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Infinitybox IOX 852-091 HSLS8 J1939 Input Expander Module Setup and Configuration Guide

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Overview

The Infinitybox IOX family of modules that allow simple switch and output integration into a J1939 network. These Input and Output Expanders are small, modular and easy to integrate into a vehicle's architecture. They can be connected into a CAN network to add switch control anywhere on a vehicle.

The Infinitybox IOX NGX HSLH8 is an 8-input variant of the IOX. There are versions the IOX NGX HSLS8 with multiple combinations of ground switched inputs and high-side switched inputs to suit the switch needs of the application.

The IOX NGX HSLS8 is completely configurable in the field by using simple J1939 commands. The CAN data rate can be set easily for networks running at 250, 500 or 1,000 kb/s. The PGN and Source Addresses can be set for all the inbound and outbound messages. Eight CAN messages can be assigned to each input when it is turned on and two CAN messages can be assigned to each input when it is turned off. These messages can be set to broadcast only upon change of state of the switch or periodically.

Warnings

The Infinitybox IOX Input/Output Expander Module is part of a fused power distribution system for vehicles. Proper care must be taken to fuse the input feeds to the module 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 IOX. Reversing polarity to the power and ground feeds will cause irreparable damage to the module and will void the warranty.

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.

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IOX NGX HSLS8 Technical Details

- Dimensions: 72 mm X 24 mm X 6 mm / 2.9” X 1.0” X 0.25”
- Inputs: 8. Options for Ground and High-Side Switches
- Operating Voltage Range: 7 to 19 VDC
- Steady-State Current Draw: 0.025 A Nominal
- Operating Temperature Range: -40 C to +85 C
- Indicator LEDs for system activity, CAN HI & LO data
- Sealed to IP67
- Input, CAN & Power Harness Lengths- 36” Custom Lengths Available

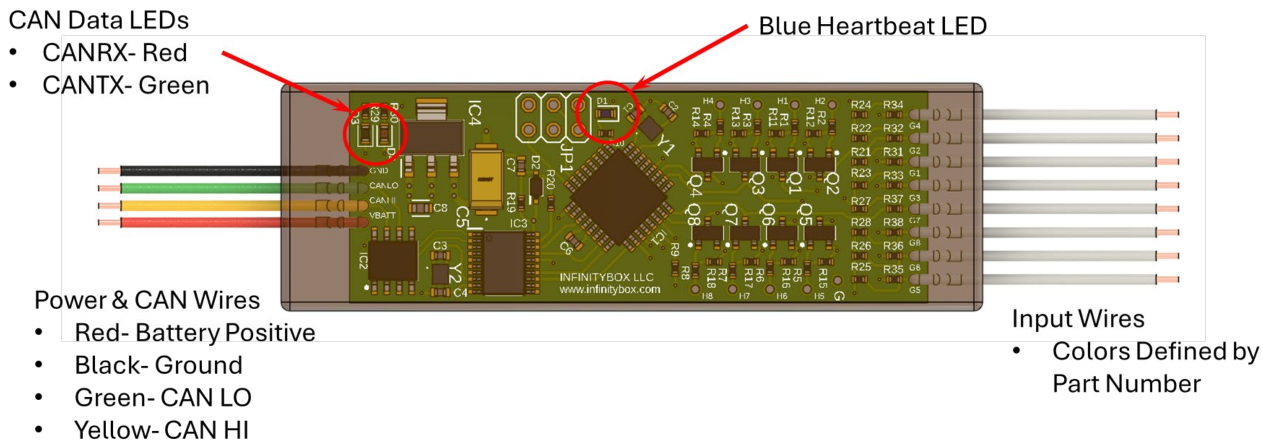
IOX NGX HSLS8 Part Number Variants

Part Number		Input 1	Input 2	Input 3	Input 4	Input 5	Input 6	Input 7	Input 8
852-091-00	Switch Type	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
	Wire Color	White-Black	White-Red	White-Blue	White-Yellow	White-Green	Blue-Black	Blue-Red	Blue-Grey
852-091-FF	Switch Type	High-Side	High-Side	High-Side	High-Side	High-Side	High-Side	High-Side	High-Side
	Wire Color	Brown	Violet	Light Green	Light Blue	White	Yellow	Blue	Green
852-091-0F	Switch Type	Ground	Ground	Ground	Ground	High-Side	High-Side	High-Side	High-Side
	Wire Color	White-Black	White-Red	White-Blue	White-Yellow	White	Yellow	Blue	Green
852-091-3F	Switch Type	Ground	Ground	High-Side	High-Side	High-Side	High-Side	High-Side	High-Side
	Wire Color	White-Black	White-Red	Light Green	Light Blue	White	Yellow	Blue	Green
852-091-C0	Switch Type	High-Side	High-Side	Ground	Ground	Ground	Ground	Ground	Ground
	Wire Color	Brown	Violet	White-Blue	White-Yellow	White-Green	Blue-Black	Blue-Red	Blue-Grey

IOX Installation Steps

Mounting the IOX

The IOX was designed to be mounted behind the switches in your vehicle. It can be easily zip tied with the harness anywhere. The following illustration shows the important parts of the IOX.



Supplying 12-volt Power

The IOX needs battery voltage and ground. The red wire from the IOX needs to connect to battery power and the black wire needs to get connected to ground. We strongly recommend fusing the red wire at 5-amps.

Wiring the IOX Inputs

Based on the version of your IOX NGX HSLS8, connect your inputs to their respective ground switched or high-side switched signals.

Connecting J1939 CAN Network

Connect the CAN HI and CAN LO wires coming from the IOX to their respective wires in the J1939 network. The network must be properly terminated.

Power-Up and LED Indicators

Normal Power-Up Sequence

When you apply power to a configured IOX NGX HSLS8:

1. **LED flashes once** (50ms) - Device is booting
2. **Heartbeat message** appears on CAN bus within 200ms
3. **LED blinks once per second** - Normal operation
4. **Input messages sent** based on current switch positions

LED Indicators

- Single Blink @ 1 Hz (Normal) Pattern: One 50ms flash every second. Device is operating normally
  - Firmware running
  - CAN communication healthy
  - Heartbeat being sent
  - Action Required: None
- Triple Blink @ 1 Hz (CAN Fault) Pattern: Three quick 50ms flashes every second.
  - CAN communication problem detected.
  - TX buffer stuck (message not sending)
  - TX error flag set
  - Bus-off condition
  - Common Causes:
    - Missing 120Ω termination resistors on CAN bus
    - Wrong bitrate (device doesn't match bus)
    - CAN wiring problem (short or open circuit)
    - CAN bus disconnected
  - Action Required:
    - Check CAN termination (120Ω at each end of bus)
    - Verify CAN bitrate matches network (default 250 kbps)
    - Check CAN HI and CAN LO wiring
    - Power cycle device after fixing bus issue

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IOX NGX HSLS8 - CAN Communication Reference

Understanding Device Messages

The IOX NGX HSLS8 communicates on the J1939 CAN bus using three primary message types: Heartbeat (status), Diagnostic (detailed statistics), and Configuration (EEPROM access). This section explains how to interpret these messages and configure the device.

Heartbeat Message

The heartbeat message is transmitted every **1 second** to indicate the device is operational and provide real-time status.

Message Identification

Default CAN ID: 0x0CFF0680

- **Priority: 0x0C (J1939 priority level 3 - medium)**
- **PGN:** 0xFF06 (65286 decimal)
- **Source Address (SA):** 0x80 (128 decimal)
- **Period:** 1000 ms ±2%

Data Bytes (8 bytes total)

Byte	Name	Description	Example
0	Firmware Major Version	Major version number	0x01 = v1.x.x
1	Firmware Minor Version	Minor/customer revision	0x18 = v1.24
2	Rolling Counter	Increments 0→255, then wraps to 0	0x3F = 63rd heartbeat
3	Input Bitmap	Current state of all 8 inputs	0x05 = IN1 and IN3 active
4	Status Flags	Error and reset indicators	0x00 = no errors
5	Uptime Counter	(Uptime in seconds ÷ 10) mod 256	0x1E = 300 seconds (5 min)
6	Reserved	Always 0x00	0x00
7	Reserved	Always 0x00	0x00

Byte 3: Input Bitmap Decoding

Each bit represents one input (1 = active/low, 0 = inactive/high):

Bit	Input	Bit	Input
0	IN1	4	IN5
1	IN2	5	IN6
2	IN3	6	IN7
3	IN4	7	IN8

Example: 0x05 = binary 0000 0101

- Bit 0 = 1 → IN1 is active
- Bit 2 = 1 → IN3 is active
- All other inputs inactive

Byte 4: Status Flags

Bit	Flag Name	Meaning
0	BUS_OFF	CAN controller in bus-off state
1	RX_OVERFLOW	Receive buffer overflow occurred
2	TX_ERROR	Transmit error detected
3	ERROR_PASSIVE	High error count (error passive state)
4	BUS_OFF_MCP	MCP2515 in bus-off (redundant with bit 0)
5	RX_OVF_MCP	MCP2515 RX overflow (redundant with bit 1)
6	WATCHDOG_RESET	Last reset caused by watchdog timer
7	BROWNOUT_RESET	Last reset caused by brownout (low voltage)

Normal operation: All bits = 0 (0x00)
Example: 0x41 = binary 0100 0001

- Bit 0 = 1 → Bus-off condition
- Bit 6 = 1 → Device recently reset due to watchdog

Complete Heartbeat Example

CAN Message:

ID: 0x0CFF0680

Data: [01] [18] [A3] [05] [00] [1E] [00] [00]

Interpretation:

- Byte 0: 0x01 → Firmware v1.x.x
- Byte 1: 0x18 → Minor version 24 (v1.24)
- Byte 2: 0xA3 → 163rd heartbeat since boot
- Byte 3: 0x05 → IN1 and IN3 active
- Byte 4: 0x00 → No errors
- Byte 5: 0x1E → 30 × 10 = 300 seconds uptime (5 minutes)
- Bytes 6-7: Reserved

Diagnostic Message

The diagnostic message is transmitted every **5 seconds** to provide detailed operational statistics and error counters.

Message Identification

Default CAN ID: 0x0CFF4680

- **Priority: 0x0C (J1939 priority level 3 - medium)**
- **PGN:** 0xFF46 (65350 decimal)
- **Source Address (SA):** 0x80 (128 decimal)
- **Period:** 5000 ms

Data Bytes (8 bytes total)

Byte	Name	Description	Range
0	Uptime LSB	Uptime in seconds, low byte	0-255
1	Uptime MSB	Uptime in seconds, high byte	0-255
2	TX Error Count	Transmit errors (mod 256)	0-255
3	RX Overflow Count	Receive overflows (mod 256)	0-255
4	Bus-Off Count	Times device entered bus-off (mod 256)	0-255
5	Input Change Count	Input state changes (mod 256)	0-255
6	Reserved	Always 0x00	0x00
7	Reserved	Always 0x00	0x00

Uptime Calculation (Bytes 0-1)

Uptime in seconds = (Byte 1 × 256) + Byte 0

Maximum displayed: 65,535 seconds (18.2 hours), then wraps to 0

Example:

- Byte 0 = 0x2C (44 decimal)
- Byte 1 = 0x01 (1 decimal)
- Uptime = (1 × 256) + 44 = **300 seconds** (5 minutes)

Error Counter Interpretation

All error counters increment and wrap at 256 (8-bit counters):

Counter	Normal Value	Action if Abnormal
TX Error Count	0 or very low	Check CAN termination, bitrate, wiring
RX Overflow	0	Reduce bus traffic or increase device priority
Bus-Off Count	0	Investigate CAN wiring, termination, or electrical noise
Input Changes	Varies by usage	Abnormally high may indicate switch bounce or noise

Complete Diagnostic Example

CAN Message:

ID: 0x0CFF4680

Data: [2C] [01] [00] [00] [00] [0F] [00] [00]

Interpretation:

- Bytes 0-1: 0x012C → 300 seconds uptime (5 minutes)
- Byte 2: 0x00 → No transmit errors
- Byte 3: 0x00 → No receive overflows
- Byte 4: 0x00 → Never entered bus-off
- Byte 5: 0x0F → 15 input state changes since boot
- Bytes 6-7: Reserved

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Writing to EEPROM

The device configuration is stored in non-volatile EEPROM memory. You can modify any EEPROM address using J1939 write commands.

Write Request Message Format

Default CAN ID: 0x0CFF1680

- **Priority: 0x0C (J1939 priority level 3 - medium)**
- **PGN:** 0xFF16 (65302 decimal)
- **Source Address:** 0x80 (128 decimal)

Data Bytes:

Byte	Name	Value	Description
0	Guard Byte	0x77	**Required** - Write command identifier
1	Address LSB	0x00-0xFF	EEPROM address low byte
2	Address MSB	0x00-0x03	EEPROM address high byte
3	Value	0x00-0xFF	Byte value to write
4-7	Padding	0xFF	Unused, must be 0xFF

EEPROM Address Format

EEPROM addresses are 16-bit (0-1023), transmitted **little-endian** (LSB first):

Example: To write to address **305** (0x0131):

- Address LSB (Byte 1) = 0x31 (low byte)
- Address MSB (Byte 2) = 0x01 (high byte)

Write Procedure

Step 1: Construct the write command

Example: Write value 0x02 to address 0x0000 (change bitrate to 500 kbps)

CAN ID: 0x0CFF1680

Data: [77] [00] [00] [02] [FF] [FF] [FF] [FF]

B0- Guard byte (required 0x77)

B1- Address LSB (0x00)

B2- Address MSB (0x00)

B3- Value to write (0x02)

B4 – B7- Padding (unused)

Step 2: Transmit the message

Send the message on the J1939 bus at the current bitrate.

Step 3: Wait for response

The device will reply within 50-100 ms with a response message (see next section).

Step 4: Verify success

Check the response status byte (byte 5) for success (0x01) or error code.

Important Notes

⚠️ **Guard Byte:** The first byte **must** be 0x77. Any other value will be rejected with error code 0xE1.

⚠️ **Write Delay:** Allow at least **50 ms** between consecutive writes to the same address to ensure EEPROM endurance.

⚠️ **Hot Reload:** Most configuration changes take effect immediately without requiring a power cycle. One exception is the CAN data rate. Power must be cycled to the IOX before the new CAN data rate will take effect.

⚠️ **Verification:** The device performs a write-verify cycle. If verification fails, it will retry once automatically.

Understanding the Response Message

After every EEPROM read or write command, the device sends a response message confirming the operation.

Response Message Format

Default CAN ID: 0x0CFF3680

- **Priority: 0x0C (J1939 priority level 3 - medium)**
- **PGN:** 0xFF36 (65334 decimal)
- **Source Address:** 0x80 (128 decimal)

Data Bytes:

Byte	Name	Description
0	Firmware Major	Major version number (e.g., 0x01)
1	Firmware Minor	Minor version number (e.g., 0x18)
2	Value or Error	Value read/written, or error code if failed
3	Address LSB	EEPROM address low byte (echo of request)
4	Address MSB	EEPROM address high byte (echo of request)
5	Status	Success (0x01) or error code
6	Reserved	Always 0x00
7	Reserved	Always 0x00

Status Codes (Byte 5)

Code	Name	Meaning
0x01	SUCCESS	Read or write completed successfully
0xE1	BAD_GUARD	Guard byte was not 0x77
0xE2	INVALID_ADDR	Address is out of range (>1023)
0xE4	TX_BUSY	CAN transmit buffer was full (retry)
0xE5	VERIFY_FAILED	Write completed but verify read didn't match

Successful Write Response Example

Write Request:

ID: 0x0CFF1680

Data: [77] [00] [00] [02] [FF] [FF] [FF] [FF]

(Write 0x02 to address 0x0000)

Response:

ID: 0x0CFF3680

Data: [01] [18] [02] [00] [00] [01] [00] [00]

B0- Firmware major: 0x01

B1- Firmware minor: 0x18 (Customer Specific Configuration)

B2- Value written: 0x02

B3- Address LSB: 0x00

B4- Address MSB: 0x00

B5- Status: 0x01 (SUCCESS)

B6 & B7- Reserved

Interpretation:

- Status 0x01 → Write successful
- Value 0x02 confirmed written to address 0x0000
- Firmware version 1.24

Failed Write Response Example

Write Request with wrong guard byte:

ID: 0x0CFF1680

Data: [88] [00] [00] [02] [FF] [FF] [FF] [FF]

Wrong guard byte (should be 0x77)

Response:

ID: 0x0CFF3680

Data: [01] [18] [E1] [00] [00] [E1] [00] [00]

B0- Firmware major: 0x01

B1- Firmware minor: 0x18

B2- Value: 0xE1 (error code)

B3- Address LSB: 0x00

B4- Address MSB: 0x00

B5- Status: 0xE1 (BAD_GUARD)

Interpretation:

- Status 0xE1 → Bad guard byte error
- Write was rejected

No changes made to EEPROM

Reading from EEPROM

You can read any EEPROM address to verify configuration or retrieve current settings.

Read Request Message Format

Default CAN ID: 0x0CFF2680

- **Priority: 0x0C (J1939 priority level 3 - medium)**
- **PGN:** 0xFF26 (65318 decimal)
- **Source Address:** 0x80 (128 decimal)

Data Bytes:

Byte	Name	Value	Description
0	Guard Byte	0x77	**Required** - Read command identifier
1	Address LSB	0x00-0xFF	EEPROM address low byte
2	Address MSB	0x00-0x03	EEPROM address high byte
3-7	Padding	0xFF	Unused, must be 0xFF

Read Procedure

Step 1: Construct the read command

Example: Read address 0x0000 (current bitrate setting)

CAN ID: 0x0CFF2680

Data: [77] [00] [00] [FF] [FF] [FF] [FF] [FF]

- B0- Guard byte (required)
- B1- Address LSB (0x00)
- B2- Address MSB (0x00)
- B3 - B7- Padding (unused)

Step 2: Transmit the message

Send the message on the J1939 bus.

Step 3: Wait for response

The device will reply within 10-50 ms with a response message.

Step 4: Extract the value

The value is in byte 2 of the response message.

Read Response Example

Read Request:

ID: 0x0CFF2680

Data: [77] [00] [00] [FF] [FF] [FF] [FF] [FF]

- (Read address 0x0000)

Response:

ID: 0x0CFF3680

Data: [01] [18] [01] [00] [00] [01] [00] [00]

- B0- Firmware major: 0x01
- B1- Firmware minor: 0x18
- B2- Value read: 0x01
- B3- Address LSB: 0x00
- B4- Address MSB: 0x00
- B5- Status: 0x01 (SUCCESS)

Interpretation:

- Status 0x01 → Read successful
- Address 0x0000 contains value 0x01
- This means bitrate is set to 250 kbps (0x01 = 250k)

Reading Multiple Addresses

To read multiple consecutive addresses:

1. Send separate read commands for each address
2. Wait for response after each read
3. Allow 50 ms between reads to avoid overwhelming the device

EEPROM Configuration Settings

EEPROM Memory Organization

The IOX NGX HSLS8 stores all configuration information in non-volatile EEPROM memory. The first 22 bytes contain system-wide settings that control device behavior and CAN communication parameters. Addresses 23-902 store input-to-CAN message mappings (covered in the Input Configuration section).

System Configuration Map (Addresses 0-22)

Address 0: CAN Bitrate

Function: Sets the CAN bus communication speed
Default Value: 0x01 (250 kbps)
Data Type: Single byte

Valid Values:

Value	Bitrate	Description
0x01	250 kbps	Standard J1939 bitrate (default)
0x02	500 kbps	High-speed applications
0x03	1 Mbps	Maximum speed

Notes:

- Invalid values (not 0x01, 0x02, or 0x03) will default to 250 kbps
- ⚠️ **Power cycle required:** Changes to bitrate are stored immediately but only take effect after the device is power cycled
- All devices on the bus must use the same bitrate

Example - Change to 500 kbps:

Step 1: Write new bitrate value (at current bitrate, e.g., 250k)

ID: 0x0CFF1680

Data: [77] [00] [00] [02] [FF] [FF] [FF] [FF]

Step 2: Wait for success response (still at 250k)

ID: 0x0CFF3680

Data: [01] [18] [02] [00] [00] [01] [00] [00]

Step 3: Power cycle the device

(Disconnect and reconnect power)

Step 4: Switch your CAN tool to 500 kbps

Step 5: Verify heartbeat appears at new bitrate

ID: 0x0CFF0680 should now be visible at 500 kbps

Addresses 1-3: Heartbeat Message Configuration

Controls the heartbeat status message that indicates device health and input states.

Address 1: Heartbeat PGN - High Byte

Function: High byte (PF) of the Heartbeat PGN
Default Value: 0xFF
Data Type: Single byte
Range: 0x00-0xFF

Address 2: Heartbeat PGN - Low Byte

Function: Low byte (PS) of the Heartbeat PGN
Default Value: 0x06
Data Type: Single byte
Range: 0x00-0xFF

Complete Default PGN: 0xFF06 (65286 decimal)

Address 3: Heartbeat Source Address

Function: J1939 Source Address for Heartbeat messages
Default Value: 0x80 (128 decimal)

Data Type: Single byte
Range: 0x00-0xFD (0-253)

Notes:

- PGN is formed as: (Address_1 << 8) | Address_2
- Must be unique on the J1939 network
- Changes take effect immediately (hot-reload)
- Source Addresses 0xFE and 0xFF are reserved by J1939 standard

Example - Change Heartbeat to PGN 0xEF11, SA 0x29:

Write PGN High: [77] [01] [00] [EF] [FF] [FF] [FF] [FF]

Write PGN Low: [77] [02] [00] [11] [FF] [FF] [FF] [FF]

Write SA: [77] [03] [00] [29] [FF] [FF] [FF] [FF]

Result: Heartbeat will now appear as:

ID: 0x0CEF1129 (Priority 0x0C, PGN 0xEF11, SA 0x29)

Addresses 4-5: Firmware Version

Address 4: Firmware Major Version

Function: Major version number
Default Value: 0x01 (version 1.x.x)
Data Type: Single byte
Access: Read-only (writes are ignored)

Address 5: Customer/Configuration Revision

Function: Customer-definable configuration revision number
Default Value: 0x18 (24 decimal)
Data Type: Single byte
Range: 0x00-0xFF
Access: User-writable - intended for customer use

Notes:

- **This address is specifically intended for customer modification**
- **Use to track custom configurations, customer variants, or revision levels**
- **Changes take effect immediately (hot-reload)**
- **Reported in heartbeat message byte 1**
- **Reported in all configuration response messages (byte 1)**
- **Does not affect device functionality - purely informational**

Example - Read Firmware Version:

Read Major: [77] [04] [00] [FF] [FF] [FF] [FF] [FF]

Response: [01] [18] [01] [04] [00] [01] [00] [00]

(Major = 0x01)

Read Minor: [77] [05] [00] [FF] [FF] [FF] [FF] [FF]

Response: [01] [18] [18] [05] [00] [01] [00] [00]

(Minor = 0x18 = 24 decimal)

Firmware Version: 1.24

Address 6: Rebroadcast Mode

Function: Controls how input messages are transmitted
Default Value: 0x01 (change-of-state only)
Data Type: Single byte

Valid Values:

Value	Mode	Behavior
0x01	Edge-Triggered	Send messages only when input state changes (default)
0x02	Periodic Rebroadcast	Rebroadcast all input states every 1 second (at heartbeat)

Notes:

- Edge-triggered mode (0x01) minimizes bus traffic
- Periodic mode (0x02) useful for controllers requiring constant updates
- Periodic mode increases bus load significantly (all configured messages sent every second)
- Changes take effect immediately (hot-reload)

Example - Enable Periodic Rebroadcast:

Write Command:

ID: 0x0CFF1680

Data: [77] [06] [00] [02] [FF] [FF] [FF] [FF]

Result: Every 1 second, all configured messages for currently-active inputs will be transmitted (in addition to edge-triggered messages)

Address 7: Initialization Stamp (Internal Use)

Function: Indicates EEPROM has been initialized with default values
Default Value: 0xA5 (after first boot initialization)
Data Type: Single byte
Access: Internal use only

Notes:

- Firmware checks this value at startup
- If not 0xA5, firmware writes factory defaults to all EEPROM addresses
- Used to detect blank/new EEPROM chips
- **Factory Reset:** Write 0x00 to this address, then power cycle to restore all defaults

Example - Force Factory Reset:

Write Command:

ID: 0x0CFF1680

Data: [77] [07] [00] [00] [FF] [FF] [FF] [FF]

Then power cycle the device. All EEPROM settings will be restored

to factory defaults, and this address will be set back to 0xA5.

Addresses 8-9: Reserved

Function: Reserved for future use
Default Value: 0xFF
Data Type: Single byte each
Access: Not currently used

Addresses 10-12: Write Request Message Configuration

Controls the CAN message used to write to EEPROM.

Address 10: Write Request PGN - High Byte

Function: High byte (PF) of Write Request PGN
Default Value: 0xFF
Data Type: Single byte
Range: 0x00-0xFF

Address 11: Write Request PGN - Low Byte

Function: Low byte (PS) of Write Request PGN
Default Value: 0x16

Data Type: Single byte
Range: 0x00-0xFF

Complete Default PGN: 0xFF16 (65302 decimal)

Address 12: Write Request Source Address

Function: J1939 Source Address for Write Request messages
Default Value: 0x80 (128 decimal)
Data Type: Single byte
Range: 0x00-0xFD (0-253)

Notes:

- This is the PGN/SA the device listens for to accept write commands
- ⚠️ **Critical:** If you change these values, you must use the NEW PGN/SA for all future write commands
- Changes take effect immediately (hot-reload)
- Default CAN ID: 0x0CFF1680

Example - Change Write Request to PGN 0xEF16, SA 0x29:

Write PGN High: [77] [0A] [00] [EF] [FF] [FF] [FF] [FF]

Write PGN Low: [77] [0B] [00] [16] [FF] [FF] [FF] [FF]

Write SA: [77] [0C] [00] [29] [FF] [FF] [FF] [FF]

Result: Device now expects write commands at:

ID: 0x0CEF1629 (Priority 0x0C, PGN 0xEF16, SA 0x29)

All future writes must use this new CAN ID!

Addresses 13-15: Read Request Message Configuration

Controls the CAN message used to read from EEPROM.

Address 13: Read Request PGN - High Byte

Function: High byte (PF) of Read Request PGN
Default Value: 0xFF
Data Type: Single byte
Range: 0x00-0xFF

Address 14: Read Request PGN - Low Byte

Function: Low byte (PS) of Read Request PGN
Default Value: 0x26
Data Type: Single byte
Range: 0x00-0xFF

Complete Default PGN: 0xFF26 (65318 decimal)

Address 15: Read Request Source Address

Function: J1939 Source Address for Read Request messages
Default Value: 0x80 (128 decimal)
Data Type: Single byte
Range: 0x00-0xFD (0-253)

Notes:

- This is the PGN/SA the device listens for to accept read commands
- ⚠️ **Critical:** If you change these values, you must use the NEW PGN/SA for all future read commands
- Changes take effect immediately (hot-reload)
- Default CAN ID: 0x0CFF2680

Example - Change Read Request to PGN 0xEF26, SA 0x29:

Write PGN High: [77] [0D] [00] [EF] [FF] [FF] [FF] [FF]

Write PGN Low: [77] [0E] [00] [26] [FF] [FF] [FF] [FF]

Write SA: [77] [0F] [00] [29] [FF] [FF] [FF] [FF]

Result: Device now expects read commands at:

ID: 0x0CEF2629 (Priority 0x0C, PGN 0xEF26, SA 0x29)

Addresses 16-18: Response Message Configuration

Controls the CAN message used for read/write responses.

Address 16: Response PGN - High Byte

Function: High byte (PF) of Response PGN
Default Value: 0xFF
Data Type: Single byte
Range: 0x00-0xFF

Address 17: Response PGN - Low Byte

Function: Low byte (PS) of Response PGN
Default Value: 0x36
Data Type: Single byte
Range: 0x00-0xFF

Complete Default PGN: 0xFF36 (65334 decimal)

Address 18: Response Source Address

Function: J1939 Source Address for Response messages
Default Value: 0x80 (128 decimal)
Data Type: Single byte
Range: 0x00-0xFD (0-253)

Notes:

- This is the PGN/SA the device uses when replying to read/write commands
- Changes take effect immediately (hot-reload)
- Your CAN monitoring tool must listen for this PGN/SA to see responses
- Default CAN ID: 0x0CFF3680

Example - Change Response to PGN 0xEF36, SA 0x29:

Write PGN High: [77] [10] [00] [EF] [FF] [FF] [FF] [FF]

Write PGN Low: [77] [11] [00] [36] [FF] [FF] [FF] [FF]

Write SA: [77] [12] [00] [29] [FF] [FF] [FF] [FF]

Result: Device will send responses at:

ID: 0x0CEF3629 (Priority 0x0C, PGN 0xEF36, SA 0x29)

Addresses 19-21: Diagnostic Message Configuration

Controls the 5-second diagnostic message with detailed statistics.

Address 19: Diagnostic PGN - High Byte

Function: High byte (PF) of Diagnostic PGN
Default Value: 0xFF
Data Type: Single byte
Range: 0x00-0xFF

Address 20: Diagnostic PGN - Low Byte

Function: Low byte (PS) of Diagnostic PGN
Default Value: 0x46
Data Type: Single byte
Range: 0x00-0xFF

Complete Default PGN: 0xFF46 (65350 decimal)

Address 21: Diagnostic Source Address

Function: J1939 Source Address for Diagnostic messages
Default Value: 0x80 (128 decimal)
Data Type: Single byte
Range: 0x00-0xFD (0-253)

Notes:

- Diagnostic message is transmitted every 5 seconds
- Contains uptime, error counters, and input change statistics
- Changes take effect immediately (hot-reload)
- Default CAN ID: 0x0CFF4680

Example - Change Diagnostic to PGN 0xEF46, SA 0x29:

Write PGN High: [77] [13] [00] [EF] [FF] [FF] [FF] [FF]

Write PGN Low: [77] [14] [00] [46] [FF] [FF] [FF] [FF]

Write SA: [77] [15] [00] [29] [FF] [FF] [FF] [FF]

Result: Diagnostic messages will now appear at:

ID: 0x0CEF4629 (Priority 0x0C, PGN 0xEF46, SA 0x29)

Address 22: Serial Number (Optional)

Function: Unique device serial number
Default Value: 0x42 (66 decimal) - demo value
Data Type: Single byte
Range: 0x00-0xFF

Notes:

- Can be used to uniquely identify multiple IOX devices on the same network
- Not currently used in heartbeat or diagnostic messages
- Reserved for future use in extended diagnostics
- User-definable for asset tracking purposes

Example - Set Serial Number:

Write Command:

ID: 0x0CFF1680

Data: [77] [16] [00] [7B] [FF] [FF] [FF] [FF]

Result: Serial number set to 0x7B (123 decimal)

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Quick Reference Table - Complete System Configuration

Address	Parameter	Default	Type	Description
0	Bitrate	0x01	Config	01=250k, 02=500k, 03=1M (power cycle req'd)
1	HB PGN High	0xFF	PGN	Heartbeat PGN high byte
2	HB PGN Low	0x06	PGN	Heartbeat PGN low byte
3	HB Source Addr	0x80	SA	Heartbeat source address
4	FW Major	0x01	RO	Firmware major version
5	FW Minor	0x18	Optional	Firmware minor version
6	Rebroadcast	0x01	Config	01=edge, 02=periodic
7	Init Stamp	0xA5	Internal	Initialization flag
8	Reserved	0xFF	-	Future use
9	Reserved	0xFF	-	Future use
10	WR PGN High	0xFF	PGN	Write request PGN high
11	WR PGN Low	0x16	PGN	Write request PGN low
12	WR Source Addr	0x80	SA	Write request SA
13	RD PGN High	0xFF	PGN	Read request PGN high
14	RD PGN Low	0x26	PGN	Read request PGN low
15	RD Source Addr	0x80	SA	Read request SA
16	RSP PGN High	0xFF	PGN	Response PGN high
17	RSP PGN Low	0x36	PGN	Response PGN low
18	RSP Source Addr	0x80	SA	Response SA
19	DIAG PGN High	0xFF	PGN	Diagnostic PGN high
20	DIAG PGN Low	0x46	PGN	Diagnostic PGN low
21	DIAG Source Addr	0x80	SA	Diagnostic SA
22	Serial Number	0x42	Optional	User-defined device ID

Legend:

- **Config** = User-configurable setting
- **PGN** = J1939 Parameter Group Number component
- **SA** = J1939 Source Address
- **RO** = Read-only (writes ignored)
- **Internal** = System use only

Configuring Input Mappings

Overview

Each of the 8 inputs on the IOX NGX HSLS8 can be configured to send J1939 CAN messages when the input changes state. Each input supports:

- **8 ON cases** - Messages sent when input becomes active.
- **2 OFF cases** - Messages sent when input becomes inactive.

These configurations are stored in EEPROM starting at address 23.

When you configure an ON case for an input, the device automatically generates an OFF message when the input goes inactive. The automatic OFF message uses:

- Same PGN as the ON case

- Same Source Address as the ON case

- All data bytes set to 0x00

You only need to configure explicit OFF cases when you need:

- Different data values than zeros

- A different PGN when OFF

- A different Source Address when OFF

Most applications only need ON cases configured.

Input Message Case Structure

Each message case consists of **11 bytes** stored consecutively in EEPROM:

Byte Offset	Field	Description
0	PGN High Byte	High byte (PF) of the J1939 PGN
1	PGN Low Byte	Low byte (PS) of the J1939 PGN
2	Source Address	J1939 Source Address (SA)
3-10	Data Bytes	8 bytes of message payload (DATA[0] through DATA[7])

Total: 11 bytes per case

EEPROM Memory Layout for Inputs

The 8 inputs occupy EEPROM addresses **23 through 902**, with each input allocated **110 bytes**:

Input	Address Range	Bytes	Contents
Input 1	23 - 132	110	8 ON cases + 2 OFF cases
Input 2	133 - 242	110	8 ON cases + 2 OFF cases
Input 3	243 - 352	110	8 ON cases + 2 OFF cases
Input 4	353 - 462	110	8 ON cases + 2 OFF cases
Input 5	463 - 572	110	8 ON cases + 2 OFF cases
Input 6	573 - 682	110	8 ON cases + 2 OFF cases
Input 7	683 - 792	110	8 ON cases + 2 OFF cases
Input 8	793 - 902	110	8 ON cases + 2 OFF cases

Within each 110-byte input block:

- **Bytes 0-87** (8 cases × 11 bytes) = ON cases 1-8
- **Bytes 88-109** (2 cases × 11 bytes) = OFF cases 1-2

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Calculating EEPROM Addresses

Formula for ON Cases

For **Input N** (1-8), **ON Case C** (1-8):

Base Address = 23 + ((N - 1) × 110)

Case Offset = (C - 1) × 11

Start Address = Base Address + Case Offset

Example: Input 3, ON Case 5

Base = 23 + ((3 - 1) × 110) = 23 + 220 = 243

Offset = (5 - 1) × 11 = 44

Start Address = 243 + 44 = 287

The 11 bytes for this case occupy addresses **287-297.**

Formula for OFF Cases

For **Input N** (1-8), **OFF Case C** (1-2):

Base Address = 23 + ((N - 1) × 110)

ON Section = 88 bytes (8 cases × 11)

Case Offset = (C - 1) × 11

Start Address = Base Address + ON Section + Case Offset

Example: Input 3, OFF Case 2

Base = 23 + ((3 - 1) × 110) = 243

ON Section = 88

Offset = (2 - 1) × 11 = 11

Start Address = 243 + 88 + 11 = 342

The 11 bytes for this case occupy addresses **342-352.**

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Quick Reference Address Table

Input 1 Address Map

Case	Type	Start Address	End Address	Offset from Base (23)
Case 1	ON	23	33	+0
Case 2	ON	34	44	+11
Case 3	ON	45	55	+22
Case 4	ON	56	66	+33
Case 5	ON	67	77	+44
Case 6	ON	78	88	+55
Case 7	ON	89	99	+66
Case 8	ON	100	110	+77
Case 1	OFF	111	121	+88
Case 2	OFF	122	132	+99

Base Addresses for All Inputs

Input	Base Address	ON Cases Start	OFF Cases Start
1	23	23	111
2	133	133	221
3	243	243	331
4	353	353	441
5	463	463	551
6	573	573	661
7	683	683	771
8	793	793	881

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Configuration Examples

Example 1: Simple ON Message (Automatic OFF)

Application: sends message when ON, automatically sends zeros when OFF

Configuration:

- Input 1
- ON Case 1 only (OFF handled automatically)

ON Message:

- PGN: 0xFEF7
- SA: 0x29
- Data: [00] [00] [00] [00] [01] [00] [00] [00]

Automatic OFF Message: When Input 1 turns off, the device automatically sends:

- PGN: 0xFEF7 (same)
- SA: 0x29 (same)
- Data: [00] [00] [00] [00] [00] [00] [00] [00] (all zeros)

Write Commands:

// ON Case 1 (addresses 23-33)

[77] [17] [00] [FE] [FF] [FF] [FF] [FF] // Addr 23: PGN High

[77] [18] [00] [F7] [FF] [FF] [FF] [FF] // Addr 24: PGN Low

[77] [19] [00] [29] [FF] [FF] [FF] [FF] // Addr 25: SA

[77] [1A] [00] [00] [FF] [FF] [FF] [FF] // Addr 26: Data[0] = 0x00

[77] [1B] [00] [00] [FF] [FF] [FF] [FF] // Addr 27: Data[1] = 0x00

[77] [1C] [00] [00] [FF] [FF] [FF] [FF] // Addr 28: Data[2] = 0x00

[77] [1D] [00] [00] [FF] [FF] [FF] [FF] // Addr 29: Data[3] = 0x00

[77] [1E] [00] [01] [FF] [FF] [FF] [FF] // Addr 30: Data[4] = 0x01

[77] [1F] [00] [00] [FF] [FF] [FF] [FF] // Addr 31: Data[5] = 0x00

[77] [20] [00] [00] [FF] [FF] [FF] [FF] // Addr 32: Data[6] = 0x00

[77] [21] [00] [00] [FF] [FF] [FF] [FF] // Addr 33: Data[7] = 0x00

Result:

- When Input 1 turns on: Sends PGN 0xFEF7 with byte 4 = 0x01
- When Input 1 turns off: Automatically sends PGN 0xFEF7 with all bytes = 0x00

Example 2: OFF Message Only

Application: sends message when OFF, automatically sends zeros when ON

Configuration:

- Input 2
- OFF Case 1 only

OFF Message:

- PGN: 0xEF00
- SA: 0x29
- Data: [01] [00] [00] [00] [00] [00] [00] [00]

Write Commands:

// OFF Case 1 (addresses 221-231)

[77] [DD] [00] [EF] [FF] [FF] [FF] [FF] // Addr 221: PGN High

[77] [DE] [00] [00] [FF] [FF] [FF] [FF] // Addr 222: PGN Low

[77] [DF] [00] [29] [FF] [FF] [FF] [FF] // Addr 223: SA

[77] [E0] [00] [01] [FF] [FF] [FF] [FF] // Addr 224: Data[0] = 0x01

[77] [E1] [00] [00] [FF] [FF] [FF] [FF] // Addr 225: Data[1] = 0x00

[77] [E2] [00] [00] [FF] [FF] [FF] [FF] // Addr 226: Data[2] = 0x00

[77] [E3] [00] [00] [FF] [FF] [FF] [FF] // Addr 227: Data[3] = 0x00

[77] [E4] [00] [00] [FF] [FF] [FF] [FF] // Addr 228: Data[4] = 0x00

[77] [E5] [00] [00] [FF] [FF] [FF] [FF] // Addr 229: Data[5] = 0x00

[77] [E6] [00] [00] [FF] [FF] [FF] [FF] // Addr 230: Data[6] = 0x00

[77] [E7] [00] [00] [FF] [FF] [FF] [FF] // Addr 231: Data[7] = 0x00

Result:

- When Input 2 turns off: Sends PGN 0xEF00 with Data[0]=0x01, other bytes = 0x00

- When Input 2 turns on: Automatically sends PGN 0xEF00 with all bytes = 0x00

Example 3: Custom ON and OFF Messages

Configuration:

- Input 3

ON Message:

- PGN: 0xEF00

- SA: 0x29

- Data: [01] [64] [00] [00] [00] [00] [00] [00]

OFF Message:

- PGN: 0xEF00

- SA: 0x29

- Data: [AA] [BB] [00] [00] [00] [00] [00] [00]

Write Commands:

// ON Case 1 (addresses 243-253)

[77] [F3] [00] [EF] [FF] [FF] [FF] [FF] // Addr 243: PGN High

[77] [F4] [00] [00] [FF] [FF] [FF] [FF] // Addr 244: PGN Low

[77] [F5] [00] [29] [FF] [FF] [FF] [FF] // Addr 245: SA

[77] [F6] [00] [01] [FF] [FF] [FF] [FF] // Addr 246: Data[0] = 0x01

[77] [F7] [00] [64] [FF] [FF] [FF] [FF] // Addr 247: Data[1] = 0x64

[77] [F8] [00] [00] [FF] [FF] [FF] [FF] // Addr 248: Data[2] = 0x00

[77] [F9] [00] [00] [FF] [FF] [FF] [FF] // Addr 249: Data[3] = 0x00

[77] [FA] [00] [00] [FF] [FF] [FF] [FF] // Addr 250: Data[4] = 0x00

[77] [FB] [00] [00] [FF] [FF] [FF] [FF] // Addr 251: Data[5] = 0x00

[77] [FC] [00] [00] [FF] [FF] [FF] [FF] // Addr 252: Data[6] = 0x00

[77] [FD] [00] [00] [FF] [FF] [FF] [FF] // Addr 253: Data[7] = 0x00

// OFF Case 1 (addresses 331-341)

[77] [4B] [01] [EF] [FF] [FF] [FF] [FF] // Addr 331: PGN High

[77] [4C] [01] [00] [FF] [FF] [FF] [FF] // Addr 332: PGN Low

[77] [4D] [01] [29] [FF] [FF] [FF] [FF] // Addr 333: SA

[77] [4E] [01] [AA] [FF] [FF] [FF] [FF] // Addr 334: Data[0] = 0xAA

[77] [4F] [01] [BB] [FF] [FF] [FF] [FF] // Addr 335: Data[1] = 0xBB

[77] [50] [01] [00] [FF] [FF] [FF] [FF] // Addr 336: Data[2] = 0x00

[77] [51] [01] [00] [FF] [FF] [FF] [FF] // Addr 337: Data[3] = 0x00

[77] [52] [01] [00] [FF] [FF] [FF] [FF] // Addr 338: Data[4] = 0x00

[77] [53] [01] [00] [FF] [FF] [FF] [FF] // Addr 339: Data[5] = 0x00

[77] [54] [01] [00] [FF] [FF] [FF] [FF] // Addr 340: Data[6] = 0x00

[77] [55] [01] [00] [FF] [FF] [FF] [FF] // Addr 341: Data[7] = 0x00

Result:

- When Input 3 turns on: Sends PGN 0xEF00 with Data[0]=0x01, Data[1]=0x64
- When Input 3 turns off: Sends PGN 0xEF00 with Data[0]=0xAA, Data[1]=0xBB

Example 4: Multiple Messages Per Input

Configuration:

- Input 4

ON Message 1:

- PGN: 0xEF00
- SA: 0x29
- Data: [80] [00] [00] [00] [00] [00] [00] [00]

ON Message 2:

- PGN: 0xFEF7
- SA: 0x2A
- Data: [00] [00] [00] [00] [08] [00] [00] [00]

Write Commands:

// ON Case 1 (addresses 353-363)

[77] [61] [01] [EF] [FF] [FF] [FF] [FF] // Addr 353: PGN High

[77] [62] [01] [00] [FF] [FF] [FF] [FF] // Addr 354: PGN Low

[77] [63] [01] [29] [FF] [FF] [FF] [FF] // Addr 355: SA = 0x29

[77] [64] [01] [80] [FF] [FF] [FF] [FF] // Addr 356: Data[0] = 0x80

[77] [65] [01] [00] [FF] [FF] [FF] [FF] // Addr 357: Data[1] = 0x00

[77] [66] [01] [00] [FF] [FF] [FF] [FF] // Addr 358: Data[2] = 0x00

[77] [67] [01] [00] [FF] [FF] [FF] [FF] // Addr 359: Data[3] = 0x00

[77] [68] [01] [00] [FF] [FF] [FF] [FF] // Addr 360: Data[4] = 0x00

[77] [69] [01] [00] [FF] [FF] [FF] [FF] // Addr 361: Data[5] = 0x00

[77] [6A] [01] [00] [FF] [FF] [FF] [FF] // Addr 362: Data[6] = 0x00

[77] [6B] [01] [00] [FF] [FF] [FF] [FF] // Addr 363: Data[7] = 0x00

// ON Case 2 (addresses 364-374)

[77] [6C] [01] [FE] [FF] [FF] [FF] [FF] // Addr 364: PGN High

[77] [6D] [01] [F7] [FF] [FF] [FF] [FF] // Addr 365: PGN Low

[77] [6E] [01] [2A] [FF] [FF] [FF] [FF] // Addr 366: SA = 0x2A

[77] [6F] [01] [00] [FF] [FF] [FF] [FF] // Addr 367: Data[0] = 0x00

[77] [70] [01] [00] [FF] [FF] [FF] [FF] // Addr 368: Data[1] = 0x00

[77] [71] [01] [00] [FF] [FF] [FF] [FF] // Addr 369: Data[2] = 0x00

[77] [72] [01] [00] [FF] [FF] [FF] [FF] // Addr 370: Data[3] = 0x00

[77] [73] [01] [08] [FF] [FF] [FF] [FF] // Addr 371: Data[4] = 0x08

[77] [74] [01] [00] [FF] [FF] [FF] [FF] // Addr 372: Data[5] = 0x00

[77] [75] [01] [00] [FF] [FF] [FF] [FF] // Addr 373: Data[6] = 0x00

[77] [76] [01] [00] [FF] [FF] [FF] [FF] // Addr 374: Data[7] = 0x00

Result:

- When Input 4 grounds: Sends BOTH messages in sequence
    - Message 1: PGN 0xEF00, SA 0x29
    - Message 2: PGN 0xFEF7, SA 0x2A
- When Input 4 releases: Both messages automatically sent with all data bytes = 0x00

Troubleshooting Input Configuration

Input Not Sending Messages

Check:

1. Verify input bitmap in heartbeat message shows input state changing
2. Read back EEPROM to confirm case is configured (not all 0xFF)
3. Ensure PGN and SA are valid (not 0xFF)
4. Test with rebroadcast mode enabled (EEPROM addr 6 = 0x02)

Wrong Message Sent

Check:

1. Read back all 11 bytes of the case configuration
2. Verify PGN bytes are in correct order (high byte, then low byte)
3. Check for cross-input aggregation (multiple inputs, same PGN/SA)
4. Verify data bytes match intended values

Messages Sent Multiple Times

Possible causes:

- Rebroadcast mode enabled (EEPROM addr 6 = 0x02)
- Multiple cases configured for same input
- Switch bounce causing rapid state changes (debounce is 50ms)

Factory Reset Procedure

To restore all settings to factory defaults:

Step 1: Write 0x00 to address 7 (Init Stamp)

Data: [77] [07] [00] [00] [FF] [FF] [FF] [FF]

Step 2: Wait for success response

Step 3: Power cycle the device

Result: All addresses 0-22 restored to factory defaults

Input configurations (addresses 23+) cleared to 0xFF

Device will initialize with 250 kbps bitrate

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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.

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