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CAN Bus I/O

User Manual

Digital inputs | Analogue inputs | CAN controlled outputs

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Contents

1. Product Overview

The CAN I/O Unit is a compact CAN bus expansion module that provides extra digital inputs, analogue inputs and relay-control outputs for an ECU, dash display, data logger or other CAN-capable device.

- **8 digital inputs** for switches or ECU low-side/open-collector signals.
- **5 analogue inputs** for 0-5 V sensor signals.
- **4 digital outputs** intended for low-current relay control.
- **CAN communication** for broadcasting input states and receiving output commands.
- **User configuration** for CAN IDs, analogue scaling/offsets and channel names.

Default Configuration Summary

Item	Default setting
CAN speed	Auto-detects 500 kbit/s or 1 Mbit/s; falls back to 500 kbit/s if no active CAN traffic is found.
Input update rate	Approximately every 100 ms (10 Hz).
Digital inputs + A1-A3 message ID	0x100
A4-A5 message ID	0x101
Output control IDs	0x102, 0x103, 0x104, 0x105
Configuration receive ID	0x700
Configuration reply ID	0x701
Analogue scale / offset	Scale = 1.0, offset = 0.0 for all 5 analogue inputs.
Default names	DI1-DI8, AI1-AI5 and DO1-DO4.

2. Important Wiring Notes

- **Power** the unit from a fused switched +12 V supply on pin 23.
- **Ground** must be shared with the ECU/CAN system and any connected sensors.
- **Digital inputs** are pull-to-ground inputs with internal pull-ups. Do not feed 12 V into these inputs.
- **Analogue inputs** accept 0-5 V sensor signals only. Do not exceed 5 V on an analogue input.
- **5 V reference outputs** are for sensor reference supply only. Do not use them to power high-current devices.
- **Digital outputs** are for switching low-current relay control circuits. Use relays, fuses and flyback protection suitable for the load.
- **CAN wiring** should use CAN High and CAN Low twisted pair wiring with correct network termination at the bus ends.

Output load warning

The output pins are described as digital outputs for relay control. They should not be used as direct high-current load outputs unless the final hardware specification confirms the required current rating.

3. Connector Pinout

The connector has 26 external pins. The table below gives each user-facing function and the default channel label used in this manual.

Pin	Label	Function	Notes
1	**DI1**	Digital input	Pull to ground to activate
2	**DI2**	Digital input	Pull to ground to activate
3	**DI3**	Digital input	Pull to ground to activate
4	**DI4**	Digital input	Pull to ground to activate
5	**DI5**	Digital input	Pull to ground to activate
6	**DI6**	Digital input	Pull to ground to activate
7	**AI1**	Analogue input 0-5 V	Sensor input
8	**DO1**	Digital output	Low-current relay control
9	**DO2**	Digital output	Low-current relay control
10	**DI7**	Digital input	Pull to ground to activate
11	**DI8**	Digital input	Pull to ground to activate
12	**5V REF**	5 V reference	Sensor reference supply
13	**AI2**	Analogue input 0-5 V	Sensor input
14	**DO3**	Digital output	Low-current relay control
15	**DO4**	Digital output	Low-current relay control
16	**GND**	Ground	Shared system/analogue ground
17	**GND**	Ground	Shared system/analogue ground
18	**5V REF**	5 V reference	Sensor reference supply
19	**AI3**	Analogue input 0-5 V	Sensor input
20	**CAN H**	CAN High	CAN bus high line
21	**CAN L**	CAN Low	CAN bus low line
22	**GND**	Ground	Shared system/analogue ground
23	**+12V SW**	+12 V switched input	Fused ignition switched supply
24	**5V REF**	5 V reference	Sensor reference supply
25	**AI4**	Analogue input 0-5 V	Sensor input
26	**AI5**	Analogue input 0-5 V	Sensor input

4. Digital Inputs

Digital inputs DI1 to DI8 are designed for pull-to-ground switching. Each input has an internal pull-up, so an open input reads as inactive and a grounded input reads as active.

- **Inactive/open input** = CAN bit value 1.
- **Active/grounded input** = CAN bit value 0.
- **All inputs inactive** normally gives digital byte 0xFF.
- **Example**: DI1 active only gives digital byte 0xFE.

Digital input	Connector pin	CAN byte 0 bit	Active state
DI1	1	Bit 0	Pulled to ground
DI2	2	Bit 1	Pulled to ground
DI3	3	Bit 2	Pulled to ground
DI4	4	Bit 3	Pulled to ground
DI5	5	Bit 4	Pulled to ground
DI6	6	Bit 5	Pulled to ground
DI7	10	Bit 6	Pulled to ground
DI8	11	Bit 7	Pulled to ground

Digital input decoding

For most ECU or dash setups, decode the digital input byte bit-by-bit. Bit value 0 means the corresponding input is active. Bit value 1 means the input is open/inactive.

5. Analogue Inputs

Analogue inputs AI1 to AI5 are intended for 0-5 V sensor signals. They can be used for pressure sensors, position sensors, temperature sensor interfaces, switches with resistor ladders, or any other sensor output that stays within the 0-5 V range.

- **Default scaling** is scale 1.0 and offset 0.0 on all analogue inputs.
- **Configured value** = raw input reading x scale + offset.
- **Transmitted value** is an unsigned 16-bit value. Keep the final scaled value within 0 to 65535.
- **Sensor reference** can be supplied from one of the 5 V reference pins, with sensor ground returned to unit/system ground.

Analogue input	Connector pin	Default message	Data bytes	Notes
AI1	7	0x100	Bytes 1-2	High byte, then low byte
AI2	13	0x100	Bytes 3-4	High byte, then low byte
AI3	19	0x100	Bytes 5-6	High byte, then low byte
AI4	25	0x101	Bytes 0-1	High byte, then low byte
AI5	26	0x101	Bytes 2-3	High byte, then low byte

6. Digital Outputs

Digital outputs DO1 to DO4 are controlled by CAN messages. They are intended to switch low-current relay control circuits or similar low-current control inputs.

- **Power-up state** outputs are off until commanded on.
- **Command byte** the output state is read from data byte 2 of the matching output CAN ID.
- **OFF command** byte 2 = 0x00.
- **ON command** byte 2 = 0x01.
- **Message length** send at least 3 data bytes, for example 00 00 01 to turn an output on.

Output	Connector pin	Default CAN ID	ON data example	OFF data example
DO1	8	0x102	00 00 01	00 00 00
DO2	9	0x103	00 00 01	00 00 00
DO3	14	0x104	00 00 01	00 00 00
DO4	15	0x105	00 00 01	00 00 00

Output command example

To turn Output 1 on using the default address, send CAN ID 0x102 with data: 00 00 01. To turn it off, send CAN ID 0x102 with data: 00 00 00.

7. Default CAN Messages

The unit broadcasts input information on the CAN bus and listens for output commands. The default message layout is shown below.

CAN ID	Direction	DLC	Byte(s)	Content
0x100	Transmit	8	0	Digital input byte. Bit 0 = DI1 through bit 7 = DI8. 1=open/inactive, 0=grounded/active.
0x100	Transmit	8	1-2	AI1 unsigned 16-bit value, high byte first.
0x100	Transmit	8	3-4	AI2 unsigned 16-bit value, high byte first.
0x100	Transmit	8	5-6	AI3 unsigned 16-bit value, high byte first.
0x100	Transmit	8	7	Reserved / unused.
0x101	Transmit	4	0-1	AI4 unsigned 16-bit value, high byte first.
0x101	Transmit	4	2-3	AI5 unsigned 16-bit value, high byte first.
0x102	Receive	>=3	2	DO1 command. 0=off, 1=on.
0x103	Receive	>=3	2	DO2 command. 0=off, 1=on.
0x104	Receive	>=3	2	DO3 command. 0=off, 1=on.
0x105	Receive	>=3	2	DO4 command. 0=off, 1=on.

Normal data byte order

The normal input broadcast sends analogue values as high byte then low byte. Configuration messages use little-endian values as described in the configuration section.

8. CAN Speed and Startup Behaviour

At startup the unit checks for traffic on common bus speeds and then starts normal operation at the detected speed.

- **Auto-detect speeds**: 500 kbit/s and 1 Mbit/s.
- **Fallback speed**: 500 kbit/s if no CAN traffic is found during startup detection.
- **Best practice**: power the CAN I/O Unit after the ECU or ensure the CAN bus is already active when the unit powers up.
- **If the wrong speed is selected**: power-cycle the unit after the CAN bus is active.

9. User Configuration Over CAN

The unit can be configured by sending setup messages to configuration receive ID 0x700. Replies are sent on configuration reply ID 0x701. Configuration changes are not permanent until the save command is sent.

- **Configuration RX ID**: 0x700.
- **Configuration TX/reply ID**: 0x701.

- **Save required**: send command 0x06 after changing IDs, scales, offsets or names.
- **Request current setup**: send command 0x07 to receive a full configuration dump.

Command	Purpose	Payload format	Reply
0x01	Set digital/input message ID	[cmd][idx=0][u16 ID, little-endian]	Echoes command and new ID
0x02	Set analogue message ID	[cmd][idx=0][u16 ID, little-endian]	Echoes command and new ID
0x03	Set output message ID	[cmd][idx 0-3][u16 ID, little-endian]	Echoes command, output index and new ID
0x04	Set analogue scale	[cmd][idx 0-4][float32 scale, little-endian]	Echoes command, channel index and scale
0x05	Set analogue offset	[cmd][idx 0-4][float32 offset, little-endian]	Echoes command, channel index and offset
0x06	Save configuration	[cmd]	Acknowledges save
0x07	Dump current configuration	[cmd]	Streams all IDs, scales, offsets and names
0x08	Set digital input name	[cmd][idx 0-7][6 ASCII characters]	Echoes saved name
0x09	Set analogue input name	[cmd][idx 0-4][6 ASCII characters]	Echoes saved name
0x0A	Set output name	[cmd][idx 0-3][6 ASCII characters]	Echoes saved name

Channel names are fixed at 6 characters. Names are stored as uppercase A-Z, numbers 0-9 and underscores. Short names are padded with underscores. Examples: FUELP_, FAN1__, MAP___, BOOST_.

Common Configuration Tasks

Task	What to change
Move the input broadcast to a different ID	Change command 0x01 for the digital + AI1-AI3 frame, and command 0x02 for the AI4-AI5 frame.
Change an output command ID	Use command 0x03 with output index 0 for DO1, 1 for DO2, 2 for DO3 or 3 for DO4.
Calibrate a 0-5 V sensor	Use analogue scale and offset so the transmitted value matches the unit you want your ECU or dash to read.
Rename channels for a display or setup tool	Use commands 0x08, 0x09 and 0x0A for DI, AI and DO names.
Make changes permanent	Send command 0x06 after changing the setup.

10. Setup Procedure

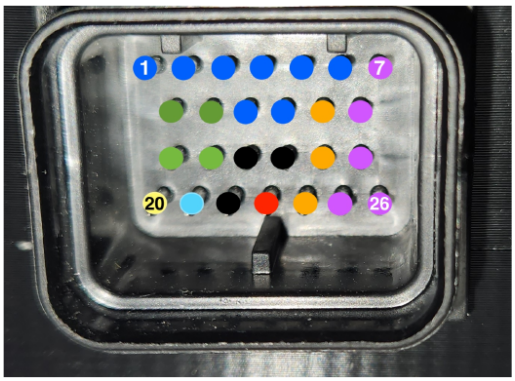
1. Mount the unit securely away from heat, moisture and moving parts.
2. Connect pin 23 to a fused switched +12 V supply.
3. Connect at least one ground pin to the vehicle/ECU ground system.
4. Connect CAN High and CAN Low to the vehicle or ECU CAN bus.
5. Connect switches to the digital inputs using pull-to-ground wiring.
6. Connect 0-5 V sensors to the analogue inputs, using the 5 V reference and ground where required.
7. Connect the digital outputs to relay control circuits or other suitable low-current control inputs.
8. Power the CAN network and confirm the unit is broadcasting IDs 0x100 and 0x101 at the expected speed.
9. Configure any changed CAN IDs, analogue scaling or channel names.
10. Send the save command so the setup is retained after power-off.

11. Troubleshooting

Symptom	Likely cause	Checks
No CAN messages seen	No power, wrong CAN speed, CAN H/L swapped or missing bus termination.	Check switched +12 V, ground, CAN H/L polarity, termination and whether the bus was active during startup.
Unit falls back to 500 kbit/s	No active CAN traffic during auto-detect.	Power-cycle the unit after the ECU/CAN network is already running.
Digital input appears inverted	Inputs are active-low by design.	Remember: open = 1, grounded = 0 in the digital input byte.
Analogue value is wrong	Sensor wiring, sensor ground, scaling or offset is incorrect.	Confirm 0-5 V at the pin, check shared ground and review scale/offset settings.
Output does not switch	Wrong CAN ID, command sent in wrong byte or output load wiring issue.	Use the configured output ID and send at least three data bytes with byte 2 set to 0 or 1.
Configuration changes lost after power cycle	Changes were not saved.	Send configuration command 0x06 after making setup changes.

Appendix A. Pinout Reference Sheet

The supplied pinout reference sheet is included below as a quick field reference for installers.



Pin	Function	Pin	Function
1	Digital In	14	Digital Out for relay
2	Digital In	15	Digital Out for relay
3	Digital In	16	Ground
4	Digital In	17	Ground
5	Digital In	18	5V reference voltage
6	Digital In	19	Analogue in 0-5v
7	Analogue in 0-5v	20	Can High
8	Digital Out for relay	21	Can Low
9	Digital Out for relay	22	Ground
10	Digital In	23	+12 switched input
11	Digital In	24	5V reference voltage
12	5V reference voltage	25	Analogue in 0-5v
13	Analogue in 0-5v	26	Analogue in 0-5v

Digital inputs are pull to ground, they have internal pull up.
Analogue Inputs are 0 to 5 Volts for sensors.
Digital outputs are for switching low current (Relays).
5 volt reference power for sensors.
Grounds are shared system and analogue.

Default Can Addresses:
0x100 Byte 0 - digital input
D1 - D8 - FE,FD,FB,BF,7F,F7,EF,DF
0x100 - 0x101 byte 1-6 Analogue input
0x100 : 1-2 = A1, 3-4 = A2, 5-6 = A3
0x101 : 0-1 = A4, 2-3 = A5
0x102 Output 1
0x103 Output 2
0x104 Output 3
0x105 Output 4