-	CAN LOW	1.5 – 2.5VDC*
2	DIG3	INPUT	0, 6, OR 12VDC
3	DIG4	INPUT	0, 6, OR 12VDC
4	DIG5	INPUT	0, 6, OR 12VDC
5	DIG6	INPUT	0, 6, OR 12VDC
6	5VRTN	ANALOG GND REF	GND
7	5VEXT	5V REF OUTPUT	5VDC
8	DIG7	INPUT	0, 6, OR 12VDC
9	DIG8	INPUT	0, 6, OR 12VDC
10	DIG9	INPUT	0, 6, OR 12VDC
11	DIG10	INPUT	0, 6, OR 12VDC
12	CAN+	CAN HI	2.5 – 3.5VDC*

J6	2-PIN	FUNCTION	VOLTAGE
1	CH12	OUTPUT	0 OR 12VDC
2	CH11	OUTPUT	0 OR 12VDC

Notes:
* PDM turns the CAN bus off after 15 – 30 seconds of inactivity. CAN voltages must be measured before it turns off.
** Digital Outputs:
Voltage may be less than 12Vdc if output is PWM.
If two outputs are configured as a reversible motor pair the voltages will reverse depending on drive direction.
***Digital Inputs:
Off = floating at about 6Vdc
On = switched to ground or 12Vdc, a single input can have two functions.