

J1939 inMOTION Cell Setup and Configuration Guide Universal Switch Interface

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Overview

The Infinitybox J1939 inMOTION Cell brings flexible multiplexed power distribution to any vehicle builder. Using standard J1939 PGN structures and commands, you can control the outputs on the inMOTION with practically any J1939 input device. This document shows how to set up the J1939 inMOTION Cell, wire it and details the PGN structure required to turn outputs on and off.

inMOTION is a unique product because it manages polarity control of loads that change direction. Examples include window lifts, lock actuators and linear actuators. inMOTION also has the ability to monitor the current flowing to the load. It learns the nominal current required to move the load. If the actual current exceeds the learned value, the output turns off which stops movement of the load.

The J1939 inMOTION Cell comes with a standard configuration that allows the end-user broad flexibility in creating their own layouts to suit their unique applications. Using simple software tools from their J1939 input device manufacturer, they can quickly configure the system in the field. In cases where custom configurations are required for a specific vehicle, the system can be modified easily. Contact technical support for more details.

Warnings

THE INFINITYBOX J1939 INMOTION CELL IS A FUSED POWER DISTRIBUTION MODULE FOR VEHICLES. PROPER CARE MUST BE TAKEN TO FUSE THE INPUT FEEDS TO THE CELL AND THE OUTPUT FEEDS FROM THE CELL. IMPROPER FUSE SELECTION CAN CAUSE DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM RESULTING IN FIRE.

PROPER CARE MUST BE TAKEN TO ENSURE THAT POWER IS CORRECTLY APPLIED TO THE INMOTION CELL. REVERSING POLARITY TO THE POWER AND GROUND FEEDS WILL CAUSE IRREPARABLE DAMAGE TO THE CELL AND WILL VOID THE WARRANTY. NEVER OPERATE THE INMOTION CELL WITHOUT BOTH POWER CONNECTION HARNESSES CONNECTED TO THE POWER INPUT CONNECTORS.

INMOTION CONTROLS THINGS THAT MOVE INCLUDING MOTORS, SOLENOIDS AND LINEAR ACTUATORS. USE CAUTION AND BE PREPARED FOR ANY MOVEMENT WHEN SETTING UP, TRAINING AND USING THE SYSTEM.

INMOTION'S CURRENT LIMITING CAPABILITIES ARE NOT INTENDED TO PROTECT USERS FROM POTENTIAL INJURY CAUSED BY OBJECTS INTERFERING WITH THE TRAVEL OF A MECHANISM IN OR ON THE VEHICLE.

ADDING ANY ELECTRONICS MODULES TO A VEHICLE WILL INCREASE THE DEMAND ON THE BATTERY. CARE MUST BE TAKEN TO MAINTAIN A CHARGE ON THE BATTERY WHEN THE VEHICLE SITS IDLE FOR PERIODS OF TIME. THIS IS ESPECIALLY IMPORTANT WITH GEL-CELL AND AGM BATTERIES. WE STRONGLY RECOMMEND INSTALLING A DISCONNECT SWITCH THAT SEPARATES THE ELECTRICAL LOADS IN THE VEHICLE FROM THE BATTERY WHEN NOT IN USE.

J1939 inMOTION Cell Technical Details

System Operating Voltage: 7.0 to 15.8 VDC

Number of Outputs: 5 Pairs of H-Bridge Outputs

Output Type: High-Side Switched via H-Bridge Relays

Maximum Current Rating per Output: 20-amps

Maximum Current Rating: 100-amps

Internal Fusing: Standard Mini™ Fuse

Maximum Operating Temperature: 85 °C

Minimum Operating Temperature: -20 °C

inMOTION Cell Installation Steps

Mounting the inMOTION Cell

Mount the inMOTION Cell on a suitable flat surface in the vehicle. Use the 4 mounting points in the corners of the cell and 1/4 -inch hardware. The recommended method to mount the inMOTION cell is to use 1/4-inch X 5/8-inch shoulder screws. If not using shoulder screws, take care as to not crush the mounting points by over tightening the screws.

Supplying 12-volt Power and Ground

The inMOTION Cell gets its 12-volt power and ground from the 2 dual 6.3 mm connectors on the edge of the cell. Each of these connectors can accept up to 50-amps. Since the cell reverses polarity to the loads, the connector must pass out the ground current to the chassis. Both of the input connectors must be used for power and ground for the inMOTION Cell.

The ground wires should match the gauge of the power input wires and should be connected to the vehicle ground. It is important that the inMOTION Cell is grounded to the chassis through a metal-to-metal connection. Make sure to remove all paint, powder coating, dirt and grease from the contact area.

The following table summarizes all of the components for these connectors. The inMOTION Cell input connectors use readily available connector components from Delphi. See the instructions from Delphi for proper assembly and termination of these connector components.

Table 1: inMOTION Input Connector Components.

		Delphi Part Number
inMOTION Input Connector	Connector	12085030
	Terminal	12033997

Table 2 identifies the power and ground cavities on the inMOTION input connectors

Table 2: Power and Ground Cavities on the inMOTION Input Connectors.

Cavity Identification	Function
A	+12 Volts
B	Ground

Both of the power feed wires to the inMOTION Cell should be protected with a fuse located as closely to the battery source as possible. Size the fuse based on the gauge of wire feeding the inMOTION Cell. The Table 3 summarizes the proper fuse sizes for different wires.

Table 3: Maximum Fuse Ratings for Different Wire Gauges.

AWG Size	Maximum Fuse Rating (Amps)
12	40
10	50

Wiring the Output Harnesses

The inMOTION output connectors use readily available connector components from Delphi. See the instructions from Delphi for proper assembly and termination of these connector components. The Table 4 summarizes all of the connector and terminal components required to build custom wiring harnesses for your J1939 inMOTION Cell.

Table 4: inMOTION Output Connector Components.

		Delphi Part Number
inMOTION Output Connector	Connector/Seal	12084891
	TPA	15324857
	Wire Seal	12015323
	Terminal	12129493

The individual output wires should be properly sized to carry the output load. The maximum output current for a single inMOTION output is 20-amperes. The total inMOTION Cell can carry up to 100-amperes. Exceeding these values will damage the cell and void the warranty. Table 5 summarizes the details of the output harnesses by connector and cavity identification.

Table 5: inMOTION Cell Output Harness Connector Details.

Cavity ID	Connector A	Connector B
A	Output 1b	Output 3a
B	Output 1a	Output 4b
C	Output 2b	Output 4a
D	Output 2a	Output 5b
E	Output 3b	Output 5a

Figure 1 identifies all of the connectors on the J1939 inMOTION Cell.

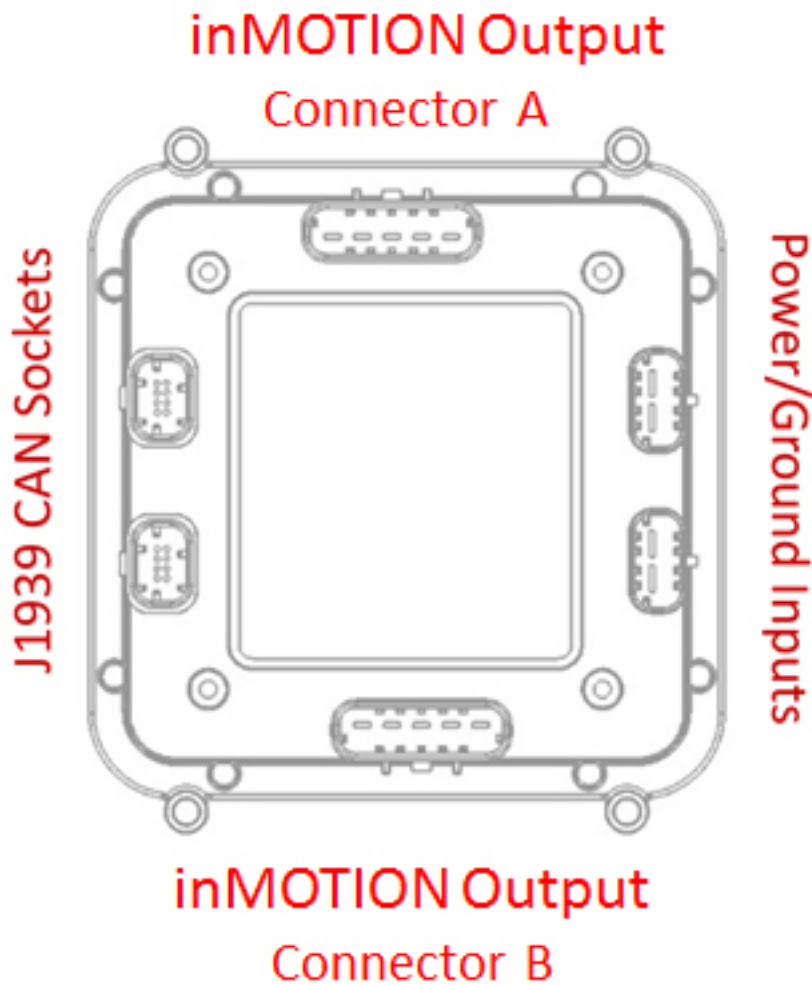


Figure 1: Socket Identification for J1939 inMOTION.

Installing Fuses

The inMOTION Cell has internal fuse holders to protect the output wires from short circuits and low-overloads. The holders are designed for a standard Mini™ automotive fuse. Select the rating of fuse to protect the smallest gauge of wire in the harness for each output. Never use a fuse rated at higher than 20-amps to protect a inMOTION output. Table 6 gives recommendations on fuse ratings for different wire gauges.

Table 6: Maximum Fuse Ratings for Different Wire Gauges.

AWG Size	Maximum Fuse Rating (Amps)
20	10
18	15
16	20
14	25

Use only OEM approved Mini™ fuses to protect the inMOTION outputs. There are numerous grey-market manufacturers of fuses that are unsafe and unreliable. Recommended manufacturers for these fuses are Littelfuse, Inc, Bussmann and Pacific Engineering.

Training inMOTION

The J1939 inMOTION Cell monitors the current flowing to each load attached to it. Before it will operate correctly, it must be trained to learn the nominal current flow from each output.

Train the output to the inMOTION Cell after all motors or solenoids are attached. Use the manual U & D (Up and Down) buttons for each pair of outputs to move all motor controlled functions to a middle position. For example, use the U button to move a window half-way up from the down position.

Once all motions are in the middle position, press the train button under the cover of the inMOTION Cell. This is the button labeled S11. This will start the training sequence. Each output will cycle for 1 second in each direction so that the inMOTION cell can learn the current draw for the motor or solenoid attached to the output.

WARNING!!! Pressing the train button will provide power to the outputs. Be prepared for the motor or solenoid attached to the output to move.

Outputs cannot operate from inputs to the J1939 input device until the cell is trained. You must repeat the training process if new outputs are attached to inMOTION.

Connecting J1939 CAN Network

The CAN sockets on the J1939 inMOTION Cell connect the J1939 input device to the cells. These sockets provide the CAN HI & LOW connection for the J1939 network. The inMOTION CAN sockets do not provide power and ground for the J1939 input device. These devices must get their fused power from another source outside of the inMOTION Cell.

There are two CAN sockets on the inMOTION Cell so that multiple J1939 inMOTIONs and J1939 inMOTION Cells can be connected on the same network. A CAN terminator plug with a 120-ohm resistor should be inserted into the last open CAN socket on the J1939 network. The two CAN sockets on an inMOTION Cell are electrically identical so you can plug the CAN connector into either socket.

Table 7 shows the function, cavity identification and wire colors for the CAN connector. Connect the corresponding wires from the J1939 input device to these cavities in the connector.

Table 7: CAN Connector Wiring Details.

Cavity ID	Function	Standard Wire Color
5	Ground	Black
6	CAN LOW	Green
7	CAN HIGH	Yellow
8	+12 Volt Power	Red

Setting the J1939 inMOTION Cell Address

Each J1939 inMOTION or J1939 inMOTION Cell must have its own unique address for the network to work correctly. The address is set by arranging jumpers in a binary pattern under the cover of the cell.

Figure 2 shows how to properly orient the jumpers on the headers to set the cell address.

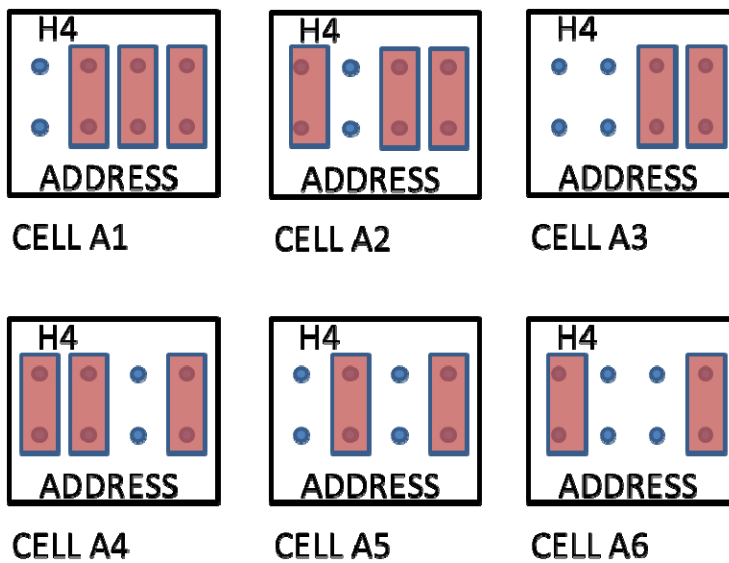


Figure 2: Correct Orientation of the Address Headers.

CAN Parameter Setup

For PGN's in the range of FF00 through FF0F, the first 60 of the 64 bits in the available 8 bytes correspond to outputs on the cells attached to the J1939 network. A (1) in any of these bits will cause its corresponding cell output to react based on its configuration table.

On one J1939 network, there can be two different groups of J1939 input devices assigned to PGN's FF00 through FF0F. J1939 input devices in Group 1 can be assigned PGN's FF00 through FF07 and can control POWERCELLs or inMOTION cells addressed at A1, A2 or A3. J1939 input devices in Group 2 can be assigned PGN's FF08 through FF0F and can control POWERCELL or inMOTION cells addressed at A4, A5 or A6. Switches assigned to Group 1 cannot control cells assigned in Group 2. Switches in Group 2 cannot control cells assigned in Group 1. See Figure 4 for more details.

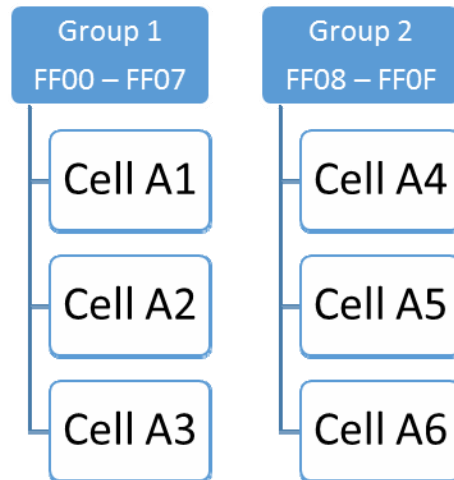


Figure 3: Groups, PGN's and Cell Addresses for J1939 Network.

In any J1939 network with a mix of POWERCELLs and inMOTION Cells, the cell addressed as A1 must be a POWERCELL. A single inMOTION Cell may exist on a J1939 network if it is addressed as A1. If multiple inMOTION Cells are to be used in a single J1939 network, there must be a POWERCELL at address A1, and the inMOTION cells must be addressed as A2 and A3.

Table 8 summarizes the control bits, the assigned personalities and the details for each output in the Group 1 cells.

Table 8: Control Bit Details for Group 1 Outputs.

	Byte 1								Byte 2								Byte 3								Byte 4								
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
Cell Address	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	
Cell Output	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	
Connector	A	A	A	A	B	A	B	B	B	B	A	A	A	A	B	A	B	A	B	B	B	A	A	A	A	B	A	B	B	B	B	A	A
Cavity ID	B	A	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	B	A	A
Personality	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	

	Byte 5								Byte 6								Byte 7								Byte 8							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Cell Address	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cell Output	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	X	X	X	X	X	X	X	X	X	X	X	X	X	
Connector	A	A	A	B	A	B	B	B	A	A	A	A	B	A	B	B	B	B	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cavity ID	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	X	X	X	X	X	X	X	X	X	X	X	X	X	
Personality	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	

Table 9 summarizes the control bits, the assigned personalities and the details for each output in the Group 2 cells.

Table 9: Control Bit Details for Group 2 Outputs.

	Byte 1								Byte 2								Byte 3								Byte 4							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Cell Address	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	4	4	
Cell Output	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b
Connector	A	A	A	A	B	A	B	B	B	B	A	A	A	A	B	A	B	B	B	B	A	A	A	A	B	A	B	B	B	B	A	A
Cavity ID	B	A	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	B	A
Personality	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	Track	

	Byte 5								Byte 6								Byte 7								Byte 8							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Cell Address	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cell Output	2a	2b	3a	3b	4a	4b	5a	5b	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	X	X	X	X	X	X	X	X	X	X	X	X	X	
Connector	A	A	B	A	B	B	B	B	A	A	A	A	B	A	B	B	B	B	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cavity ID	D	C	A	E	C	B	E	D	B	A	D	C	A	E	C	B	E	D	X	X	X	X	X	X	X	X	X	X	X	X	X	
Personality	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	Express	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	

inMOTION Personality Glossary

The J1939 inMOTION has a pre-configured library of personalities that define how the output reacts when it receives a J1939 command. The following list describes these different personalities and their behaviors.

Track

Track is the most basic personality. The output tracks the state of the input. When the J1939 switch is pressed or latched into an ON position, it is broadcasting an ON command to the inMOTION Cell output. That output will remain ON as long as the J1939 input device is broadcasting the ON command or until the inMOTION Cell output turns off because the output current exceeds the learned value. When the J1939 input device broadcasts an OFF command, the inMOTION output turns OFF.

Express

The Express function will operate the inMOTION output like a toggle. The toggle personality latches the state of the inMOTION Cell output in either an ON or OFF state based on receiving a command from the J1939 input device. The J1939 input device broadcasts a command indicating that the state of the switch has changed from OFF to ON and back to OFF again. This action causes the inMOTION Cell to change the state of the output from OFF to ON or ON to OFF. This is to be used with J1939 inputs devices that have a momentary mechanical action and broadcast a change in switch state in the pressed position of the switch.

The inMOTION output will continue to drive the output until the cell detects an increase in current flowing to the output that exceeds the learned current. This function can be used to automatically extend linear actuators.

NOTE: Use the Express function with caution. This will cause the motion of a motor or linear actuator connected to inMOTION to run continuously. Injury or death can occur if the inMOTION Cell is not trained properly.

Powering the System

Once the J1939 input devices are properly set up and configured, connect the network to +12 volts through the input harnesses to the cells. After 3 seconds, the system will be communicating with the J1939 input devices.

There is a blue LED located towards the center of the inMOTION Cell under the clear cover. This light indicates the status of the communication on the network. When the system receives a packet of data on the J1939 network, the light should blink.

Warranty Information

Infinitybox, LLC (“Infinitybox”) warrants against any defects in materials and workmanship to the Product’s modules, wiring harnesses and accessory modules for a period of one (1) year from the first date of purchase. Subject to the terms of this warranty described below, Infinitybox will replace any such defective Product that is returned to Infinitybox within the one (1) year period from initial purchase. Replacement of any defective part or Product will not extend the applicable warranty period.

The warranty does not apply to: (i) any Product that is not installed in compliance with the applicable Product documentation; (ii) any defect in, or failure of, the Product resulting from an accident, shock, negligence, water immersion or misuse; (iii) any Product that has been modified, adjusted, repaired, or disassembled by any party other than Infinitybox; or (iv) any defect other than in materials and workmanship.

This warranty covers only the original purchaser of Product purchased from an Infinitybox authorized dealer in the United States. In order to receive warranty service, purchaser must provide Infinitybox with a copy of the receipt stating the dealer name, product purchased and date of purchase. Products found to be defective during the warranty period will be replaced (with a product deemed to be equivalent or better) at the discretion of Infinitybox.

Infinitybox’s sole liability for any defective Product is limited solely to the replacement of Product pursuant to this warranty. Infinitybox reserves the right to replace any repairable parts with new or refurbished parts.

INFINITYBOX DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, SUCH AS WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE. IN NO EVENT SHALL INFINITYBOX BE LIABLE FOR ANY PUNITIVE, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LIABILITY FOR LOSS OF USE, LOSS OF PROFITS, LOSS OF PRODUCT OR BUSINESS INTERRUPTION HOWEVER THE SAME MAY BE CAUSED, INCLUDING NEGLIGENCE.